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HOW FINTECH PLAYS THE MEDIATING ROLE OF RISK MITIGATION AND ENHANCES BANK PROFITABILITY

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ABSTRACT

FinTech has emerged as a critical engine of sustainable development in the banking sector. This study investigates how FinTech adoption affects bank profitability, with a particular focus on the mediating role of bank risk. Using panel data from 82 Chinese commercial banks over the period 2013–2023, we construct a bank-level FinTech adoption index based on textual analysis and the entropy weighting method. The results show that FinTech adoption significantly enhances bank profitability, with risk mitigation serving as an important transmission mechanism. Specifically, FinTech adoption reduces credit and liquidity risk, with the credit risk channel playing the most prominent mediating role. Heterogeneity analyses further indicate that these effects are more pronounced for regional banks and in regions with less developed digital infrastructure, highlighting FinTech's role in alleviating structural disadvantages. The findings remain robust through a series of robustness checks and endogeneity tests. Overall, this study suggests that the profitability gains from FinTech adoption are closely linked to its capacity to reshape banks' risk–return trade-offs through comprehensive risk reduction. These results emphasize the importance of aligning digital transformation strategies with risk management objectives and offer policy-relevant insights for regulators and policymakers in emerging economies.

Keywords: FinTech, bank profitability, bank risk, digital transformation.

INTRODUCTION

In recent years, financial technology (FinTech) has significantly promoted the digital transformation of the banking industry. By integrating advanced digital technologies, banks can improve operational efficiency, enhance information processing capabilities, and redesign financial services (Mirza et al., 2023; Tang & Wu, 2024). This transformation is particularly evident in China, one of the world's largest digital finance markets, where commercial banks have widely adopted mobile banking platforms, namely AI-driven credit assessment systems, and blockchain-based payment solutions[1]. These technologies help banks reduce reliance on physical branches, improve customer risk screening and monitoring, and expand revenue streams through personalized digital services (Boot et al., 2021). As a result, FinTech adoption has become a strategic tool for banks seeking to strengthen competitiveness, improve financial performance and support sustainable development in an increasingly digital financial system.

A growing stream of studies explores how FinTech adoption influences bank profitability. On the one hand, FinTech may enhance profitability by lowering operational costs, improving customer experience, and expanding revenue sources through digital financial services (Li et al., 2022; Singh et al., 2021). On the other hand, FinTech investments often involve high fixed costs, technological uncertainty, and potential cyber and operational risks, which may offset its expected benefits (Mansour, 2024). Consequently, empirical evidence on the profitability effects of FinTech adoption remains mixed, highlighting the need to further explore the underlying transmission mechanisms.

Bank risk management represents a key area in which FinTech adoption may influence profitability. By enabling real-time data analytics, automated monitoring, and advanced risk assessment tools, FinTech strengthens bank risk management capabilities (Cheng & Qu, 2020; Guo, 2022; Wu et al., 2023). For instance, FinTech enables banks to implement predictive models for risk management, identify abnormal transaction patterns and potential fraud, and strengthen liquidity monitoring through automated regulatory reporting, which collectively contribute to more resilient profitability under changing conditions. However, existing studies largely focus on either the direct FinTech–profitability relationship or a single dimension of bank risk, paying limited attention to the mediating role of risk. In particular, few studies simultaneously consider overall bank risk, credit risk, and liquidity risk within a unified analytical framework. In addition to these dimensions, operational risk associated with technological disruptions and cybersecurity threats has also received increasing scholarly attention in the FinTech era (Cheng & Qu, 2023).

However, such risks are often more closely related to banks' internal processes and technological infrastructure, and consistent bank-level measures remain difficult to obtain over extended periods. Therefore, this study focuses on overall risk, credit risk, and liquidity risk, which represent the core dimensions of banks' financial stability and are more directly linked to profitability outcomes. These risk dimensions capture distinct but complementary aspects of banks' vulnerability and stability. Overall bank risk reflects the aggregate outcome of the risk-taking behavior and resilience of banks (Laeven & Levine, 2009); for example, credit risk represents the core asset-side risk directly affecting income quality and default losses (Duffie & Singleton, 2003), while liquidity risk captures the ability

[1] Refer to Yicai Global. (2023, September 5). China's banking giants are working on AI as smaller lenders look on. https://www.yicaiglobal.com/news/big-chinese-banks-are-developing-ai-models-smaller-lenders-stay-on-the-fence and TAB Insights. (2023, October 30). Leading players revolutionize China's financial industry with flexible data solutions, AI, and enhanced cores. https://tabinsights.com/article/leading-players-revolutionise-chinas-financial-industry-with-flexible-data-solutions-ai-and-enhanced-cores

of banks to manage funding pressures and absorb short-term shocks (Kashyap et al., 2002). Ignoring such heterogeneous risk channels may lead to an incomplete understanding of how FinTech adoption affects bank profitability.

The Chinese banking sector provides a compelling context to examine these issues. As a major emerging economy and a global leader in FinTech development, China has experienced rapid digital transformation in banking. The global digital finance market surpassed $4.5 trillion in 2024, with China's market reaching $3.2 trillion and serving as a major engine of global growth (Li et al., 2020). The coexistence of large national banks, joint-stock banks, and numerous regional institutions generates substantial heterogeneity in the resources, risk profiles, and FinTech adoption of banks. Furthermore, policy initiatives like the "FinTech Development Plan (2022-2025)" explicitly aim to leverage technology for enhancing financial inclusion and systemic stability. This environment offers an ideal setting to investigate how FinTech adoption reshapes bank profitability through different risk channels.

Against this backdrop, this study addresses the following research questions: (1) Does FinTech adoption enhance bank profitability? (2) How does FinTech adoption influence banks' risk profiles, including overall risk, credit risk, and liquidity risk? (3) Do these risk dimensions mediate the relationship between FinTech adoption and bank profitability?

This study has several contributions. First, it provides systematic evidence on the profitability effects of FinTech adoption and identifies bank risk as a key mediating channel. Second, by distinguishing among overall risk, credit risk, and liquidity risk, it offers deeper insights into the heterogeneous risk-related mechanisms through which FinTech shapes bank profitability. Third, this study develops a bank-level FinTech index by combining textual analysis with the entropy weight method, enabling a more precise and institution-specific measurement of FinTech adoption. The findings provide valuable implications for bank managers and policymakers in emerging economies, underscoring FinTech's role in enhancing risk management, reinforcing systemic stability, and fostering sustainable banking development.

LITERATURE REVIEW

Bank FinTech and Bank Profitability

According to resource dependence theory (Pfeffer & Salancik, 1978), organizations rely on external resources to reduce environmental uncertainty and secure more sustainable development. For commercial banks, FinTech constitutes a critical external resource that enables them to proactively manage dependence on technological innovation, mitigate uncertainties stemming from competition with technology firms, and cultivate new pathways for growth (Murinde et al., 2022). FinTech adoption has fundamentally reshaped the business models and operating processes of banks. By leveraging advanced data-driven and intelligent digital technologies, banks can enhance operational performance, lower transaction expenses, and improve customer experience (Hasan et al., 2023; Königstorfer & Thalmann, 2020). These technological advancements enable banks to optimize internal processes, expand service channels, and develop innovative financial products, which are expected to improve profitability.

Existing empirical studies generally suggest that FinTech adoption enhances bank profitability through multiple channels. First, digital platforms significantly reduce the reliance of banks on physical branches and labor-intensive operations, thereby improving cost efficiency (Wang et al. 2021). Second, data-driven technologies enable more precise cross-selling and the provision of personalized financial services, which expand revenue sources beyond traditional interest income (Tang & Wu, 2024). Third, emerging technologies improve transparency and efficiency in regulatory auditing and cross-border payments, helping banks reduce operational risk and compliance costs (Al-Dmour et al., 2024; Patel et al., 2022). Moreover, FinTech enables banks to better compete with FinTech startups, thereby strengthening their market position and income-generating capacity (Thakor, 2020). Nevertheless, some studies caution that high investment costs and technological uncertainty may weaken the profitability effects of FinTech, particularly in the short run (Gupta et al., 2018). In addition, intensified competition from technology firms may exert downward pressure on interest margins (Philippon, 2016). Despite these potential challenges, the net impact of FinTech adoption is expected to improve bank profitability. Thus, the following hypothesis is proposed:

Hypothesis 1. FinTech adoption is positively associated with bank profitability.

Bank FinTech and Bank Risk

Beyond profitability, FinTech adoption may significantly affect the risk profiles of banks. Building on dynamic capabilities theory (Teece et al., 1997), this transformation can be understood as banks building the capacity to sense, seize, and reconfigure technological resources. Specifically, FinTech technologies strengthen the data-handling capabilities of banks, enabling more effective risk identification, monitoring, and control. By reducing information asymmetry and strengthening internal controls, FinTech adoption is expected to mitigate the various forms of bank risk.

FinTech Adoption and Overall Bank Risk

Overall bank risk serves as a critical indicator of operational stability and resilience. FinTech adoption empowers banks with advanced analytical tools and real-time monitoring systems, significantly enhancing their capability to identify potential vulnerabilities and respond swiftly to adverse shocks (Daud et al., 2022; Guo, 2022). FinTech-based applications strengthen the informational capabilities of banks, thereby enabling substantial improvements in risk identification, assessment, and timely intervention (Nahar et al., 2024; Shibahathulla et al., 2024). By strengthening internal risk management practices and facilitating more diversified income structures, FinTech adoption may enhance financial stability and reduce the likelihood of bank distress. Meanwhile, FinTech adoption may involve new risks, including cybersecurity threats, technological dependence, and operational complexity. Moreover, the rapid pace of digital innovation may outstrip existing regulatory and risk management frameworks, potentially generating systemic concerns (Oko-Odion & Angela, 2025).

Empirical findings on how FinTech adoption affects bank risk are inconclusive. While most studies suggest that it has risk-reducing effects, a minority emphasize emerging vulnerabilities in digitally intensive banks (Liyanaarachchi et al., 2021). On balance, we argue that FinTech lowers information acquisition costs, enhances the speed and quality of information processing, and strengthens risk management capabilities, thereby contributing to lower overall bank risk. Accordingly, we propose Hypothesis 2a:

Hypothesis 2a. FinTech adoption is negatively associated with overall bank risk.

FinTech Adoption and Credit Risk

Credit risk reflects the possibility that borrowers may default on their obligations and constitutes a central risk in banking. Traditional credit assessments rely on historical statements and standardized scoring systems, which are often backward-looking, constrained by limited data, and susceptible to information asymmetry (Berger & Udell, 2002). FinTech has the potential to fundamentally transform this landscape by enhancing the accuracy, timeliness, and scope of assessments. The core logic of FinTech in mitigating credit risk lies in reducing information asymmetry in lending (Stiglitz & Weiss, 1981). FinTech adoption enables banks to leverage big data analytics and machine learning algorithms to improve risk assessment models. In the pre-lending stage, these technologies enhance client screening, especially for borrowers with limited traditional credit histories, thereby providing more precise credit decisions and reducing the likelihood of non-performing assets from the outset (Cheng & Qu, 2020). During post-lending monitoring, real-time data processing allow banks to dynamically track borrowers' operational conditions and repayment status, enabling early identification of potential risk through intelligent warning systems (Sebastian, 2025). This continuous monitoring mechanism not only strengthens the timeliness of risk control, but also enhances the proactivity of risk response, effectively preventing credit risk from becoming more severe. Thus, FinTech contributes to lowering default probabilities and reducing credit risk, which leads to the following hypothesis:

Hypothesis 2b. FinTech adoption is negatively associated with the credit risk of banks.

FinTech Adoption and Liquidity Risk

Liquidity risk arises when banks fail to meet short-term funding obligations. Ineffective liquidity management may force banks to rely on costly external funding, thereby increasing vulnerability to funding shocks (Chen et al., 2018), FinTech adoption enhances the liquidity risk management of banks by improving data integration, real-time information processing, and forecasting accuracy of cash flows. Specifically, digital technologies enable banks to monitor deposit flows, loan drawdowns, and payment activities more frequently and timely (Hasan et al., 2023). Advanced analytics and automated systems facilitate more accurate liquidity demand forecasting and dynamic adjustment of funding strategies (Harle et al., 2016). Moreover, FinTech applications improve internal coordination across treasury, risk management, and business units, allowing banks to respond more promptly to liquidity pressures. As a result, FinTech adoption strengthens the ability of banks to manage funding liquidity and reduces exposure to liquidity risk. Accordingly, we propose Hypothesis 2c:

Hypothesis 2c. FinTech adoption is negatively associated with banks' liquidity risk.

Bank FinTech, Bank Risk, and Profitability

The impact of FinTech adoption on bank profitability may operate indirectly through its impact on bank risk. Consistent with the risk–return framework, lower risk levels contribute to more stable earnings and sustainable profitability by reducing losses, funding costs, and capital constraints (Saunders et al., 2026). By strengthening information acquisition, processing efficiency, and real-time monitoring, FinTech improves the risk assessment and management capabilities of banks, leading to reduced risk across multiple dimensions and ultimately translating into higher profitability (Thakor, 2020). Specifically, reductions in overall bank risk can enhance operational stability and resilience, leading to more sustainable financial performance. Lower credit risk reduces loan losses and provisioning expenses, thereby directly improving profitability. Similarly, lower liquidity risk can decrease reliance

on costly external funding and mitigate the likelihood of liquidity shortfalls, contributing to improved earnings performance. In addition, lower risk exposure stabilizes earnings and capital positions, further supporting sustainable profitability (Berger & Bouwman, 2013). These arguments suggest that bank risk serves as a key transmission channel linking FinTech adoption to bank profitability. Accordingly, we propose the following mediation hypotheses:

Hypothesis 3a: FinTech adoption enhances bank profitability through reducing overall risk.

Hypothesis 3b: FinTech adoption enhances bank profitability through reducing credit risk.

Hypothesis 3c: FinTech adoption enhances bank profitability through reducing liquidity risk.

METHODOLOGY

Sample Selection and Data Source

This study used panel data for 82 Chinese commercial banks over the period 2013–2023. The sample included five (5) state-owned commercial banks, 11 joint-stock commercial banks, 48 city commercial banks, and 18 rural commercial banks. In total, they represented over 90% of the total banking assets in China. The data for this study came from several sources. Bank-level variables were compiled from the annual reports of banks and the CSMAR database. FinTech adoption indicators were constructed based on textual analysis of the annual reports of banks, combined with the entropy weight approach. Macroeconomic variables were obtained from official statistics released by the National Bureau of Statistics of China. The resulting panel dataset has enabled a rigorous empirical analysis of the links between FinTech adoption, bank risk, and profitability within the Chinese banking industry.

Variable Measurements

Dependent Variables: Bank Profitability

Bank profitability is proxied by Return on Assets (ROA), defined as the ratio of net income to total assets. ROA is commonly used in banking studies to evaluate the efficiency of banks in generating earnings from their asset base (Zheng et al., 2023). It provides a standardized view of performance, facilitating cross-bank comparability. In robustness checks, we alternatively used Return on Equity (ROE) to ensure our findings were not sensitive to the choice of profitability measure.

Independent Variable: FinTech Adoption

Bank-level FinTech adoption is measured using an index derived from textual disclosures in the annual reports of banks. The construction proceeded in the following three stages. First, following Huang et al. (2023) and Wang (2024), we developed a FinTech lexicon encompassing 118 keywords, which were categorized into six core dimensions: artificial intelligence, big data, blockchain, cloud computing, online-based FinTech applications and mobile-based FinTech applications. Secondly, this study employed Python-based web crawlers and text mining techniques to programmatically collect and analyze the full-text annual reports. For each bank-year observation, our algorithm scanned the reports to identify and count keywords occurrences, and then aggregating the totals for each of the six predefined dimensions. Third, these raw dimension-level term frequencies were synthesized into a single composite index using the entropy weight method, which objectively assigned weights based on

the informational variation each dimension provided across the sample. This approach goes beyond simple text analysis by integrating the entropy weight method, thereby yielding a more objective FinTech adoption index. The full list of keywords is provided in Appendix A.

Mediating Variables: Bank Risk

To examine the channels through which FinTech adoption affected profitability, we considered three distinct dimensions of bank risk as mediating variables as follows: overall risk, credit risk, and liquidity risk.

Overall bank risk is measured by Z-score ($\mathrm{ZSCORE} = \frac{\mathrm{ROA+CAR}}{\sigma(\mathrm{ROA})}$). A higher Z-score reflects greater bank stability and, correspondingly, lower overall risk (Conlon et al., 2020; Demirgüç-Kunt & Huizinga, 2010).

Credit risk is captured by the non-performing loan ratio (NPL). This ratio serves as a direct and widely accepted measure of asset quality in banking. A higher NPL signals poorer loan portfolio quality and implies higher expected credit losses (Cheng & Qu, 2020; Wu et al., 2023).

Liquidity risk is captured by the liquidity ratio (LR), measured as liquid assets divided by total assets. A higher LR indicates a stronger buffer of liquid assets and a greater ability to withstand funding shocks, and is, thus associated with lower liquidity risk (Yahaya et al., 2022).

Control Variables

Following prior studies (e.g., Khan et al., 2023; Zhao et al., 2023), we incorporated a set of control variables at both the bank and macroeconomic level. Bank-level controls encompass size (SIZE), measured as the natural logarithm of total assets; the cost-to-income ratio (CIR); the capital adequacy ratio (CAR); the debt-to-asset ratio (DAR); and the loan-to-deposit ratio (LDR). At the macro level, economic development is controlled by using provincial per capita GDP (PGDP) to account for cross-regional heterogeneity. A detailed definition of variables is as shown in Table 1.

Table 1

Definition of Variables

	Variable Name	Symbol	Variable Definition
Dependent Variables	Return on total asset	ROA	Net income/Total assets
	Return on equity	ROE	Net income/Average net asset
Independent Variables	FinTech Index	FIN	Text analysis & Entropy weight method
	FinTech keyword density	FIN_ratio	FinTech word counts/total report words
Mediating Variables	Overall risk	ZSCORE	Ln((ROA+CAR)/σ(ROA))
	Credit risk	NPL	Non-performing loans/total loans
	Liquidity ratio	LR	Liquid assets/total assets
Control Variables	Asset size	SIZE	Ln (total assets)
	Cost-to-Income ratio	CIR	Operating costs/operating income

(continued)

Variable Name	Symbol	Variable Definition
Capital adequacy ratio	CAR	Capital/ Risk weighted assets
Debt-to-Asset ratio	DAR	Total liabilities/total assets
Loan-to-Deposit ratio	LDR	Total loan/total deposit
Gross domestic product	PGDP	Per capita GDP

Model Construction

To empirically examine the relationships proposed in Hypotheses 1–3, we employed panel regression models. Equation (1) examines the direct effect of FinTech adoption on bank profitability：

$$\mathrm{ROA}_{it} = \alpha_o + \alpha_1 \mathrm{FIN}_{it} + \alpha_2 \mathrm{Control}_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (1)$$

To examine Hypotheses 2a–2c, we then regressed each risk dimension on FinTech adoption:

$$\mathrm{ZSCORE}_{it} = \alpha_o + \alpha_1 \mathrm{FIN}_{it} + \alpha_2 \mathrm{Control}_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (2a)$$

$$\mathrm{NPL}_{it} = \alpha_o + \alpha_1 \mathrm{FIN}_{it} + \alpha_2 \mathrm{Control}_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (2b)$$

$$\mathrm{LR}_{it} = \alpha_o + \alpha_1 \mathrm{FIN}_{it} + \alpha_2 \mathrm{Control}_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (2c)$$

Finally, to test whether bank risk mediated the link between FinTech and profitability (Hypotheses 3a–3c), we estimated the following regressions:

$$\mathrm{ROA}_{it} = \alpha_o + \alpha_1 \mathrm{FIN}_{it} + \alpha_2 \mathrm{ZSCORE}_{it} + \alpha_3 \mathrm{Control}_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (3a)$$

$$\mathrm{ROA}_{it} = \alpha_o + \alpha_1 \mathrm{FIN}_{it} + \alpha_2 \mathrm{NPL}_{it} + \alpha_3 \mathrm{Control}_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (3b)$$

$$\mathrm{ROA}_{it} = \alpha_o + \alpha_1 \mathrm{FIN}_{it} + \alpha_2 \mathrm{LR}_{it} + \alpha_3 \mathrm{Control}_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (3c)$$

In these models, ROA_{it} denoted return on assets, FIN_{it} measured FinTech adoption, ZSCORE_{it}, NPL_{it}, and LR_{it} represented overall risk, credit, and liquidity risk, respectively. $\mathrm{Control}_{it}$ included bank-specific and macroeconomic control variables. Bank and year fixed effects were captured by μ_i and δ_t, while ε_{it} denoted the error term.

RESULTS AND DISCUSSIONS

Descriptive Statistics Analysis

As shown in Table 2, the sample consists of 902 bank-year observations. The average ROA was 0.846, with a relatively low dispersion across banks. FIN showed a mean of 0.089, accompanied by a standard deviation of 0.108, reflecting substantial variation in FinTech adoption among banks. Regarding bank risk indicators, the sample banks exhibited a high average ZSCORE (3.438) and low dispersion (SD = 0.520), implying a generally stable banking system. The non-performing loan ratio (NPL) averaged 1.455, but ranged widely from 0.030 to 4.690, reflecting divergence in credit risk levels. Meanwhile, liquidity risk (LR) showed a mean value of 0.620, pointing to generally contained liquidity positions

across the sample. Control variables also exhibited reasonable dispersion. Bank size (SIZE) varied substantially across institutions, while CIR, CAR, DAR, LDR and PGDP remained within economically plausible ranges.

Table 2

Summary Statistics

VarName	Obs	Mean	Median	SD	Min	Max
ROA	902	0.846	0.843	0.314	0.180	1.614
FIN	902	0.089	0.051	0.108	0.001	0.490
ZSCORE	902	3.438	3.492	0.520	2.251	4.489
NPL	902	1.455	1.430	0.563	0.030	4.690
LR	902	0.620	0.577	0.217	0.278	1.602
SIZE	902	8.506	8.162	1.566	6.081	12.447
CIR (%)	902	31.935	31.390	5.752	21.510	46.903
CAR (%)	902	13.294	13.140	1.587	10.690	17.740
DAR (%)	902	92.597	92.666	1.368	88.351	95.052
LDR (%)	902	72.166	71.315	13.246	44.230	101.910
PGDP	902	7.422	6.967	2.890	3.089	15.330

FinTech Adoption and Bank Profitability

Table 3 presents the baseline regression results. Column (1) reports the specification without control variables, while Columns (2) and (3) progressively include bank-specific controls and macroeconomic factors.

Across all specifications, the estimated coefficient on FIN was consistently positive and significant at the 1% level. In the full model (Column 3), a one-unit increased in FinTech adoption was associated with a 0.3420 rise in ROA. This finding is consistent with existing empirical evidence showing that FinTech adoption enhances bank profitability through improvements in operational efficiency, information processing, and service innovation (e.g., Singh et al., 2021; Tang & Wu, 2024). The adoption of mobile banking platforms, AI-driven credit assessment and blockchain-based payment systems improves operational efficiency by reducing reliance on physical branches and labor-intensive processes. Data-driven analytics enable more precise personalized services, expanding revenue streams beyond traditional interest income. Digital technologies also enhance process transparency and regulatory compliance, helping banks lower operational risk and compliance costs. Specifically in the Chinese context, these effects are reinforced by supportive regulatory frameworks, such as the FinTech Development Plan[2] (The People's Bank of China, 2022), and close collaboration between banks and technology giants. This enables Chinese banks to more effectively leverage FinTech to reduce costs, enhance efficiency, and diversify revenue sources, thereby improving profitability.

Regarding control variables, bank size exhibited a positive effect on profitability once additional controls were included, suggesting scale advantages for larger banks. CIR exhibited a strong negative relationship with ROA, indicating that operational inefficiency reduced profitability. CAR showed a positive but statistically insignificant effect, whereas DAR and LDR were negatively related to

[2] The People's Bank of China, PBC Issues Fintech Development Plan (2022 to 2025), available at: https://www.pbc.gov.cn/en/3688110/3688172/4437084/2025080817504626255/index.html

profitability, suggesting that excessive leverage and aggressive lending might undermine the financial performance of banks. Moreover, regional economic development (PGDP) exerted a significantly positive relationship with ROA, highlighting the importance of macroeconomic conditions for bank profitability.

Overall, the baseline results support **Hypothesis 1**, which is in line with prior findings that FinTech adoption significantly enhances bank profitability.

Table 3

The Impact of FinTech Adoption on Bank Profitability

	(1) ROA	(2) ROA	(3) ROA
FIN	0.5218***	0.3802***	0.3420***
	(4.8186)	(3.6940)	(3.5017)
SIZE		0.0678	0.1252***
		(1.5374)	(2.9631)
CIR		-0.0198***	-0.0189***
		(-11.4911)	(-11.5469)
CAR		0.0050	0.0040
		(0.7847)	(0.6583)
DAR		-0.0241***	-0.0313***
		(-2.7409)	(-3.7386)
LDR		-0.0038***	-0.0028***
		(-4.2274)	(-3.3154)
PGDP			0.0973***
			(9.5672)
Constant	0.8001***	3.3031***	2.6787***
	(71.0540)	(3.7230)	(3.1751)
Bank & Year FE	Yes	Yes	Yes
N	902	902	902
F	23.22***	36.48***	47.87***
Adjusted R^2	0.6855	0.7441	0.7700

Notes. t-statistics in parentheses; * p < 0.1, ** p < 0.05, *** p < 0.01.

FinTech Adoption and Bank Risk Profiles

Table 4 examines the association between FinTech adoption and the various dimensions of bank risk, including overall risk (ZSCORE), credit risk (NPL), and liquidity risk (LR).

The findings indicate that FinTech adoption was systematically associated with lower bank risk across multiple dimensions. Specifically, FIN was positively correlated with ZSCORE (β = 0.2125, p < 0.05), suggesting enhanced bank stability and reduced overall risk. FIN was negatively related to NPL at the 1% significance level (β = -0.6633), consistent with improved credit risk control and lower non-performing loans. Furthermore, FIN exhibited a positive and significant relationship with LR (β = 0.2951, p < 0.01), implying stronger liquidity positions among banks with higher levels of FinTech adoption.

These risk-mitigating effects can be attributed to several underlying mechanisms. First, AI-driven credit assessment and real-time monitoring systems enhance banks' ability to identify and manage credit risks before they materialize, reducing ex-post non-performing loans. Second, big data analytics enable more

accurate stress testing and liquidity forecasting, allowing banks to maintain optimal liquidity buffers and respond proactively to market shocks. Third, digital platforms facilitate diversified funding sources and improve deposit stability, thereby reducing liquidity risk. These technological advancements collectively strengthen the risk management capacity of banks and contribute to greater financial stability, aligning with prior empirical evidence (He et al., 2023; Liu & Wang, 2022). In China, these effects are amplified through proactive prudential regulation and institutional mechanisms, such as the regulatory sandbox, which allows banks to pilot AI-driven risk tools under close supervisory oversight, ensuring that innovation enhances rather than compromises financial stability.

Taken together, the results support **Hypotheses 2a–2c** and indicate that FinTech adoption not only enhanced bank profitability, but also contributed to risk mitigation by improving overall stability, reducing credit risk, and strengthening liquidity positions. This dual effect of promoting returns and reducing risk provides a direct motivation to examine whether risk reduction serves as a key channel through which FinTech influences profitability.

Table 4

The Impact of FinTech Adoption on Bank Risk Profiles

	(1) ZSCORE	(2) NPL	(3) LR
FIN	0.2125**	-0.6633***	0.2951***
	(2.2659)	(-2.6605)	(3.1733)
SIZE	0.0404	-0.5882***	0.1892***
	(0.9963)	(-5.4515)	(4.6998)
CIR	-0.0043***	0.0098**	-0.0016
	(-2.7133)	(2.3456)	(-0.9984)
CAR	-0.0207***	-0.0433***	0.0092
	(-3.5488)	(-2.7942)	(1.5873)
DAR	-0.1109***	-0.0464**	0.0119
	(-13.7972)	(-2.1739)	(1.4918)
LDR	-0.0012	0.0126***	-0.0005
	(-1.4350)	(5.8156)	(-0.6653)
PGDP	0.0174*	-0.2832***	-0.0136
	(1.7793)	(-10.9110)	(-1.4042)
Constant	13.7079***	12.2729***	-2.0481**
	(16.9197)	(5.6983)	(-2.5493)
Bank & Year FE	Yes	Yes	Yes
N	902	902	902
F	40.19***	35.90***	6.46***
Adjusted R^2	0.9225	0.5329	0.5631

FinTech, Risk Profiles, and Bank Profitability: A Mediation Analysis

To further examine the mechanism through which FinTech adoption affects bank profitability, this section investigates whether bank risk profiles serve as mediating channels. Building on the baseline model, we sequentially incorporated measures of ZSCORE, NPL, and LR to assess their mediating roles.

Table 5 presents the mediation analysis results. Column (1) reports the baseline specification linking FinTech adoption to bank profitability. Columns (2)–(4) introduce ZSCORE, NPL, and LR as mediating variables, respectively.

Across all specifications, the coefficient on FIN remained positive and statistically significant, and its magnitude decreased after the inclusion of risk variables. This pattern provides initial evidence that bank risk profiles partially mediate the relationship between FinTech adoption and profitability. Specifically, ZSCORE carries a positive and highly significant coefficient, indicating that lower overall risk (higher stability) is associated with higher profitability. The coefficient of FIN decreased from 0.3420 to 0.2783, suggesting that improved overall stability constituted an important channel through which FinTech enhanced profitability. NPL exhibited a significantly negative effect on ROA, implying that lower credit risk contributed to higher profitability. The FIN coefficient further declined to 0.2625, indicating that credit risk reduction constituted a key transmission channel. Similarly, LR was also positively related to profitability, while the coefficient on FIN decreased relative to the baseline, suggesting that reduced liquidity risk (improved liquidity conditions) also mediated the FinTech–profitability relationship.

To formally test the significance of the indirect effects, we conducted Sobel tests and bootstrap mediation tests with 1,000 replications. The results, as reported in the Table 6, confirm that the indirect effects through ZSCORE, NPL, and LR are statistically significant. Notably, the credit risk channel accounted for the largest share (23.23%) of the total effect, followed by overall risk (18.62%) and liquidity risk (10.17%). This ordering of mediation effects suggests that FinTech adoption influences bank profitability through multiple risk dimensions, with the credit risk channel exhibiting a relatively more pronounced contribution, while improvements in overall stability and liquidity conditions play complementary roles. The distinct magnitudes of these mediating channels provide insights into how FinTech adoption reshapes bank profitability.

The pronounced role of the credit risk channel can be explained by the structural characteristics of China's banking sector. Unlike their counterparts in developed markets where non-interest income constitutes a substantial share of revenues, Chinese commercial banks remain predominantly credit-driven, with interest income accounting for approximately 70-80% of total revenues (China Banking Association, 2023). Consequently, FinTech-driven improvements in credit assessment, risk identification and monitoring directly enhance asset quality and reduce non-performing loans, yielding the strongest positive effect on profitability. In contrast, improvements in overall stability (ZSCORE) and liquidity conditions (LR) mainly enhance operational resilience and resource management, providing complementary but relatively smaller contributions to bank profitability. These results are broadly consistent with prior empirical studies emphasizing not only the critical importance of credit risk management in banking profitability (Adekunle, 2025; Duffie & Singleton, 2003), but also that they highlight the particular significance of the credit risk channel in the Chinese context, where regulatory guidance and digital lending platforms enable banks to leverage FinTech effectively for loan quality control. These findings further underscore that the risk-mitigating effects of FinTech should be

interpreted in light of the specific institutional and business model characteristics of the Chinese banking system.

By investigating these multiple risk-based transmission channels within a unified analytical framework, this study fills an important empirical gap regarding the risk-mediated pathways linking FinTech adoption to bank profitability, and offers a clearer mechanism-based interpretation of how FinTech reshapes the risk structures of banks to enhance profitability. Thus, these findings support **Hypotheses 3a–3c** and demonstrate that bank risk is not merely an outcome of FinTech adoption, but a central mechanism through which FinTech affects bank profitability.

Table 5

The Mediating Role of Bank Risk in FinTech-Profitability

	(1) ROA	(2) ROA	(3) ROA	(4) ROA
FIN	0.3420***	0.2783***	0.2625***	0.3072***
	(3.5017)	(2.9642)	(2.8094)	(3.1438)
ZSCORE		0.2996***		
		(8.5091)		
NPL			-0.1198***	
			(-9.0930)	
LR				0.1179***
				(3.1995)
SIZE	0.1252***	0.1131***	0.0548	0.1029**
	(2.9631)	(2.7911)	(1.3363)	(2.4164)
CIR	-0.0189***	-0.0176***	-0.0177***	-0.0187***
	(-11.5469)	(-11.1835)	(-11.3285)	(-11.4932)
CAR	0.0040	0.0102*	-0.0012	0.0029
	(0.6583)	(1.7390)	(-0.2046)	(0.4821)
DAR	-0.0313***	0.0019	-0.0368***	-0.0327***
	(-3.7386)	(0.2174)	(-4.6081)	(-3.9230)
LDR	-0.0028***	-0.0025***	-0.0013	-0.0027***
	(-3.3154)	(-3.0248)	(-1.5808)	(-3.2584)
PGDP	0.0973***	0.0921***	0.0634***	0.0989***
	(9.5672)	(9.4306)	(6.1040)	(9.7686)
Constant	2.6787***	-1.4289	4.1484***	2.9201***
	(3.1751)	(-1.5175)	(5.0599)	(3.4671)
Bank & Year FE	Yes	Yes	Yes	Yes
N	902	902	902	902
F	47.87	54.66	56.48	43.64
Adjusted R^2	0.7700	0.7888	0.7913	0.7726

Table 6

Mediation Effects of Bank Risk: Sobel and Bootstrap Test Results

	Sobel Test		Bootstrap Tests		% of Total Effect
	Indirect effect	p-value	Indirect effect	p-value	
ZSCORE	0.0637**	0.029	0.0637**	0.021	18.62%
NPL	0.0794**	0.011	0.0794**	0.011	23.23%
LR	0.0348**	0.024	0.0348*	0.065	10.17%

Notes. *** p<0.01, ** p<0.05, * p<0.10; bootstrap with 1000 replications.

Robustness Tests

Robustness checks were conducted by modifying key variable definitions and sample compositions, with the corresponding results reported in Table 7.

Alternative Variable Definitions

First, ROE was used as a substitute for ROA. Column (1) shows that FIN remained positive and statistically significant, confirming that FinTech adoption still enhanced bank profitability. Second, we adopted an alternative proxy for FinTech adoption; FIN_ratio, which was defined as the proportion of FinTech-related keywords in the annual report of banks. The results show that FIN_ratio was also positively and significantly related to ROA, confirming that our findings were insensitive to the specific construction of FinTech adoption.

Alternative Sample Compositions

Third, to account for potential structural breaks caused by the 2015 stock market turmoil, we excluded observations from that period. The results in Column (3) remain consistent with the baseline findings, with FIN remaining positive and statistically significant. Finally, we removed observations from the COVID-19 affected years 2020 and 2021 to mitigate the influence of pandemic-related shocks. Column (4) shows that FIN remained positively related to profitability, supporting the robustness of our conclusions.

Taken together, the robustness checks suggest that the positive association between FinTech adoption and bank profitability was stable across alternative profitability measures, different FinTech proxies, and various sample restrictions.

Table 7

Robustness Tests: Alternative Measures and Subsamples

	(1) Replace ROA ROE	(2) Replace FIN ROA	(3) Exclude 2015 ROA	(4) Exclude 2020&2021 ROA
FIN	3.6077***		0.3355***	0.3621***
	(2.7161)		(3.2877)	(2.9997)
FIN_ratio		0.2489**		
		(2.0872)		
SIZE	2.3007***	0.1036**	0.1200***	0.1043**
	(4.0022)	(2.4739)	(2.7291)	(2.1917)

(continued)

	(1) Replace ROA ROE	(2) Replace FIN ROA	(3) Exclude 2015 ROA	(4) Exclude 2020&2021 ROA
CIR	-0.2357***	-0.0197***	-0.0192***	-0.0203***
	(-10.5973)	(-12.0657)	(-11.2071)	(-10.7415)
CAR	0.0832	0.0050	0.0036	0.0002
	(1.0084)	(0.8155)	(0.5438)	(0.0261)
DAR	0.8121***	-0.0336***	-0.0258***	-0.0373***
	(7.1345)	(-3.9919)	(-2.8783)	(-3.9221)
LDR	-0.0645***	-0.0026***	-0.0026***	-0.0029***
	(-5.5942)	(-3.0834)	(-2.9552)	(-3.0219)
PGDP	1.4045***	0.0992***	0.0909***	0.0969***
	(10.1545)	(9.7172)	(8.5165)	(8.4848)
Bank & Year FE	Yes	Yes	Yes	Yes
N	902	902	820	738
F	66.90***	46.29***	41.44***	38.48***
Adjusted R^2	0.8062	0.7678	0.7696	0.7565

Endogeneity Test

Endogeneity may arise from reverse causality and omitted variable bias. To address this concern, we conducted both lagged-variable and instrumental-variable tests.

Lagged FinTech Adoption

First, we replaced FinTech adoption with its one-period and two-period lags. Table 8 shows that both lagged FinTech variables remained positive and statistically significant in Columns (1) and (2), alleviating concerns about short-term reverse causality.

Instrumental Variable Approach

Second, we adopted a two-stage least squares (2SLS) approach, using the one-period lag of the regional Digital Inclusive Finance Index as an instrument for bank FinTech. This instrument is theoretically justified: regional FinTech development is likely correlated with an individual bank's adoption (relevance condition), but is unlikely to directly affect a specific bank's profitability after controlling for economic conditions (PGDP, CPI) and bank-level factors (exclusion restriction). The first-stage results (Column 3) confirm a strong positive predictive power of the instrument for FIN (β= 0.3121, $p < 0.01$). The Anderson LM statistic and the Cragg-Donald Wald F statistic both rejected the null hypothesis of a weak instrument. As shown in Column (4), the second-stage results reveal a statistically positive influence of FinTech adoption on bank profitability (β= 0.8710, $p < 0.05$), which is in line with the baseline evidence.

Table 8

Endogeneity Tests: Lagged FinTech Adoption and Instrumental Variable

	(1) ROA	(2) ROA	(3) 2SLS_1stStage: FIN	(4) 2SLS_2ndStage: ROA
L.FIN	0.3343***			
	(3.4916)			
L2.FIN		0.2823***		
		(2.9756)		
IV			0.3121***	
			(7.3429)	
FIN				0.8710**
				(2.1975)
SIZE	0.1720***	0.2131***	-0.0737***	0.1657***
	(3.7967)	(4.3317)	(-5.0593)	(3.1812)
CIR	-0.0148***	-0.0127***	-0.0021***	-0.0177***
	(-8.7729)	(-7.3174)	(-3.6526)	(-9.4839)
CAR	0.0084	0.0092	0.0051**	0.0003
	(1.3630)	(1.5083)	(2.4081)	(0.0512)
DAR	-0.0306***	-0.0308***	-0.0044	-0.0292***
	(-3.6435)	(-3.6423)	(-1.4905)	(-3.3805)
LDR	-0.0025***	-0.0021**	0.0007**	-0.0031***
	(-2.9126)	(-2.4544)	(2.4062)	(-3.4658)
PGDP	0.1085***	0.1036***	-0.0134***	0.0950***
	(10.1240)	(9.1783)	(-3.1231)	(9.0669)
Constant	1.8525**	1.3815*	0.1895	
	(2.2198)	(1.6488)	(0.6041)	
Anderson LM			56.755	
CD Wald F			53.919	
Bank & Year FE	Yes	Yes	Yes	Yes
N	820	738	902	902
F	38.46***	29.34***	21.42***	45.18***
Adjusted R^2	0.7727	0.7759	0.7596	0.1785

Further Analysis

We additionally explored whether the effect of FinTech adoption on bank profitability varied across bank types and regional digital infrastructure levels.

Heterogeneity by Bank Type

Table 9 presents the results for national and regional banks in Column (1) and Column (2), respectively. FinTech adoption significantly enhanced profitability for regional banks ($\beta = 0.5233$, $p < 0.01$), whereas the effect was insignificant for national banks. A plausible explanation is that regional banks rely more heavily on technological innovation to overcome geographical constraints, optimize services, and enhance competitiveness. In contrast, the pre-existing scale and business advantages of large national banks may reduce the marginal benefits of FinTech adoption.

Heterogeneity by Regional Digital Infrastructure Level

Column (3) and Column (4) report heterogeneity across regions with different levels of digital infrastructure. The coefficient of FinTech adoption was significantly positive only in regions with less developed digital infrastructure (β= 0.3952, p < 0.01), whereas it was insignificant in high-level regions. This finding aligns with the "catching-up" effect: in regions with weaker digital foundations, investments in FinTech can more effectively fill service gaps and reach new customers, yielding higher marginal returns. In well-developed regions, however, competition in technology application is already intense, leaving limited room for additional gains.

The heterogeneity analyses indicate that the profitability-enhancing impact of FinTech was not uniform but was significantly moderated by the strategic positioning of banks and the external digital infrastructure level.

Table 9

Heterogeneity Analysis: Bank Type and Regional Digital Infrastructure Level

	(1) National ROA	(2) Regional ROA	(3) High Digital Infrastructure	(4) Low Digital Infrastructure
FIN	-0.0930	0.5233***	0.2002	0.3952***
	(-0.9683)	(3.0075)	(1.4078)	(2.6273)
SIZE	0.2351***	0.1337***	0.1987***	0.0363
	(3.3273)	(2.5859)	(2.9619)	(0.5674)
CIR	-0.0047	-0.0196***	-0.0177***	-0.0198***
	(-1.3744)	(-10.6831)	(-6.7271)	(-8.9086)
CAR	0.0519***	-0.0020	0.0006	-0.0095
	(4.2024)	(-0.2917)	(0.0767)	(-1.1075)
DAR	-0.0416**	-0.0289***	-0.0077	-0.0445***
	(-2.1147)	(-3.0591)	(-0.6036)	(-3.9865)
LDR	-0.0010	-0.0037***	0.0015	-0.0048***
	(-0.6796)	(-3.7118)	(1.1912)	(-3.7665)
PGDP	0.0000	0.0957***	0.0626***	0.0094
	(.)	(8.7043)	(3.7886)	(0.3862)
Constant	1.7169	2.6114***	-0.2345	5.6621***
	(0.7835)	(2.8276)	(-0.1842)	(4.9927)
Bank & Year FE	Yes	Yes	Yes	Yes
N	176	726	438	464
F	7.61***	42.10***	14.41***	20.51***
Adjusted R^2	0.8734	0.7636	0.8010	0.8136

CONCLUSION

This study investigates the impact of FinTech adoption on bank profitability and the underlying risk-related mechanisms using panel data from 82 Chinese commercial banks. Based on a bank-level FinTech index constructed through textual analysis and an entropy weight method, the results show a positive association between FinTech adoption and bank profitability. This finding remains stable across alternative profitability measures, different FinTech proxies, various sample restrictions, and

after addressing potential endogeneity concerns. More importantly, the analysis demonstrates that risk mitigation constitutes a central transmission mechanism through which FinTech adoption enhances profitability. By jointly examining overall credit, and liquidity risk, this study extends existing research that typically focuses on a single risk dimension. Through reductions across multiple risk dimensions, FinTech enables banks to achieve more stable and sustainable profitability.

These findings yield critical implications for commercial banks, policymakers, and financial regulators. For commercial banks, FinTech should be viewed as a strategic instrument for risk governance rather than merely a tool for efficiency gains. Accordingly, bank managers should align FinTech investments with specific risk-management objectives—such as credit screening, real-time monitoring, and liquidity forecasting—to enhance competitiveness while building a more sustainable foundation for profitability. For policymakers, the findings provide support for China's ongoing policy initiatives that promote FinTech to enhance financial stability and high-quality development, such as the FinTech Development Plan (2022–2025). Differentiated policy incentives, such as regulatory sandboxes and RegTech-oriented supervision, may further amplify these benefits by guiding banks toward prudent and risk-sensitive applications of FinTech.

For financial regulators, the findings underscore the importance of incorporating a risk-based perspective into the supervision of banks' digital transformation. Since the profitability effects of FinTech operate primarily through changes in the risk structures of banks, supervisory frameworks should focus on how FinTech reshapes credit allocation, liquidity management, and overall risk-taking behavior.

While this study focuses on the Chinese banking sector, the identified mechanisms are likely applicable to other emerging economies undergoing rapid digital transformation. Future research could extend the present study framework to cross-country settings or explore the long-term sustainability effects of specific FinTech applications.

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REFERENCES

Adekunle, A. O. (2025). Evaluating the impact of the management of credit risk, market risk and liquidity risk on the performance of banks in Nigeria. *Gusau Journal of Accounting and Finance*, *6*(1), 361-380.

Al-Dmour, A., Al-Dmour, R., Al-Dmour, H., & Al-Adwan, A. (2024). Blockchain applications and commercial bank performance: The mediating role of AIS quality. *Journal of Open Innovation: Technology, Market, and Complexity*, *10*(2), 100302. https://doi.org/10.1016/j.joitmc.2024.100302

Berger, A. N., & Bouwman, C. H. S. (2013). How does capital affect bank performance during financial crises? *Journal of Financial Economics*, *109*(1), 146-176. https://doi.org/10.1016/j.jfineco.2013.02.008

Berger, A. N., & Udell, G. F. (2002). Small business credit availability and relationship lending: The importance of bank organisational structure. *The Economic Journal*, *112*(477), F32-F53. https://doi.org/10.1111/1468-0297.00682

Boot, A., Hoffmann, P., Laeven, L., & Ratnovski, L. (2021). Fintech: What's old, what's new? *Journal of Financial Stability*, *53*, 100836. https://doi.org/10.1016/j.jfs.2020.100836

Chen, Y.-K., Shen, C.-H., Kao, L., & Yeh, C.-Y. (2018). Bank liquidity risk and performance. *Review of Pacific Basin Financial Markets and Policies*, *21*(01), 1850007. https://doi.org/10.1142/S0219091518500078

Cheng, M., & Qu, Y. (2023). Does operational risk management benefit from FinTech? *Emerging Markets Finance and Trade*, *59*(14), 4012-4027. https://doi.org/10.1080/1540496X.2022.2164464

Cheng, M., & Qu, Y. (2020). Does bank FinTech reduce credit risk? Evidence from China. *Pacific-Basin Finance Journal*, *63*, 101398. https://doi.org/10.1016/j.pacfin.2020.101398

China Banking Association. (2023). *2023 Annual Report on the Development of China's Banking Industry*.

Conlon, T., Cotter, J., & Molyneux, P. (2020). Beyond common equity: The influence of secondary capital on bank insolvency risk. *Journal of Financial Stability*, *47*, 100732. https://dx.doi.org/10.2139/ssrn.3126805

Daud, S. N. M., Ahmad, A. H., Khalid, A., & Azman-Saini, W. N. W. (2022). FinTech and financial stability: Threat or opportunity?. *Finance Research Letters*, *47*(Part B), 102667. https://doi.org/10.1016/j.frl.2021.102667

Demirgüç-Kunt, A., & Huizinga, H. (2010). Bank activity and funding strategies: The impact on risk and returns. *Journal of Financial Economics*, *98*(3), 626-650. https://doi.org/10.1016/j.jfineco.2010.06.004

Duffie, D., & Singleton, K. J. (2003). *Credit risk: Pricing, measurement, and management*. Princeton University Press.

Guo, X. H. (2022). *How does fintech application affect Commercial Banks: From the perspective of efficiency, business and risk* [Doctoral dissertation, Shanghai University of Finance and Economics].

Gupta, S. D., Raychaudhuri, A., & Haldar, S. K. (2018). Information technology and profitability: Evidence from Indian banking sector. *International Journal of Emerging Markets*, *13*(5), 1070-1087. https://doi.org/10.1108/IJoEM-06-2017-0211

Harle, P., Havas, A., & Samandari, H. (2016). *The future of bank risk management*. McKinsey & Company.

Hasan, M., Hoque, A., & Le, T. (2023). Big data-driven banking operations: Opportunities, challenges, and data security perspectives. *FinTech*, *2*(3), 484-509. https://doi.org/10.3390/fintech2030028

He, X. G., Luo, X., & Kuang, Y. Q. (2023). Digital transformation and commercial bank risk-taking. *Enterprise Economy*, *42*(6), 121-132.

Huang, L., Huang, S. G., & Yang, C. J. (2023). The Impact and role mechanism of fintech on green credit——based on the perspective of fintech in commercial banks. *Journal of Financial Development Research*, (7), 73-82. https://doi.org/10.19647/j.cnki.37-1462/F.2023.07.009

Kashyap, A. K., Rajan, R., & Stein, J. C. (2002). Banks as liquidity providers: An explanation for the coexistence of lending and deposit-taking. *The Journal of Finance*, *57*(1), 33-73. https://doi.org/10.1111/1540-6261.00415

Khan, H. H., Khan, S., & Ghafoor, A. (2023). Fintech adoption, the regulatory environment and bank stability: An empirical investigation from GCC economies. *Borsa Istanbul Review*, *23*(6), 1263-1281 https://doi.org/10.1016/j.bir.2023.10.010

Königstorfer, F., & Thalmann, S. (2020). Applications of artificial intelligence in commercial banks–A research agenda for behavioral finance. *Journal of Behavioral and Experimental Finance*, *27*, 100352. https://doi.org/10.1016/j.jbef.2020.100352

Laeven, L., & Levine, R. (2009). Bank governance, regulation and risk taking. *Journal of Financial Economics*, *93*(2), 259-275. https://doi.org/10.1016/j.jfineco.2008.09.003

Li, C. T., Yan, X. W., & Song, M. (2020). FinTech and corporate innovation: Evidence from Companies listed on the NEEQ market. *China Industrial Economics,* (1), 81-98. https://doi.org/10.19581/j.cnki.ciejournal.2020.01.006

Li, Z. H., Chen, H. L., & Zhang, X. D. (2022). The impact of fintech upon the profitability of commercial banks. *Journal of Zhongnan University of Economics and Law*, *254*(5), 56-68.

Liu, M. F., & Wang, Q. (2022). Research on the impact mechanism of digital finance on commercial bank risk-taking. *Journal of Accounting and Economics*, *36*(1), 86-104. https://doi.org/10.16314/j.cnki.31-2074/f.2022.01.006

Liyanaarachchi, G., Deshpande, S., & Weaven, S. (2021). Market-oriented corporate digital responsibility to manage data vulnerability in online banking. *International Journal of Bank Marketing*, *39*(4), 571-591. https://doi.org/10.1108/IJBM-06-2020-0313

Mansour, N. (2024). The impact of Fintech development on commercial banks' profitability. *Journal of Organizational and End User Computing*, *36*(1), 1-18. https://doi.org/10.4018/JOEUC.349933

Mirza, N., Umar, M., Afzal, A., & Firdousi, S. F. (2023). The role of fintech in promoting green finance, and profitability: Evidence from the banking sector in the euro zone. *Economic Analysis and Policy*, *78*, 33-40. https://doi.org/10.1016/j.eap.2023.02.001

Murinde, V., Rizopoulos, E., & Zachariadis, M. (2022). The impact of the finTech revolution on the future of banking: Opportunities and risks. *International Review of Financial Analysis*, *81*, 102103. https://doi.org/10.1016/j.irfa.2022.102103

Nahar, J., Hossain, M. S., Rahman, M. M., & Hossain, M. A. (2024). Advanced predictive analytics for comprehensive risk assessment in financial markets: Strategic applications and sector-wide implications. *Global Mainstream Journal of Business, Economics, Development & Project Management*, *3*(4), 39-53. https://doi.org/10.62304/jbedpm.v3i4.148

Oko-Odion, C., & Angela, O. (2025). Risk management frameworks for financial institutions in a rapidly changing economic landscape. *International Journal of Science and Research Archive*, *14*(1), 1182-1204. https://doi.org/10.30574/ijsra.2025.14.1.0155

Patel, R., Migliavacca, M., & Oriani, M. E. (2022). Blockchain in banking and finance: A bibliometric review. *Research in International Business and Finance*, *62*, 101718. https://doi.org/10.1016/j.ribaf.2022.101718

Pfeffer, J., & Salancik, G. R. (1978). *The external control of organizations: A resource dependence perspective*. Harper & Row.

Philippon, T. (2016). *The fintech opportunity* (Working Paper No. 22476). National Bureau of Economic Research.

Saunders, A., Cornett, M. M., & Erhemjamts, O. (2026). *Financial institutions management: A risk management approach.* McGraw-Hill

Sebastian, D. (2025). Modernizing credit risk with data mesh: A large bank's transformation to real-time credit intelligence. *Journal of Computer Science and Technology Studies*, *7*(10), 650-664. https://doi.org/10.32996/jcsts.2025.7.10.65

Shibahathulla, T. K., Ali, M. A., Gayyor, O., & Ghaffari, A. Z. (2024). The role of automated controls and streamlined compliance in managing risks in digital finance. *International Journal of Financial Engineering*, *11*(03), 2443004. https://doi.org/10.1142/S2424786324430047

Singh, R., Malik, G., & Jain, V. (2021). FinTech effect: Measuring impact of fintech adoption on banks' profitability. *International Journal of Management Practice*, *14*(4), 411-427. https://doi.org/10.1504/IJMP.2021.116587

Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American Economic Review*, *71*(3), 393-410. https://www.jstor.org/stable/1802787

Tang, S. F., & Wu, W. Y. (2024). Impact of digital transformation on the profitability of commercial banks: Empirical evidence from listed commercial banks in China. *Journal of Technology Economics*, *43*(9), 72-84. https://doi.org/10.12404/j.issn.1002-980X.J24012314

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, *18*(7), 509-533. https://doi.org/10.1002/(SICI)1097-0266(199708)18:7%3C509::AID-SMJ882%3E3.0.CO;2-Z

Thakor, A. V. (2020). Fintech and banking: What do we know?. *Journal of Financial Intermediation*, *41*, 100833. https://doi.org/10.1016/j.jfi.2019.100833

The People's Bank of China. (2022). *FinTech development plan (2022-2025)*. https://www.pbc.gov.cn/zhengwugongkai/4081330/4406346/4693549/4470403/index.html

Wang, J. T. (2024). *Research on the impact of digitalization on risk taking in commercial banks* [Master's thesis, East China Normal University].

Wang, Y., Sui, X. P., & Zhang, Q. (2021). Can fintech improve the efficiency of commercial banks? — An analysis based on big data. *Research in International Business and Finance*, *55*, 101338.

Wu, X., Jin, T., Yang, K., & Qi, H. (2023). The impact of bank FinTech on commercial banks' risk-taking in China. *International Review of Financial Analysis*, *90*, 102944. https://doi.org/10.1016/j.irfa.2023.102944

Yahaya, A., Mahat, F., Yahya, M. H., & Matemilola, B. T. (2022). Liquidity risk and bank financial performance: An application of system GMM approach. *Journal of Financial Regulation and Compliance*, *30*(3), 312-334. https://doi.org/10.1108/JFRC-03-2021-0019

Zhao, Y., Goodell, J. W., Wang, Y., & Abedin, M. Z. (2023). Fintech, macroprudential policies and bank risk: Evidence from China. *International Review of Financial Analysis*, *87*, 102648. https://doi.org/10.1016/j.irfa.2023.102648

Zheng, C., Rahman, M. A., Hossain, S., & Moudud-Ul-Huq, S. (2023). Does fintech-driven inclusive finance induce bank profitability? Empirical evidence from developing countries. *Journal of Risk and Financial Management*, *16*(10), 457.

Appendix A. Classification of FinTech-Related Keywords

Category	Keywords
Artificial Intelligence (26)	Artificial Intelligence, Robotics, Machine Learning, Deep Learning, Neural Network, Facial Recognition, Biometrics, Pattern Recognition, Face Payment, Virtual Reality, Augmented Reality，Natural Language Processing, Knowledge Graph, Smartization, Smart Deposit, Smart Counter, Smart Finance, Smart Branch, Smart, Smart Bank, Smart Marketing, Intelligent, Intelligence-based, Intelligent Risk Control, Intelligent Finance, Automation
Big Data (20)	Big Data, Big Data Analysis, Big Data Services, Big Data Technology, Big Data Models, Big Data Mining, Data Warehouse, Data Technology, Data Models, Data Mining, Data Governance, Data Center, Digitalization, Digital Transformation, Digital Finance, Digital Signatures, Digital Ecosystem, Digital Bank, Digital Credit Card, Digital Marketing
Blockchain (11)	Blockchain, Distributed Ledger, Supply Chain, Internet of Things, Near Field, Quantum, Quantum Communication, Quantum Telecommunication, Data Encryption, Digital Currency, Electronic Money
Cloud Computing (19)	Distributed, Distributed Storage, Distributed databases, Distributed Computing, Distributed architecture, Financial Cloud, Trusted Computing, Cloud Migration, Private Cloud, Virtualization, Privacy Computing, Cloud, Cloud Platform, Cloud System, Cloud Architecture, Cloud Services, Cloud Service Platform, Cloudization, Cloud Computing
Online-based FinTech Applications（26）	E-commerce, Electronic, Electronic Finance, E-channels, E-banking, E-payment, Electronic commerce, Internet, Internet Finance, Financial Technology, FinTech, Digital technology, Network, Online Finance, Online Wealth Management, Online Lending, Online Consumer Loans, Online Banking, Online Payment, Internet Banking, Online Transaction, Web-based Banking, Internet payment, Online Platform, Online-enabled
Mobile-based FinTech Applications（16）	Scenario-based, Scenario-based Finance, Open Platform, Open Banking, Platformization, Mobile Banking APP, Mobile Payment, Barcode Payment, Mobile E-commerce, Mobile Finance, Mobile Internet, Mobile Connectivity, Mobile Banking, Digital Payment, Direct Bank, Data Center