

Research on the Impact, Mechanism and Heterogeneity of Financial Technology on the Operations of Commercial Banks

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Abstract. FinTech refers to the new business model, application, process and product formed after digital technology enters the financial services sector. This article distinguishes between the external shock caused by the entry of FinTech enterprises into traditional financial markets and the internal transformation carried out by commercial banks through the application of digital technology. It examines the impact of FinTech on the operations of commercial banks from three aspects: profitability, risk-taking and business structure, and analyzes three transmission mechanisms: information asymmetry, market competition and liquidity creation. The research shows that the external development of FinTech will divert bank deposits, payment services and credit customers, putting pressure on traditional income; after banks apply digital technology to customer identification, credit approval and internal operations, they can reduce information processing costs and expand service scope. FinTech helps to reduce the credit risk of individual banks, while deposit competition, profit constraints, model convergence and enhanced inter-bank connections may increase risk-taking or expand systemic risks. These impacts vary with bank size, property rights and business model, as well as the level of digital infrastructure and technology application in the region. Regulatory authorities need to implement classified supervision based on the source of technology, bank type and risk level, while commercial banks should choose a transformation path that is compatible with their customer base and technical capabilities.

Keywords: Financial Technology, Commercial Bank, Profitability, Risk Taking, Liquidity Creation, Heterogeneity

1. Introduction

Financial technology refers to the financial innovation formed by the combination of digital technologies such as big data, cloud computing, artificial intelligence, and blockchain with financial business. The Financial Stability Board defines it as technology-driven financial service innovation, which can create new business models, applications, processes or products, and have a substantive impact on financial markets, financial institutions and financial service provision [1]. From the perspective of commercial bank operations, financial technology includes both the external impact caused by the entry of fintech enterprises into markets such as payment, credit and wealth

management, and the digital transformation of commercial banks where digital technologies are applied in customer identification, product pricing, credit approval, internal operations and risk management. The development of external fintech mainly changes the market competition faced by banks, while the internal digital transformation of banks directly affects information processing, business costs and risk management capabilities.

There are differences in the judgments made by current research on the impact of fintech operations. One group of studies holds that fintech enterprises, relying on data, platforms, and online scenarios, enter traditional financial markets, which will divert banks' deposits, payment services, and credit customers, resulting in increased capital costs, reduced fee income, and narrowed profit margins [2, 3]. Another group of studies found that after commercial banks apply digital technologies, they can expand information sources, reduce customer identification and credit approval costs, and improve operational efficiency and risk management capabilities [4, 5]. The differences in these two sets of conclusions are also related to the scope of indicators. The regional digital finance index mainly reflects the external technological and competitive environment in which banks operate, while indicators such as technological investment, annual report texts, and cooperation between banks and technology enterprises are closer to the banks' own digital capabilities; bank operating results include profitability, credit risk, risk assumption, systemic risk, and business structure, and different indicators correspond to different functional links with varying effects.

Based on this, this paper distinguishes between the external shocks of fintech and the internal digital transformation of banks, and examines their respective impacts on the profitability, risk-taking, and business structure of commercial banks. It also analyzes the transmission mechanism from three aspects: information asymmetry, market competition, and liquidity creation. On this basis, it further compares the differences in the impacts on banks of different sizes, ownership, business models, and regions, and proposes corresponding regulatory and digital transformation suggestions.

2. The multi-dimensional impact of financial technology on bank operations

When fintech enters the banking sector, it simultaneously alters the bank's revenue sources, cost structure, risk identification, and asset-liability allocation. The external development of fintech affects bank operations through customer diversion and market competition, while the internal digital transformation of banks influences operational efficiency through information processing and process reengineering. These two effects combine, causing the operational results to change with the stage of development and the bank's conditions.

2.1. Structure changes in profitability

The profits of commercial banks mainly come from the interest margin of deposits and loans, income from intermediary services, and other operating and investment gains. They are affected by factors such as capital costs, asset returns, business scale, and operating expenses. After fintech enterprises enter the traditional financial market, they will influence bank profits through three aspects: liabilities, assets, and payments. On the liability side, online wealth management and platform-based financial products increase customers' sensitivity to yields and transaction convenience, and some low-cost deposits shift to market-oriented financial products. Banks need to raise deposit prices or increase interbank funds to maintain the liability scale [2]. On the asset side, internet platforms use consumption, transaction, and payment data to conduct online credit,

competing for the original retail and small and medium-sized enterprise customers of banks. On the payment side, third-party payments reduce banks' opportunities to directly contact customers and also divert settlement and handling fee revenues. These changes increase banks' customer acquisition and capital costs, and compress the profits of traditional businesses.

In the early stage of fintech development, external competition usually manifests itself before the internal technological benefits of banks [3], based on data from Chinese commercial banks, found that the competitive effect of fintech was stronger than the technological spillover effect during the sample period, and it had a negative impact on bank profits. City commercial banks were more significantly affected [6]. discovered that there is a U-shaped relationship between fintech and the profitability of commercial banks: in the early stage of development, the diversion effect of platform institutions on customers and business was strong; as banks gradually absorbed digital technologies, the technological spillover effect began to increase. Fintech enterprises can quickly enter the standardized payment and retail credit markets, while the system construction, organizational adjustment, and talent accumulation of banks require a longer period. Thus, there is a time lag between the competitive impact and the technological benefits.

After banks applied digital technology to their internal operations, online channels could expand the scope of services, automatic approval and intelligent operations could reduce repetitive manual work, and customer data analysis could help in customer stratification and cross-selling of products [5]. found that after banks entered strategic cooperation with technology enterprises, they could improve their operating performance by enhancing innovation capabilities, improving operational management, developing inclusive finance, and expanding intermediary businesses. However, digital transformation also requires bearing the costs of information system construction, data governance, talent acquisition, and compliance management [7]. studied 8,227 bank branches and found that fintech reduced sales expenses but increased operating and management costs, and the profitability and growth of the branches in the sample were restrained. Whether the application of technology can increase profits depends on whether banks can convert the system investment into customer growth, unit cost reduction, and improvement of the income structure.

2.2. Hierarchical impact of risk undertaking

The risks of commercial banks include both the individual risks formed by each bank in its credit, market and operational activities, as well as the systemic risks resulting from the spread of risks through common assets, interbank business and interbank connections. Financial technology can enhance the bank's ability to identify borrower risks, and it will also change risk undertaking through deposit competition, profit constraints and interbank connections. Therefore, it is necessary to make judgments based on different risk levels.

At the individual risk level, banks can obtain information such as borrowers' transactions, payments, taxes, and supply chain information beyond financial statements, collateral, and credit records, and convert continuous business records into credit characteristics. After the data enters the credit granting model, banks can improve the accuracy of identifying default probabilities, shorten the approval time, and promptly issue warnings when abnormal situations occur during post-loan operations [4]. found that fintech can reduce bank risks by alleviating information asymmetry, expanding business boundaries, and enhancing risk response capabilities [5]. also found that after commercial banks and technology enterprises carry out strategic cooperation, credit risks have decreased.

External competition will influence a bank's risk appetite through debt costs and profit constraints. After platform products divert deposits and high-quality customers, the bank's funding

costs increase, and the net interest margin and franchise value decline. To maintain profits, some banks may increase high-yield loans, relax customer admission standards, or expand interbank business, thereby increasing risk-taking [2]. found that internet finance changed the bank's liability structure, increased the proportion of market-based funds, and prompted banks to allocate riskier assets; [8] further pointed out that internet finance affects bank risk-taking by intensifying deposit competition, increasing interest payment costs, and changing the deposit structure. When banks use fintech themselves, efficiency improvement and business diversification can increase the operating-related franchise value, which inhibits risk-taking [9]. Changes in individual risk depend on which is more advantageous: the profit pressure caused by competition or the risk management benefits resulting from internal transformation.

Systemic risk is also influenced by inter-bank connections and business models. When multiple banks use similar data, models, and asset allocation rules, market changes may lead to synchronized adjustments; banks' concentrated reliance on a few technology service providers also increases the common sources of operational risks [10]. found that fintech can expand systemic risk spillover by enhancing bank risk-taking and strengthening inter-bank connections [11]. observed during the examination of banks' internal digital transformation that digitization can reduce network interdependence and systemic risk. The former study focused on the comprehensive impact formed by fintech development, while the latter study focused on the internal transformation of banks. The technical sources and risk transmission links of the two conclusions are different. Even after the credit risk of a single bank decreases, it is still necessary to continue to examine the common technological dependence, asset allocation convergence, and risk transmission.

2.3. Dynamic adjustment of business structure

FinTech has enabled commercial banks to restructure their assets, liabilities, and income through changes in customer acquisition methods and credit technologies. On the asset side, online customer acquisition, remote credit granting, and automatic approval have reduced the unit service cost of microloans, allowing banks to cover the small and medium-sized enterprises and tail-end customers with higher service costs under the traditional branch model [12]. found that digital footprints can complement traditional credit information and enhance the ability to distinguish credit risks; [13] discovered that technology-based lending institutions can shorten the processing time for mortgage loans and maintain strong supply capacity when loan demand increases. The evidence from [14] on China's banking industry shows that digital transformation can expand bank credit supply and promote more credit funds to flow into the real economy.

Changes in credit technology will also alter the customer boundaries of banks of different sizes. In the past, small and medium-sized banks mainly relied on branch locations, local relationships, and soft information services to serve small and micro enterprises. After large banks adopted data technology, they could convert enterprise transactions, tax information, and business activities into standardized information, thereby reducing the management costs of cross-regional operations and small loans [15]. found that fintech strengthened transaction-based loan technologies and promoted bank credit supply for small and micro enterprises; [16] pointed out that after large banks entered the small and micro loan market, they would compete for the low-risk customers originally held by small and medium-sized banks, which would have a market crowding-out effect on small and medium-sized banks. On the liability side, internet wealth management and other high-liquidity products increased the sensitivity of deposits to yield rates; on the income side, third-party payment and online wealth management compressed some traditional fee income, and also promoted banks to develop scenario finance, wealth management, and comprehensive financial services. The

downward shift of customers on the asset side, the marketization of the liability side, and the adjustment of income sources jointly drove changes in the business structure of the banking industry.

3. The internal mechanism of impact transmission

The influence of fintech on banks' profits, risks and business structure mainly occurs in three operational aspects: information production, market competition, and asset-liability transformation. Information production determines whether banks can identify and price risks; market competition affects customers, funds and profits; and liquidity creation connects the sources of liabilities, loan disbursement and risk assumption.

3.1. Mechanism for reducing information asymmetry

Information asymmetry refers to the situation where borrowers and banks have different information regarding the business conditions, repayment capabilities, and risk levels. Banks reduce the monitoring costs for both parties by collecting information, screening borrowers, and conducting post-loan supervision [17]. Financial technology first expands the sources of information, incorporating payment, transaction, tax, logistics, and supply chain records into credit evaluation; data processing technology then converts scattered records into comparable credit characteristics, helping banks identify the stability of borrowers' operations and their probability of default; the credit granting and post-loan systems adjust loan amounts, interest rates, and warning rules based on new information. After the scope of information acquisition expands and processing time is shortened, the screening and supervision costs of banks decrease, and adverse selection and moral hazard are alleviated.

Digital data will also change the way soft information is used. Small and micro enterprises lack standardized financial statements and qualified collateral, and their operational capabilities, transaction relationships, and the intentions of business owners usually rely on soft information formed through long-term interactions. Financial technology can convert some transaction and behavior records into standardized indicators, enabling large banks to process small loans regionally and in batches [12]. found that digital footprints have information content that complements traditional credit reporting; [15] discovered that financial technology has enhanced the transactional loan technology of banks, promoting the integration of soft and hard information. Local relationships, business owner capabilities, and operational intentions still cannot be fully encoded, and data deviations and model inaccuracies may cause new identification errors. Whether the information mechanism can improve credit allocation depends on data quality, model stability, and whether manual review can retain necessary local information.

3.2. Market competition mediating mechanism

FinTech has transformed bank competition, mainly manifested in new entrants competing for customers and funds, as well as banks using technology to adjust costs and products. After platform institutions enter the payment, wealth management, and credit markets by leveraging low-cost customer acquisition and online scenarios, the transfer of customers increases the bank's customer acquisition costs, the substitution of deposits raises the fund prices, and the net interest margin and fee income are squeezed. The decline in profits will prompt banks to reduce costs, develop new products, and may also prompt banks to increase high-yield assets and risk exposure [2]. and [8]

respectively revealed the process by which internet wealth management and deposit competition affect bank operations through liability structure, capital costs, and asset allocation.

After banks apply digital technology to their operations, they can reduce some branch and labor costs, expand customer coverage, and increase the value of business-related franchises through product diversification [9]. When competition pressure is low, banks may lack the motivation for technological transformation and product innovation; when competition is intense, profits and franchise values will decline, which in turn will strengthen the motivation to pursue high-yield assets [18]. pointed out that the relationship between bank competition and failure risk may be U-shaped. Evidence from Chinese small and medium-sized banks also shows that digital finance can increase risk-taking by intensifying competition [19]. The transmission process of market competition can be summarized as "customer and capital transfer - changes in income and costs - adjustment of business strategies - changes in profits and risks", and the direction of the effect depends on whether the cost improvement of banks can cover the competitive losses.

3.3. Mechanisms of liquidity creation and management

Liquidity creation refers to the process by which banks utilize short-term or immediately redeemable liabilities to support non-liquid assets such as loans, thereby providing payment and financing convenience to the economy [20]. FinTech influences liquidity creation through two aspects: the source of liabilities and the allocation of assets. After online wealth management and platform-based products divert stable deposits, the funding base and profit margin that banks rely on for term conversion are affected; after banks enhance their digitalization level, the costs of customer identification, loan approval, and transaction processing decrease, which is conducive to expanding loan issuance [21]. found that when the coverage and usage depth of FinTech increase, the external competitive effect is strong, and the overall, asset-side, and off-balance sheet liquidity creation of banks are suppressed, while the influence on the liability side lacks significant evidence; an increase in the bank's own digitalization level will promote liquidity creation.

Liquidity creation and liquidity hoarding reflect different banking behaviors. Liquidity creation measures the conversion of short-term liabilities into non-liquid assets, while liquidity hoarding reflects the precautionary behavior of banks holding cash and other highly liquid assets to cope with uncertainties. These two indicators cannot be mutually substituted [22]. found that fintech increases active risk-taking by enhancing liquidity creation, and reduces passive risk-taking by improving operational efficiency [23]. discovered that fintech can enhance banks' risk tolerance and reduce precautionary holdings of liquid assets [24]. further found that risk-taking and operating performance are important channels through which fintech alleviates liquidity hoarding. Fintech may respectively alter loan disbursement, term mismatch, and liquid asset holdings. Research and regulation need to first clearly define the liquidity indicators being examined.

4. Heterogeneity analysis of the impact

The same fintech shock will vary due to differences in the fixed investment capacity, customer base, information sources, and regional digital conditions of banks. The scale affects whether banks can share the technical costs, property rights and business models influence decision-making and risk preferences, and regional infrastructure determines whether data can be transformed into credit and operational capabilities.

4.1. Bank scale heterogeneity

Large banks possess more customer data, a more complete technical team, and stronger capital-bearing capacity. They can spread the costs of system construction and model development over a larger business scale [25]. found that as the bank size expands, the risk-suppressing effect of fintech shifts from lacking significance to being significant, and it shows a non-linear enhancement; technological application also increases the interest income and customer deposit ratio of large banks. After large banks utilize data technology to enter the microcredit market, they can reduce the information disadvantage caused by past reliance on branches and local relationships, thereby competing for the low-risk customers that small and medium-sized banks originally had [16].

After obtaining technical services, small and medium-sized banks may also achieve significant marginal improvements in risk management and customer coverage [4]. found that the role of fintech in risk management is stronger in small and medium-sized banks; [16] and [25] discovered that small and medium-sized banks face customer exclusion and insufficient conversion ability of technological investment. The sources of these two results are different: sharing technologies and online channels can make up for the original technical shortcomings of small and medium-sized banks, while large banks entering local markets across regions will increase competition pressure. Whether small and medium-sized banks can benefit from fintech depends on whether they can adopt affordable technical solutions while retaining local customers and soft information advantages.

4.2. Property rights and business model heterogeneity

Property rights differences are often intertwined with bank size, capital adequacy ratio, and business structure. State-owned large banks possess advantages in terms of funds, human resources, and data, and can undertake long-term system construction and apply their technical capabilities for internal or external group output; Shareholding banks have a relatively high proportion of retail business, with quick product adjustments and market responses, and are more susceptible to market-based debt fluctuations and inter-bank competition; City commercial banks and rural commercial banks rely on local customers and relationship information. If a unified platform and standard model lack local data support, it may undermine their original comparative advantages [26]. found that the impact of fintech on the profitability of different property rights banks varies [27]. found that fintech can enhance the willingness to provide inclusive loans, reduce risks, and improve operating performance. Property rights heterogeneity needs to be analyzed together with scale and business model, and the differences in capital, customers, and technical capabilities should not be entirely attributed to property rights nature.

4.3. Heterogeneity of regional digital infrastructure

The regional network, computing power, credit information, and public data conditions determine whether banks can continuously obtain and process customer information. When the digital infrastructure is more complete, banks are more likely to use tax, transaction, and supply chain data for credit granting, and online credit is also more likely to cover small and medium-sized enterprises [15]. found that the effect of fintech on promoting credit supply to small and medium-sized enterprises is the strongest in the eastern region, followed by the central region, and there is no significant evidence in the western region [28]. examined the risk-taking ability of banks and found that fintech brings stronger marginal improvements in less developed regions. The former study

measures small business credit supply, while the latter measures the ability of banks to identify and bear risks. The outcome variables are different, so a direct comparison of directions cannot be made.

FinTech will also reduce the information and service costs caused by distance. Online customer acquisition, remote due diligence, and centralized risk control reduce the reliance of branches on on-site contact, enabling the head office to provide models, data and operational support to distant branches [27]. found that the farther a branch is from the head office, the more significant the improvement in the performance and risk control of inclusive lending brought about by FinTech. After the distance constraint is weakened, remote areas still require stable networks, verifiable data and local service personnel for support. Regional digital infrastructure construction should not only expand network coverage but also improve the quality of public data and the degree of cross-departmental data integration.

5. Conclusion and policy implications

The direction of bank operations being influenced by fintech depends on whether the impact comes from external competition or internal transformation within the bank, and also on whether the bank can convert technological investment into information processing, cost control, and risk management capabilities. Regulation and bank transformation should be configured with policy tools based on specific operational aspects, and it is not necessary to infer all operational outcomes solely based on a single fintech indicator.

5.1. Implement hierarchical and categorized supervision

The regulatory authorities should distinguish between individual credit risks, active risk-taking, liquidity risks, and systemic risks, and monitor deposit migration, net interest margin, expansion of high-risk assets, model concentration, technology outsourcing, and inter-bank associations separately. For systemically important banks, the focus should be on assessing the risk transmission formed by common models, shared service providers, and network interconnections; for small and medium-sized banks, attention should be paid to the compression of capital due to technological investment, customer loss, and the decline in liquidity buffers. When fintech development is rapid and inter-bank associations are strengthened, stress testing, counter-cyclical capital, and liquidity requirements can be used to limit the risk spillover [10, 29].

5.2. Select a transformation path compatible with bank conditions

Large banks can build a universal technology platform and output data, models and operational capabilities, while controlling the concentration of technology service providers and the boundaries for the use of internal data within the group. Shareholding banks can leverage their advantages in retail products and organizational adjustments, linking technology investment to outcome indicators such as customer retention, risk costs and non-interest income. Small and medium-sized banks are more suitable for adopting modular procurement, industry collaboration and regional cooperation, concentrating on transforming the weakest links in customer identification, credit monitoring and operations, and retaining local soft information and differentiated services. All types of banks need to set up pilot scope, effect evaluation and exit arrangements, and the scale of technology investment cannot directly replace the evaluation of transformation effects.

5.3. Improving digital infrastructure and talent systems

Underdeveloped regions should prioritize the completion of network, computing power, credit assessment, and public data standards, and establish a data usage mechanism that is authorized, traceable, and capable of correcting errors. Cross-institutional data sharing requires clear definitions of data usage scope, retention period, and responsibility boundaries, as well as retention of channels for manual appeals and review. Talent development should cover financial business, data analysis, model verification, cybersecurity, and compliance management. Through regional joint laboratories, job rotations, and continuous training, the technical absorption capacity of small and medium-sized banks can be enhanced. Digital infrastructure determines whether banks can obtain and process data, while data governance and talent capabilities determine whether technology can be effectively transformed into business results.



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(a) This is the first part



(b) This is the second part

Figure 2: A figure containing two parts

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