Impact of Financial Digitalization on Organizational Performance: A Look at the Dark Side

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ABSTRACT

Digitalization profoundly affects organizational performance, especially in the financial industry, by disrupting established business models and providing new opportunities for value creation. The combination of advanced internet technology and financial services—namely financial technology (fintech)—has become the most inflammatory component of financial digitalization. However, there is limited knowledge in academia about the effect of fintech on traditional financial intermediation. Using panel data of China’s bank sector from 2013 to 2019, the researchers found that financial digitalization is negatively associated with the performance of banks. In addition, further research on the moderating effect shows that the monetary policy easing cycle, the high financial friction environment, and the risk-taking preference of banks could mitigate the negative effect of fintech development on bank performance. These findings contribute to the literature on financial digitization and traditional financial intermediation and have implications for banking practitioners and regulators.

KEYWORDS
Dark Side of Digitalization, Financial Digitalization, Financial Technology, Organizational Performance

INTRODUCTION

The development of digitalization has become a key factor affecting organizational performance because it provides new opportunities for value creation (Matt et al., 2015). Since the introduction of automated teller machines (ATMs) into the financial industry, extensive digital research on the financial sector has focused on academic discussion (Zavolokina et al., 2016). The new concept of digital technology is bringing creative destruction to the financial industry, whose core is manipulating and transmitting digital information (Clarke, 2019). The global spread of information technology (IT) has intensified the digital innovation of the financial industry. Recent research on the digitalization of the financial industry regards the combination of artificial intelligence, blockchain, cloud computing, big data technology, and the financial industry as “financial technology (fintech),” which is considered the most disruptive component in the process of financial digitalization (Gomber et al., 2017). Fintech broadly describes the modern connection between mature business activities in the financial services industry (e.g., transaction banking, money lending) and internet-related technologies (e.g., mobile
internet, cloud computing) (Puschmann, 2017). Fintech’s disruption is reflected in more and more mature technology companies, and fintech start-ups (collectively referred to as “fintech companies”) are involved in wholesale payment, retail finance, insurance, investment management, and other financial services. This challenges traditional financial service providers (Abdou, & Jasimuddin, 2020; An & Rau, 2021; Gomber et al., 2017; Lee, 2015; Omigie et al., 2020; Panos & Wilson, 2020; Peng et al., 2020; Rahman et al., 2020; Zavolokina et al., 2016). Although the discussion about the digitalization of the financial industry has a long history, research on the effect of fintech on the financial industry lacks sufficient discussion (Phan et al., 2020; Wang et al., 2020).

Banks, as a traditional financial intermediary, are an essential part of the finance industry by allocating scarce financial resources (Bos & Kool, 2006). Existing literature has begun to study the effect of the development of fintech on banks, but there is no consensus on whether the two are “foes” or “friends.” Some studies suggest that the development of fintech has increased competition in the financial industry, which may reduce bank performance. First, fintech start-ups can meet the diverse financial needs of their customers more efficiently and conveniently (Mazana et al., 2016). Second, fintech subsidiaries derived from internet giants can develop richer financial service solutions based on existing technology foundations and platform application scenarios, which further intensifies the competition faced by the banking industry (Temelkov, 2018). Third, mature IT companies gradually become involved in financial services and rely on a solid technology base to respond flexibly to the development of fintech (Bollaert et al., 2021). In addition, some studies have discussed the role of banking industry participation in fintech development to promote performance. First, banks provide customers with more cost-effective and faster transaction processing by leveraging fintech to shape digital products and optimize operational processes (Lee et al., 2021). Second, banks can use big data to detect fraud and enhance network security to improve the risk management of online banking (Gai et al., 2018). In short, the development of fintech is a double-edged sword for bank performance.

This study explores the effect of fintech development on bank performance in the context of financial digitalization in China. There are several reasons why the study scenario is set in China. First, China has become a leading fintech market globally (Ernst Young, 2019). Investment in China’s fintech industry accounted for more than 46% of total global investment in 2018 (Accenture, 2018). The adoption rate of fintech in the Chinese market reached 87% in 2019, while the adoption rate of fintech products used for money transfer and mobile payment was 95% (Ernst Young, 2019). The fintech market in China provides opportunities for the development of fintech with high adoption rates and suitable market conditions (Wharton, 2019). Second, China’s fintech companies are proliferating, including fintech start-ups (e.g., Lianyirong, Bairong, Snowball) and mature IT companies involved in the financial sector (e.g., Alipay, Jingdong Finance, WeChat Pay). According to KPMG (2019), four Chinese fintech companies are listed among the top 10 global fintech innovators. Third, China’s banking industry is actively participating in the development of fintech. Specifically, fintech services are developed by establishing fintech subsidiaries affiliated with the headquarters (Wang et al., 2020)—for example, One Connect of Ping An Bank and CIB FinTech of Industrial Bank (IDC, 2021). In addition, banks promote the application of fintech by increasing research and development investment in IT (Ky et al., 2019). For example, in 2020, Chinese banking institutions’ total IT capital investment reached 207.8 billion yuan, an increase of 20% on the previous year (Deloitte, 2021). Fourth, fintech actively cooperates with the banking industry to promote the transformation of traditional financial services by using rich internet application scenarios and cutting-edge IT (Meinert, 2017). Therefore, it is interesting to study China’s financial digitalization to determine the effect of the development
of fintech on bank performance. This study aims to answer whether and how fintech development affects bank performance.

To answer this research question, this study uses the non-bank payment data published by the People’s Bank of China (PBC) to measure the effect of fintech development on the performance of listed banks. The development of non-bank payments can reflect the financial business development of non-bank institutions (e.g., Alipay, WeChat). Non-bank institutions continue to expand their business in the field of basic payment, which involves the traditional business and intermediary business of banks and has a negative effect on the business activities of banks. Conversely, China’s non-bank payment is closely linked with the banking industry, which forces the industry to actively carry out digital development to achieve business connectivity with non-bank institutions. This study finds consistent evidence that the development of fintech is significantly related to bank performance—in particular, the development of fintech reduces bank performance. It also finds that loose monetary policy, high financial friction environment, and banks’ risk preference positively moderate the negative correlation between the development of fintech and bank performance. Figure 1 shows the conceptual framework. The robustness analysis considers whether the development of fintech varies according to the ownership of banks by dividing the sample of banks into two categories: state-owned and non-state-owned. In addition, the robustness of the results is further tested by replacing the dependent variable. In conclusion, the results support this study’s hypothesis and provide evidence of robustness.

Figure 1. Conceptual framework

This study makes new theoretical contributions to financial digitization and banking literature. First, it provides empirical support for existing research on the relationship between financial digitalization and traditional financial intermediaries. Fintech, as a form of digital financial development focusing on technology innovation, has been the focus of scholars’ discussion on the relationship with banks, but no consensus has been reached (Guo & Shen, 2016; Li et al., 2017; Phan et al., 2020; Wang et al., 2020). This study considers the effect of the development of fintech on bank performance and draws empirical evidence of a negative relationship. Second, this study enriches the research on monetary policy by introducing and examining its effect on the relationship between fintech development and banking (Hasan et al., 2020; Mumtaz & Smith, 2020). The empirical results of this study indicate that the challenge of fintech development to the banking industry may be weakened in the monetary policy easing cycle. Third, this study enriches the existing literature by analyzing the effect of financial frictions on the relationship between fintech development and banking (Guérineau & Leon, 2019; Zamani & Giaglis, 2018). The empirical results of this study indicate that the challenge of fintech development to the banking industry may be weakened in an environment of high financial friction. Fourth, this study contributes to the growing literature on banks’ risk preference in the context of financial digitization, demonstrating that banks’ risk preference is an essential factor affecting the
relationship between fintech development and banking. Recent studies have attempted to explore the black and white sides of the effect of financial innovation on banks’ risk preference but have not reached a consensus (Di et al., 2020; Gomber et al., 2017; Navaretti et al., 2017; Panos & Wilson, 2020; Wang et al., 2020). The empirical results of this study point out that the risk-taking preference of banks may weaken the challenge of fintech development to the banking industry.

This study is arranged as follows. The relevant theoretical literature is described, followed by the development of the hypotheses. The research methods are then introduced, including data, variables, and models. This is followed by the analytical results and robustness tests. Finally, the theoretical and practical implications and future research directions of the study are summarized and discussed.

THEORETICAL BACKGROUND

Financial Digitalization

Digitization is an opportunity for organizations to adopt digital technologies to provide new value creation opportunities that significantly affect organizational performance (Matt et al., 2015). The “creative destruction” brought about by digital technologies fundamentally disrupts the organization’s established business model by challenging established structures, processes, and capabilities (Clarke, 2019). At the core of the financial industry is the manipulation and transmission of digital information, and new digital technology concepts provide the foundation for innovative solutions in the industry (Schueffel, 2016; Setia et al., 2013). Financial digitization is used to describe the broad digitization of the financial services sector (Gattenio, 2002). It refers to the use of existing tools that are mainly provided by banks and mobile devices to access and deliver financial services through digital channels (Pazarbasioglu et al., 2020).

The digitalization of the financial industry is closely related to technology development. The academic discussion on the digitization of the financial industry began in 1967 with the introduction of digital processes and services such as ATMs and computers, which transformed financial services from an analog industry to a data industry (Zavolokina et al., 2016). Since the acceleration of computerization, IT has been widely used in the internal operations of financial institutions to manage internal risks (Schueffel, 2016). By the beginning of the twenty-first century, traditional financial service providers, as the core players of digital financial institutions, had entirely digitized their interactions with the outside world, as well as their internal processes. However, the 2008 financial crisis was a turning point for traditional financial service providers to dominate the legitimacy and resources of financial services. The post-crisis adjustment of market conditions and the convergence of IT (cloud computing, big data, internet of things, social computing) contributed to the emergence of new innovative players in the financial services industry (Goldstein et al., 2019). Start-ups that rely on the development of IT to enter digital finance are engaging in innovation for integrated mobile solutions, distributed digital banking, payment solutions, crowdfunding, and peer-to-peer (P2P) lending (Gomber et al., 2017). While traditional financial service providers are also actively involved in this space and have mastered the digital services and processes described above (e.g., ATMs), new financial service providers are creating untried business models, processes, products, and services that are still novel and have the potential to be disruptive to the established financial industry (Wang et al., 2020). Recent studies on the digitization of the financial industry refer to these financial innovations that place a greater emphasis on technological development as “fintech” and consider them the most disruptive components of financial digitization.

Fintech

The discussion on digitalization in the financial industry has been carried out for a long time, but research into fintech has only recently aroused the interest of scholars. Fintech broadly describes the modern connection between mature business activities in the financial services industry (e.g.,
transaction banking, money lending) and internet-related technologies (e.g., mobile internet, cloud computing) (Puschmann, 2017). Fintech is disruptive in the financial sector because it leverages automated information processing and internet technology to provide more efficient, flexible, and secure financial services and innovative financial digital solutions (Lee & Shin, 2018). Research indicates that fintech solutions can be provided by traditional financial service providers (e.g., commercial banks) and fintech-established technology companies and start-ups. Cai (2018) emphasizes the disruptive and sustaining characteristics of fintech, respectively. Among them, disruptive focuses on established technology companies and start-ups challenge traditional financial service providers by creating new business models and financial services. However, sustainability considers traditional financial service providers to protect their market positions through the development and usage of IT (Gomber et al., 2017).

With the development of IT, financial digitization is no longer just an instrument for the financial industry to improve the automation of internal processes; fintech companies that are newly involved in the financial field are gradually occupying a place in the market (Nüesch et al., 2015). Existing research explores the main reasons why fintech companies “creatively disrupt” the market share of traditional financial service providers. First, the design of financial services offered by fintech companies places a greater emphasis on customer process centricity, which addresses the needs of customers that are not addressed by traditional financial service providers (Mazana et al., 2016). For example, Sign2Pay’s smartphone or tablet touch panel can transfer money with a signature on the touch panel, making money transactions between customers more convenient. Second, fintech companies born of internet companies can develop financial service solutions based on various online consumption scenarios (Temelkov, 2018). For example, Alipay relies on Alibaba’s Taobao Mall to provide customers with shopping settlement and installment payment services. Third, the agile innovation of fintech companies with IT backgrounds can more flexibly respond to development and changes in the IT field. For example, introducing third-party payment platforms provides customers with higher efficiency and lower costs in their payment behavior, which challenges the monopoly of traditional financial service providers (Temelkov, 2018).

However, traditional financial service providers have also driven changes in financial digitization and started offering fintech solutions to their clients. Research has explored the widespread use of fintech in the financial services industry. First, traditional financial service providers have developed digital products to provide customers with more cost-effective and faster transaction processing (Lee & Shin, 2018). For example, the mobile banking applications launched by traditional commercial banks meet the need of customers for online self-service essential banking services. Second, traditional financial service providers use big data to search and analyze customers’ investment decisions and behavior patterns to provide customized marketing services (Gai et al., 2018). In addition, the application of big data can be used to detect fraud and enhance cybersecurity, thereby improving risk management in traditional banking online operations (Gupta & Tham, 2018).

**Fintech and the Banking Industry**

The rise of fintech is a crucial form of digital financial innovation and has had a significant effect on the traditional business of commercial banks (Chishti & Barberis, 2016; Jagtiani & Lemieux, 2018). There is no consensus in existing literature on whether fintech is a bank’s “friend” or “foe.” Navaretti et al. (2018) point out that fintech companies as new entrants in the financial field may intensify the competition for banks that provide existing financial services. However, the initiative of banks to initiate fintech innovation may improve their operational efficiency. Research has extensively explored the factors that make fintech competitive in the banking industry. For example, Buchak et al. (2018b) point out that fintech companies can respond more flexibly to demand shocks because of their technological advantages, and their lending operations have robbed traditional banks of a market share in key areas such as residential mortgage loans. Fuster et al.’s (2019) study on the mortgage business shows that fintech companies have advantages in faster loan decisions and a more personalized
customer experience than the banking industry. In addition, algorithm-based credit services offered by fintech lenders have an advantage over face-to-face lending in the banking industry in terms of their ability to screen borrowers (Fuster et al., 2019). Fintech’s competition with the banking industry is also reflected in the wealth management business. For example, robot advisor services offered by fintech companies save on the maintenance and salaries of bricks-and-mortar offices previously required by wealth advisors, which allows for lower fees and minimum investment requirements for wealth management services (Abraham et al., 2019; Abunadi, & Alqahtani, 2019; Hong, 2019; Gao et al., 2019; Grant, & Yeo, 2019; Sila, 2019).

While fintech firms compete with traditional banking in various financial services, fintech also has a profoundly positive effect on banks that proactively initiate digital financial innovations (Lee et al., 2021). Fintech development in the banking industry can promote the construction of intelligent system architectures and broaden the business configuration of the banking industry in terms of space and scale (Financial Stability Board, 2017). The technological innovation of fintech companies has played a vital demonstration role in the development of financial digitalization in the banking industry. Technological innovation spillovers from fintech firms can be absorbed and applied by banks to improve operational efficiency (Thakor, 2020). For example, the theory of information asymmetry points out that the banking industry, as a financial intermediary, plays a key role in reducing information asymmetry in financial markets (Maskara & Mullineaux, 2011; Zheng, Bai, & Cross, 2021). Customer credit information systems developed based on fintech, such as big data, can effectively reduce the risk of transaction business provided by the banking industry (Thakor, 2020). In addition, the banking industry widely uses cloud computing to communicate information between departments, which helps the banking industry expand the scale of the organization by improving the efficiency of internal management.

**HYPOTHESES DEVELOPMENT**

**Effects of Fintech on Bank Performance**

The emergence of fintech companies resulting from financial digitization has blurred customers' traditional perceptions of financial service providers (Merello et al., 2022). Although the banking industry is actively embracing fintech, the threat of fintech companies to the market share and effectiveness of the banking industry is irreversible. First, fintech companies can gain a competitive advantage in credit markets through regulatory arbitrage. Regulatory arbitrage means that fintech companies avoid unfavorable supervision by taking advantage of loopholes and lags in the regulatory system (Anagnostopoulos, 2018). By studying the United States (US) mortgage market, Buchak et al. (2018b) point out that regulation is the main factor driving the rapid growth of fintech loans. Unlike the traditional banking industry, which is subject to regulatory constraints on risk and capital in the Basel Accord, fintech companies face different regulatory requirements (Buchak et al., 2018b). In the case of China, the regulatory policy applicable to fintech companies is based on wait-and-see and case-by-case, without uniform regulations, which provides them with opportunities for regulatory arbitrage (Hasan et al., 2020). Compared with banks’ strict credit review systems, fintech companies rely on big data to make it easier for individual and institutional borrowers to obtain loans, thereby squeezing banks’ share in the credit market (Thakor, 2020).

Second, competition from fintech companies that provide financial services similar to banks reduces the banking industry’s efficiency through substitution effects (Phan et al., 2020). By adopting more agile and advanced IT, fintech companies provide financial services such as financial consulting, lending, asset management, and payments, which belong to the traditional banking industry (Chishti & Barberis, 2016). Fintech companies have advantages in information sharing, customer acquisition, and operating costs (Thakor, 2020). The banking industry also actively seeks cooperation with mature internet companies, using their rich internet application fields and more advanced IT to promote digital
business development in the banking industry (Klus et al., 2019). However, due to the restriction of data confidentiality and access rights, the negotiation process and the cooperation agreement between the two parties took a long time. In addition, distributing the benefits of new products or services launched has become a vital issue for both parties to the agreement (Wang et al., 2020). These factors may constitute a source of reduced bank performance.

Third, the banking industry actively uses fintech in its own business and operational activities. The banking industry has accelerated financial digitization by increasing investment in IT research and development (Thakor, 2020), but it has also developed fintech by establishing partially controlled or wholly owned fintech subsidiaries. These subsidiaries provide IT-driven fintech solutions to groups or subsidiaries (Wang et al., 2020). To date, there is still a debate about the effect of IT investment on organizational effectiveness. Solow’s (1987) seminal study points out that the total productivity of an organization does not increase significantly due to the use of IT, which is the “IT Productivity Paradox.” Brynjolfsson’s (1993) study further proposes a learning curve perspective to explain this paradox. Specifically, the output created by IT needs to be combined with the organization’s experience. The development of fintech in the banking industry often requires a long cycle and requires huge overall investment, which reduces the investment conversion rate of fintech development in the banking industry. These factors may increase the operating costs of the banking industry, thereby reducing performance (Beccalli, 2007). Therefore, this study proposes:

**Hypothesis 1:** Fintech is negativity associated with bank performance; that is, high fintech development generates lower bank performance than low fintech development.

**Moderating Effects of Monetary Policy**

Monetary policy is the critical factor affecting bank performance (Borio et al., 2017). It affects the financial industry through various channels. A classic example is the bank lending channel (BLC), which gained traction in the debate in the monetary policy transmission literature after the US subprime mortgage crisis (Jiménez et al., 2020), because it emphasizes banks’ critical role in the entire financial system and the close connection between bank deposits and loan supply (Bernanke & Gertler, 1995). From the BLC perspective, it is assumed that loose monetary policy enables banks to increase loans due to the relative enlargement in funding (Jiménez et al., 2020). Tight monetary policy is believed to cause a rise in loan prices, which leads to a decline in loan demand (Yang & Shao, 2016). In addition, recent research on the risk-taking channel of monetary policy points out that looser monetary policy encourages banks to take more risks, which is reflected in banks providing more credit to riskier borrowers, thereby improving profitability (Jiménez et al., 2012). Existing literature provides extensive evidence of the positive relationship between loose monetary policy and bank performance. As Philippon (2016) mentions, the rise of fintech has presented challenges for monetary policymakers. Fintech’s reshaping of the traditional financial industry makes it a critical uncertainty factor affecting monetary policy transmission (Yang & Shao, 2016). Recent research has increasingly focused on the role of monetary policy in the digital age of the financial sector (He, 2018).

Existing research investigating the effect of monetary policy on the relationship between fintech and banks is sparse and inconclusive. Previous studies have focused on the competitive advantage of fintech lenders over banks under the adverse effect of monetary policy. For instance, de Roure et al. (2019) develop a bank and P2P lender competition model that incorporates the endogenous choice of banks and fintech lenders. Their results confirm that the development of fintech lenders has caused a loss of bank market share. In the case of adverse monetary policy shocks to the banking system, fintech lenders have a competitive advantage. Hasan et al.’s (2020) research explores the relationship between monetary policy transmission and fintech. Their empirical results show that the effectiveness of monetary policy transmission is negatively affected by fintech through regulatory arbitrage channels and competitive channels. Specifically, the regulatory arbitrage channel points
out that in terms of deposits, fintech companies relying on regulatory arbitrage are more likely to absorb more deposits by increasing earnings during the monetary tightening cycle (Xiao, 2020); on the lending side, fintech lending to the market can offset the decline in bank lending (Chen et al., 2018). Competitive channels emphasize the substitution of fintech loans for bank loans. Therefore, during the monetary tightening cycle, the development of fintech may hinder the effectiveness of monetary policy transmission.

However, few studies have considered the monetary easing cycle, in which banks can increase loans due to the relative enlargement in funding sources and have a more robust appetite for risk-taking. Whether the competitive advantage of fintech companies compared with banks has changed under the monetary easing cycle is not understood. This study proposes that looser monetary policy may mitigate the adverse effect of fintech development on the banking sector. First, given that banks have more liquidity during the monetary easing cycle, they can provide more loans to customers, thereby reducing the adverse effect of fintech lending on the bank business. Second, by establishing the trust theory of bank and non-bank loans, Merton and Thakor (2019) show that banks have an endogenous advantage over non-banks (including fintech lenders) in getting investors to trust them in making good loans. That is, banks’ unique way of obtaining low-cost loans provides them with more advantages in establishing investor trust. This theory suggests that in a scenario of loose monetary policy, the investor trust advantage in the banking sector can reduce the threat of fintech lenders. Third, the financial innovation that incorporates IT brought about by fintech development has a demonstration effect on the entire financial market (Yang & Shao, 2016). As market lending is favored, more banks choose to absorb technology spillovers developed by fintech and launch more wealth management and credit products by acquiring existing online platforms or constructing an online banking business (Thakor, 2020). Under looser monetary policy, investor trust advantages in the banking industry could make their diversified wealth management and credit products more popular. Therefore, the following hypothesis is proposed:

**Hypothesis 2:** Monetary policy moderates the negative relationship between fintech development and bank performance such that the negative relationship is weaker when monetary policy is looser.

**MODERATING EFFECTS OF FINANCIAL FRICTION**

Financial institutions may experience various kinds of friction that impose restrictions on their efficiency and strategies. Regulations and taxes, bankruptcy costs, and principal–agent issues can significantly influence banks’ business strategies. Studies propose two main channels through which financial friction can arise in the banking system: market structure friction and information friction (Chortareas et al., 2012). Higher market structure friction represents higher market concentration and imperfect competition, which is reflected in the greater power of a few participants in the market. The imperfect competition of the market structure is the key factor triggering financial friction. After suffering the negative shock of the US subprime mortgage crisis, the worldwide banking industry implemented deregulation by relaxing the barriers to entry to the banking industry, which significantly enhanced competition (Chortareas et al., 2011). From the perspective of information friction, Leland and Pyle (1977) propose that financial intermediaries can serve as a financial signal evaluator and information producer. Information asymmetry is particularly severe in the banking sector and has the greatest effect on bank credit supply (Chortareas et al., 2011). Diamond (1984) examines the imperfect information allocation between banks and borrowers in the credit rationing model. The research indicates that a low level of information asymmetry can present managers with less significant uncertainty and decrease capital costs, causing them to try to maximize their returns by adopting progressive credit strategies.

Although similar financial services provided by fintech companies pose an irreversible challenge to bank performance, for banks that actively participate in the digital process, the benefits of their
fintech development can be immediate (Lee et al., 2021). This study proposes that in a market environment of high financial friction, the banks’ embrace of fintech may mitigate the threat of fintech companies to bank performance. First, by actively investing in IT innovation and absorbing technological spillovers from fintech firms, it is likely that banks will be a great success in financial services involving record-keeping, processing, and calculation (He et al., 2021; Merton & Thakor, 2019; Zheng, Xiong, Chen, & Li, 2021). Fintech significantly modifies banks’ traditional methods of fund management and transactions. The advantage of combining the trading methods with fast-developing technology is that it dramatically reduces transaction and management costs (Thakor & Merton, 2018). Second, under higher financial friction scenarios, customer demand for safe assets and deposit insurance systems continues to give traditional bank intermediaries an advantage over other forms of lending in terms of trust and funding costs for depositors (Thakor, 2020). The unique credit system constructed by banks based on user background information and consumption records, together with information-related technology for mitigating personal information problems and moral hazards, may be more reasonable under a high level of information friction (de Roure et al., 2019). Third, the participation of fintech has strengthened the competition among banks, and the participation of fintech lenders has also intensified the competition in the financial industry. Boot and Thakor (2000) construct a banking model to analyze the effect of competition between banks and non-bank sectors on funding corporations in the capital market. Their model predicts that banks may expand lending by investing more in relationship loans if they consider the non-bank sector a more significant threat, suggesting that in the context of high financial friction, the banking sector may expand lending, which could reduce the threat of fintech lenders to the credit business to a certain extent (Degryse & Ongena, 2007). Therefore, this study proposes the following hypothesis:

**Hypothesis 3:** Financial friction moderates the negative relationship between fintech development and bank performance such that the negative relationship is weaker when the financial friction is higher.

**Moderating Effects of Bank Risk Preference**

In addition to the bank risk channel of monetary policy transmission mentioned above, existing studies have extensively discussed the factors affecting banks’ risk preference, including external environmental factors such as deposit insurance (Demirgüç-Kunt & Detragiache, 2002), the political system (Chen et al., 2015), and external regulation (Klomp & De Haan, 2012); and bank characteristics such as capital adequacy (Furlong & Keeley, 1989), size (Laeven & Levine, 2009), and corporate governance (Chen et al., 2017). In particular, the banking literature has widely discussed the franchise value paradigm for bank risk-taking. Given the particularity of banks’ high risks, all countries have implemented franchise systems for the banking industry (Saunders et al., 1990). The franchise value enables banks not only to obtain the operating conditions created by financial policies, such as competition restrictions, interest rate controls, and implicit government guarantees (Demsetz et al., 1996), but also to form operating advantages in terms of economies of scale, information resources, and market reputation (Afonso et al., 2014). Banks may take more risky actions to improve efficiency in a scenario where franchise values are negatively affected (Jiménez et al., 2013).

This study proposes that banks’ risk-taking behavior may mitigate the threat of fintech companies to bank performance. First, according to the competitive vulnerability theory, changes in franchise value stem from increased competition in the financial market, which may change the risk appetite behavior of commercial banks (Fungáčová et al., 2014). Commercial banks absorb advanced IT and realize product and service innovation, thereby intensifying competition among banks. Further, fintech companies have progressively penetrated commercial banks’ core business fields, intensifying the competition between traditional financial intermediaries. Banks will implement a risk-taking lending strategy to gain a significant market share (Wang et al., 2020). Second, embracing fintech is
an inevitable digital trend for banks because it can alleviate the threat posed by fintech companies relying on advanced digital technology to the banking business. However, at the same time, banks face potential risks in participating in fintech development. For banks that actively participate in fintech development, the primary mode is to cooperate with existing technology companies and set up fintech subsidiaries affiliated with banks (Meinert, 2017). Both of the above approaches require banks to make large investments in the initial stage, which may increase banks’ operational risk. Third, according to the “technology spillover theory,” the positive employee turnover effect could be another interesting point to conduct the alternation of banks’ risk perception, which refers to banks’ employment of highly qualified fintech personnel with extensive experience in the field (Wang et al., 2020). By absorbing advanced spillover technologies in fintech, traditional commercial banks can increase their competitiveness and strengthen product innovation and risk management, making them more prone to risk-taking behaviors. Therefore, this study proposes the following hypothesis:

**Hypothesis 4:** Bank risk preference moderates the negative relationship between fintech development and bank performance such that the negative relationship is weaker when banks prefer more risk-taking behaviors.

**METHOD**

**Sample and Data**

The data were sampled quarterly from 2013 to 2019. The financial data of the 16 listed banks included in this study were obtained from the Wind-Financial Terminal (WIND). The fintech data from the “online payment business processed by non-bank payment institutions” in the quarterly Payment System Operation report released by the PBC. The online payment business of non-bank payment institutions in the report includes online payment services such as mobile payments and internet payments handled by non-banking institutions. The primary macro variable data were from the PBC. The corporate data required to calculate the financial friction variables were from the Credit Investigation System (CIS) Construction and Operation Report. The missing individual data were collected online. Table 1 introduces the definitions and sources of the variables.

### Table 1. Variable definition

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition</th>
<th>Source</th>
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<tbody>
<tr>
<td>NIM</td>
<td>(Bank interest income - Bank interest expense) / Bank total assets (%)</td>
<td>WIND</td>
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<tr>
<td>Fintech</td>
<td>Online payment transactions processed by non-bank payment institutions / Total payment transactions processed by the payment system (%)</td>
<td>PBC</td>
</tr>
<tr>
<td>Monetary policy</td>
<td>Quarterly growth rate of M2 (%)</td>
<td>PBC</td>
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<tr>
<td>Financial friction</td>
<td>Number of enterprises included in the Credit Reference System / Number of total enterprises above designated size (%)</td>
<td>WIND</td>
</tr>
<tr>
<td>Bank risk</td>
<td>Natural logarithm of (ROA + CAR) / σ(ROA), where ROA is the return on assets, CAR is the ratio of bank equity to total assets, and σ(ROA) is the standard deviation of ROA</td>
<td>WIND</td>
</tr>
<tr>
<td>Bank size</td>
<td>Normalized natural logarithm of total bank assets</td>
<td>WIND</td>
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<tr>
<td>Bank liquidity</td>
<td>Bank liquid assets / Bank total assets (%)</td>
<td>WIND</td>
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<tr>
<td>Income diversity</td>
<td>1 - [((Net Interest Income - Other Operating Income) / (Operating Income)] (%)</td>
<td>WIND</td>
</tr>
<tr>
<td>Leverage</td>
<td>Bank equity / Bank total assets</td>
<td>WIND</td>
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<tr>
<td>Shadow banking</td>
<td>Bank interbank assets / Bank total assets (%)</td>
<td>WIND</td>
</tr>
<tr>
<td>NPL</td>
<td>Bank non-performing loans / Bank total loan balance (%)</td>
<td>WIND</td>
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<tr>
<td>GDP</td>
<td>Natural logarithm of quarterly GDP</td>
<td>PBC</td>
</tr>
<tr>
<td>Inflation</td>
<td>Growth rate of consumer price index (%)</td>
<td>PBC</td>
</tr>
</tbody>
</table>
VARIABLES

Dependent Variable

- **Bank performance**: Existing empirical literature on banking indicates that bank profitability is crucial for measuring performance (Ahamed & Mallick, 2019). For example, the literature on bank profitability suggests that net interest margin (NIM) is an appropriate measure of the banking industry’s profitability (Demirgüç-Kunt & Huizinga, 1999; Robin et al., 2018). This indicator is consistent with the bank’s classic definition: the bank acts as an intermediary between borrowers and lenders. Net interest is determined by the interest difference paid by the borrower and provided by the bank to depositors. Therefore, NIM measures the difference between the benefits of the bank’s use of funds and the cost of sourcing the funds. It is calculated as the difference between the bank’s interest income and interest expense divided by its total assets. Return on assets (ROA) is also widely used in research on bank performance; it measures the efficiency with which banks use their existing portfolio of assets to earn income (Pasiouras & Kosmidou, 2007). The indicator is calculated as the bank’s net profit as a percentage of total assets. In addition, return on equity (ROE) is increasingly used in research on bank performance (Pennacchi & Santos, 2021). This indicator measures the bank’s ability to generate profits from equity. ROE is calculated as net income as a percentage of shareholders’ equity. This study refers to Robin et al.’s (2018) research in using NIM to measure bank performance. ROA and ROE are also used to obtain bank performance in robustness tests.

Independent Variable

- **Fintech**: Given the wide range of fintech businesses and the issue of data availability, studies have not reached a consensus on which measurement methods to use in the empirical analysis of fintech. The research techniques that have been used to assess fintech can be divided into three major streams: aggregated indicators of third-party financial terminals, financial data of fintech lending platforms, and fintech indices in the text mining approach. Qiao et al. (2018) use the Wind Internet Finance Composite Index as a surrogate variable to study the effect of fintech risk spillover on the bank’s investment strategy. Some studies have used P2P platform data as fintech proxy variables (Greiner & Wang, 2010; Herzenstein et al., 2011). Motivated by the research of Askitas and Zimmermann (2009), who indicate that the number of news releases implies supply information related to corporate investment, Guo and Shen (2016) adopt the text mining approach to construct a fintech index using information items from Baidu, China’s largest search engine, to explore the difference in banks’ risk preferences before and after the rise of fintech.

Most studies on fintech in China use Yu’ebao’s return rate and online payment data, which are publicly available, as fintech proxy variables (Xia & Hou, 2016). Given that Yu’ebao’s data are relatively small and online payment data are comparatively complete, the current study uses online payment data as a fintech proxy variable—specifically, the fintech data from the “online payment business processed by non-bank payment institutions” in the quarterly Payment System Operation report released by the PBC. The online payment business of non-bank payment institutions in the report includes online payment services (e.g., mobile payment and internet payment) handled by non-banking institutions. Fintech’s calculation is the ratio of online payment transactions processed by non-bank payment institutions to the total payment transactions processed by the payment system.
Moderating Variables

- **Monetary policy**: Unlike many developed economies in which central banks adopt policy interest rates as monetary policy indicators, the PBC applies various monetary policy tools to regulate the macroeconomy. Geiger (2008) divide China’s monetary policy instruments into price-based tools, specific credit policy tools, and quantity-based tools. Quantity-based monetary policy is a tool widely used by the PBC. For instance, changing the required reserve ratio and open market operations can maintain the stability of currency values. The PBC also adopts various price-based policy tools, including interest rates paid on excess reserves, rediscount rates, and benchmark interest rates. China’s interest rate policy is under development. Since 2000, the PBC has set the intermediate target of monetary policy as controlling the growth of M2, and the use of the above monetary tools aims to achieve the growth rate of M2 adjusted by the PBC quarterly (Chen et al., 2018). Therefore, the current study uses the quarterly growth rate of M2 as an indicator of China’s monetary policy. A higher M2 quarterly growth rate represents a monetary policy easing cycle.

- **Financial Friction**: According to the literature, there are two ways to choose financial friction proxy variables. The first is based on two similar concepts: that financial friction and financial markets are not completely compatible, and that the level of interest rate marketization and the degree of financial institution competition can be selected. The second is based on the inverse proportion of the completeness of the social credit system and the transaction costs generated by financial market supervision such that the level of social credit system construction indicators can be selected. Considering the availability and continuity of data, this study follows Zhan and Xu (2016) in choosing the second method and using the data of the CIS to measure financial friction. Since 2004, the PBC has organized financial institutions to establish a unified corporate and personal credit investigation system dedicated to stabilizing the financial system and improving the social environment. The calculation of financial friction is the ratio of the number of enterprises above the designated size to the number of enterprises included in the CIS. The more enterprises included in the CIS, the higher the financial market’s degree of transparency, thus reducing friction in the financial market.

- **Bank risk Preferences**: The literature comprises extensive research on bank risk using a variety of risk preference measurement variables, such as the expected default frequency, the ratio of weighted risk to assets, the franchise value, the non-performing loan ratio, and the Z-score (Laeven & Levine, 2009). The Z-score is generally regarded as the primary proxy variable of banks’ bankruptcy risk probability. Referring to Lepetit et al. (2008), the current study adopts it as the banks’ risk preference variable. The Z-score can be calculated as follows:

\[
Z - score_{it} = \left( ROA_{it} + CAR_{it} \right) / \sigma_i \left( ROA_{it} \right)
\]

where \( ROA_{it} \) is the return on assets, \( CAR_{it} \) is the ratio of bank equity to total assets, and \( \sigma_i \left( ROA_{it} \right) \) is the standard deviation of ROA, which is calculated using the moving average method. Banks’ stability increases with higher ROA and equity-to-asset ratios and decreases with higher earnings volatility (i.e., the standard deviation of ROA). Therefore, a higher Z-score represents increased bank stability; that is, an increasing Z-score is associated with a decrease in a bank’s preference for risk-taking behaviors.
Control Variables

- **Bank characteristic variables:** Research indicates that bank-specific characteristics may affect banks’ access to external financing and credit provision (Ehrmann et al., 2003). Consistent with similar studies on bank performance (Acharya & Naqvi, 2012; Afonso et al., 2014), the current study adopts Size and Liquidity as control variables at the bank characteristics level. Size is expressed as the logarithm of the bank’s asset size. There is no consensus in the banking research literature on the effect of bank size on performance. The expansion of the bank scale may lead to a lack of supervision of considerable assets, which harms the bank’s performance (Miller & Noulas, 1997). Liquidity is the ratio of liquid assets, measured as liquid assets (including interbank loans, cash, and securities) to total assets. A higher proportion of liquid assets may negatively affect a bank’s performance as a result of lower interest rate income and higher overheads (Afonso et al., 2014). Referring to Laeven and Levine’s (2007) study, the current study controls for Income Diversity, which is calculated as 1 − [(Net Interest Income − Other Operating Income)/(Operating Income)]. A bank’s higher level of Income Diversity refers to a more diverse business activity leading to more volatile returns, which may reduce bank performance. Then, the study controls for Leverage, calculated as the ratio of a bank’s equity to total assets. Deficiencies in managing risky assets resulting from a bank’s higher leverage may reduce performance (Vazquez & Federico, 2015). Next, the study controls for the Shadow Banking business, because growing literature indicates that shadow banking represents the process of externalizing bank asset operating statements to evade supervision and other motivations (Li et al., 2014). Therefore, an increase in shadow banking business may reduce bank performance. Shadow Banking is calculated as the interbank assets to total assets ratio. Finally, the study controls for Non-Performing Loans (NPL), calculated as the ratio of NPL to the bank’s total loan balance. Deterioration of bank credit quality caused by high NPL may lead to considerable losses in bank operations and reduced performance (Messai & Jouini, 2013).

- **Macro Characteristic Variables:** Business cycle fluctuations and the credit demands of enterprises and consumers may affect bank performance. Referring to Maddaloni and Peydró’s (2011) research, the current study adopts Inflation and Gross Domestic Product (GDP) as the control variables at the macroeconomic level. Inflation is calculated as the growth rate of the consumer price index. High inflation levels may reduce bank performance by negatively affecting lending activity (Boyd et al., 2001). GDP is calculated as the natural logarithm of real GDP. Existing literature extensively suggests the positive effect of GDP growth on bank performance (Trujillo-Ponce, 2013).

Descriptive Statistics

Table 2 reports the descriptive statistics of the main regressors. The performance variable NIM ranged between 0.26 and 2.66, with a mean of 1.29 and a standard deviation of 0.606. In terms of fintech, the observed values ranged between 0.26 and 3.85, with a mean of 1.96 and a standard deviation of 1.226, indicating heterogeneity in fintech development in the sample years. Specifically, Figure 2 illustrates the development trend of fintech in China from 2013 to 2019. It shows a growth tendency, which reflects the rapid expansion of fintech in the financial industry. In 2017, the fintech index declined significantly, mainly due to strict regulatory policies. First, in early 2017, the PBC announced the establishment of the NetsUnion Clearing Corporation (NUCC) as the operator of the network clearing platform for non-bank payment institutions. The payment business in the fintech area must be processed through the NUCC platform, which accelerates the clearance of fintech companies without payment business licenses (Jin, 2018). Second, the PBC introduced strict prohibitions on raising funds through initial coin offerings (Wang et al., 2020). With the compliance rectification of fintech institutions, the development of fintech in China was still rising at the end of 2017. In
addition, the fintech index fell significantly in mid-2018, primarily due to the large-scale collapse of the P2P industry caused by the risk accumulation of P2P online lending platforms. The large-scale collapse of the P2P industry also widely affected the development of the fintech market through the financial chain of equity and debt (Huang, 2018). Figure 2 shows that the negative effect continued until the end of 2019. As a result of the platform’s transformation through the reduction of P2P services and cooperation with financial institutions, the development of fintech resumed its upward trend at the end of 2019. Therefore, the fintech data used in this study comprehensively reflects the development trend of fintech.

Table 3 shows the pairwise correlations between the key variables. The correlation between fintech development variables and bank performance is negative, which indicates that fintech development inhibits bank performance. In addition, there is no strong correlation between other macroeconomic variables and bank characteristic variables, which means that the use of the above variables in this model will not lead to serious multicollinearity.

Table 2. Summary statistics of main variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs.</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIM</td>
<td>448</td>
<td>1.291</td>
<td>0.606</td>
<td>0.264</td>
<td>2.660</td>
</tr>
<tr>
<td>Fintech</td>
<td>448</td>
<td>1.960</td>
<td>1.226</td>
<td>0.260</td>
<td>3.850</td>
</tr>
<tr>
<td>Monetary policy</td>
<td>448</td>
<td>2.572</td>
<td>0.908</td>
<td>0.731</td>
<td>4.821</td>
</tr>
<tr>
<td>Financial friction</td>
<td>448</td>
<td>1.667</td>
<td>0.175</td>
<td>1.333</td>
<td>1.917</td>
</tr>
<tr>
<td>Z-score</td>
<td>448</td>
<td>3.278</td>
<td>0.455</td>
<td>1.734</td>
<td>4.429</td>
</tr>
<tr>
<td>Size</td>
<td>448</td>
<td>29.038</td>
<td>1.057</td>
<td>26.670</td>
<td>31.050</td>
</tr>
<tr>
<td>Liquidity</td>
<td>448</td>
<td>48.252</td>
<td>9.663</td>
<td>25.000</td>
<td>75.070</td>
</tr>
<tr>
<td>Income diversity</td>
<td>448</td>
<td>28.967</td>
<td>8.439</td>
<td>7.949</td>
<td>57.170</td>
</tr>
<tr>
<td>Leverage</td>
<td>448</td>
<td>7.720</td>
<td>0.795</td>
<td>5.891</td>
<td>10.067</td>
</tr>
<tr>
<td>Shadow banking</td>
<td>448</td>
<td>2.943</td>
<td>2.232</td>
<td>0.399</td>
<td>16.571</td>
</tr>
<tr>
<td>NPL</td>
<td>448</td>
<td>1.288</td>
<td>0.358</td>
<td>0.460</td>
<td>2.350</td>
</tr>
<tr>
<td>GDP</td>
<td>448</td>
<td>30.573</td>
<td>0.197</td>
<td>30.192</td>
<td>30.952</td>
</tr>
<tr>
<td>Inflation</td>
<td>448</td>
<td>2.119</td>
<td>0.740</td>
<td>0.800</td>
<td>4.490</td>
</tr>
</tbody>
</table>
Model

To test the hypotheses, this study adopts a model similar to the panel model used by Wang et al. (2020). The benchmark panel models are expressed as follows:

\[
\text{Bank Performance}_i, t = \alpha_1 + \alpha_2 \text{Fintech}_t + \alpha_3 \text{Size}_i, t + \alpha_4 \text{Liquidity}_i, t + \alpha_5 \text{Income}_i, t + \alpha_6 \text{Leverage}_i, t + \alpha_7 \text{Shadow Bank}_i, t + \alpha_8 \text{NP L}_i, t + \alpha_9 \text{GDP}_t + \alpha_{10} \text{Inflation}_t + \varphi_i + \varphi_t + \epsilon_{i, t}.
\]

(1)

Equation (1) tests Hypothesis 1, where the subscripts \( i \) and \( t \) represent bank and time. \( \text{Bank Performance}_i, t \) is the performance measure of bank \( i \) in time \( t \). \( \text{Fintech}_t \) indicates fintech development over time. \( \text{Size}_i, t, \text{Liquidity}_i, t, \text{Income}_i, t, \text{Leverage}_i, t, \text{Shadow Bank}_i, t \) and \( \text{NP L}_i, t \) together control the bank-specific characteristics that may affect performance. \( \text{GDP}_t \) and \( \text{Inflation}_t \) control the macroeconomic characteristic variables. \( \varphi_i \) and \( \varphi_t \) represent bank-fixed effects and time-fixed effects, respectively. \( \epsilon_{i, t} \) is the idiosyncratic error. The coefficient of \( \text{Fintech}_t \) (\( \alpha_2 \)) is expected to be negative because higher fintech development may generate lower bank performance:

\[
\text{Bank Performance}_i, t = \alpha_1 + \alpha_2 \text{Fintech}_t + \alpha_3 \text{Fintech} \times \text{Monetary Policy}_i, t + \alpha_4 \text{Monetary Policy}_i, t + \alpha_5 \text{Bankchart Control}_i, t + \alpha_6 \text{Macro Control}_i + \varphi_i + \varphi_t + \epsilon_{i, t}.
\]

(2)

\[
\text{Bank Performance}_i, t = \alpha_1 + \alpha_2 \text{Fintech}_t + \alpha_3 \text{Fintech} \times \text{Financial Friction}_i, t + \alpha_4 \text{Financial Friction}_i, t + \alpha_5 \text{Bankchart Control}_i, t + \alpha_6 \text{Macro Control}_i + \varphi_i + \varphi_t + \epsilon_{i, t}.
\]

(3)

\[
\text{Bank Performance}_i, t = \alpha_1 + \alpha_2 \text{Fintech}_t + \alpha_3 \text{Fintech} \times \text{Bank Risk}_i, t + \alpha_4 \text{Bank Risk}_i, t + \alpha_5 \text{Bankchart Control}_i, t + \alpha_6 \text{Macro Control}_i + \varphi_i + \varphi_t + \epsilon_{i, t}.
\]

(4)

Equation (2) tests Hypothesis 2, where \( \text{Monetary Policy}_i, t \) represents the proxy of monetary policy. Here, the study adopts the M2 growth rate as the measurement of monetary policy. A higher
M2 growth rate indicates a monetary loosening cycle. Bank characteristics, reflecting the control variables of bank characteristics (Size, Liquidity, Income diversity, Leverage, Shadow banking and NPL), and Macro Control, reflects the control variables of macroeconomic characteristics (GDP and Inflation). In addition to \( \alpha_2 \) mentioned above, the coefficient of Fintech * Monetary Policy, \( (\alpha_3) \) is expected to be positive because the negative relationship of fintech and bank performance may be weaker when monetary policy is looser.

Equation (3) tests Hypothesis 3, where Financial friction represents the proxy of financial friction. Here, this study adopts the ratio of the number of enterprises above the designated size to the number of enterprises included in the CIS as the measurement of financial friction. The less enterprises that are included in the CIS indicates higher friction in the financial market. In addition to \( \alpha_2 \) mentioned above, the coefficient of Fintech * Financial Friction, \( (\alpha_3) \) is expected to be positive because the negative relationship of fintech and bank performance may be weaker when financial friction is higher.

Equation (4) tests Hypothesis 4, where Bank Risk represents the proxy of banks’ risk preference. Here, this study adopts the Z-score as the measurement of banks’ risk preference. A higher Z-score represents increased bank stability; that is, an increasing Z-score is associated with a decrease in a bank’s preference for risk-taking behaviors. In addition to \( \alpha_2 \) mentioned above, the coefficient of Fintech * Bank Risk, \( (\alpha_3) \) is expected to be negative because the negative relationship of fintech and bank performance may be weaker when banks prefer more risk-taking behaviors.

This study concerns the effect of fintech on banks’ efficiency from 2013 to 2019, including the individual data of 16 listed banks during this period. Therefore, the study adopts the panel data model for estimation. The panel data set was composed of individual data on the listed banks over time, with multiple observations for each. Therefore, panel data can reduce collinearity, provide a greater degree of freedom, and control individual heterogeneity (Hsiao, 2014). The conventional panel data model is defined as follows:

\[
y_{it} = x_{it}'\beta + e_{it}, \quad e_{it} = \alpha_i + \varepsilon_{it}
\]

where \( e_{it} \) is a compound error term containing two parts, namely \( \alpha_i \) and \( \varepsilon_{it} \). \( \alpha_i \) is a permanent time-invariant error component, also referred to as individual effects and unobserved heterogeneity. According to the characteristics of \( \alpha_i \), panel data models can be divided into fixed effects (FE) and random effects (RE) models. \( \varepsilon_{it} \) is the error component that changes about \( i \) and \( t \), also referred to as idiosyncratic error (Wooldridge, 2005). The within-group estimator and the feasible generalized least squares estimator can estimate the FE and RE models, respectively. By testing whether \( \alpha_i \) is correlated with other explanatory variables as the basis for screening the FE and RE models, Hausman (1978) proposes a test based on the difference between FE and RE estimates to verify which specification is more suitable for panel data. Under the null hypothesis that \( \alpha_i \) is not related to other explanatory variables, the parameter estimates obtained using the within-group estimator to estimate the FE model and the feasible generalized least squares estimator to estimate the RE are unbiased and consistent. However, this is not valid. If the null hypothesis is rejected, the parameter estimates of the FE model are consistent, but those of the RE model are not.
RESULTS

Main Hypotheses Tested

This section conducts empirical analysis regarding the influence of fintech on bank performance. The empirical results are presented in Table 4. Column (1) reports the full-sample estimation result, and Columns (2) and (3) report the subsample estimation results for banks with different performance, respectively. The sample is first divided according to banks’ NIM. Large banks are defined as those with NIM above the median of the NIM distribution for the entire sample; small banks are those with NIM below the median of the distribution. According to the Hausman test results, Models 1–3 are estimated using the FE method.

Table 4. Effect of Fintech development on bank performance

<table>
<thead>
<tr>
<th></th>
<th>(1) Total</th>
<th>(2) Large bank</th>
<th>(3) Small bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fintech</td>
<td>-0.934***</td>
<td>-0.899***</td>
<td>-0.95***</td>
</tr>
<tr>
<td></td>
<td>(0.031)</td>
<td>(0.040)</td>
<td>(0.051)</td>
</tr>
<tr>
<td>Size</td>
<td>-0.417***</td>
<td>-0.611***</td>
<td>-0.176</td>
</tr>
<tr>
<td></td>
<td>(0.109)</td>
<td>(0.143)</td>
<td>(0.175)</td>
</tr>
<tr>
<td>Liquidity</td>
<td>-0.007**</td>
<td>-0.005**</td>
<td>-0.008***</td>
</tr>
<tr>
<td></td>
<td>(0.002)</td>
<td>(0.003)</td>
<td>(0.002)</td>
</tr>
<tr>
<td>Income diversity</td>
<td>-0.016***</td>
<td>-0.020***</td>
<td>-0.020***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.004)</td>
<td>(0.004)</td>
</tr>
<tr>
<td>Leverage</td>
<td>0.023</td>
<td>0.041</td>
<td>0.032</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.039)</td>
<td>(0.027)</td>
</tr>
<tr>
<td>Shadow banking</td>
<td>0.008</td>
<td>0.002</td>
<td>0.016</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.009)</td>
<td>(0.013)</td>
</tr>
<tr>
<td>NPL</td>
<td>0.086</td>
<td>0.232**</td>
<td>0.064</td>
</tr>
<tr>
<td></td>
<td>(0.059)</td>
<td>(0.100)</td>
<td>(0.077)</td>
</tr>
<tr>
<td>GDP</td>
<td>6.871***</td>
<td>6.520***</td>
<td>7.037***</td>
</tr>
<tr>
<td></td>
<td>(0.156)</td>
<td>(0.228)</td>
<td>(0.216)</td>
</tr>
<tr>
<td>Inflation</td>
<td>0.043***</td>
<td>0.078***</td>
<td>0.019</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.024)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>_cons</td>
<td>-194.434***</td>
<td>-178.284***</td>
<td>-206.399***</td>
</tr>
<tr>
<td></td>
<td>(4.942)</td>
<td>(7.116)</td>
<td>(7.125)</td>
</tr>
<tr>
<td>Hausman test (p-value)</td>
<td>0.005</td>
<td>0.014</td>
<td>0.000</td>
</tr>
<tr>
<td>Observations</td>
<td>448</td>
<td>224</td>
<td>224</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.865</td>
<td>0.872</td>
<td>0.871</td>
</tr>
</tbody>
</table>

Standard errors are in parentheses.
*** p<.01, ** p<.05, * p<.1

Column (1) depicts the statistic results of full-sample estimation on bank performance. The result indicates that fintech development negatively influences bank profitability (α = −0.934; p < 0.01); therefore, these results support Hypothesis 1. Three possible explanations can be provided for this finding. First, although the traditional banking industry is actively embracing the development of fintech, the industry lacks experience in the development of fintech, and the application of new technologies requires a long learning cycle (Beccalli, 2007; Brynjolfsson, 1993). Second, the banking industry develops fintech primarily through IT investment and cooperation with existing technology companies, which makes the massive expenditure of the banking industry. In addition, banks’ investment in IT research and development may not produce the same improvement in their effectiveness (Kriebel & Debener, 2020). Third, fintech companies derived from the development of financial digitization provide bank-like financial services (e.g., lending, payment transactions, and wealth management), together with regulatory arbitrage opportunities, which undoubtedly challenge the banking industry as a traditional financial service provider (Buchak et al., 2018b).

Columns (2) and (3) depict the subsample estimation results on bank performance. Interestingly, there is heterogeneity in the negative effect of fintech on the profitability of banks of different sizes.
Specifically, fintech development for small banks \( (\alpha = -0.950; P < 0.01) \) is greater than that of large banks \( (\alpha = -0.899; p < 0.01) \). This result indicates that small banks are more likely to be negatively affected by the development of fintech than large banks. There are two possible explanations. First, the more abundant capital accumulation raised by the sound operation system of large banks may reduce the negative effect of the huge cost of investing in IT development on their profitability. Second, large banks participate in the fintech wave by using extensive technology networks to seek cooperation with existing technology companies or to set up fintech subsidiaries themselves, which reduces the risk that fintech results are incompatible with the commercial structure of large banks.

In addition to the above, the characteristics of banks in various control variables have different effects on bank performance. The coefficient of Size in Column (1) is significantly negative, indicating that the expansion of bank size may be detrimental to profitability, mainly because banks cannot regulate large amounts of assets (Miller & Noulas, 1997). Further, the empirical results of different bank sizes support the “too big to fail” hypothesis put forward by Afonso et al. (2014); that is, large banks with more robust sovereign support may engage in riskier lending businesses than small banks, which will lead to the loss of their profitability. The coefficient of Liquidity is significantly negative, and the possible explanation is that banks with a higher proportion of liquid assets may face higher management fees and lower interest income, which negatively affects bank performance (Demirguc-Kunt & Detragiache, 2002). The study also finds evidence supporting the adverse effect of a bank’s Income Diversity on performance, consistent with research that emphasizes that a bank’s diverse business activities may lead to erratic returns (Laeven & Levine, 2007). The empirical results of NPL are significantly positive only in the sample of large banks, possibly because the increase in NPL of large banks may be due to active lending activities. Although the high NPL ratio may lead to the deterioration of bank credit quality, the solid customer base and sufficient capital accumulation of large banks make the effect of NPL on bank performance limited (Atahau & Cronje, 2019). Otherwise, no evidence is found that Leverage and Shadow Banking significantly affect bank performance.

The effects of macroeconomic control variables indicate that higher GDP is associated with higher bank performance; good economic conditions promote bank profitability (Chen et al., 2018). The coefficient of Inflation is significantly positive, indicating that higher inflation is related to the high profitability of banks. Perry (1992) points out that if banks can fully anticipate inflation, then profitability may be improved by raising the lending rate accordingly. This is similar to the findings of Tan and Floros (2012); that is, when inflation is expected, banks positively affect income growth by adjusting lending rates.

**Moderating Hypotheses Tested**

This section discusses the results of the mixed panel data model, which integrates the two-way interactions of the external (monetary policy and financial friction) and internal (banks’ risk preference) factors that may influence the effect of fintech on bank performance. The preliminary estimation is also based on the FE model, according to the Hausman test. The estimated results are presented in Table 5. Model 1 includes monetary policy as a two-way interaction moderating variable, whereas Models 2 and 3 include the two-way interaction terms of financial friction and bank risk-taking, respectively.
In Model 1, the estimated result is consistent with Hypothesis 2, that looser monetary policy produces a positive moderating effect on the negative relationship between fintech development and bank performance. The estimated coefficient of two-way interaction Fintech x Monetary Policy ($\alpha = 0.076; p < 0.01$) is significantly positive. A graph of the moderating effect of monetary policy is presented in Figure 3. This result implies that this negative relationship between fintech development and bank performance will be weaker (stronger) when the M2 increase rate is higher (lower). There are two reasonable explanations for the empirical results. First, banks have greater liquidity in the easy money cycle and can provide more loans to customers, which mitigates the threat of fintech lending to banks’ lending business (Jiménez et al., 2020). Second, banks have unique trust advantages over non-banks (including fintech lenders), which are reflected in risk regulation, capital requirements, and relationship lending (Merton & Thakor, 2019). The demand for loans in the credit market increases during the loose monetary cycle, and with the advantage of trust, the loan business provided by banks will further reduce the threat of fintech lending.

In Model 2, the estimated result is consistent with Hypothesis 3, that higher financial friction has a positive moderating effect on the negative relationship between fintech development and bank performance. The estimated coefficient of two-way interaction Fintech x Financial Friction ($\alpha = 0.452; p < 0.01$) is significantly positive. A graph of the moderating effect of financial friction is presented in Figure 4. This result implies that this negative relationship between fintech development

<table>
<thead>
<tr>
<th>Table 5. Two-way interaction effect on monetary policy, financial friction, and banks’ risk performance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>(1) NIM</td>
</tr>
<tr>
<td>Fintech</td>
</tr>
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<tr>
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</tr>
<tr>
<td>Fintech x financial friction</td>
</tr>
<tr>
<td>Financial friction</td>
</tr>
<tr>
<td>Fintech x bank risk</td>
</tr>
<tr>
<td>Bank risk</td>
</tr>
<tr>
<td>Size</td>
</tr>
<tr>
<td>Liquidity</td>
</tr>
<tr>
<td>Income diversity</td>
</tr>
<tr>
<td>Leverage</td>
</tr>
<tr>
<td>Shadow banking</td>
</tr>
<tr>
<td>NPL</td>
</tr>
<tr>
<td>GDP</td>
</tr>
<tr>
<td>Inflation</td>
</tr>
<tr>
<td>_cons</td>
</tr>
<tr>
<td>Hausman test (p-value)</td>
</tr>
<tr>
<td>Observations</td>
</tr>
<tr>
<td>R-squared</td>
</tr>
</tbody>
</table>

Standard errors are in parentheses

*** p<.01, ** p<.05, * p<.1
and bank performance will be weaker (stronger) when financial friction is higher (lower). Although
tech companies compete with banks by providing similar financial services to banks, the empirical
results of Model 2 reveal the potential benefits of banks’ active participation in fintech development,
especially in an environment of high financial friction. First, banks combine traditional transaction
methods with rapidly developing technologies by actively investing in IT innovation and absorbing
technology spillovers from fintech companies, thereby reducing information asymmetry and decreasing
transaction and management costs (Thakor & Merton, 2018; Zheng, Zhang, Zhan, & Sharma et al.,
2022; Zheng, Fan, Wang, H., & Liu, 2021). Second, the development of fintech has subverted the
market structure of the traditional finance industry. This makes the competition among banks fierce,
while the participation of fintech companies has intensified the competition in the finance industry.
The intensification of industry competition encourages banks to expand relationship loans, which
can reduce the threat of fintech lenders to the credit business with the banking industry to a certain
extent (Degryse & Ongena, 2007).

In Model 3, the estimated result is consistent with Hypothesis 4, that a higher bank risk preference
has a positive moderating effect on the negative relationship between fintech development and bank
performance. The estimated coefficient of two-way interaction Fintech x Bank Risk \( \alpha = 0.484; p < 0.01 \)
is significantly positive. A graph of the moderating effect of banks’ risk preference is presented in
Figure 5. This result implies that this negative relationship between fintech development and bank
performance will be stronger (weaker) when the bank Z-score is higher (lower). There are two possible
explanations for this finding. First, embracing fintech is an inevitable digital trend for banks, which
need to take corresponding risks to actively participate in the development of fintech (Meinert, 2017).
Specifically, cooperation with existing technology companies and the establishment of fintech
subsidiaries affiliated with banks require banks to make a huge overall investment in the initial stage,
which may increase their operational risk (Wang et al., 2020). Second, the intense competition brought
about by the development of fintech in the financial industry threatens the franchise value of banks,
which encourages banks to mitigate the hazard of fintech companies by adopting more risk-taking
behavior.

Figure 3. Moderating effect of monetary policy
Robustness Checks

This study conducts a robust test to support the reliability of the above empirical results. First, it divides the bank sample into state-owned banks (SOBs) and non-state-owned banks (NSOBs) to examine whether the effect of fintech development on bank performance varies with the ownership characteristics of banks. The division between SOBs and NSOBs is a key feature of China’s banking system. The market value of SOBs is directly protected and controlled by the central government, while the rest of the commercial banks are NSOBs. Existing studies on China’s banking system highlight that NSOBs are characterized by a more flexible regulatory system and lower capital size (Chen et al., 2018). Tables 6 and 7 depict the estimation results of bank performance of SOBs and NSOBs, respectively. The empirical results of Tables 6 and 7 are consistent with Hypotheses 1–4, and there is no change in the direction and significance of the key variables. In particular, the development of fintech is found to have a significant effect on NSOBs ($\alpha = -0.894; P < 0.01$) was higher than that of SOBs ($\alpha = -0.542; P < 0.01$) is larger. Second, referring to the research of Pasiouras and Kosmidou (2007), this study replaces the measurement variables of bank performance
from NIM to ROA and ROE to further examine the consistency of the above empirical results. Tables 8 and 9 show the main and moderating effects of the development of fintech on bank performance, respectively. Again, the empirical results of Tables 8 and 9 are consistent with Hypotheses 1–4, with no change in the direction and significance of the effect of the key variables.

Table 6. Robustness checks: Subsample of state-owned banks

<table>
<thead>
<tr>
<th></th>
<th>(1) NIM</th>
<th>(2) NIM</th>
<th>(3) NIM</th>
<th>(4) NIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fintech</td>
<td>-0.542***</td>
<td>-0.647***</td>
<td>-0.792**</td>
<td>-0.389</td>
</tr>
<tr>
<td></td>
<td>(0.065)</td>
<td>(0.062)</td>
<td>(0.048)</td>
<td>(0.229)</td>
</tr>
<tr>
<td>Fintech x monetary policy</td>
<td>0.051**</td>
<td>0.051**</td>
<td>0.044</td>
<td>0.021</td>
</tr>
<tr>
<td>Monetary policy</td>
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<td>-0.017</td>
<td>-0.020</td>
<td>-0.016</td>
</tr>
<tr>
<td></td>
<td>(0.044)</td>
<td>(0.044)</td>
<td>(0.044)</td>
<td>(0.044)</td>
</tr>
<tr>
<td>Fintech x financial friction</td>
<td>0.426*</td>
<td>0.244</td>
<td>0.255</td>
<td>(0.753)</td>
</tr>
<tr>
<td>Financial friction</td>
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<td>0.255</td>
<td>0.255</td>
<td>(0.753)</td>
</tr>
<tr>
<td>Fintech x bank risk</td>
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<td>-0.220***</td>
<td>-0.220***</td>
<td>-0.220***</td>
</tr>
<tr>
<td>Bank risk</td>
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<td>0.623***</td>
<td>0.623***</td>
<td>0.623***</td>
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<tr>
<td></td>
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<td>(0.188)</td>
<td>(0.188)</td>
<td>(0.188)</td>
</tr>
<tr>
<td>Size</td>
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<td>-4.031***</td>
<td>-4.127***</td>
<td>-3.591***</td>
</tr>
<tr>
<td></td>
<td>(0.564)</td>
<td>(0.564)</td>
<td>(0.564)</td>
<td>(0.564)</td>
</tr>
<tr>
<td>Liquidity</td>
<td>-0.008*</td>
<td>-0.007*</td>
<td>-0.002</td>
<td>-0.011***</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Income diversity</td>
<td>-0.010*</td>
<td>-0.010*</td>
<td>-0.010*</td>
<td>-0.010*</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.006)</td>
</tr>
<tr>
<td>Leverage</td>
<td>-0.024</td>
<td>-0.024</td>
<td>-0.024</td>
<td>-0.024</td>
</tr>
<tr>
<td></td>
<td>(0.055)</td>
<td>(0.055)</td>
<td>(0.055)</td>
<td>(0.055)</td>
</tr>
<tr>
<td>Shadow banking</td>
<td>0.010</td>
<td>0.009</td>
<td>0.009</td>
<td>0.009</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>NPL</td>
<td>0.289</td>
<td>0.301*</td>
<td>-0.002</td>
<td>-0.002</td>
</tr>
<tr>
<td></td>
<td>(0.170)</td>
<td>(0.174)</td>
<td>(0.231)</td>
<td>(0.197)</td>
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<td>GDP</td>
<td>7.296***</td>
<td>6.945***</td>
<td>7.334***</td>
<td>6.776***</td>
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<tr>
<td></td>
<td>(0.284)</td>
<td>(0.306)</td>
<td>(0.278)</td>
<td>(0.278)</td>
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<tr>
<td>Inflation</td>
<td>0.002</td>
<td>0.014</td>
<td>0.014</td>
<td>0.014</td>
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<tr>
<td></td>
<td>(0.027)</td>
<td>(0.027)</td>
<td>(0.027)</td>
<td>(0.027)</td>
</tr>
<tr>
<td>_cons</td>
<td>-88.787***</td>
<td>-86.734***</td>
<td>-96.394***</td>
<td>-97.109***</td>
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<td>Observations</td>
<td>112</td>
<td>112</td>
<td>112</td>
<td>112</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.933</td>
<td>0.933</td>
<td>0.933</td>
<td>0.933</td>
</tr>
</tbody>
</table>

Standard errors are in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7. Robustness checks: Subsample of non-state-owned banks

<table>
<thead>
<tr>
<th></th>
<th>(1) NIM</th>
<th>(2) NIM</th>
<th>(3) NIM</th>
<th>(4) NIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fintech</td>
<td>-0.894***</td>
<td>-1.018***</td>
<td>-1.647***</td>
<td>-0.283**</td>
</tr>
<tr>
<td></td>
<td>(0.039)</td>
<td>(0.049)</td>
<td>(0.267)</td>
<td>(0.118)</td>
</tr>
<tr>
<td>Fintech x monetary policy</td>
<td>0.036***</td>
<td>0.036***</td>
<td>0.036***</td>
<td>0.036***</td>
</tr>
<tr>
<td>Monetary policy</td>
<td>-0.098***</td>
<td>-0.098***</td>
<td>-0.098***</td>
<td>-0.098***</td>
</tr>
<tr>
<td></td>
<td>(0.033)</td>
<td>(0.033)</td>
<td>(0.033)</td>
<td>(0.033)</td>
</tr>
<tr>
<td>Fintech x financial friction</td>
<td>0.690***</td>
<td>0.690***</td>
<td>0.690***</td>
<td>0.690***</td>
</tr>
<tr>
<td>Financial friction</td>
<td>0.688</td>
<td>0.688</td>
<td>0.688</td>
<td>0.688</td>
</tr>
<tr>
<td>Fintech x bank risk</td>
<td>-0.174***</td>
<td>-0.174***</td>
<td>-0.174***</td>
<td>-0.174***</td>
</tr>
<tr>
<td>Bank risk</td>
<td>0.405***</td>
<td>0.405***</td>
<td>0.405***</td>
<td>0.405***</td>
</tr>
<tr>
<td></td>
<td>(0.090)</td>
<td>(0.090)</td>
<td>(0.090)</td>
<td>(0.090)</td>
</tr>
<tr>
<td>Size</td>
<td>-0.522***</td>
<td>-0.599***</td>
<td>-0.975***</td>
<td>-0.662***</td>
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<tr>
<td></td>
<td>(0.121)</td>
<td>(0.116)</td>
<td>(0.123)</td>
<td>(0.123)</td>
</tr>
<tr>
<td>Liquidity</td>
<td>-0.006***</td>
<td>-0.006***</td>
<td>-0.006***</td>
<td>-0.006***</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Income diversity</td>
<td>-0.018***</td>
<td>-0.017***</td>
<td>-0.020***</td>
<td>-0.021***</td>
</tr>
<tr>
<td></td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
<td>(0.003)</td>
</tr>
<tr>
<td>Leverage</td>
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<td>-0.002</td>
<td>-0.002</td>
<td>-0.002</td>
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<tr>
<td></td>
<td>(0.024)</td>
<td>(0.024)</td>
<td>(0.024)</td>
<td>(0.024)</td>
</tr>
<tr>
<td>Shadow banking</td>
<td>0.011</td>
<td>0.008</td>
<td>0.008</td>
<td>0.008</td>
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<tr>
<td></td>
<td>(0.008)</td>
<td>(0.007)</td>
<td>(0.007)</td>
<td>(0.007)</td>
</tr>
<tr>
<td>NPL</td>
<td>0.059</td>
<td>0.041</td>
<td>-0.026</td>
<td>-0.226***</td>
</tr>
<tr>
<td></td>
<td>(0.064)</td>
<td>(0.054)</td>
<td>(0.070)</td>
<td>(0.062)</td>
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<tr>
<td>GDP</td>
<td>7.016***</td>
<td>6.680***</td>
<td>7.318***</td>
<td>6.918***</td>
</tr>
<tr>
<td></td>
<td>(0.180)</td>
<td>(0.183)</td>
<td>(0.167)</td>
<td>(0.167)</td>
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<tr>
<td>Inflation</td>
<td>0.026</td>
<td>0.040**</td>
<td>0.110***</td>
<td>0.056***</td>
</tr>
<tr>
<td></td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
<td>(0.020)</td>
</tr>
<tr>
<td></td>
<td>(5.644)</td>
<td>(5.722)</td>
<td>(5.542)</td>
<td>(5.444)</td>
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<td>Observations</td>
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<td>336</td>
<td>336</td>
<td>336</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.864</td>
<td>0.877</td>
<td>0.890</td>
<td>0.876</td>
</tr>
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</table>

Standard errors are in parentheses

*** p<0.01, ** p<0.05, * p<0.1
Table 8. Robustness checks: Effect of Fintech development on bank performance with alternative measures

<table>
<thead>
<tr>
<th></th>
<th>(1) ROA</th>
<th></th>
<th>(2) ROE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fintech</td>
<td>-0.431***</td>
<td>(0.015)</td>
<td>-6.903***</td>
<td>(0.237)</td>
</tr>
<tr>
<td>Size</td>
<td>-0.263***</td>
<td>(0.052)</td>
<td>-3.962***</td>
<td>(0.843)</td>
</tr>
<tr>
<td>Liquidity</td>
<td>-0.004***</td>
<td>(0.001)</td>
<td>-0.067***</td>
<td>(0.013)</td>
</tr>
<tr>
<td>Income diversity</td>
<td>0.000</td>
<td>(0.001)</td>
<td>-0.004</td>
<td>(0.020)</td>
</tr>
<tr>
<td>Leverage</td>
<td>0.011</td>
<td>(0.010)</td>
<td>0.248</td>
<td>(0.169)</td>
</tr>
<tr>
<td>Shadow banking</td>
<td>0.002</td>
<td>(0.003)</td>
<td>0.016</td>
<td>(0.056)</td>
</tr>
<tr>
<td>NPL</td>
<td>-0.083***</td>
<td>(0.028)</td>
<td>-1.879***</td>
<td>(0.435)</td>
</tr>
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<td>GDP</td>
<td>3.273***</td>
<td>(0.074)</td>
<td>49.467***</td>
<td>(1.205)</td>
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<td>Inflation</td>
<td>0.018**</td>
<td>(0.008)</td>
<td>0.032</td>
<td>(0.131)</td>
</tr>
<tr>
<td>_cons</td>
<td>-90.753***</td>
<td>(2.344)</td>
<td>-1366.393***</td>
<td>(38.169)</td>
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<td>Observations</td>
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<td>(2.332)</td>
<td>448</td>
<td>(3.725)</td>
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<td>R-squared</td>
<td>0.854</td>
<td>(0.067)</td>
<td>0.842</td>
<td>(1.084)</td>
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</table>

Standard errors are in parentheses
***p<.01, **p<.05, *p<.1

Table 9. Robustness checks: Two-way interaction effect of monetary policy, financial friction, and banks' risk preference with alternative measures

<table>
<thead>
<tr>
<th></th>
<th>(1) ROA</th>
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<th>(2) ROE</th>
<th></th>
<th>(3) ROA</th>
<th></th>
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<th>(5) ROA</th>
<th></th>
<th>(6) ROE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fintech</td>
<td>-0.479***</td>
<td>(0.019)</td>
<td>-7.656***</td>
<td>(0.319)</td>
<td>-0.82***</td>
<td>(0.115)</td>
<td>15.116***</td>
<td>(1.856)</td>
<td>0.007</td>
<td>(0.046)</td>
<td>0.949</td>
<td>(0.730)</td>
</tr>
<tr>
<td>Fintech x monetary policy</td>
<td>0.030***</td>
<td>(0.006)</td>
<td>0.428***</td>
<td>(0.103)</td>
<td>-0.08***</td>
<td>(0.013)</td>
<td>-0.666***</td>
<td>(0.221)</td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>Monetary policy</td>
<td>-0.084***</td>
<td>(0.013)</td>
<td>-0.506***</td>
<td>(0.221)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fintech x financial friction</td>
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<td>(0.067)</td>
<td>5.594***</td>
<td>(1.084)</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Financial friction</td>
<td>-0.284</td>
<td>(0.232)</td>
<td>-7.297*</td>
<td>(3.725)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Fintech x bank risk</td>
<td>-0.114***</td>
<td>(0.012)</td>
<td>-2.091***</td>
<td>(0.185)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Bank risk</td>
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<td>(0.033)</td>
<td>2.383***</td>
<td>(0.525)</td>
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<td></td>
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</tr>
<tr>
<td>Size</td>
<td>-0.275***</td>
<td>(0.050)</td>
<td>-4.119***</td>
<td>(0.827)</td>
<td>-0.36***</td>
<td>(0.054)</td>
<td>-5.841***</td>
<td>(0.886)</td>
<td>0.007</td>
<td>(0.051)</td>
<td>0.949</td>
<td>(0.810)</td>
</tr>
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<td>Liquidity</td>
<td>-0.050***</td>
<td>(0.010)</td>
<td>-0.065***</td>
<td>(0.011)</td>
<td>-0.07***</td>
<td>(0.010)</td>
<td>-0.143***</td>
<td>(0.011)</td>
<td>-0.034***</td>
<td>(0.011)</td>
<td>-0.063***</td>
<td>(0.011)</td>
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<tr>
<td>Income diversity</td>
<td>0.000</td>
<td>(0.001)</td>
<td>0.000</td>
<td>(0.001)</td>
<td>-0.001</td>
<td>(0.001)</td>
<td>-0.011</td>
<td>(0.001)</td>
<td>-0.003***</td>
<td>(0.001)</td>
<td>-0.055***</td>
<td>(0.001)</td>
</tr>
<tr>
<td>Leverage</td>
<td>0.005</td>
<td>(0.010)</td>
<td>-0.331***</td>
<td>(0.167)</td>
<td>0.01</td>
<td>(0.011)</td>
<td>-0.203</td>
<td>(0.165)</td>
<td>-0.006</td>
<td>(0.010)</td>
<td>-0.153</td>
<td>(0.159)</td>
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<tr>
<td>Shadow banking</td>
<td>0.001</td>
<td>(0.001)</td>
<td>0.004</td>
<td>(0.001)</td>
<td>-0.003</td>
<td>(0.001)</td>
<td>-0.073</td>
<td>(0.001)</td>
<td>0.035</td>
<td>(0.001)</td>
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<tr>
<td>NPL</td>
<td>-0.092***</td>
<td>(0.003)</td>
<td>-1.998***</td>
<td>(0.055)</td>
<td>-0.174***</td>
<td>(0.024)</td>
<td>-3.644***</td>
<td>(0.024)</td>
<td>-0.134***</td>
<td>(0.024)</td>
<td>-2.525***</td>
<td>(0.040)</td>
</tr>
<tr>
<td>GDP</td>
<td>3.144***</td>
<td>(0.075)</td>
<td>47.259***</td>
<td>(1.243)</td>
<td>3.313***</td>
<td>(0.074)</td>
<td>50.165***</td>
<td>(1.189)</td>
<td>3.162***</td>
<td>(0.081)</td>
<td>52.468***</td>
<td>(1.285)</td>
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<tr>
<td>Inflation</td>
<td>0.027***</td>
<td>(0.008)</td>
<td>0.16</td>
<td>(0.133)</td>
<td>0.046***</td>
<td>(0.010)</td>
<td>0.570***</td>
<td>(0.154)</td>
<td>0.030***</td>
<td>(0.008)</td>
<td>0.416***</td>
<td>(0.121)</td>
</tr>
<tr>
<td>_cons</td>
<td>-86.356***</td>
<td>(2.409)</td>
<td>-1307.955***</td>
<td>(39.682)</td>
<td>-88.708***</td>
<td>(2.460)</td>
<td>-1321.826**</td>
<td>(39.535)</td>
<td>-83.500***</td>
<td>(2.392)</td>
<td>-1354.641***</td>
<td>(38.176)</td>
</tr>
<tr>
<td>Observations</td>
<td>448</td>
<td>(448)</td>
<td>448</td>
<td>(448)</td>
<td>448</td>
<td>(448)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>R-squared</td>
<td>0.864</td>
<td>0.849</td>
<td>0.865</td>
<td>0.853</td>
<td>0.883</td>
<td>0.880</td>
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Standard errors are in parentheses
***p<.01, **p<.05, *p<.1
DISCUSSION

Conclusion

This study provides empirical support for research into financial digitalization and organizational performance by examining the influence of fintech development on bank performance. The results indicate that the development of fintech is negatively correlated with bank performance. Therefore, the empirical evidence from this study suggests that the development of fintech leads to a competitive effect between fintech firms and banks that dominates the cooperative effect of banks improving their performance by actively participating in fintech development, which poses a challenge to bank performance. The study also finds the moderating effects of monetary policy and financial friction as external factors. In particular, monetary policy moderates the relationship between the development of fintech and bank performance; that is, in the monetary easing cycle, the threat of fintech development to bank performance is reduced compared with the monetary tightening cycle. In an external environment of high financial friction, the threat of fintech development to bank performance could be weakened compared with low financial friction. In addition, the risk preference of banks is found to moderate the relationship between fintech development and bank performance; that is, banks implementing more risk-taking behavior could weaken the negative effect of fintech development on bank performance.

Theoretical Implications

This study makes several theoretical contributions to the literature. First, it provides empirical support for existing research that discusses the relationship between the digital development of finance and traditional financial intermediation. The relationship between fintech and banks has long been the focus of scholars’ discussions, but no consensus has been reached. Recent research has attempted to use empirical data to measure the effect of fintech development on the banking industry. For example, some research adopts fintech lending and the number of fintech companies in corresponding investigations (Li et al., 2017; Phan et al., 2020). However, these indicators only focus on the competition of fintech development on banks; the benefits of banks’ participation in fintech development are not reflected. Scholars also discuss the development of fintech by analyzing the attention of fintech-related information on search engines or media (Guo & Shen, 2016; Wang et al., 2020). Although this indicator considers the overall situation, the stability is doubtful because the measurement accuracy is subject to the choice of keywords. This study contributes to the overall study of the digitalization of the financial industry in the Chinese context by using non-bank payment data. The development of non-bank payments can reflect the financial business development of non-bank institutions (e.g., Alipay, WeChat Pay). Non-banking institutions continue to expand their business in the primary payment field, which involves the traditional and intermediary businesses of banks. In addition, China’s non-bank payment is closely related to the banking industry, forcing it to actively develop its digital development to achieve business connections with non-banking institutions. Therefore, the fintech data used in this study comprehensively reflects the development trend of fintech.

Second, this study enriches the research on financial digitalization and monetary policy by introducing monetary policy and examining its effect on the relationship between fintech development and banking. Previous studies have discussed the effect of the rise of fintech on monetary policy. For example, Hasan et al. (2020) explore the relationship between financial digitalization and the transmission mechanism of monetary policy. While the development of fintech may improve the effectiveness of monetary policy transmission because non-banks may also be affected by policy interest rates (Rajan, 2006), non-banks may weaken the effect of monetary policy on banks through competition and regulatory arbitrage channels (Buchak et al., 2018b). Mumtaz and Smith (2020) explore the role of fintech in the transmission of monetary policy and find that the development of technologies related to financial digitization has a significant effect on monetary policy by increasing demand for money. However, few studies have explored the effect of fintech development on the
banking sector in different monetary policy cycles. The empirical results of this study indicate that the challenge of fintech development for the banking industry could be weakened in the monetary policy easing cycle. Specifically, loose monetary policy increases banks’ loan volume and, combined with the unique trust advantage of customers to the bank, this may alleviate fintech’s challenges to the banking industry.

Third, this study enriches the existing literature by analyzing the effect of financial friction on the relationship between fintech development and banking. Existing literature mainly focuses on the effect of the development of fintech on financial friction. For example, Zamani and Giaglis (2018) show that the development and application of blockchain technology in the financial industry can be diversified and decentralized. The increasing competitive pressure in the banking industry caused by decentralization prompts managers to improve operational efficiency, which reduces financial friction (Hart, 1983). In addition, extensive information sharing caused by the broad application of big data analysis in the financial industry can reduce information friction (Guérineau & Leon, 2019). However, few studies have explored the effect of fintech development on the banking industry in different financial friction environments. The empirical results of this study indicate that the challenge of fintech development to the banking industry may be weakened in an environment of high financial friction. Specifically, market concentration is higher in the context of high financial friction. When participants with more market power face more intense competition brought about by the development of fintech, they may mitigate the effect of fintech companies by increasing the issuance of relationship loans. In addition, in an environment with a high degree of financial friction, market participants actively embrace the development of fintech, which makes them alleviate the challenges of fintech companies to some extent.

Fourth, this study contributes to the growing literature on banks’ risk preference in the context of financial digitization, demonstrating that banks’ risk preference is an essential factor affecting the development of fintech and bank relationships. Recent studies have attempted to explore the black and white sides of the effect of financial innovation on banks’ risk preference but have not reached a consensus (Navaretti et al., 2017). From the perspective of the black side, first, the addition of fintech companies that provide similar financial services challenges traditional financial service providers, increasing banks’ risk-taking behavior (Di et al., 2020; Gomber et al., 2017; Panos & Wilson, 2020). Second, the development of fintech by banks requires high coordination costs and transaction costs through cooperation with specific technology service providers and internet companies, which places tremendous financial pressure on banks and increases the risk level. From the perspective of the white side, banks actively embrace the development of fintech and achieve service optimization and business innovation by combining fintech means and their customer trust advantages, which reduces the incentive for banks to take risks (Wang et al., 2020). However, few studies have explored the effect of banks’ risk preference on fintech development and banking relationships. The empirical results of this study indicate that the risk-taking appetite of banks may weaken the challenge of fintech development to the banking industry. Specifically, banks with risk-taking appetites could be more willing to bear the risks brought about by their development of fintech and cooperation with fintech companies, which further mitigates the threat of fintech development.

**Practical Implications**

This study has practical implications for banks and regulators. First, banks should pay attention to the effect of developing “bank-like” fintech companies on financial business. A typical example in China is Ant Group’s rapid expansion in the financial sector. In 2020, 7.29 billion users conducted financial service transactions through the platform, and a total of 1.7 trillion yuan of consumer loans were granted to users. In the first quarter of 2021, Ant Group became the largest seller of non-money-market mutual funds in China, breaking through the market dominated by banks (Jiang et al., 2022). In addition, NSOBs are more negatively affected by the development of fintech than SOBs. A possible explanation is that because of their smaller size, NSOBs have less funds to invest
in financial digitalization and have fewer cooperative networks with technology companies, which makes the ability of NSOBs to transform, absorb, and use fintech relatively weak. In addition, NSOBs accumulate less information about individual and corporate loan users than SOBs, making it difficult for them to offset the effect of fintech companies by increasing relationship loans.

Second, the external environment of the monetary easing cycle and high financial friction may mitigate the adverse effects of fintech development. However, the banking industry should note that with a change in the external environment, the adverse effects of banks may intensify. Many countries implemented loose monetary policies after the subprime crisis to support financial intermediaries and improve the macroeconomy (Freixas et al., 2015). However, scholars are increasingly concerned about the adverse effects of loose monetary policy on financial stability, followed by recent discussions on the implementation of macroprudential policies and prudent monetary policies by policymakers (Adrian & Liang, 2014; Bernanke, 2020). Therefore, in the foreseeable future, the monetary easing cycle that is beneficial to the bank credit business may be tightened, further aggravating fintech companies’ challenges. The same trend may also occur in financial friction factors as countries pay more attention to the construction of credit systems and the decentralization and transparency changes brought about by financial digitalization.

Third, with the rapid development of financial digitalization, there has been a general trend for banks to actively participate in fintech development. At present, banks participate in digital transformation mainly by increasing internal IT investment, setting up fintech branches affiliated with headquarters, and cooperating with existing fintech and technology companies. However, these approaches require banks to make massive investments early, which may increase their operational risks. In addition, cooperation with technology companies risks a long achievement cycle and cooperation failure (Wang et al., 2020). As the empirical results of this study show, banks with a risk-taking appetite can mitigate the threat of fintech. Thus, banks embracing fintech development may enable them to dabble in a new digital world (Kerényi & Müller, 2019).

Fourth, this study has practical implications for regulators. Recently, more scholars have been discussing that the development of fintech is a double-edged sword for financial stability. While fintech may promote financial stability by increasing the convenience of financial services and improving efficiency and diversification (Fung et al., 2020; Guérineau & Leon, 2019; Zamani & Giaglis, 2018), it may also amplify contagious, procyclical, and volatility of financial markets (Dastin, 2017; Fung et al., 2020; Gemayel & Preda, 2018). This study indicates that fintech development negatively affects banks, and banks’ risk-taking appetite can reduce the challenge of fintech. These results should alert regulators to the threat to financial stability posed by fintech development and banks’ response. Specifically, fintech companies may use leading big data analysis technology to establish a dominant and monopolistic position in the financial market. Regulators need to pay attention to the market monopoly and discrimination problems that may arise from the rapid expansion of fintech companies. Regulators could adapt to the development trend of IT and develop certification standards for fintech products through the development and application of advanced technologies (e.g., cloud computing, big data, blockchain). Further, there is still regulatory arbitrage in China’s financial market, and fintech companies have gradually become comprehensive financial players after actively obtaining a financial license. Regulators should improve the existing regulatory framework, including the access threshold, corporate governance, and capital requirements, to make up for regulatory shortcomings. Finally, the competition and cooperation relationship between fintech and traditional financial intermediaries brought about by fintech development may lead to an increase in financial institutions’ risk and be transmitted to the whole financial market. Regulators need to clarify the business rules and scope of fintech companies.

**Limitations and Future Research**

Although the empirical results of this study are robust, we recognize that they have some limitations, which also generate future research agendas. First, this study is only based on the particular situation
of financial digitalization in China. Fintech companies are widely involved in financial services and have close ties with traditional financial intermediaries; therefore, the universality of the findings of this study outside China needs to be further explored. Future studies can be extended to other countries to test the generality of our results. Second, although the indicators selected in this study can measure the overall effect of fintech development, which was ideal to answer the hypotheses, future research should find more comprehensive indicators to measure the trend of fintech development. Third, this study only selects monetary policy and financial friction as external factors and banks’ risk preference as an internal factor to explore their effect on the relationship between fintech development and bank performance. Future research should find other vital factors that affect the relationship between fintech development and bank performance to further enrich the research.

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REFERENCES


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