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# **Essays on Fintech development**

A thesis

submitted in fulfilment

of the requirements for the degree

of

**Doctor of Philosophy in Finance**

at

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by

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THE UNIVERSITY OF  
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## **Abstract**

Fintech is a contraction of the term "financial technology", which has become increasingly popular in the financial sector in recent years. Even the outbreak of the COVID-19 pandemic in December 2019 has not changed the fact that the Fintech industry is growing. The rapid development of Fintech has significantly impacted the traditional financial landscape, redefining the delivery of financial services, broadening their coverage, and significantly improving efficiency and convenience, injecting new vitality into the global financial industry.

The aim of this thesis is to explore the impact of Fintech on the incumbent financial system and the real economy in the Chinese context. First, to gauge the development of the Fintech area in China, this paper uses various Fintech development indicators. Notably, this thesis builds the Fintech development index by combining the multidimensional information that involves advanced technologies and Fintech-related fields. The study also uses the Peking University Digital Financial Inclusion Index of China (PKU-DFIIC) and hand-collected and constructed datasets of Fintech patents. Second, this thesis comprehensively analyses the implications of Fintech developments on corporate operational strategies in several key areas including risk-taking, liquidity creation, diversification, fraud, tax avoidance, financing, and investment policies. By exploring how Fintech shapes corporate development strategies and influences value growth in these areas, the thesis reveals the role of Fintech in optimizing resource allocation, improving corporate efficiency, and reducing operational risk. Moreover, the study analyses the potential risks and challenges that the Fintech development may pose.

The main contribution of this thesis is to provide new empirical evidence for the impact of Fintech on the development of traditional financial institutions and the real economy and to fill the gaps in existing research. Through an in-depth exploration of the economic consequences of the Fintech field, this paper not only reveals the role of Fintech in promoting the transformation of the real economy but also provides new perspectives on the benign development of the Fintech industry. Meanwhile, the findings

provide valuable insights into the transformation of China's existing economic system, especially in terms of how to optimize the financial service system, improve the efficiency of resource allocation, and achieve sustainable growth in the context of the digital economy, which has important political implications.

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# Contents

<b>1</b>	<b>Chapter 1 Introduction</b> .....	<b>5</b>
1.1	Overview .....	5
1.2	Research background .....	6
1.3	Research questions .....	8
1.4	Contribution to the literature .....	10
1.5	Thesis outline .....	12
1.6	Note on publications .....	14
<b>2</b>	<b>Chapter 2 Literature review</b> .....	<b>18</b>
<b>3</b>	<b>Chapter 3 Fintech, bank diversification and liquidity: Evidence from China</b>	<b>25</b>
<b>4</b>	<b>Chapter 4 Fintech development, corporate tax avoidance and firm value..</b>	<b>46</b>
<b>5</b>	<b>Chapter 5 Fintech and corporate risk-taking: Evidence from China.....</b>	<b>65</b>
<b>6</b>	<b>Chapter 6 Does Fintech innovation impact corporate fraud? Evidence from China .....</b>	<b>75</b>
<b>7</b>	<b>Chapter 7 Fintech development and corporate financial policy: Evidence from corporate financing and investment .....</b>	<b>87</b>
<b>8</b>	<b>Chapter 8 Conclusion.....</b>	<b>109</b>

8.1	Overview .....	109
8.2	Key results .....	110
8.3	Future research.....	112
<b>9</b>	<b>Appendix: Co-Authorship form .....</b>	<b>116</b>

# Chapter 1

## Introduction

### 1.1 Overview

In recent years, financial technology (Fintech) has become the focus of attention in the global financial industry and is playing an increasingly critical role in financial services innovation and industry transformation. The Financial Stability Board (FSB) defined Fintech as technology-enabled financial innovation, that can cause novel products, services, processes, or business models and significantly impact the incumbent financial market and financial services institutions (e.g., banks, insurance, stock markets, venture firms, etc.).<sup>1</sup> With the breakthroughs in cutting-edge technologies, such as artificial intelligence, big data, blockchain and cloud computing and the growing penetration of technology in the financial sector, Fintech is gradually breaking down the boundaries of the traditional financial system. Especially, Fintech is reshaping the supply model of financial services and pushing the financial ecosystem towards more efficient, inclusive and intelligent development.

A growing body of academic research (Jia, 2024; Lu et al., 2024; Zhang et al., 2024) indicates that Fintech, through the introduction of innovative and diversified financial products and services, effectively fills the service gaps of the traditional financial system, enhances the accessibility and convenience of financial services, and promotes financial inclusion. Relying on emerging technologies, Fintech effectively breaks through the time and space limitations of traditional financial services and realises the digitalisation of financial service processes. This disruptive development has not only

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<sup>1</sup><https://www.fsb.org/work-of-the-fsb/financial-innovation-and-structural-change/Fintech/>

changed the competitive pattern of the existing financial industry but also promoted the comprehensive upgrading and innovation of the financial system. Fintech has great potential to improve the efficiency of financial services reduce transaction costs and information asymmetry problems, and thus provide more flexible and efficient financing channels for small and medium-sized enterprises (SMEs) and low-income people who are difficult to be covered by traditional financial services (Ding et al., 2022; Nie et al., 2023). In short, under the context of the on-going evolution of the global financial system, Fintech, as an emerging dimension in the financial system, not only reshapes the function of financial intermediation and improves the efficiency of resource allocation, but also greatly affects the financing environment and business behavior of companies, with far-reaching impacts on the strategy planning and long-term development of companies. Although research on Fintech is gradually increasing, there remains no consensus on how Fintech will affect the financial sector and the real economy.

The main purpose of this thesis is an in-depth analysis of the economic consequences of Fintech development. As a new dimension of the financial system, the financial development driven by the Fintech emergence profoundly impacts the strategic planning and long-term development of incumbent firms. This thesis presents an empirical analysis of the impact of Fintech on corporate behavior and the operation of financial institutions based on the institutional environment and practical context of the Chinese market. More specifically, this thesis focuses on the impact of Fintech at the firm level, highlighting the role of Fintech in driving banks' liquidity creation, banks' diversification strategies, corporate tax avoidance, corporate risk-taking capacity, corporate fraud, financing and investment strategies, and further investigating the potential mechanisms of the impact. The findings not only enrich the literature on the impact of Fintech development, but also provide new academic perspectives and insights for promoting enterprise value enhancement, realizing high-quality development of enterprises, and facilitating the improvement of regulatory policies.

## **1.2 Research background**

My research will mainly focus on the Chinese market. Over the past few years, the growth of the Fintech sector in China has been particularly remarkable (Guo et al.,

2023). The bank-centered economic system in China has left huge room and potential for the growth of Fintech. Many large Fintech companies, such as Ant Group, Lufax, Tencent, and ZhongAn Insurance, provide services in various fields involving online lending, digital payments, financial management, and insurance, which are gradually expanding the coverage and accessibility of financial services in the Chinese market. A number of small Fintech start-ups are also gradually entering the market. These small Fintech platforms provide low-threshold, highly liquid financial products, allowing more people to invest in financial products and achieve asset appreciation. With the support of advanced technology, Fintech companies have broken through the geographical boundaries of traditional financial services. They not only provide basic financial services to groups underserved by traditional financial services but also meet the needs of different consumers and businesses through diversified products. Especially for customer groups that have been neglected by traditional financial institutions, such as those in remote areas or with low incomes, the low-threshold online service model of Fintech companies is highly important. At the same time, many traditional banks are gradually joining the Fintech wave. A report by Deloitte titled "China Banking Industry 2021 Review and 2022 Outlook" shows that in 2021, the proportion of Fintech investment in the operating income of Chinese banks increased by about 15%. The "Listed banks in China: 2023 review and Outlook" report by EY, shows that the amount of investment in Fintech as a percentage of operating income and the proportion of Fintech personnel in overall FTEs of listed Chinese banks are still growing. According to EY's Listed banks in China: 2023 review and Outlook report, investment in Fintech as a percentage of operating income and Fintech staff as a percentage of total full-time equivalents at listed Chinese banks continues to rise. In 2023, 25 listed banks disclosed their investment in Fintech/IT, with a total of RMB170.1 billion. The Chinese traditional banking industry's investment in Fintech, the optimal allocation of human resources, and the adjustment of its overall strategy reflect the importance the banking industry attaches to Fintech, as well as the development trend of the financial industry and changes in market demand.

With the rapid advancement of Fintech, the Chinese government issued laws and regulations in this field to improve the regulatory framework. In 2013, the People's Bank of China issued "the Notice on Precautions Against the Risks of Bitcoins" to

ban China's banks and payment service providers from providing Bitcoin-related services. In 2015, the "Development Plan for Big Data" emphasized the need to promote the development of Big Data technology in the financial sector. In 2017, seven government administrations in China (the People's Bank of China, the Office of the Central Leading Group for Cyberspace Affairs, the Ministry of Industry and Information Technology, the State Administration for Industry and Commerce, the China Banking Regulatory Commission, the China Securities Regulatory Commission, and the China Insurance Regulatory Commission), jointly issued "the Announcement on Preventing Financial Risks from Initial Coin Offerings". This announcement explicitly prohibited initial coin offerings (ICOs) financing activities in China's market. Financial institutions were banned from carrying out cryptocurrency-related businesses, including account registration, transactions, etc. Meanwhile, cryptocurrency trading platforms are prohibited from providing exchange services between fiat currencies and virtual currencies. In September 2019, the People's Bank of China (PBOC) released the "Fintech Development Plan for 2019-2021". This plan clarifies the guidance, basic principles, development objectives, main tasks, and safeguards for the development of the Fintech sector. In January 2022, the PBOC released the second Fintech development plan, "Fintech Development Plan for 2022-2025", which is based on "China's 14th Five-Year Plan" and aims to further promote the development of the Fintech industry in China. The unique economic system and political environment in China provide an interesting research context for exploring the real impact of the expansion of the Fintech sector.

### **1.3 Research questions**

This thesis focuses on the impact of the rise of Fintech on the development of the financial system and real economy in the Chinese context. Based on the above discussion, this thesis examines the following research questions:

1. Does the Fintech development affect the liquidity and diversification of banks?
  - Does the Fintech development have a greater impact on the liquidity and diversification of small or state-owned banks?
  - Does COVID-19 affect the relationship between Fintech development and bank liquidity and diversification?

2. Does the Fintech development influence corporate tax avoidance?
  - Does the impact of the Fintech on corporate tax avoidance increase firm value?
  - What are the possible impact channels of Fintech on corporate tax avoidance?
  - Does the internal information quality, internal control or dispersion of operations impact the relationship between Fintech and corporate tax avoidance?
  - Does the Fintech development reduce the tax risk of firms?
3. Does the Fintech development affect corporate risk-taking?
  - What are the possible impact channels of Fintech on corporate risk-taking?
  - Does Fintech have a more pronounced impact on the risk-taking of younger, smaller, or non-state-owned firms?
  - What is the influence mechanism of Fintech on corporate risk-taking?
4. Does Fintech innovation impact corporate fraud?
  - What are the plausible channels through which Fintech innovation affects corporate fraud?
  - How does Fintech innovation affect different types of fraud?
  - Does governance, external regulation, or performance pressure affect the relationship between FinTech and corporate fraud?
5. How does Fintech influence the financial policies of companies?
  - Does Fintech affect a company's investment policy?
  - Does Fintech affect corporate financing policies?
  - Do ownership structures and financial constraints drive the impact of Fintech on corporate financial policies?
  - What are the channels through which Fintech influences the investment and financing policies of firms?

## 1.4 Contribution to the literature

This thesis contributes to the existing literature in a number of important ways.

- First, this thesis offers several new insights into the impact of Fintech developments on traditional financial institutions and the real economy. Although several previous studies have examined the various impacts on Fintech development, such as social responsibility (Nguyen & Dang, 2023; Li et al., 2024a), innovation capability (Ding et al., 2022; Liu et al., 2023; Li et al., 2024b), corporate transformation (Luo et al., 2022; Wu et al., 2024), information disclosure (Wen et al., 2023; Yang et al., 2024), and environmental, social, and governance (ESG) performance (Gao et al., 2024; Hu et al., 2025; Liu et al., 2025), there are still some limitations in the relevant areas of research. Especially, there is a lack of consensus on the influence mechanisms of Fintech development on business decisions and financial system stability. This thesis fills the gap in the literature and further enriches the theory and empirical research on the real impact of Fintech development from several key perspectives, including diversification, liquidity creation, tax avoidance strategies, corporate risk-taking, financial fraud, financing access, and investment decisions. The findings document the critical role of Fintech in corporate development. My thesis also reveals the mechanism through which Fintech affects corporate behavior, deepens the academic understanding of Fintech-enabled enterprise development, and provides valuable guidance for policymakers and market participants. Furthermore, this thesis further discusses the impact of changes in corporate strategy driven by Fintech development on firm value in several chapters, showing how Fintech can be an important enabler of firm value growth, which provides new channels and perspectives for firms to promote value growth. Furthermore, several chapters in this thesis discuss the impact of changes in corporate strategy driven by Fintech development on firm value, showing how Fintech can be an important enabler of firm value growth, providing new channels and perspectives for firms to drive value growth.
- Second, this thesis contributes to relevant research in the field of financial development by highlighting the key role of Fintech development in curbing informa-

tion asymmetry in financial markets and improving the quality of financial information. The information asymmetry problem is prevalent in traditional markets, which limits the effectiveness of resource allocation and reduces the market's overall efficiency. Information asymmetry also exposes firms to higher costs and greater uncertainty in the financing process, thereby limiting their development potential and growth. The results from this thesis provide strong evidence for the critical role of Fintech in curbing the information asymmetry issue, suggesting that Fintech can significantly reduce the negative impacts of information asymmetry and thus promote the healthy growth of firms. These results not only broaden the research perspectives on how Fintech affects the development strategies of firms, but also enrich the related works in the financial development domain.

- Third, this thesis contributes to the literature by using text mining and factor analysis methods to construct a new Fintech development index. In existing Fintech-related studies, the measurement method of Fintech development has not yet been standardized. A variety of indicators constructed using different methods have been used in a number of studies. For example, Ding et al. (2022), Yang and Zhang (2022), Wang et al. (2023) and Guo et al. (2024) use the Peking University Digital Financial Inclusion Index of China compiled by a research team from the Institute of Digital Finance at Peking University and Ant Financial Services Group. Corbet et al. (2023), Fang et al. (2023), and Wen et al. (2023) measure Fintech development based on the number of Fintech patents. In order to extend this line of research, Chapter 3 of this thesis proposes a new approach to construct an index to measure Fintech development. The construction of this new index is based on multi-dimensional information data that can more comprehensively reflect the development trend and dynamics of the Fintech field in the Chinese market. This new index provides a new perspective for measuring the overall development of Fintech and addresses the lack of consistent measurement standards in existing research. Through this newly proposed Fintech index, this thesis provides more accurate and systematic data support for academic research in the field of Fintech and promotes the development of this field.

## 1.5 Thesis outline

The remainder of this thesis is organized as follows.

- Chapter 2 reviews Fintech-related studies and provides a summary of the key findings from existing literature.
- Chapter 3 attempts to explore the relationship between the emergence of Fintech and the development of the incumbent financial system. This chapter focuses on the Chinese banking sector. The banking industry is the core of the Chinese financial system. As an emerging dimension of the financial system, the financial innovation and changes in the market environment driven by Fintech will inevitably impact the development strategies of the traditional banking industry. Therefore, by using a new Fintech development index constructed by text mining and factor analysis methods, Chapter 3 examines the influence of Fintech development on Chinese commercial banks from the perspective of liquidity creation and diversification. In addition, this chapter explores the heterogeneity of the impact of Fintech development on banks with different characteristics in the Chinese context. Moreover, considering the impact of the outbreak of the COVID-19 pandemic on the global financial market at the end of 2019, Chapter 3 discusses the impact of the COVID-19 outbreak on the nexus between Fintech and bank liquidity creation and diversification strategies. Analyzing 101 Chinese banks over the period between 2011 and 2021, this chapter demonstrates that Fintech development decreases bank liquidity creation while promoting bank diversification. Given the differences in social resources, capital, operational models, and organizational structures of banks with different characteristics, state-owned banks, and smaller banks have been less responsive to the Fintech development. In addition, the study finds that the outbreak of the COVID-19 pandemic enhances the inhibitory effect of Fintech on bank liquidity creation and weakens its contribution to bank diversification. A version of Chapter 3 of this thesis has been published in the *Research in International Business and Finance*.
- In Chapter 4, the focus of this thesis shifts to the implications of the rise of the Fintech sector for the development of the real economy. In China, the de-

velopment of the real economy is of paramount importance. It is not only the cornerstone for achieving long-term sustainable economic development but also the core driving force for economic growth. Utilizing financial data from listed companies in China from 2011 to 2021, Chapter 4 first analyses the impact of the Fintech development on corporate financial planning from the aspect of tax avoidance strategies. In addition, considering that corporate tax avoidance is often viewed by a number of existing researches (Armstrong et al., 2015; Edwards et al., 2016; Hasan et al., 2021) as a risky but value-adding investment opportunity, the study further investigates whether the impact of Fintech development on corporate tax avoidance leads to changes in firm value. The empirical results suggest that Fintech development increases tax avoidance behavior, thus contributing to the increase in firm value. Meanwhile, Fintech development provides more opportunities for firms to improve the effectiveness and compliance of their planning, decrease potential tax risks, and increase the degree of the tax preferences enjoyed. A version of Chapter 4 of this thesis has been published in the *International Review of Financial Analysis*.

- Chapter 5 studies the impact of the development of Fintech development on corporate risk-taking. The degree of corporate risk-taking reflects the risk appetite of firms in making business decisions, that is, the extent to which firms are willing to incur costs in pursuit of high returns. Fintech development eases information asymmetry, lowers agency costs, and reduces corporate financial constraints, and therefore is anticipated to improve corporate risk-taking. The chapter uses data for A-share listed firms in the Shanghai and Shenzhen stock exchanges between 2011 and 2020 to confirm that Fintech development improves corporate risk-taking. A version of Chapter 5 of this thesis has been published in the *Finance Research Letters*.
- The research areas in Chapter 6 involve Fintech innovation and corporate fraud. Corporate fraud is a hot topic in the field of corporate governance and has an adverse shock on the quality development of the real economy. Corporate fraud can be regarded as the consequence of a trade-off by managers between the benefits of fraud and the costs of committing fraudulent activities. Fintech innovation

may create new opportunities for enhanced monitoring and prevention of corporate fraud. The sample in this chapter contains all Chinese A-share companies listed on the Shanghai and Shenzhen Stock Exchanges between 2011 and 2022, except for financial companies, special treatment (ST) companies, and companies with a severe lack of financial information. The main finding suggests that Fintech innovation can inhibit corporate fraud. This chapter also highlights the role of Fintech innovation on information asymmetry and financial constraints. A version of Chapter 6 of this thesis has been published in the *Finance Research Letters*

- Chapter 7 examines the nexus between Fintech development and corporate financial policy from two aspects, corporate financing and investment strategies. Investment and financing strategies are two complementary and critical strategies in a company's financial planning that have a direct impact on its resource allocation, financial structure, and long-term growth. This chapter adds to the growing literature on the economic consequences of Fintech developments by documenting the positive impact of Fintech developments on financing and investment. A version of Chapter 7 of this thesis has been published in the *Journal of International Money and Finance*.
- Chapter 8 concludes this thesis, which offers a comprehensive summary of the main results of this thesis and discusses the direction of future research.

## 1.6 Note on publications

A number of journal articles have originated from this thesis.

1. **Tang, M.**, Hu, Y., Corbet, S., Hou, Y. G., & Oxley, L. (2024). Fintech, bank diversification and liquidity: Evidence from China. *Research in International Business and Finance*, 67, 102082.

- This publication is shown in Chapter 3.

2. **Tang, M.**, Hu, Y., Hou, Y. G., Oxley, L., & Goodell, J. W. (2025). Fintech development, corporate tax avoidance and firm value. *International Review of Financial Analysis*, 97, 103765.

- This publication is shown in Chapter 4.

3. **Tang, M.**, Hou, Y. G., Goodell, J. W., & Hu, Y. (2024). Fintech and corporate risk-taking: Evidence from China. *Finance Research Letters*, 64, 105411.

- This publication is shown in Chapter 5.

4. **Tang, M.**, Hu, Y., Hou, Y. G., & Goodell, J. W. (2024). Does fintech innovation impact corporate fraud? Evidence from China. *Finance Research Letters*, 67, 105917.

- This publication is shown in Chapter 6.

5. **Tang, M.**, Hu, Y., Hou, Y. G., Oxley, L., & Goodell, J. W. (2025). Fintech development and corporate financial policy: Evidence from corporate financing and investment. *Journal of International Money and Finance*, 157, 103386.

- This publication is shown in Chapter 7.

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# Chapter 2

## Literature review

The rise of Fintech has generated far-reaching impacts on the development of financial markets and the real economy. As the field of Fintech attracts more and more attention, related academic research is also increasing. However, the real impact of Fintech development has not been comprehensively explored. On the one hand, some studies believe that Fintech can improve the quality of information in financial markets, curb the information asymmetry problem, improve the efficiency of financial services, increase the efficiency of business management, reduce operating costs and promote (Begenau et al., 2018; Lee & Shin, 2018; Chiu & Koepl, 2019), which is conducive to the innovation and development of the traditional financial industry as well as the real economy. According to the Financial Stability Board (FSB), Fintech can improve financial stability by increasing the efficiency, diversification, transparency and resilience of the financial system. In a fast-changing market environment, traditional financial institutions have gradually been unable to meet the diversified needs of their customers for financial services and products. Especially after the COVID-19 outbreak, financial institutions have been forced to change the way they interact with their customers. Due to travel restrictions, more and more customers are seeking online services. Compared to traditional financial institutions, Fintech firms have new business models with greater flexibility, efficiency, and opportunities. The rise of Fintech firms has expanded the customer base, which has helped to increase capital turnover and liquidity in the financial sector. For example, P2P Lending Fintech uses big data to more accurately assess the credit risk of SMEs, potentially allowing for increased accessibility of loans to SMEs (Jagtiani & Lemieux, 2019). With the rapid development of emerging technologies, traditional

financial institutions are gradually realizing the importance of Fintech in improving efficiency, optimizing services, reducing costs, and enhancing competitiveness, and have begun to take the initiative to seek cooperation with Fintech companies or develop their own technologies through their research and development to adapt to this trend. Numerous studies have confirmed the impact of Fintech on financial markets. You et al. (2023) confirm that the introduction of Fintech platforms as an additional distribution channel for funds has significantly attracted more capital flows. Compared to traditional distribution channels, the convenience of Fintech platforms attracts younger investors, creating a larger investor base. Third-party payment (TPP), as the main payment method for e-commerce, has a symbiotic relationship with the financial sector (Yao et al., 2018). In the long run, TPP has a favorable impact on the economic value added to the financial sector. Innovations in third-party payment technology help expand the depth and breadth of the business of the traditional banking industry. The Chinese market has a relatively weak credit system. Internet third-party payment reduces credit risk and effectively alleviates transaction security and trust issues between sellers and consumers (Cheng et al., 2017), and has become the main payment method for Chinese customers. TPP can increase the turnover rate of funds without creating liquidity risk, which is conducive to increasing institutional earnings and maximizing shareholder wealth. Wang et al. (2021b) examine the potential impact of Fintech on the banking sector. Their study shows that Fintech improves the total factor productivity of banks. More specifically, the development of Fintech is conducive to improving the profitability, financial innovation, and risk control of Chinese commercial banks. The adoption of Fintech by banks is instrumental in reshaping or optimizing traditional business models. The positive impact of Fintech on the total factor productivity of urban commercial banks is most pronounced, followed by national banks and rural commercial banks. One of the plausible reasons for this difference is that urban commercial banks have relatively few opportunities to acquire offline customers due to the limitations on the number of new branches. Hence, they try to compensate for this shortcoming by adopting Fintech. For rural commercial banks, although they face the same pressures and difficulties, they can hardly afford the high initial cost of adopting Fintech due to their small size and capital pressure. Employing emerging technologies within banks increases the efficiency of their risk management, improves their internal governance and business model, in-

creases diversification, and thus reduces credit risk (Cheng & Qu, 2020). Financial technology products (FTPs) provide a new impetus for the banking industry to improve its performance (Chen et al., 2021). The high utility of FTPs enables high-quality banking services and high work efficiency. Furthermore, through big data analytics, FTPs enable banks to provide targeted financial services or products based on customers' financial behavior and personal preferences. Lee et al. (2021) verify that Fintech innovations generally contribute to increasing the cost efficiency of banks and enhancing the technologies used by banks.

Financial innovation driven by Fintech provides strong support for the transformation and growth of the real economy (Ding et al., 2022). Fintech can provide innovative and diverse financial products and services through emerging technologies, promote the transformation and innovation of traditional business models, and enrich the channels through which individuals or enterprises can access financial services (Gomber et al., 2017; Nambisan et al., 2017). Fintech can alleviate the problem of information asymmetry (Zhang et al., 2024). Fintech lending platforms can collect soft credit information through non-traditional alternative sources of information, which is valuable for customers with little or no credit history (Jagtiani & Lemieux, 2018). As Abbasi et al. (2021) argue, Fintech firms are able to incorporate more factors to accurately assess a borrower's credit risk at a lower operating cost due to their adoption of emerging technologies. As Fintech firms generally have the advantages of low cost, high efficiency, and low risk, they can process loan applications more efficiently than traditional banks, providing SMEs with quick access to finance. As new technologies accelerate the loan application process, SMEs can reduce transaction costs and effectively take advantage of business opportunities through this fast access to funds (Fuster et al., 2019).

On the other hand, as a new dimension of financial development, Fintech emergence intensifies market competition and affects the stability of the traditional financial system. The application of emerging technologies may lead to technological risks, such as privacy protection risks and digital transaction risks. In addition, the relative lack of Fintech regulatory policies increases regulatory risks (Murinde et al., 2022). All of these situations can increase the credit risk of financial institutions and lead to the disruption of the original financial system. Moreover, as an inevitable consequence

of the development of Fintech, financial innovation can lead to the over-expansion of credit in financial markets, which ultimately triggers the occurrence of financial crises (Brunnermeier, 2009). Fintech developments have facilitated the emergence of Fintech firms that are able to offer financial services typically provided by traditional financial institutions (Thakor, 2020). These similar products or services may trigger substitution effects, which can lead incumbent financial institutions to abandon some of their activities (Phan et al., 2020). Customers are no longer limited to choosing financial services from traditional institutions, which leads to a gradual decline in customer reliance on traditional institutions (Anagnostopoulos, 2018; Buchak et al., 2018). Therefore, Fintech poses a huge potential threat to existing participants in the financial industry. Moreover, many Fintech activities rely on third-party service providers. If these third-party service providers fail, the financial institutions linked to them will be exposed to systemic risk. Fintech is also penetrating several areas of China's banking sector. Some studies (Wang et al., 2021a; Corbet et al., 2023) have shown that Fintech developments could affect the stability of the existing banking system. Banks adopting emerging technologies, setting up Fintech subsidiaries or partnering with Fintech companies can incur high initial investment costs. Long technology transformation cycles can increase banks' capital pressure. Furthermore, the increasing number of Fintech firms has intensified competition in the industry. They grab the market share of banks and erode their profits.

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## **Chapter 3**

# **Fintech, bank diversification and liquidity: Evidence from China**

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## Fintech, bank diversification and liquidity: Evidence from China

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### ABSTRACT

This research investigates the influence of Fintech development on bank diversification and liquidity in China. Analysing 101 banks between 2011 and 2021, we apply robust text mining processes and implement factor analyses to construct a Fintech development index, which is used to test for specific liquidity and diversification influence across the Chinese banking industry. Our results provide robust empirical evidence that the development of Fintech reduces bank liquidity creation and helps to increase bank diversification. We find further evidence that this relationship is heterogeneous. Both state-owned and smaller banks, as measured by market capitalisation, are found to have presented a weaker response to Fintech development. Moreover, the outbreak of the COVID-19 pandemic is found to have enhanced the inhibitory effect of Fintech on bank liquidity creation, and thereby weakening its contribution to bank diversification.

### 1. Introduction

Fintech refers to a contraction of the term “financial technology”, which has been a rapidly developing topic across the financial industry in recent years. The [Financial Stability Board](#) (FSB) defined Fintech as technology-enabled financial innovation, which can generate novel products, services, processes or business models, and can significantly impact the incumbent financial market and financial services institutions. Despite the evolution and rapid contagion effects sourced within the COVID-19 pandemic in December 2019 ([Conlon et al., 2020](#); [Corbet et al., 2020b, 2022c,f](#)), the Fintech industry has continued to grow rapidly, directly influencing the banking industry by driving the transformation of traditional business models and innovation across financial services and products, while also changing the competitive market environment ([Navaretti et al., 2018](#); [Thakor, 2020](#); [Corbet et al., 2020c](#); [Murinde et al., 2022](#)).

Banks typically have a dominant position in the financial system. According to the theory of financial intermediation, banks perform a pivotal role in mobilising and reallocating social capital, using liquid liabilities to finance illiquid assets, thereby providing liquidity to the market.<sup>1</sup> In China, the vital role of banks in macroeconomic regulation and the prevention of economic risks further strengthens their dominant position ([Fletcher et al., 2021](#); [Meegan et al., 2021](#)). Chinese banks have a strong capacity to absorb deposits and provide the main access to financing for enterprises and households. To maintain the stability of the national economic system, banks are required to conduct significant liquidity management processes to best coordinate the relationship between the supply and demand for liquidity in the market ([Navaretti et al., 2018](#); [Murinde et al., 2022](#)). In particular, the business environment is particularly volatile in the aftermath of the COVID-19 outbreak. Banks are facing greater liquidity management requirements,

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<sup>1</sup> This process is also known as *liquidity creation*, which is one of the key functions of banks.

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driven by changes in market demand for bank loans and banks' ability to absorb deposits and government policy interventions.<sup>2</sup> Theoretically, income diversification can reduce default risk (Nguyen et al., 2012b; Meng et al., 2018) and insolvency risk (Sanya and Wolfe, 2011; Pennathur et al., 2012), and effectively increase bank profits and risk-adjusted profits (Chiorazzo et al., 2008; Elsas et al., 2010; Meslier et al., 2014). Hsieh et al. (2013) confirm that banks can enhance their stability through income diversification. However, the marginal costs generated by a high degree of diversification may well offset its benefits (Chen et al., 2018). Yang et al. (2020) indicate that the high level of diversification can increase the similarity of banking activities and create common exposures, further exacerbating interdependence and risk contagion in the banking industry, ultimately causing systemic risk. In short, liquidity management and diversification strategy development are crucial but complex parts of bank management.

Fintech development has dramatically impacted the development of the banking industry (Dranev et al., 2019; Lv and Xiong, 2022). On the one hand, Fintech adoption can lead to technological risks and increased bank operational costs. In addition, Fintech companies can intensify market competition, diverting bank deposits and threatening banks' lending business. However, on the other hand, Fintech can optimise banking technology and improve traditional models, thereby increasing management efficiency, risk tolerance and profitability and allowing banks to obtain more resources and capacity to create liquidity and implement diversification strategies. Hence, the impact of Fintech on bank liquidity and diversification is uncertain. However, existing studies give little attention to this topic. Thus far, only Guo and Zhang (2022) analyse the role of bank Fintech (the development and application of Fintech in the banking industry) on banks' liquidity. Our study investigates the relationship between the two from the perspective of macro Fintech development in China while considering a more comprehensive measure of bank liquidity that enables us to capture the effects of Fintech-driven financial innovation and changes in the market environment on bank liquidity. In addition, to our knowledge, this research is the first to discuss the role of COVID-19 outbreaks on the link between Fintech development and bank liquidity and diversification. Our study on the impact of Fintech on banks' diversification and liquidity has important implications for the management of banks, economic growth and the stable development of the financial system.

Our research empirically investigates how the Fintech development impacts the diversification and liquidity of banks in China. We obtain data from the Chinese market from 2011 to 2021 and construct the Fintech development index using text mining and factor analysis. To measure banks' liquidity, we estimate the two liquidity indicators (LC(catfat) and LC(catnonfat)) based on the work of Berger and Bouwman (2009). We also consider the net stable funding ratio (NSFR) introduced by the Basel III Committee and the leverage ratio. The extent of bank diversification measures the bank's shift from traditional business activities to non-interest income activities. Our diversity measures are built according to the banks' income statement structure. We also use an assets-based diversification measure as a supplement. The findings confirm that Fintech development negatively impacts bank liquidity and positively benefits regarding diversification. We further observe that these nexuses are heterogeneous among banks with different characteristics. The influence of Fintech development upon liquidity and diversification is found to be significantly weaker among state-owned and smaller banks. Furthermore, our results highlight the importance of major black-swan events such as the COVID-19 pandemic, which is found to reinforce the adverse effects of Fintech on bank liquidity while weakening its positive impacts on bank diversification.

This paper makes a number of contributions to the existing literature based on the following aspects: first, this paper builds the Fintech development index by combining the multidimensional information which involves advanced technologies and Fintech-related fields. Secondly, this paper enriches the literature on the impact of Fintech on the banking industry. A large stream of previous literature assesses the relationship between Fintech and bank risk or profitability, while the impact of Fintech on bank diversification and liquidity is undetermined. We discuss the effect of Fintech from a new perspective and extend the existing Fintech-related literature. Thirdly, this study finds a new determinant for bank diversification and liquidity. Previous literature has identified some determinants affecting bank liquidity, including market competition, credit and monetary policy, capital, bank characteristics and macroeconomic factors (Diamond and Rajan, 2000; Berger and Bouwman, 2017; Jiang et al., 2019). Moreover, the reasons for bank diversification involve bank size, risk and macroeconomic environments (Demsetz and Strahan, 1997; Lepetit et al., 2008; Nguyen et al., 2012a; Meng et al., 2018). In this study, we empirically analyse the driver role of emerging technologies and new industry trends on bank diversity and liquidity. Finally, we consider the heterogeneous impact of Fintech on banks. We debate the role of bank characteristics (size and ownership structure) and the financial crisis triggered by the COVID-19 outbreak. The sudden outbreak and rapid spread of COVID-19 in late 2019 triggered huge financial upheavals. The Chinese government imposed a series of quarantine measures to control the spread of the virus. These restrictions cause a severe shock to the development of the real economy. Our research examines how Fintech affects bank diversification and liquidity policies in the context of economic turmoil by focusing on a rare COVID-19 epidemic shock. The findings provide further evidence on the interplay between Fintech and the banking sector during the epidemic.

The remainder of this study is structured as follows. Section 2 discussed the growing interconnectivity between the Chinese banking sector and Fintech development, while Section 3 summarises the related literature and provides the hypothesis development. Section 4 offers information on data sources, variables and methodology. Section 5 presents the key findings. The robustness checks and heterogeneity analyses are shown in Section 6. Finally, Section 7 is the conclusion.

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<sup>2</sup> In the meantime, to cope with the complex industry environment, banks need to pursue appropriate business strategies that facilitate risk diversification and improve profitability. Diversification is seen as a common strategy for banks to resist shocks.

## 2. The growing interconnectivity of Fintech and the Chinese banking industry

### 2.1. The Chinese banking industry

As a rapidly emerging economy, China has a non-negligible influence on the changes in the global economic landscape. Over the past few decades, China has devoted itself to the reform and development across a number of economic areas (Corbet et al., 2022d,e) including that of the banking sector and has made certain achievements. However, compared to developed countries, China's banking system is not well developed. The banking sector is a core component of the Chinese economic system, providing liquidity to the economy. Chinese banks derive their income primarily from traditional business activities such as deposit and loan operations. However, due to stringent capital regulations and unstable deposit–loan spread income, Chinese banks have pursued diversification strategies.

Chinese banks face a relatively strict regulatory environment. The liquidity creation, scope of business and market entry of banks are all under strict government regulation (Hou et al., 2018; Meng et al., 2018). China Banking Regulatory Commission (CBRC) has issued a series of regulatory standards and indicator requirements for the liquidity of Chinese banks. In 2011, CBRC published the “Guidelines for Implementing New Regulatory Standards in the PRC Banking Industry”. This guidance is intended to establish the financial regulatory framework for China's banking sector by combining the regulatory standards of Basel III with the development status of the Chinese bank industry to set requirements for several bank indicators, including liquidity. In February 2014, the CBRC issued the “Measures for the Liquidity Risk Management of Commercial Banks (Provisional)”, which introduced the overall framework and regulatory requirements for banks' liquidity risk management system. In 2018, the measures for the Liquidity Risk Management of Commercial Banks were officially implemented and replaced the previous provisional version. Additionally, the business scope and product categories of Chinese banks are bound to comply with the Commercial Banking Law and are regulated by several regulatory institutions, including the CBRC.

The banking sector in China has been attaching importance to digital transformation and gradually increasing its investment in Fintech over several years. According to the “Chinese banking sector 2021 review and 2022 outlook” report from Deloitte, Chinese banks' Fintech investment to operating income ratio grew by around 15% in 2021 compared to the corresponding period last year. And the Industrial and Commercial Bank of China, Agricultural Bank of China and China Construction Bank invest more than RMB20 billion (around US\$2.9 billion) in Fintech. The number of sci-tech personnel within each bank is increasing annually. Many Chinese commercial banks are developing digital service formats and building their own Fintech smart service platforms benefiting from the empowering effects of advanced technologies (Li et al., 2022). For example, the Bank of China self-established the Honghu distributed technology platform, the Xinghan Big data platform and the Fuyao DevOps cloud platform; The Industrial and Commercial Bank of China implemented smart banking ecosystem project (ECOS) and built a blockchain and cloud technology platform with independent intellectual property rights, such as ICBC Seal Chain and ICBC Turing; China Construction Bank develops a series of Fintech innovation platforms like CCB Cloud and CCB Public Cloud to provide customers with a broader range of financial products and services.

### 2.2. The Chinese Fintech industry

The Chinese FinTech industry has grown substantially in recent years and is emerging as one of the major players in the global market. The transaction value of the Chinese Fintech market reached US\$2,496 billion in 2020. The revenue of China's Fintech industry from 69 billion RMB Yuan in 2013 to approximately 1.5 trillion RMB Yuan by 2019. In addition, the total value of Fintech investment activity (via PE, VC and M&A) in mainland China reached about US\$26,191 million, the peak in recent years. Although, investment declined in the following years under the impact of the significant maturation of the Fintech sector and the outbreak of the COVID-19 epidemic. Chinese Fintech sector still remains strongly competitive within the global market. Digital payment is a hot business field in China's Fintech industry. The digital payment users in China are over 987 million. According to the ‘Payment System Report (2021)’ released by the People's Bank of China, the transaction volume of electronic payment reached 275 billion, a 16.9% increase year-on-year.

The rapid growth of Fintech has made a significant impact on the financial landscape in China. In addition to fintech unicorns, China's financial market is also flooded with smaller fintech companies. These Fintech companies benefit from advanced technology and a degree of regulatory advantage to provide financial products and services at low cost, lowering the threshold of access to financial services. In addition, Fintech companies do not have the complex credit assessment processes and high collateral requirements of banks, allowing them to provide more convenient and efficient services to customers. For financially constrained SMEs and individual clients, Fintech is a cheaper and more convenient option. In short, the emergence of Fintech reduces the price of services, expands the coverage of financial services in China, and gradually changes the habits of Chinese customers in accessing financial services.

Overall, given the critical position of the Chinese banking sector and its regulatory environment, and the booming FinTech industry in China, China provides an interesting research context for our study.

### 3. Literature review and hypothesis development

#### 3.1. Review of Fintech-related literature

Many existing studies have suggested that the emergence of Fintech can have far-reaching implications upon the entire financial landscape (Kim et al., 2016; Schueffel, 2016; Li et al., 2017; Anagnostopoulos, 2018; Jagtiani and Lemieux, 2018; Kyriazis et al., 2020; Allen et al., 2021; Wang et al., 2021b). As Fintech continues to develop, some novel technologies processes, such as blockchain (Underwood, 2016; Notheisen et al., 2017; Akyildirim et al., 2020b; Cioroianu et al., 2021; Hu et al., 2021), big data analytics (Begenau et al., 2018; Akyildirim et al., 2021b; Corbet et al., 2022g), smart contract (Giancaspro, 2017; Akyildirim et al., 2021a; Corbet et al., 2022b), and cryptocurrency (Corbet et al., 2020a; Akyildirim et al., 2020a; Celeste et al., 2020; Akhtaruzzaman et al., 2020; Papadamou et al., 2021; Liu and Tsyvinski, 2021; Conlon et al., 2021, 2022; Kyriazis et al., 2023), are rapidly penetrating the various financial industry fields, which involve insurance, financing, crowdfunding, third-party payment and wealth management (Fuster et al., 2019; Thakor, 2020). Blockchain technology is instrumental in reducing costs, improving data security and trustworthiness of online transactions and enabling safer information sharing (Underwood, 2016; Giancaspro, 2017; Notheisen et al., 2017). Big data technologies improve the efficiency of data integration and processing and provide customised and personalised services or products to consumers (Anshari et al., 2019). The appearance of a smart contract enables the automation of some critical processes in the contract, which improves enterprise efficiency, lowers legal and transaction costs, and increases transparency and anonymity (Giancaspro, 2017; Corbet et al., 2022a). As an alternative payment mechanism, electronic payments satisfy customers' needs for online transactions (Gomber et al., 2017). Fintech is reshaping how people spend, manage wealth, and access financial services.

#### 3.2. The impact of Fintech on the banking industry

Some previous literature surrounding Fintech especially analyses the relationship between the growing product and the traditional banking industry, confirming that Fintech can directly affect the development of the banking industry. For example, Fintech innovation can influence bank performance (Dwivedi et al., 2021; Zhao et al., 2022). Al-Dmour et al. (2021) demonstrate that novel financial technologies, such as big data and digital currency technology, can improve bank performance. Phan et al. (2020) utilise the quantity of Fintech firms as a proxy to measure Fintech development, finding that Fintech has had a number of significant negative influences upon the performance of banks. Additionally, Fintech development presents both challenges and opportunities for banks' risk-taking. Wang et al. (2021a) identify that Fintech development has undermined the bank industry's stability and intensified Chinese banks' risk-taking in general. The high initial investment costs incurred in taking on new technologies and the long conversion cycle of technological achievements can exert financial pressure on banks, therefore elevating banks' risk-taking. Moreover, the growing number of Fintech companies has increased competition within the industry, reducing market share from existing banks and eroding profits, therefore potentially elevating risk tolerance.

However, Deng et al. (2021), and Hu et al. (2022) believe that Fintech can reduce the risk-taking of Chinese banks by reducing management costs and optimising business processes. Banna et al. (2021) reach similar conclusions by analysing data from OIC countries. They confirm the inhibition effect of Fintech-based financial inclusion on banks' risk. Li et al. (2022) also find that applications of Fintech within banks facilitate the reduction of bank risk-taking by improving their risk management capacity. Cheng and Qu (2020) provide evidence that the Fintech development within banks can effectively reduce their credit risk. However, this effect is relatively weaker in Chinese state-owned banks. Moreover, Fintech also has a significant impact on the efficiency of traditional banks. Lee et al. (2021) discover that Fintech innovation improves banks' efficiency and modernises their financial technology, particularly in city commercial banks. Wang et al. (2021b) analyse the role of Fintech development in promoting banks' total factor productivity (TFP). Furthermore, Chen et al. (2021) report that the implementation of Fintech products (FTPs) positively impacts the work efficiency and service quality of banks.

In general, past studies have mainly assessed the impact of Fintech on traditional banks from the perspective of bank performance, risk-taking and efficiency. However, research on the relationship between Fintech and bank diversification and liquidity remains extremely scarce. Hence, we empirically investigate this issue using evidence from the Chinese market to enrich Fintech-related literature.

#### 3.3. Fintech and bank liquidity

The development of Fintech can influence bank liquidity in various ways. On the one hand, Fintech may reduce bank liquidity creation by channel of reducing banks' profitability, raising bank risk and influencing the market environment. Firstly, Fintech can reduce bank profitability and weaken the incentives to support their liquidity creation. The high initial investment and maintenance costs incurred by the adaptation of Fintech by traditional banks create great financial pressure on banks (Wang et al., 2021a). Qiu et al. (2018) point out that Fintech growth increases the cost of debt and the asset risk of banks. And, Deng et al. (2021) believe that banks facing a highly competitive environment may increase deposit rates to stimulate deposit business, which increases capital pressure on banks. Moreover, Zhao et al. (2022) argue that the excessive competition caused by Fintech innovation can lead to the deterioration of banks' profitability and asset quality. Based on the consumer hypothesis and the disruptive innovation hypothesis, Fintech developments generate new products and services that can replace older products or services to achieve disruptive innovation in the traditional financial sector, and therefore Fintech development will undermine the profitability of traditional banks. As

discussed above, Fintech development can raise banks' costs and diminish banks' profitability, ultimately reducing bank capital and ability to resist adverse shocks and diminishing their incentives to create liquidity. Secondly, Fintech can increase the risks of banks. Applying advanced technologies, such as big data and artificial intelligence, can increase operational risks in the banking sector. The issues such as app security and data security are becoming new security challenges for banks. Fintech companies can provide a more efficient and cheaper alternative to banks' business, and thus they are more attractive to some clients. As a result, banks may lose their clients to competitors, which can increase banks' credit risk. Increased operational and credit risk can trigger liquidity shortages for banks. Thirdly, Fintech companies are likely to generate crowding-out effects on the traditional banking sector (Yang and Wang, 2022), encroach on the bank's traditional business areas and ultimately influence liquidity creation of banks. As Guo and Shen (2016), Boot et al. (2021) state that Fintech companies can weaken the intermediary role of banks, divert deposits and threaten lending business from banks.

Following the emergence of Fintech, many Fintech companies entered the Chinese market and expanded rapidly in traditional banking areas such as lending and wealth management. For example, the Ant Group, a China Fintech giant, launched several online service platforms, including Alipay, Yu'e Bao and Huabei, to make inroads into the digital payment, wealth management and microfinance markets; Lufax is an online financial services platform with over 50 million registered users, which operates in the financial management and digital lending fields; Du Xiaoman Financial is a Fintech firm which offers online investment, online payment and online credit consulting services. Compared to traditional banks with heavy regulatory baggage, complex corporate structures and legacy IT systems, Fintech companies are more flexible and, therefore, easier to take advantage of new technologies (Gomber et al., 2017; Anagnostopoulos, 2018). Such companies initially target niche markets neglected by banks, offer personalised services to customers, and gradually venture into traditional areas of banking. In particular, compared to other countries, China has experienced the growth and operational stability of once large Fintech unicorns that eventually achieved a dominant position in the Fintech industry, such as Alibaba, JD Digits and Lufax. These large Fintech companies, possessing full licences, are identified to be more competitive than smaller Fintech companies (Hornuf et al., 2021) and possess a non-negligible impact on the traditional banking sector. In short, Fintech companies intensify market competition, threaten the market share of traditional banking, and reduce the ability of traditional banks to create liquidity. Moreover, based on the "fragility channel" view, increased competition causes greater bank fragility and reduced bank profits. Banks thus implement tighter deposit and credit policies when they face a highly competitive environment to avoid the risk of runs (Petersen and Rajan, 1995; Horvath et al., 2016; Ali et al., 2019).

On another hand, Fintech may increase bank liquidity creation. Firstly, the applications of Fintech in the banking industry are beneficial in helping banks to optimise their business processes (Puschmann, 2017), attract customers (Belanche et al., 2019), and therefore increase their deposit and lending business. For the incumbent banking industry, certain legacy business processes and management systems are no longer able to rapidly identify and respond to the changing consumer needs, which may lead to customer churn problems. Advanced technologies contribute to easing such problems by allowing banks to improve their old business processes, enhance the user experience and broaden channels for banks to construct long relationships with their customers. These factors can stimulate the growth of banks' deposit and loan volume, ultimately increasing bank liquidity. Secondly, Fintech has improved banks' risk identification and tolerance. As Cheng and Qu (2020) confirmed that Fintech could effectively reduce banks' credit risk by increasing the efficiency of their risk management and improving internal governance. To date, various modern technologies have been used in the operational processes of banks. For example, Big Data technology can effectively alleviate the information asymmetry between banks and customers, which banks widely use in the corporate credit assessment process to lower the customer default risk (Wang et al., 2020). Big data is also applied for security and fraud detection in banks (Hassani et al., 2018). Banks also adopt blockchain technology in business processes such as information confirmation and payment settlement due to its tamper-evident and traceable nature (Guo and Liang, 2016). In addition, artificial intelligence (AI) helps banks to improve the security of their business processes and optimise their risk defences, including fraud identification and financial crime prevention (Königstorfer and Thalmann, 2020). In a nutshell, traditional banks enhance their risk tolerance by benefiting from the new technology and consequently have more opportunities to create liquidity. Finally, Fintech credit development intensifies competition in the loan market and could have a spillover impact on bank lending (Ding et al., 2022). That is, Fintech may promote the lending business of banks. In addition, the expansion of Fintech companies may drive banks to develop lenient pricing policies and stimulate bank liquidity. Tang et al. (2021) point out that fierce competition can even spur banks to grant more high-risk loans.

Based on the above discussions, we make the following hypotheses:

**Hypothesis 1a (H1a).** Fintech development has a negative effect on the liquidity creation of banks.

**Hypothesis 1b (H1b).** Fintech development has a positive effect on the liquidity creation of banks.

### 3.4. Fintech and bank diversification

Focusing on hypothesis 2, we consider the association between Fintech developments and banking diversification from two perspectives: the internal and external impacts of Fintech. Considering the internal effects of Fintech on banks, the development and application of new technologies increase flexibility (Drnevic and Croson, 2013) and stimulate financial innovation (Barrett et al., 2015; Zavolokina et al., 2016; Wonglimpiyarat, 2017) in the banking sector. Calomiris (1998) mentions that one of the vital dimensions of bank diversification is improving banks' ability to offer diversified products. Fintech empowers the development of the banking industry. Novel technologies widened the possibilities for banks to provide new products and services. Additionally,

Fintech adaptation can incur high costs and affect bank profits, thereby increasing bank risk. Banks are incentivised to diversify their revenue sources to improve profitability and control risk.

With regards to the influence of Fintech on the external environment of banks, Fintech growth can have both a disruptive and innovative effect on the financial sector. The development of novel technologies offers opportunities for the emergence of new products and business models in the market, gradually changing customer behavioural habits (Leong et al., 2017; Chen et al., 2021). To cope with market trends and meet changing customer needs, traditional banks are incentivised to reconsider current operation models and pursue diversification strategies. Banks absorb new technologies in various ways, such as developing internal Fintech departments, partnering or merging with Fintech companies (Hornuf et al., 2021), to increase the digitalisation of their banking operations and expand business boundaries. As a result, bank diversity has increased.

In addition, Fintech reduces the need for traditional financial intermediaries (banks) (Thakor, 2020). The new competitors (Fintech companies) develop rapidly by relying on emerging technologies and pose threats to banks' traditional business. Specifically, due to the overlap between their business areas, Fintech companies are encroaching on the traditional business area of commercial banks and threatening the banks' position as traditional intermediaries (Chamley et al., 2012). Traditional banks no longer remain the only option for customers to conduct financial services, and customers' reliance on banks is declining. The intermediation advantages of banks are thus diminished. Banks are forced to innovate their traditional business models to increase diversity with a view to reducing intermediation costs.

Overall, the advancement of Fintech can stimulate financial innovation and generate risk within the banking sector, prompting banks to increase diversification. In addition, Fintech growth can increase competition across the market and influence consumer behaviour. The external market environment influences some banks to adopt diversification strategies aimed at meeting new market demands as well as reducing intermediation costs and risks. Therefore, we propose Hypothesis 2.

**Hypothesis 2 (H2).** Fintech development has a positive impact on bank diversification.

#### 4. Data, variables and methodology

##### 4.1. Data

We collect bank financial data from the CSMAR database, the Wind database and the annual reports of banks. The Fintech-related and Macro data are obtained from the Baidu index database and the National Bureau of Statistics of China, respectively. The sample period is from January 2011 through to December 2021. The final sample<sup>3</sup> consists of data from 101 banks, including 5 state-owned banks, 13 joint-stock banks, 75 city commercial banks and 8 rural commercial banks. The selected sample banks account for over 85% of the total assets of the Chinese banking industry.

##### 4.2. The creation of bank liquidity and diversification measures (dependent variables)

We follow Berger and Bouwman (2009) to construct our primary bank liquidity measures, LC(catfat) and LC(catnonfat). In the first step, we classify the assets, liabilities, equity and off-balance sheet activities of the sample banks into three categories: liquid, semi-liquid and illiquid. In the second step, each category is assigned a weight. More specifically, the weights of liquid assets, illiquid liabilities and liquid guarantees are  $-0.5$ . The weights of semi-liquid assets, semi-liquid liabilities and semi-liquid guarantees are  $0$ , and the weights of illiquid assets, liquid liabilities and illiquid guarantees are  $0.5$ . Finally, we calculate the bank's annual liquidity using the former two steps. Based on these three steps, we calculate two bank liquidity creation measures: LC(catfat) and LC(catnonfat). Berger and Bouwman (2009) mentioned that LC(catfat) is their preferred liquidity indicator. The details for the components and weight applied to each category can be seen in Appendix A, Table A.1. We use the ratio of the bank's annual liquidity over total assets to represent our dependent variable. The lack of bank liquidity can exacerbate failure risks for banks. The decrease in LC (catfat) and LC (catnonfat) implies a decline in liquidity creation by banks. The calculation formulas of LC(catfat) and LC(catnonfat) are as follows:

$$LC(catfat) = \frac{(0.5 * Illiquid\ assets + 0 * Semiliquid\ assets - 0.5 * Liquid\ assets + 0.5 * Liquid\ liabilities + 0 * Semiliabilities - 0.5 * Illiquid\ liabilities + 0.5 * Illiquid\ guarantees + 0 * Semiliquid\ guarantees - 0.5 * Liquid\ guarantees)}{Total\ assets} \quad (1)$$

$$LC(catnonfat) = \frac{(0.5 * Illiquid\ assets + 0 * Semiliquid\ assets - 0.5 * Liquid\ assets + 0.5 * Liquid\ liabilities + 0 * Semiliabilities - 0.5 * Illiquid\ liabilities)}{Total\ assets} \quad (2)$$

Additionally, we follow Vazquez and Federico (2015), where we employ two additional liquidity indicators: the net stable funding ratio (NSFR) and the leverage ratio (Lev), to enhance the robustness of our findings. The net stable funding ratio and the leverage ratio are the new regulatory standards introduced by Basel III. In 2008, the financial crisis influenced the global banking sector.

<sup>3</sup> We exclude banks that present evidence of multiple years of missing financial data during the sample period.

To enhance the effectiveness of bank liquidity management and financial supervision, the Basel Committee developed quantitative standards for assessing banks' liquidity, namely, Basel III. The introduction of the NSFR and Lev ratios are important components of Basel III. The NSFR ratio aims to require banks to maintain adequate, stable funding to cover their required stable funding, promoting the long-term resiliency of banks. The Lev ratio measures bank leverage. The higher NSFR and Lev ratio represent lower liquidity creation for banks.

The NSFR ratio is defined as the ratio of available stable funding to required stable funding. For calculating the NSFR, we classify and weigh the bank's assets and liabilities according to the regulatory standards introduced by Basel III. The designed details of available and required stable funding are shown in [Appendix B, Table B.1](#). The Lev ratio is the ratio of shareholder's equity to assets. We use these two ratios as alternative liquidity measures in our robustness checks.

When considering banking diversification measures, our main diversification indicator (DIV) is measured by an adjusted Herfindahl–Hirschman index (HHI), representing the diversity of the bank's main business activities. The total operating income of banks is decomposed into net interest income and non-interest income. We follow [Stiroh and Rumble \(2006\)](#) and [Hou et al. \(2018\)](#) to build an HHI used for measuring bank diversification. This indicator is widely used in existing bank diversity-related literature. Therefore, the formula for DIV is expressed as:

$$DIV = 1 - HHI = 1 - \left[ \left( \frac{NON}{TOR} \right)^2 + \left( \frac{II}{TOR} \right)^2 \right] \quad (3)$$

Where TOR refers to the net operating income, decomposed into net interest and non-interest income. NON and II represent non-interest income and net interest income, respectively. Banks with income diversification strategies are expected to generate higher income on sources beyond traditional banking activities (interest operations) ([Edirisuriya et al., 2015](#)). Therefore, a higher DIV implies a higher level of bank diversification. In addition, we base on the approach of [Elsas et al. \(2010\)](#) to construct our second diversity indicator, DIV1, which considers more diversified income origins. A higher value of DIV1 indicates higher bank diversity.

$$DIV1 = 1 - HHI = 1 - \left[ \left( \frac{II}{TOR} \right)^2 + \left( \frac{COM}{TOR} \right)^2 + \left( \frac{TRA}{TOR} \right)^2 + \left( \frac{OPE}{TOR} \right)^2 \right] \quad (4)$$

Where II refers to interest income. COM is commission income. TRA captures trading income. OPE is other operating income. TOR refers to total operating income, calculated as the sum of II, COM, TRA and OPE. We also add several alternative diversity variables to provide robustness to the results. First, we add an asset-based indicator, the loan-to-asset ratio (LTA), to complement the bank diversity measure ([Baele et al., 2007](#)). Moreover, we employed different approaches from the existing literature to construct new diversity indicators: DIV2 and DIV3. The DIV2 is defined as the ratio of non-interest income to total operating income (DIV2), which is used by many prior studies ([Lepetit et al., 2008](#); [DeYoung and Torna, 2013](#); [Meslier et al., 2014](#); [Williams, 2016](#)) to capture the income diversification of banks. Finally, the last diversity indicator (DIV3) is based on flow variables ([Baele et al., 2007](#)). The calculation formula is  $DIV3 = 1 - |2x - 1|$ , where  $x$  is the non-interest income ratio to total operating income. A lower loan-to-asset ratio (LTA), a higher proportion of non-interest income to total income (DIV2) and a higher DIV3 means a higher level of bank diversity.

#### 4.3. Fintech measures (independent variable)

In this study, we adopt text mining and factor analysis methods to construct the Fintech development index, which measures the development trend of FinTech in China. Firstly, we select the dimensions used to build the Fintech development index. We collect data from multiple dimensions, including network transmission, payment, resource, risk management, big data, distributed technology and AI technology, to make the constructed Fintech development index reflect more comprehensive information. For selecting these dimensions, we consider several categories of advanced technologies in the FinTech sector, besides referring to the FinTech industry classification proposed by the Basel committee. The selected keywords for each dimension are displayed in [Table 1](#). Secondly, we count the Baidu search index of the selected original keywords. More precisely, we search in the Baidu Index database for the Baidu search index of each original keyword and count the annual average of these corresponding Baidu search indexes.<sup>4</sup> Thirdly, we employ factor analysis methods to construct the index. Before conducting the factor analysis, we first do the Kaiser–Meyer–Olkin (KMO) test and Bartlett's test to determine whether the initial data of keywords is appropriate for factor analysis. The data analysis results for each dimension show that the KMO test values are all greater than 0.5, and the p-values of the Bartlett test are less than 0.01, indicating a strong correlation between the tested variables. Therefore, the selected data are suitable for factor analysis. Next, we extract the common factors with eigenvalues larger than 1. The cumulative variance contribution of the extracted common factors exceeded 80%, which means that these common factors can adequately generalise the initial keyword indicators.<sup>5</sup> We then rotate the factor structure based on the principle of variance maximisation and calculate the factor scores.<sup>6</sup>

<sup>4</sup> The Baidu Search Index is built based on keywords as the object and the search volume of Internet users in the Baidu search engine as the database, representing users' attention. Many previous papers ([Askitas and Zimmermann, 2009, 2011](#)) have used internet search volume to measure unobservable socio-economic-political phenomena and found a strong correlation between search volume and some socio-economic-political phenomena. In an era of advanced online information, the higher the keyword search popularity and the greater attention of users means, the better Fintech development. In addition, considering the habits of many users who prefer using mobile clients to search for information, we count the data from both PC and mobile sources.

<sup>5</sup> The results of the KMO test, Bartlett's test and factor cumulative variance contribution are shown in [Appendix C, Table C.1](#).

<sup>6</sup> In addition, we set the range of the factor scores between 0 and 1 by applying max–min normalisation. Finally, we obtain the Fintech index for each dimension. Then, based on the above steps, we integrate the Fintech indices for each dimension into a composite index, the Fintech development index, which is used as the explanatory variable in this study.

**Table 1**  
Initial keywords of Fintech development index.

Dimension	Keywords			
Network transmission	E-bank Internet banking abbreviation	Mobile phone banking	Online bank	Network banking
Payment	QR code payment Network payment	Third party payment	Online payment	Mobile payment
Resource allocation	Online lending Crowdfunding	Network investment P2P loan	P2P	Internet investment
Risk management	Internet financing Internet insurance	Online car insurance Network insurance	Credit system	Online insurance
Big data technology	Big data Big data management and application	Big data analytics	Data mining	
Distributed technology	Cloud computing Blockchain	Digital currency Internet of things	Cloud platform	Cloud service
AI technology	Artificial intelligence Fingerprint recognition	Biometric identification Natural Language Processing	Face recognition	Intelligent robot

Note: The selected keywords for each dimension are displayed in the above table. We presented evidence of the dimensions used to build the Fintech development index. We collect data from multiple dimensions, including network transmission, payment, resource, risk management, big data, distributed technology and AI technology, to make the constructed Fintech development index reflect more comprehensive information. For selecting these dimensions, we consider several categories of advanced technologies in the FinTech sector, besides referring to the FinTech industry classification proposed by the Basel committee.

In addition, following Ding et al. (2022), we employ the Peking University digital financial inclusion index of China for robustness testing. This index is compiled by a joint research team formed by the Institute of Digital Finance at Peking University and Ant Financial Services Group, using data from Ant Financial Services' extensive dataset on digital financial inclusion, which measures the current state of digital financial inclusion in China.

#### 4.4. Control variables

Based on the existing literature, we select several bank-specific control variables that may influence the relationship between Fintech and banks' diversification and liquidity. To proxy the banks' management efficiency, we include CTI in our regressions, measured as the ratio of the total bank costs to total income (Abuzayed et al., 2018; Zheng et al., 2019). We use ROA to account for the profitability of banks, which is defined as the ratio of net income over total assets (Díaz and Huang, 2017; Mahdi and Abbes, 2018; Shim, 2019). NPL is the ratio of non-performing loans to total loans, reflecting banks' asset quality (Horvath et al., 2016; Ahamed, 2017; Davydov et al., 2021). Due to the potential scale economies of large banks, we consider the bank size (SIZE) as a control variable, computed by the logarithm of total assets for the bank (Lepetit et al., 2008; Tran et al., 2016; Díaz and Huang, 2017; Berger et al., 2019). In addition, We also add the macroeconomic variable GDP to capture the impacts of the macroeconomic environment on bank diversification and liquidity. GDP is measured by the annual growth rate of GDP (Sissy et al., 2017; Davydov et al., 2018). All variables' definitions and data sources are observed in Table 2.

#### 4.5. Methodology

Our baseline regression models are as follows:

$$\mathbf{BankLiquidity}_{i,t} = \alpha + \beta * \mathbf{FinTech}_t + \gamma * \mathbf{Control}_{i,t} + \delta * \mathbf{Macro}_t + \omega_i + \varepsilon_{i,t} \quad (5)$$

Where  $i$  and  $t$  denote the specific bank  $i$  and year  $t$ , respectively.  $\mathbf{BankLiquidity}_{i,t}$  represents the liquidity of bank  $i$  in year  $t$ , measured by the ratio of bank liquidity creation (catfat and catnonfat) to total assets.  $\mathbf{FinTech}_t$  indicates the Fintech development in year  $t$ .  $\mathbf{Control}_{i,t}$  is the series of bank control variables (CTI, ROA, NPL and SIZE).  $\mathbf{Macro}_t$  is the GDP growth rate.  $\beta$ ,  $\gamma$  and  $\delta$  are the coefficients of variables.  $\alpha$  refers to the constant term.  $\omega_i$  are bank fixed effects, and  $\varepsilon_{i,t}$  refers to the idiosyncratic error.

$$\mathbf{BankDiversification}_{i,t} = \alpha + \beta * \mathbf{FinTech}_t + \gamma * \mathbf{Control}_{i,t} + \delta * \mathbf{Macro}_t + \omega_i + \varepsilon_{i,t} \quad (6)$$

where  $i$  and  $t$  denote the specific bank  $i$  and year  $t$ , respectively.  $\mathbf{BankDiversification}_{i,t}$  represents the diversification of bank  $i$  in year  $t$ , measured by two income diversification indicators, DIV and DIV1.  $\mathbf{FinTech}_t$  indicates the Fintech development in year  $t$ .  $\mathbf{Control}_{i,t}$  is the series of bank control variables (CTI, ROA, NPL and SIZE).  $\mathbf{Macro}_t$  is the GDP growth rate.  $\beta$ ,  $\gamma$  and  $\delta$  are the coefficients of variables.  $\alpha$  refers to the constant term.  $\omega_i$  are bank fixed effects, and  $\varepsilon_{i,t}$  refers to the idiosyncratic error. In this study, we control for the bank fixed effects,<sup>7</sup> and heteroscedasticity-robust standard errors are clustered at the bank level.

<sup>7</sup> We do not use year-fixed effects in our model because our Fintech development variable is the same for all banks in a given period, which implies a multicollinearity issue. Many studies (Nguyen and Phan, 2017; Phan et al., 2019; D'Mello and Toscano, 2020) drop controlling for year-fixed effects in the model

**Table 2**  
Variable descriptions.

Variables	Definition	Source
<b>Dependent variables:</b>		
LC(catfat)	The liquidity creation (catfat) normalised by total assets	CSMAR database and annual reports of the banks
LC(catnonfat)	The liquidity creation (catnonfat) normalised by total assets	CSMAR database and annual reports of the banks
DIV	The first income diversification measure (adjusted Herfindahl–Hirschman index) based on net interest and non-interest income	CSMAR database and annual reports of the banks
DIV1	The second income diversification measure (adjusted Herfindahl–Hirschman index) based on the category of bank income	CSMAR database and annual reports of the banks
<b>Independent variables:</b>		
Fintech	The Fintech development index constructed by factor analysis	Baidu index
<b>Control variables:</b>		
CTI	The ratio of total bank costs to total income	CSMAR database
ROA	The ratio of net income to total assets	CSMAR database
NPL	The ratio of non-performing loans to total loans	CSMAR database
SIZE	The logarithm of banks' total assets (million)	CSMAR database
<b>Macro variables:</b>		
GDP	The annual GDP growth rate	National Bureau of Statistics of China

Note: This table reports the definitions and data sources of the main variables used in this study.

**Table 3**  
Descriptive statistics.

Variables	Mean	Std. Dev.	Median	Maximum	Minimum
Fintech	0.606	0.324	0.715	1.000	0.000
LC(catfat)	0.431	0.188	0.436	0.896	-0.183
LC(catnonfat)	0.366	0.179	0.377	0.871	-0.184
DIV	0.206	0.171	0.166	0.985	0.000
DIV1	0.285	0.158	0.280	0.640	0.000
CTI	0.489	0.183	0.517	1.776	0.004
ROA	0.009	0.004	0.009	0.025	-0.018
NPL	0.014	0.009	0.013	0.139	0.000
SIZE	12.631	1.699	12.233	17.376	8.718
GDP	0.097	0.036	0.101	0.184	0.027

Note: This table reports descriptive statistics for our main variables, including mean, standard deviation, median, maximum and minimum values. The definitions of these variables can be seen in Table 2.

## 5. Result

### 5.1. Descriptive statistics, correlation and stationarity tests

In Table 3, we report the descriptive statistics of our main variables. The explanatory variable, Fintech, has a mean of 0.606 and ranges between 0.000 and 1.000. The mean values of variables LC(catfat) and LC(catnonfat) are 0.431 and 0.366, respectively. The difference between the maximum and minimum values of the two liquidity measures represents a more significant difference in liquidity creation between banks. The average DIV is 0.206, while the average DIV1 is 0.285. The summary statistics for the control variables (CTI, ROA, NPL and SIZE) and the macro variables (GDP) are also shown in Table 3.

We conduct Pearson correlation tests for each of the variables used in this study to avoid multicollinearity issues. The correlation matrix is reported in Table 4. The correlation coefficients between the variables are relatively small, indicating no multicollinearity problem in our models. Furthermore, we also do the unit root test of our variables. The results indicate that the data are stationary.

### 5.2. Main findings

Table 5 contains the estimation results of our regression models. Panel A demonstrates the impact of Fintech on bank liquidity, whereas Panel B shows the correlation between Fintech development and bank diversification. As shown in Panel A, the coefficients of the Fintech development index are negative and statistically significant at the 1% level, implying that Fintech development can reduce banks' liquidity. These results are consistent with our Hypothesis 1a. In conjunction with the above discussion, we list several

when using similar macro time series variables. Huang et al. (2022) discuss that controlling for year dummy variables can lead to multicollinearity problems in models which contain macro time series variables with micro-level finance panel data variables. The multicollinearity issue renders the parameters of the macro variables unidentifiable.

**Table 4**  
Pearson correlation coefficient matrix.

	(1)	(2)	(3)	(4)	(5)	(6)
(1) Fintech	1.000					
(2) CTI	0.058	1.000				
(3) ROA	-0.436**	-0.205**	1.000			
(4) NPL	0.379**	0.142**	-0.456**	1.000		
(5) SIZE	0.185**	-0.228**	-0.030	-0.008	1.000	
(6) GDP	-0.485**	0.193**	0.256**	-0.214**	-0.106**	1.000

Note: This table reports the Pearson correlation coefficients. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively. The definitions of these variables can be seen in Table 2.

**Table 5**  
The effects of Fintech development on bank liquidity and diversification.

Variables	Panel A		Panel B	
	(1)	(2)	(3)	(4)
	LC(catfat)	LC(catnonfat)	DIV	DIV1
Fintech	-0.330*** (0.032)	-0.333*** (0.032)	0.053** (0.026)	0.066** (0.029)
CTI	-0.288*** (0.046)	-0.282*** (0.046)	-0.046 (0.041)	-0.063 (0.044)
ROA	-3.954 (2.562)	-4.810* (2.534)	0.574 (3.208)	0.286 (3.672)
NPL	1.575* (0.813)	1.774** (0.781)	-0.801 (0.807)	-0.634 (0.888)
SIZE	0.155*** (0.023)	0.139*** (0.022)	0.037* (0.020)	0.038* (0.021)
GDP	-0.062 (0.108)	-0.084 (0.105)	0.053 (0.130)	0.129 (0.146)
C	-1.168*** (0.302)	-1.023*** (0.298)	-0.208 (0.264)	-0.215 (0.277)
Bank F.E.	Yes	Yes	Yes	Yes
Observations	995	995	995	995
R-squared	0.382	0.394	0.084	0.089

Note: This table reports the impact of Fintech development on bank liquidity and diversification from 2011 to 2021. Panel A shows the effect of Fintech development on bank liquidity, while Panel B presents the impact of Fintech development on bank diversification. The standard errors are shown in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively. The definitions of these variables can be seen in Table 2.

potential mechanisms to explain the findings. First, the costs of adapting to Fintech increase capital pressures on banks and reduce their profitability, undermining their capability to create liquidity. Second, Fintech development increases bank risks, leading to bank liquidity decline. Thirdly, the rapid development of novel technologies intensifies market competition. The erosion of banks' traditional deposit and loan business areas by fintech companies reduces banks' ability to create liquidity.

Meanwhile, our findings are also consistent with the 'fragility channel' view that when some banks face intense competitive pressures, they will pursue tighter credit policies to reduce liquidity creation and lower the risks of bank runs. We turn next to Panel B. The results show that the Fintech index's coefficients are positively and significantly associated with two bank diversification measures. These findings support our previous prediction (H2) that Fintech development can promote bank diversification. We provide the following possible explanations for this relationship. First, traditional banks recognise the potential of Fintech and have begun to modify their strategies to accommodate emerging technologies. Applying Fintech within the banking sector stimulates financial innovation and increases the bank's diversification. In addition, many banks implement diversification strategies to bolster returns and resist the shock from Fintech. Furthermore, with the development of Fintech, the increasingly competitive market environment also forces banks to innovate old business processes and models and offer new products and services to meet new market demands.

In addition, Table 6 reports the results of regression before adding control variables. The coefficients of Fintech are significantly negative in Panel A and positive in Panel B, consistent with the results shown in Table 5.

## 6. Robustness testing procedures

### 6.1. Alternative Fintech development measure

Following Ding et al. (2022), we employ the Peking University digital financial inclusion index of China as an alternative variable to proxy the development of Fintech. This index is jointly constructed by the Institute of Digital Finance at Peking University and Ant Financial Services Group, based on data from Ant Financial's data set on digital financial inclusion. The change in the digital

**Table 6**  
The effects of Fintech development on bank liquidity and diversification.

Variables	Panel A		Panel B	
	(1)	(2)	(3)	(4)
	LC(catfat)	LC(catnonfat)	DIV	DIV1
Fintech	−0.131*** (0.017)	−0.145*** (0.016)	0.079*** (0.017)	0.092*** (0.019)
Constant	0.511*** (0.010)	0.454*** (0.010)	0.221*** (0.010)	0.229*** (0.011)
Bank F.E.	Yes	Yes	Yes	Yes
Observations	1001	1001	1001	1001
R-squared	0.075	0.098	0.058	0.063

Note: The table reports the results of the regression model before adding control variables. The standard errors are shown in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively. The definitions of these variables can be seen in Table 2.

**Table 7**  
Alternative proxy for Fintech development: the Peking University digital financial inclusion index.

Variables	Panel A		Panel B	
	(1)	(2)	(1)	(2)
	LC(catfat)	LC(catnonfat)	DIV	DIV1
DFIIC	−0.084*** (0.023)	−0.073*** (0.023)	0.041* (0.021)	0.051** (0.023)
CTI	−0.387*** (0.046)	−0.388*** (0.047)	−0.023 (0.040)	−0.033 (0.044)
ROA	−1.332 (2.843)	−2.010 (2.953)	0.528 (3.116)	0.264 (3.590)
NPL	1.260** (0.605)	1.529*** (0.563)	−0.602 (0.831)	−0.526 (0.897)
SIZE	−0.026 (0.029)	−0.058** (0.028)	0.021 (0.029)	0.023 (0.032)
GDP	−1.170*** (0.198)	−1.157*** (0.197)	0.140 (0.201)	0.273 (0.219)
C	1.763*** (0.264)	2.003*** (0.268)	−0.348 (0.302)	−0.455 (0.335)
Bank F.E.	Yes	Yes	Yes	Yes
Observations	924	924	924	924
R-squared	0.258	0.277	0.069	0.075

Note: This table reports the impact of Fintech development on bank diversification and liquidity with using the Peking University digital financial inclusion index. The variable, DFIIC, is measured by the logarithm of the aggregate digital financial inclusion index. Panel A in this table shows the effect of Fintech developments on bank liquidity, while Panel B presents the impact of Fintech developments on bank diversification. The standard errors are shown in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively. The definitions of these variables can be seen in Table 2.

financial inclusion index can be seen as a proxy of the Fintech development trend in China. The variable, DFIIC, is measured by the logarithm of the aggregate digital financial inclusion index. Table 7 demonstrates the regression results where the independent variable measuring the Fintech development is the digital financial inclusion index. The coefficients of DFIIC are negative and significant at the 1% level in Panel A and significantly positive in Panel B. Our results are robust after using the Peking University digital financial inclusion index as a measure for Fintech development in China.

## 6.2. Alternative proxies for bank liquidity and diversification

To test the robustness of our results, we use several alternative, dependent variables to re-conduct the regression analysis. All results are presented in Table 8. Panel A shows results with the net stable funding ratio and the leverage ratio as independent variables. Banks with higher NSFR and Lev have a lower level of liquidity creation. Panel B reports regression results using the alternative diversity measures. The lower loan-to-asset ratio (LTA) or higher DIV2 and DIV3 indicate that banks are inclined towards non-traditional banking activities, that is, a higher degree of diversification. From Table 8, we can observe that Fintech has a significant positive impact on two alternative liquidity indicators, indicating that Fintech still erodes banks' liquidity after changing liquidity measures. In Panel B, the coefficient on FinTech is significantly negative in columns (3) and significantly positive in columns (4) and (5), implying that the growth of FinTech promotes the diversification of banks. These findings are consistent with our earlier conclusions, which confirms the robustness of our main findings.

**Table 8**  
Alternative dependent variables.

Variables	Panel A		Panel B		
	(1)	(2)	(1)	(2)	(3)
	NSFR	LEV	LTA	DIV2	DIV3
Fintech	0.061* (0.032)	0.017*** (0.00)	-0.046*** (0.015)	0.104*** (0.029)	0.098* (0.051)
CTI	0.124* (0.067)	-0.026*** (0.01)	-0.103*** (0.018)	-0.034 (0.034)	-0.055 (0.085)
ROA	1.613 (5.509)	-0.534 (0.78)	0.326 (2.049)	-4.927 (3.928)	3.626 (7.721)
NPL	-1.745* (0.922)	0.074 (0.13)	2.000*** (0.615)	-0.684 (0.889)	-1.283 (1.350)
SIZE	-0.178*** (0.038)	-0.014** (0.01)	0.035*** (0.013)	0.004 (0.019)	0.070 (0.047)
GDP	-0.016 (0.115)	0.018 (0.01)	0.027 (0.046)	0.239 (0.159)	0.148 (0.238)
C	3.411*** (0.528)	0.254*** (0.09)	0.046 (0.182)	0.141 (0.258)	-0.580 (0.651)
Bank F.E.	Yes	Yes	Yes	Yes	Yes
Observations	995	995	995	995	995
R-squared	0.343	0.064	0.191	0.095	0.069

Note: This table reports the impact of Fintech development on bank diversification and liquidity with using proxy independent variables. Panel A in this table shows the effect of Fintech developments on bank liquidity, while Panel B presents the impact of Fintech developments on bank diversification. The standard errors are shown in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively. The definitions of these variables can be seen in Table 2.

**Table 9**  
Reverse causation.

Variables	Panel A		Panel B	
	(1)	(2)	(1)	(2)
	LC(catfat)	LC(catnonfat)	DIV	DIV1
L.Fintech	-0.234*** (0.031)	-0.239*** (0.031)	0.073*** (0.027)	0.098*** (0.031)
CTI	-0.450*** (0.054)	-0.452*** (0.053)	-0.058* (0.032)	-0.085** (0.035)
ROA	-7.445** (3.508)	-8.964** (3.475)	2.681 (3.603)	1.946 (3.925)
NPL	1.436 (0.915)	1.732** (0.832)	-0.622 (0.996)	-0.451 (1.072)
SIZE	0.154*** (0.030)	0.139*** (0.029)	0.019 (0.023)	0.006 (0.025)
GDP	0.280 (0.171)	0.289* (0.166)	-0.020 (0.120)	0.068 (0.129)
Constant	-1.157*** (0.399)	-1.019** (0.397)	-0.000 (0.300)	0.179 (0.330)
Bank F.E.	Yes	Yes	Yes	Yes
Observations	995	995	995	995
R-squared	0.343	0.354	0.086	0.099

Note: This table reports the impact of Fintech development on bank diversification and liquidity by using the lagged Fintech development index as an explanatory variable. The standard errors are shown in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively. The definitions of these variables can be seen in Table 2.

### 6.3. Endogenous issue — reverse causation & the two-stage least squares (2SLS) instrumental variables model

We use the one-year lagged Fintech development index (L.Fintech) as the explanatory variable to eliminate the reverse causality. The results, shown in Table 9, are consistent with those of the previous models (shown in Table 5), which indicates that our results are robust.

In this section, we employ the two-stage least squares (2SLS) instrumental variable method to re-estimate our models for reducing the potential endogeneity problem. Referring to Sheng (2021) and Muganyi et al. (2022), we choose the annual growth rate of internet penetration as the instrumental variable. The development and penetration of the Internet are closely bound up with Fintech development. However, it is not directly related to bank diversity and liquidity. These conditions mean that the internet penetration growth rate is the suitable instrumental variable for Fintech. The chosen instrumental variable has a statistically significant relationship with our independent variable (Fintech). LM statistic in all models is significant at the 1% level. Thus, the

**Table 10**  
The effects of Fintech development on bank liquidity and diversification (2SLS instrumental variable approach).

Variables	Panel A		Panel B	
	(1)	(2)	(1)	(2)
	LC(catfat)	LC(catnonfat)	DIV	DIV1
Fintech	-0.248*** (0.049)	-0.252*** (0.047)	0.085** (0.040)	0.086* (0.045)
CTI	-0.344*** (0.045)	-0.338*** (0.043)	-0.068* (0.037)	-0.077* (0.041)
ROA	-4.110** (1.966)	-4.965*** (1.888)	0.513 (1.617)	0.248 (1.796)
NPL	1.271* (0.654)	1.472** (0.628)	-0.920* (0.538)	-0.709 (0.598)
SIZE	0.112*** (0.028)	0.097*** (0.027)	0.020 (0.023)	0.028 (0.026)
GDP	0.081 (0.157)	0.057 (0.150)	0.109 (0.129)	0.164 (0.143)
Bank F.E.	Yes	Yes	Yes	Yes
Observations	995	995	995	995
R-squared	0.374	0.385	0.081	0.089
Anderson LM statistic	211.230***	211.230***	211.230***	211.230***
CD Wald F statistic	274.722***	274.722***	274.722***	274.722***

Note: This table reports the impact of Fintech development on bank diversification and liquidity by using the two-stage least squares (2SLS) instrumental variable method. We apply the annual growth rate in internet penetration as the instrumental variable. Panel A in this table shows the effects of Fintech developments on bank liquidity, while Panel B presents the impacts of Fintech developments on bank diversification. The standard errors are shown in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively. The definitions of these variables can be seen in Table 2.

null hypothesis of the under-identified model is rejected. The F-statistic is larger than the critical value provided by Stock–Yogo weak ID test (Stock and Yogo, 2002), meaning there is no weak instrumental variable issue. Table 10 presents the regression results of 2SLS model. We can see that with the inclusion of instrumental variables, there remains a significant positive relationship between Fintech development and bank diversity and liquidity, despite the fact that the magnitude of coefficients on Fintech varies to some extent across the four models compared to the previous models. Therefore, our previous findings are robust and not impacted by potential endogeneity bias.

#### 6.4. Heterogeneity analyses

In this section, we investigate whether the relationship between Fintech and banks' liquidity and diversification will be driven by bank heterogeneity, as follows, we consider the role of the banks' year of establishment and ownership structure. Furthermore, we also explore whether the COVID-19 virus outbreak can affect these nexus.

##### 6.4.1. The role of bank ownership structure

We first test the heterogeneous impacts of Fintech on liquidity and diversification of banks with different ownership. Given the ownership nature differences among banks, different types of banks possess distinct business models, organisational structures and social resources. Thus, we classify our sample into three categories, including state-owned banks (Panel I), joint-stock banks (Panel II), and city and rural commercial banks (Panel III). Table 11 shows the regression results. All coefficients of Fintech are statistically insignificant in Panel I. In contrast, the coefficients of Fintech are negatively and significantly at the 1% level in all models in Panel II. Fintech is significantly negative in columns (1) and (2) of Panel III. These results exhibit that the impacts of Fintech developments on liquidity among state-owned banks are weakest, and it has the most obvious effects on the diversity of joint-stock banks. Our findings align with Cheng and Qu (2020) and Lee et al. (2021) that the reaction of state-owned banks to Fintech is relatively weak. This makes sense, as state-owned banks have a more complex corporate structure and adapt to new technologies more slowly. Moreover, they enjoy an implicit government guarantee and face the more strict supervision and intervention from the government of liquidity creation (Chen et al., 2015; Tang et al., 2021) and diversification (Hou et al., 2018). In contrast, joint-stock, city, and rural banks are more sensitive to the shock of Fintech developments. They, therefore, have more incentives to pursue diversification strategies and expand their business scope to strengthen their competitiveness. However, city and rural banks generally have a relatively fragile financial situation and a shortage of talent and technology resources. Whereas joint-stock banks have a relatively better financial position and more flexible strategies, they can rapidly and effectively apply advanced technologies to their business models. As a result, the contribution of Fintech to diversification is most pronounced among joint-stock banks.

##### 6.4.2. The role of bank size

We also investigate whether the size of banks will drive the relationship between Fintech and banks' liquidity and diversification. We use the mean of banks' total assets as the cut-off to classify our sample. Banks with total assets below the sample mean are defined

**Table 11**  
The effects of Fintech development on banks with different ownership structures.

Variables	Panel A		Panel B	
	(1)	(2)	(1)	(2)
	LC(catfat)	LC(catnonfat)	DIV	DIV1
<b>Panel I: State-owned banks</b>				
Fintech	-0.011 (0.013)	-0.011 (0.012)	0.014 (0.017)	0.017 (0.023)
Constant	-1.854 (1.223)	-2.307* (0.978)	-0.267 (1.219)	-0.765 (1.718)
Controls	Yes	Yes	Yes	Yes
Bank F.E.	Yes	Yes	Yes	Yes
Observations	55	55	55	55
R-squared	0.724	0.774	0.381	0.446
<b>Panel II: Joint-stock banks</b>				
Fintech	-0.368** (0.123)	-0.335** (0.130)	0.205*** (0.028)	0.239*** (0.038)
Constant	-2.644 (1.742)	-2.280 (1.841)	-0.062 (0.413)	-0.029 (0.547)
Controls	Yes	Yes	Yes	Yes
Bank F.E.	Yes	Yes	Yes	Yes
Observations	136	136	136	136
R-squared	0.500	0.472	0.634	0.617
<b>Panel III: City and rural banks</b>				
Fintech	-0.372*** (0.034)	-0.390*** (0.033)	0.025 (0.033)	0.031 (0.035)
Constant	-1.263*** (0.293)	-1.181*** (0.275)	-0.259 (0.283)	-0.299 (0.290)
Controls	Yes	Yes	Yes	Yes
Bank F.E.	Yes	Yes	Yes	Yes
Observations	804	804	804	804
R-squared	0.388	0.416	0.062	0.062

Note: This table reports the impacts of Fintech development on the diversification and liquidity of banks with different ownership structures. Panel I, II and III show the results for state-owned, joint-stock, and city and rural banks, respectively. The standard errors are shown in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively. The definitions of these variables can be seen in Table 2.

**Table 12**  
The effects of Fintech development on banks with different sizes.

Variables	Panel A		Panel B	
	(1)	(2)	(1)	(2)
	LC(catfat)	LC(catnonfat)	DIV	DIV1
<b>Panel I: Large banks</b>				
Fintech	-0.370*** (0.066)	-0.350*** (0.067)	0.059* (0.035)	0.075* (0.042)
Constant	-1.868*** (0.579)	-1.718*** (0.590)	-1.328*** (0.351)	-1.407*** (0.439)
Controls	Yes	Yes	Yes	Yes
Bank F.E.	Yes	Yes	Yes	Yes
Observations	425	425	425	425
R-squared	0.459	0.459	0.325	0.308
<b>Panel II: Small banks</b>				
Fintech	-0.342*** (0.038)	-0.339*** (0.037)	0.040 (0.041)	0.046 (0.044)
Constant	-1.051*** (0.386)	-0.905*** (0.359)	0.418 (0.337)	0.398 (0.358)
Controls	Yes	Yes	Yes	Yes
Bank F.E.	Yes	Yes	Yes	Yes
Observations	570	570	570	570
R-squared	0.359	0.388	0.033	0.032

Note: This table reports the impacts of Fintech development on the diversification and liquidity of banks of different sizes. Panel I and II show respectively the results for large and small banks. The standard errors are shown in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively. The definitions of these variables can be seen in Table 2.

**Table 13**  
The role of the COVID-19 outbreak in the relationship between Fintech development and bank diversification and liquidity.

Variables	Panel A		Panel B	
	(1)	(2)	(1)	(2)
	LC(catfat)	LC(catnonfat)	DIV	DIV1
Fintech	-0.201*** (0.030)	-0.194*** (0.029)	0.065** (0.028)	0.081*** (0.031)
<i>Fintech * COVID</i>	-0.913*** (0.220)	-0.922*** (0.212)	-0.552*** (0.199)	-0.584*** (0.210)
COVID	0.766*** (0.151)	0.785*** (0.146)	0.378*** (0.137)	0.402*** (0.145)
CTI	-0.229*** (0.041)	-0.218*** (0.042)	-0.047 (0.042)	-0.063 (0.045)
ROA	0.967 (2.603)	0.560 (2.586)	0.744 (3.282)	0.558 (3.841)
NPL	1.570** (0.772)	1.760** (0.747)	-0.740 (0.792)	-0.571 (0.869)
SIZE	0.039 (0.024)	0.015 (0.024)	0.016 (0.026)	0.015 (0.026)
GDP	-0.281** (0.129)	-0.291** (0.124)	-0.176 (0.178)	-0.110 (0.197)
Constant	0.143 (0.314)	0.376 (0.316)	0.063 (0.339)	0.088 (0.343)
Bank F.E.	Yes	Yes	Yes	Yes
Observations	995	995	995	995
R-squared	0.455	0.483	0.093	0.098

Note: This table reports the impacts of Fintech development on bank diversification and liquidity while considering the role of the COVID-19 outbreak. COVID is the dummy variable, which equals 1 if the bank is observed during the outbreak period of the COVID-19 virus and 0 otherwise. The standard errors are shown in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively. The definitions of these variables can be seen in Table 2.

as small banks, and banks with total assets above the median assets are defined as large banks. The results are shown in Table 12. According to the magnitude and significance of the coefficients of Fintech in Panel A and B, we find that large banks are more strongly affected than small banks by Fintech. This result may be attributable to the fact that large banks have more resources, capital and capacity to adopt Fintech. With the development of Fintech, many large banks have created Fintech service platforms or established Fintech subsidiaries. Such business strategies enrich the product categories and broaden the range of services offered by banks, but also increase the capital pressure and operational risks of banks. In contrast, most small banks have capital constraints that make them challenging to develop Fintech independently. As a result, Fintech has a stronger capability to influence large banks.

#### 6.4.3. COVID-19 pandemic, Fintech and bank liquidity and diversification

Next, we turn to the role of the outbreak of the COVID-19 pandemic. COVID-19 broke out in China at the end of 2019, posing a serious threat to economic and social development. The quarantine measures, including travel and contact restrictions, imposed to prevent the virus spread caused the real economy to suffer serious shock. To test whether the COVID-19 outbreak affects the linkage between Fintech and banks, we introduce the COVID-19 dummy variable and the interaction between Fintech and the COVID-19 dummy variable (that is, *Fintech \* COVID*) to complement our model. The dummy variable, COVID, equals one if the bank is observed during the outbreak of the COVID-19 virus (2020–2021) and 0 otherwise. The regression results are presented in Table 13. The results reveal that Fintech remains significantly negatively correlated with banks' liquidity and positively associated with diversification.

In Panel A, the interaction term *Fintech \* COVID* dummy is significantly negative, showing that the outbreak of COVID-19 enhances the negative relationship between Fintech and bank liquidity. These results may be because banks faced stronger competitive pressure from Fintech companies during the virus outbreak. After the outbreak, numerous businesses were forced to cease operations and production. Enterprises have less liquidity and need more loan assistance. Moreover, the segregation policy led to a surge in consumer demand for online financial services. In this new market environment, the relative advantages of Fintech firms are even more pronounced. Fintech companies have become more popular during the pandemic as they can offer more convenient financial services and efficient financing channels to customers affected by the pandemic's restrictive measures compared to traditional banks. Thus, the outbreak strengthens the negative impact of Fintech on bank liquidity. In Panel B, the coefficients of the interaction term are significantly negative, implying that the positive effects of Fintech development on bank diversity turn weaker after the epidemic. The traditional banking sector faces a double shock from economic volatility and industry competition during the pandemic, impacting banks' profitability and risk-taking. In addition, traditional banks are instruments of government to regulate the economy. In the aftermath of the epidemic, the country's economic environment was turbulent, and banks were subjected to more government intervention in their operations. These political and financial pressures, directly or indirectly caused by the COVID-19 epidemic, may slow the adoption of novel technologies in the banking industry, resulting in a weaker benefit impact of Fintech on bank diversity.

**Table A.1**  
Liquidity classification of bank activities (LC(cat fat) and LC(cat nonfat)).

<b>Assets:</b>		
Liquid assets (weight = -0.5)	Semiliquid assets (weight = 0)	Illiquid assets (weight = 0.5)
Cash and funds deposited in the Central Bank	Interbank lendings	Loans and advances
Trading financial assets	Precious metal	Recoursable financial assets acquired
Derivative financial assets		Long-term equity investments
Deposits in other banks		Investment real estates
Interests receivable		Deferred income tax assets
Available-for-sale financial assets		Fixed assets
Held-to-maturity investments		Goodwill
Investment in receivables		Other intangible assets
		Other assets
<b>Liabilities plus equity:</b>		
Illiquid liabilities plus equity (weight = -0.5)	Semiliquid liabilities (weight = 0)	Liquid liabilities (weight = 0.5)
Deferred income tax liabilities	Interbank borrowing funds	Total deposits
Total shareholders' equity		Employee compensation payable
Taxes payables		Borrowings from Central Bank
Bonds payable		Derivative financial liabilities
Expected liabilities		Trading financial liabilities
Interest payable		Financial assets sold with repurchase agreement
Other liabilities		Trading financial liabilities
<b>Off-balance sheet activities</b>		
Illiquid guarantees (weight = 0.5)	Semiliquid guarantees (weight = 0)	Liquid guarantees (weight = -0.5)
Acceptances and documentary credits	Other off-balance sheet exposure to securitisations	
Unused commitments		
Other off-balance sheet liabilities		

Note: The details for the components and weight applied to each category can be seen in [Appendix A, Table A.1](#). We use the ratio of the bank's annual liquidity over total assets to represent our dependent variable.

## 7. Conclusion

Bank liquidity creation and diversification strategies are vital in managing the banking system and broad national economic stability. Chinese banks provide the main financing channel for companies and individuals as the primary liquidity provider to the current economic system. In the meantime, to diversify economic risk and enhance core competitiveness, many commercial banks opt for diversification strategies, seeking multiple income sources and reducing their reliance on traditional businesses. Fintech, as an emerging force, influences the internal business model of banks and the external industry environment. This study empirically analyses the impact of Fintech development on the diversification and liquidity of banks in China. We build a Fintech development index using data from the Chinese market between 2011 and 2021. Our findings suggest that Fintech development can significantly reduce banks' liquidity. We also find a strong and positive association between Fintech and the diversification of banks. Moreover, We further find that the role of Fintech in facilitating banks is heterogeneous. These results imply that Fintech development reduces the financial intermediation role of banks while promoting the conversion of banks to non-traditional businesses and reducing their reliance on traditional interest income. The effects of Fintech on state-owned and small banks are more significant than other banks. The explosion of the COVID-19 epidemic catalyses Fintech's effects on bank liquidity and reduces its role in bank diversification.

Given the vital position of banks in the Chinese economic system, our study has important political implications. The development of the Fintech industry is intensifying financial market competition. Traditional banks are facing a threat posed by Fintech enterprises. Regulators should pay close attention to the development of the emerging Fintech industry and develop appropriate regulatory approaches and policies to create a level playing field and promote healthy competition and cooperation between banks and fintech companies. In addition, commercial banks should actively embrace new technologies and adapt to new industry trends as fast as possible. Also, banks should pursue appropriate development strategies to avoid issues of liquidity shortages and over-diversification caused by market competition and the acceptance of new technologies.

There are several limitations to our study. Firstly, our selection of the sample range is limited by the lack of data. Secondly, our study only contains a sample of the Chinese market. Future research could further discuss the linkages and influence mechanisms between Fintech and the banking sector in various political systems and economic environments.

## Data availability

Data will be made available on request.

**Table B.1**  
Liquidity classification of bank activities (Nsfr).

Required stable funding (RSF)		Available stable funding (ASF)	
Term	Weight	Term	Weight
Investment real estate		Expected liabilities	
Deferred income tax asset		Bonds payable	100%
Other intangible assets		Total shareholders' equity	
Fixed assets		Other deposits	90%
Goodwill	100%	Deposits from financial institutions	
Other Assets		Interest payable	
Loans and advances		Borrowings from the Central Bank	50%
Precious metal	85%	Trading financial liabilities	
Available-for-sale financial asset		Interbank borrowing funds	
Long-term equity investment		Financial assets sold with repurchase agreement	
Held-to-maturity investment		Employee compensation payable	
Deposits in other banks	50%	Taxes payable	
Interests receivable		Deferred income tax liabilities	
Investment in receivables		Derivative financial liabilities	0%
Cash and funds deposited in the Central Bank		Other liabilities	
Trading financial assets			
Derivative financial assets	0%		
Interbank lendings			
Recoursable financial assets acquired			

Note: The NSFR ratio is defined as the ratio of available stable funding to required stable funding. For calculating the NSFR, we classify and weigh the bank's assets and liabilities according to the regulatory standards introduced by Basel III. The designed details of available and required stable funding are shown in [Appendix B, Table B.1](#). The Lev ratio is the ratio of shareholder's equity to assets. We use these two ratios as alternative liquidity measures in our robustness checks.

**Table C.1**  
The factor analysis (Annual).

Index	Network transmission		Payment		Resource allocation		Risk management		Big data technology		Distributed technology		AI technology	
KMO test	0.624		0.644		0.524		0.540		0.621		0.521		0.704	
Bartlett test (P-value)	<.001		<.001		<.001		<.001		<.001		<.001		<.001	
Common factor	1	2	1	2	1	2	1	2	1	2	1	2	1	2
Variance contribution (%)	47.319	46.930	59.026	34.205	42.224	38.500	46.284	36.666	66.447	29.732	49.084	33.575	74.648	21.325
Cumulative variance contribution (%)	94.249		93.230		80.724		82.950		96.179		82.659		95.973	

Note: This table reports the results of KMO tests, Bartlett test and factor variance contribution.

## Appendix A

See [Table A.1](#).

## Appendix B

See [Table B.1](#).

## Appendix C

See [Table C.1](#).

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## **Chapter 4**

# **Fintech development, corporate tax avoidance and firm value**

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## Fintech development, corporate tax avoidance and firm value

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## ABSTRACT

We examine the relationship between fintech development and tax avoidance, as well as investigate whether this relationship has an impact on firm value. Using the data from Chinese A-listed firms, we provide evidence that fintech development increases tax avoidance, which facilitates firm value. Moreover, we find that fintech raises after-tax income and future cash flow by facilitating firms to avoid tax. Fintech development is negatively associated with tax risk and positively related to the effectiveness of firms in capitalizing on tax preferences. We further determine that the positive effects of fintech are more pronounced among firms with low internal information quality, weak internal control, and more geographically dispersed operations. Digital transformation, cash flow uncertainty, and regional economic development are the important potential channels through which fintech development influences tax avoidance. Our results are robust to alternative measures and endogeneity issues.

## 1. Introduction

Fintech refers to technology-based financial innovation. Rapid penetration of novel technologies such as big data, blockchain, cloud computing, and artificial intelligence in various financial sectors accelerates financial digitalization, mitigates information friction, and fosters financial inclusion (Ding et al., 2022; Tang, Hu et al., 2024; Wen et al., 2023; Yang & Zhang, 2022). With the emergence of fintech, its potential impact on real economic development has received increasing attention. Fintech development can reduce the threshold and costs associated with accessing financial services, ease corporate financial constraints, and provide financial support for the development and transformation of firms. Furthermore, the advent of fintech improves the financial market informativeness (Wen et al., 2023). By mitigating information asymmetry between the financial market and firms (Guo et al., 2023), fintech facilitates more efficient capital allocation and greater market transparency (Fuster et al., 2019), thereby alleviating the agency problem. In addition, the fintech development effectively enhances the ability of firms to couple and process internal data. Fintech empowers management to access and analyze non-standardized, unstructured internal data from a bottom-up approach, and promptly extract valuable information from vast amounts of data (Nie et al., 2023; Wu et al., 2024). This improvement not only allows management to gain a comprehensive understanding of a firm's operational status and potential risks but also facilitates more effective decision-making

processes (Lai et al., 2023; Luo et al., 2022). Given the crucial importance of fintech to the development of the real economy, the discussion on the connection between fintech and corporate strategic decisions and value growth has important practical significance.

Tax planning is an indispensable component of corporate financial planning and strategic decision-making because taxation is one of the major costs in business operations. Based on a traditional tax view, tax avoidance can enhance firm value by increasing cash flow and reducing tax costs, which is highly attractive to managers (Zhu et al., 2023). However, implementing tax avoidance strategies requires firms to invest large amounts of financial resources and spend upfront inputs before the expected benefits can be generated (Hasan et al., 2021). Overly aggressive tax avoidance strategies may create risks and impose potential costs such as tax penalties, reputational damage, and agency costs (Hasan et al., 2014). Thus, the motivation of firms to avoid taxes is driven by management's trade-off between the marginal costs and benefits of tax avoidance strategies.

The advent of fintech has created new avenues for tax avoidance for businesses. It is anticipated that fintech will help businesses to better understand and utilize tax incentives, identify utilized tax opportunities, and reduce tax planning costs. However, it is important to note that tax avoidance activities of enterprises are often accompanied by tax risks. Therefore, firms need to weigh the tax benefits and potential risks associated with the adoption of fintech for tax planning. Legitimate tax planning can only contribute to the maximization of tax and

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financial benefits for enterprises. Our study is motivated by the rapid expansion of the fintech sector, the critical importance of corporate tax planning, and their implications for corporate management and the healthy growth of the real economy.

Despite the changes in corporate governance and market conditions brought about by the development of fintech that may potentially affect firms' tax avoidance decisions. However, the impact of fintech developments on corporate tax avoidance remains an important but unexplored topic in the literature. Therefore, this paper aims to investigate the impact of fintech development on corporate tax avoidance and its value implications by analyzing data from Chinese listed companies from 2011 to 2021.

We present several possible plausible avenues to explain how advances in fintech could potentially affect firms' tax avoidance decisions. On the one hand, we consider three channels through which fintech may reduce the effective corporate tax rate. The first is the digitalization channel. Fintech advancements provide external financing and technical support for firms' digital transformation (Chen et al., 2023). The adoption of digital technology in firms enhances their information processing capabilities and enables them to conduct strategic planning and allocate resources at the firm-wide level (Zhou et al., 2022), which is conducive to recognizing tax opportunities and reducing the difficulty and cost of tax planning. The second one is the cash flow uncertainty channel. Fintech mitigates cash flow uncertainty by broadening corporate financing channels and optimizing capital management (Guo et al., 2023). This lowers the difficulty of managers in forecasting taxable income and marginal tax rates (Chen et al., 2024), improves management forecast accuracy, and increases the effectiveness and potential benefits of tax avoidance strategies implemented by managers based on their expected values. In addition, fintech improves financial market informativeness, which helps firms select appropriate investment projects (Lv & Xiong, 2022). The increased stability of investment returns improves the value of cash flows generated by tax avoidance. Also, fintech strengthens the sensitivity of enterprises to market changes (Li et al., 2021), reduces the risks associated with market demand fluctuations, and improves the stability of corporate finances, which in turn helps enterprises identify more tax opportunities. The third channel is regional economic development. Fintech development stimulates regional economic growth by improving financial inclusion (Li et al., 2020). In regions with good economic growth, local governments may face less fiscal pressure and therefore be more willing to introduce tax incentives. On the other hand, fintech may reduce corporate tax avoidance motivations through the financial constraint channel. Fintech reduces the information opacity and broadens the financing channels of firms, thus easing the financial constraints of firms (Ding et al., 2022; Guo et al., 2023; Lai et al., 2023). The reduction of external financing pressure on firms reduces the need for internal funds, which in turn lowers the incentives for firms to avoid taxes (Haque et al., 2023; Law & Mills, 2015).

Based on the existing fintech-related literature (Ding et al., 2022; Yang & Zhang, 2022), we utilize the Peking University Digital Financial Inclusion Index of China (PKU-DFIIC) as the measure of fintech development. Meanwhile, we use the GAAP effective tax rate (GETR) and cash effective tax rate (CETR) to capture corporate tax avoidance (Bradshaw et al., 2019; Chen et al., 2010; Guo, Li et al., 2023; Khan et al., 2017). After controlling for a set of control variables, we find that fintech is negatively associated with the corporate effective tax rate, which means that fintech growth can improve the degree of corporate tax avoidance. Moreover, the analysis of the value-implications of tax avoidance and fintech suggests that tax avoidance is a driver to raising firm valuation and also an important channel through which fintech development improves firm valuation. This result also means that fintech helps assist companies with value-creating tax planning efforts. Our study is robust to alternative definitions of the main variables.

In further analyses, our results demonstrate that fintech increases firms' future cash flows and after-tax income by facilitating tax avoidance, which promotes firms' profitability and financial stability and

generates economic benefits for firms. Such an increase in economic benefits could be a potential channel for fintech-driven tax avoidance activities to raise a firm's market valuation. Furthermore, fintech improves tax avoidance without creating tax risks but rather facilitates more efficient capitalization of tax preferences by firms. This result indicates that our main result of a positive association between fintech and corporate tax avoidance does not mean that fintech encourages firms to adopt excessively risky tax policies, instead enabling firms to optimize their tax structure, develop more compliant and efficient tax avoidance strategies, and identify under-utilized tax planning opportunities. The results presented in the cross-sectional analyses suggest that fintech development has a more pronounced effect on tax avoidance for firms with low internal information quality, weak internal control, and more geographically dispersed operations. Next, we delve into the potential mechanisms by which fintech may lead to an increase in tax avoidance. We demonstrate that the digitalization of firms, cash flow uncertainty, and regional economic development are the potential channels through which the impact of fintech development on tax avoidance can be achieved.

Finally, we perform three tests to mitigate potential endogeneity concerns. First, we use a DID test and consider the "Guidance on Promoting the Healthy Development of Internet Finance" jointly issued by the People's Bank of China and the Ministry of Finance as a policy shock. The results show that the issuance of this guidance effectively increases tax avoidance. Second, we apply the instrumental variable method and follow Fang et al. (2023) to take the provincial Internet penetration rate as the instrumental variable of the fintech development index. The two-stage least squares regression (2SLS) results suggest that instrumented fintech still maintains a significant positive association with the level of tax avoidance. Last, we run propensity score matching (PSM) analyses to address selectivity bias. The PSM results are consistent with the main results. Overall, our results are robust to endogeneity concerns.

Our study makes two important contributions. First, we contribute to the existing research on the determinants and the value implications of corporate tax avoidance behavior. In terms of the determinants of tax avoidance, prior studies have discussed how corporate tax avoidance behavior is influenced by managerial characteristics (Baghdadi et al., 2022; Gul et al., 2020; Wen et al., 2020), corporate governance (Minnick & Noga, 2010; Wahab & Holland, 2012), and the corporate operating environment (Huang et al., 2016; Shen et al., 2021; Zhu et al., 2023). Our study provides compelling evidence that fintech is a novel and economically important determinant of corporate tax avoidance strategies. Our results confirm the significant effects of fintech advancements on tax avoidance and reveal the underlying mechanisms, which provide new insights to expand the understanding of corporate tax avoidance behaviors. Furthermore, this study extends research on the value implications of corporate tax avoidance. In the existing literature, it is inconclusive regarding whether corporate tax avoidance benefits firm valuation growth. Hasan et al. (2021) show that tax avoidance behavior increases the value of firms with high levels of organizational capital. Desai and Dharmapala (2009) find that the positive effect of tax avoidance on firm value is only reflected in well-governed firms. The findings of Chen et al. (2014) indicate that the combination of high information transparency and tax avoidance behavior can increase firm value, whereas tax avoidance reduces firm value when firms have low information transparency. We extend the relevant literature by showing a positive correlation between tax avoidance and firm valuation. Moreover, we find that investors view firms' tax avoidance driven by fintech development as a value-adding activity, which provides new channels and perspectives for firm value enhancement and further shows the important real impact of fintech on firm development.

Second, our empirical study of fintech development and corporate tax avoidance adds new evidence of the connection between technological advances and real economic activities. An extensive body of

existing literature examines the impact of fintech on firm behavior and performance from a variety of perspectives including financial reporting quality (Wen et al., 2023), sell-side research quality (Jame et al., 2022), investment efficiency (Huang, 2022; Lv & Xiong, 2022), excess leverage (Lai et al., 2023), firms' digitalization (Chen et al., 2023; Guo, Feng, Lin, 2023), innovation (Ding et al., 2022) and risk management (Cheng & Qu, 2020; Nie et al., 2023). However, there are relatively few discussions on the impact of fintech on corporate tax avoidance. To the best of our knowledge, this is the first study that reveals the causal relationship between fintech development and corporate tax avoidance. Our results emphasize the important role that fintech plays in the strategic decisions of firms and enrich the discussion on the economic consequences of fintech development by showing that fintech development improves tax avoidance and raises the firm's value. The present study addresses a significant gap in the existing literature on the impact of fintech on tax avoidance, while also providing new evidence on the positive role of fintech in enhancing firms' economic performance. By revealing the dual impact of fintech on corporate tax avoidance and value creation, the findings of this study provide valuable insights and implications for the development of future policy and the formulation of corporate strategies.

The remainder of the paper proceeds as follows. Section 2 review the existing literature and develop our hypotheses. Section 3 provides details of the research design. Section 4 presents the empirical results. Section 5 discuss robustness tests and address endogeneity concerns. Section 6 concludes.

## 2. Literature review and hypotheses development

### 2.1. Literature review

#### 2.1.1. Fintech development

Fintech advancements provide disruptive potential for financial development and new opportunities and drivers for growth across all industries. Existing research in the fintech field discusses the impact of fintech on shifts in the financial system, corporate development, and regional economic growth. For the financial system, fintech development eases the information friction issues in the traditional financial market, optimizes financial resource allocation, and improves the efficiency, accessibility, and affordability of financial services (Banna et al., 2021; Philippon, 2016). Wen et al. (2023) posit that fintech improves the financial market informativeness. Guo et al. (2023) discuss the vital role of fintech development in mitigating the information asymmetry between the financial market and firms. They argue that fintech can lower information costs and add more price information, particularly in the trading market. In addition, fintech helps lenders conduct more effective risk assessments of customers and provide more resources to capital markets. Fuster et al. (2019) suggest that fintech innovation can reduce friction in mortgage lending and improve the efficiency of the U.S. mortgage market without increasing loan risk. Huang et al. (2020) show that fintech approaches have information and modeling advantages that can alleviate the issues of insufficient and costly information for SMEs and broaden access to financial services for under-served firms. Ding et al. (2022) believe that better-developed fintech means indicates greater growth of the financial markets. Their results suggest that Internet credit intensifies bank loan competition and thus raises the accessibility of loans to financially constrained firms. Nie et al. (2023) argue that fintech can analyze unstructured data to obtain large amounts of multidimensional information based on data mining techniques. In terms of corporate development, Chen et al. (2023) find that fintech promotes the digital transformation of firms, including digital technology and digital application. Guo, Feng, Lin (2023) also state that digital technology empowers traditional financial inclusion to significantly boost business digitalization. Lai et al. (2023) posit that fintech strengthens the capacity of firms to secure external financing and generates internal

capital, which reduces the firm's excess leverage. Lv and Xiong (2022) show that fintech can help firms make better investment decisions and improve their investment efficiency by increasing the opacity of information in transactions. Adopting the data from SMEs, Huang (2022) find similar conclusions. Big data and cloud computing technologies help firms broaden the sharing of access and achieve business reshaping (Nambisan et al., 2019). In addition, fintech enhances the risk management capabilities of firms (He et al., 2023; Jin et al., 2022). For regional economics, fintech adoption influences regional economic development by increasing the accessibility of financial services and broadening information channels. Yang and Zhang (2022) confirm that fintech development promotes financial inclusion and Cai et al. (2024) demonstrate a positive relationship between fintech adoption and rural economic development. They find that fintech adoption improves rural household earnings, which narrows the urban-rural income gap. Li et al. (2020) argue that consumption is one of the key driving forces of economic development and that digital inclusive finance significantly promotes household consumption.

#### 2.1.2. Tax avoidance

Taxes are a significant cost in the financial statements of a business. Through an effective tax avoidance strategy, companies can not only legally cut their tax burden, but also achieve a more optimal allocation of corporate resources. Theoretically, firms can raise cash flow and fund value-added investment opportunities through tax reductions, which benefits firm value (Armstrong et al., 2012). Nevertheless, tax planning is a time-consuming, complex, costly, and knowledge-intensive firm activity. Companies may need to invest large amounts of financial resources and incur high upfront costs to design and implement high-quality, compliant tax avoidance strategies before they realize the benefits of tax avoidance (Mills et al., 1998). In addition, over-aggressive tax avoidance behavior can generate potential costs (Hasan et al., 2014), such as the increased risk of audits and monetary punishments for firms by tax authorities (Hanlon & Slemrod, 2009; Mills, 1998), increased agency risk (Desai & Dharmapala, 2006; Desai et al., 2007), and damage to reputation (Bankman, 2004). Therefore, the tax avoidance strategy of a firm can be viewed as the outcome of management's trade-off between the expected benefits and potential costs from this strategy (Chen et al., 2024; Guo, Li et al., 2023). When the marginal benefits exceed marginal costs, rational managers are highly likely to commit tax avoidance activities, because tax avoidance creates economic benefits and has the potential to increase company valuations (Hasan et al., 2021). Our paper differs from previous research by examining the association between fintech development and tax avoidance, therefore contributing to the existing literature.

### 2.2. Hypotheses development

The existing literature emphasizes the significant impact of fintech development on firms' internal management and external environment. In this context, we discuss the potential mechanisms underlying the role of fintech on corporate tax avoidance and propose our hypotheses.

#### 2.2.1. Fintech development and tax avoidance

It is not yet fully understood how the development of fintech affects the way corporations handle their tax obligations. On the one hand, the development of fintech is expected to reduce costs and risks, increase the potential benefits of corporate tax planning, and affect the tax environment of enterprises, which is conducive to promoting the effectiveness of corporate tax avoidance activities. More specifically, first, fintech advancements accelerate corporate digitalization, which is anticipated to improve the ability of firms to engage in tax avoidance activities and reduce the marginal costs and risks associated with tax avoidance. As Chen et al. (2023) stated, fintech development provides fertile soil for the digital transformation of businesses: the necessary capital and high-tech talent. Specifically, fintech development

increases the quality and transmission efficiency of information in the capital market, improves corporate transparency, and reduces information asymmetry (Guo et al., 2023), which eases external financing constraints and provides capital for the digital transformation of enterprises. And, the development of the fintech field provides a conducive environment for the cultivation of related high-tech talents, therefore, regions with prosperous fintech aggregate more technical human resources to support the digital transformation of enterprises (Cheng & Qu, 2020). The corporate digital transformation driven by fintech enhances a firm's ability to integrate and process information, as well as its capability to deploy strategic planning and resource allocation at the enterprise-wide level. Information is the key basis for companies to develop effective tax avoidance strategies. Information uncertainty and ambiguity can increase the cost of tax avoidance because companies are unable to fully assess the effectiveness of their tax avoidance strategies in such conditions (Dang et al., 2019; Shen et al., 2021). Improvements in the information processing capabilities of firms increase sensibility and agility to internal and external opportunities and threats (Li et al., 2021), which are conducive to enterprises promptly adjusting their tax strategies to identify unexploited tax reduction opportunities, meanwhile reducing potential tax risks. Furthermore, the application of emerging digital technologies within firms also improves internal control quality. The decentralized and disinter-mediated network structure relying on blockchain technology would strengthen the interactive integration of resources and the interconnection of information and sect-oral collaboration (Cheng et al., 2024). The internal control quality represents a company's internal governance capabilities. If internal controls are weak, firms may have management issues such as weak risk management, lack of key personnel, inadequate communication, and "tone at the top", leading to missing tax avoidance opportunities (Bauer, 2016). Jiménez-Angueira (2018) note that companies invest more resources to improve internal control when internal controls are weak. Such an effort to enhance internal controls draws resources away from the firm's tax planning activities. Qin et al. (2022) argue that the weakness or loss of internal controls in a business would cause an imbalance of power and responsibility, and the relevant staff will thus lose the initiative to explore and utilize tax preferences, which in turn increases the tax burden of the enterprise. Improvements in the quality of internal controls provide a nice environment for managers to conduct tax planning (Gallemore & Labro, 2015). We therefore believe that accelerating corporate digitalization is a channel through which fintech can affect tax avoidance.

Second, fintech improves the effectiveness and potential benefits of tax avoidance strategies implemented by enterprises and increases motivation for tax avoidance, as fintech reduces the uncertainty of the cash flow, which lowers the difficulty of managers in predicting the taxable income and marginal tax rate. Cash flow uncertainty can obscure tax opportunities and make it more difficult for managers to accurately estimate future taxable income. Hopland et al. (2018) argue that greater cash flow uncertainty implies that the actual taxable income and marginal tax rates are more likely to deviate from their expected values. This leads to a reduction in the effectiveness and potential benefits of tax avoidance strategies that firms plan and implement based on their expectations (Chen et al., 2024; McGuire et al., 2014), which decreases a firm's tax avoidance motivation. Regarding mitigating cash flow uncertainty, previous research (Deng et al., 2013) has confirmed the significant role that access to external finance plays. Fintech development increases credit accessibility and optimizes corporate capital management, which reduces cash flow uncertainty and thus improves the effectiveness of tax avoidance activities. Fintech also shapes information quality in financial markets (Bollaert et al., 2021) and leads enterprises to choose optimal investment projects (Lv & Xiong, 2022). Decreased instability of investment income raises the value of cash flows generated by tax avoidance, enhancing the firm's motivation for tax avoidance. Additionally, changing market environments and consumer demands can increase the uncertainty of a firm's

business. The novel digital technologies involved in the fintech field can help firms to more accurately identify and reasonably predict customer preference and demand (Luo et al., 2022) and strengthen the sensitivity of the firm to market opportunities (Li et al., 2021) that reduce the risk generated by market demand volatility and improve the stability of corporate finances. When revenue for a business is stable, management can more accurately predict taxable income and identify opportunities for tax savings. In short, the fintech development can improve the potential benefits of tax avoidance by reducing cash flow uncertainty.

Third, fintech development stimulates local economic growth and therefore eases fiscal pressures on local officials, which may increase the likelihood of tax incentives adopted by local governments. Li et al. (2024) show that in China, large government agencies rely on local government revenues to operate. When fiscal revenues are low, local governments may strengthen tax enforcement and limit tax preferences to generate additional short-term fiscal incomes. Fintech development improves financial inclusion, reduces income inequality, raises incomes, and narrows regional development gaps, which is anticipated to stimulate local economic development (Ozili, 2018; Sarma & Pais, 2011) and raise local government fiscal resources. Cai et al. (2024) confirm the positive association between fintech adoption and rural economic development. They find that fintech adoption improves rural household earnings, which narrows the urban-rural income gap. Li et al. (2020) argue that consumption is one of the fundamental driving forces of economic development and that digital inclusive finance significantly promotes household consumption. Regional economic development can boost local government fiscal revenues. When local governments encounter less fiscal pressure, they are more likely to implement preferential tax policies to attract and retain businesses (Dang et al., 2019).

Based on the above discussion, we propose the following hypothesis:

**Hypothesis 1 (H1).** Fintech development significantly increases corporate tax avoidance.

**Hypothesis 2 (H2).** This positive relationship is achieved by facilitating the digitization of businesses, reducing cash flow uncertainty, and promoting regional economic development.

On the other hand, fintech development has the potential to reduce corporate information opacity, broaden corporate financing channels, and ease corporate financial constraints, therefore reducing the proclivity for corporations to engage in tax avoidance strategies. Tax savings can be regarded as a form of corporate finance source (Haque et al., 2023). When an enterprise's external financing resources are restricted or fully depleted, tax savings can increase the enterprise's available cash flow and reduce its dependence on costly external financing. As Edwards et al. (2016) suggested, the increased financial constraints will create stronger incentives for companies to generate additional internal funds through tax planning. Fintech development can increase the amount of high-quality information in the financial market and reduce the cost of information acquisition and dissemination, and thus effectively reducing the information asymmetry problem between lending institutions and enterprises. When the problem of information asymmetry is alleviated, firms will gain greater access to credit and experience fewer financial constraints (Guo et al., 2023). Furthermore, the emergence of new fintech credit platforms has intensified competition in the traditional credit market, which can lead to a reduction in prices and an expansion in the availability of financial resources (Cetorelli & Strahan, 2006). The easing of firms' financial constraints implies a reduction in the cost of external financing faced by firms and an increase in the accessibility of external funds, which contribute to reducing firms' reliance on internal financing and their incentives to avoid taxes. Thus, we propose the other hypothesis:

**Hypothesis 3 (H3).** Fintech development significantly decreases corporate tax avoidance.

**Hypothesis 4 (H4).** Fintech inhibits corporate tax avoidance through the financial constraint channel.

### 2.2.2. Fintech development, tax avoidance and firm value

Fintech development is gradually becoming an important factor in boosting company valuation growth. For example, Meng and Lee (2007) point out that the investment in information technology greatly improves firms' market value in China. They believe that IT is a shortcut for firms in developing countries to catch up with firms in developed countries according to the catch-up theory, because it enables developing countries to skip several stages of development. Ma and Wang (2024) suggest that fintech applications significantly facilitate firm growth and value. Nevertheless, the channels for the impacts of fintech on firm valuation remain for further exploration.

Tax avoidance can be recognized as a value-enhancing activity as it prevents the transfer of wealth resources to the government. Numerous studies show that tax avoidance increases cash flow and earnings and funds investment opportunities, which is value-enhancing to shareholders (Edwards et al., 2016; Hasan et al., 2021). Armstrong et al. (2015) also argue that tax avoidance is a risky but value-added investment opportunity available to management. Combining this view with the possible promotion of tax avoidance by fintech, we believe that fintech may add to firm valuation via the tax avoidance channel. Based on that, we propose the following hypothesis:

**Hypothesis 5 (H5).** Fintech development improves firm value by increasing tax avoidance.

## 3. Research design

### 3.1. Variables

#### 3.1.1. Measures of tax avoidance

As in Guo, Li et al. (2023), we deploy two indicators to proxy for the extent of corporate tax avoidance. The GAAP effective tax rate (*GETR*) is the first proxy, defined as the ratio of total income tax expense to pretax income. Our second proxy is the cash effective tax rate (*CETR*), which is computed as cash taxes paid divided by pretax income. Given that Chinese enterprises do not disclose cash income tax expenses, we measure the cash tax paid as income tax expense minus the change in income tax payable from year  $t - 1$  to year  $t$  (Bradshaw et al., 2019). We truncate *GETR* and *CETR* within the interval 0 and 1. Consistent with prior literature (Bradshaw et al., 2019; Guo, Li et al., 2023; Khan et al., 2017), a lower value of *GETR* or *CETR* means a higher level of tax avoidance.

We also use two alternative proxies to capture corporate tax avoidance, namely *AETR* and *BTD*. Referring to Chen et al. (2022), we compute *AETR* as the applicable statutory income tax rate minus the effective tax rate. *BTD* represents the book-tax difference, which equals pretax income minus taxable income, scaled by total assets (Shen et al., 2021; Wen et al., 2020). A higher value of *AETR* or *BTD* indicates a higher level of tax avoidance.

#### 3.1.2. Measures of fintech development

Our primary independent variable is the fintech development index (*Fintech*). *Fintech* is defined as the natural logarithm of the provincial aggregated Peking University Digital Financial Inclusion Index of China (PKU-DFIIC).<sup>1</sup> The PKU-DFIIC index is constructed by a research group from the Institute of Digital Finance at Peking University and the Research Institute at Ant Group. The construction of this index is based on Ant Group's massive data and aims to measure the level of development and adoption of fintech in each region of China, which is

widely used as a fintech development measure in existing studies (Ding et al., 2022; Yang & Zhang, 2022). We show the whole system of the digital financial inclusion index of China (PKU-DFIIC) in Appendix B.

In this study, we primarily use provincial indices to assess the level of fintech development in each region of China. However, given the significant differences between Chinese cities in economy, technology, etc., it is not easy to adequately control these inter-city differences by relying only on provincial data. Therefore, we introduced a city-level index to more accurately reflect the impact of a city's fintech adoption on corporate tax avoidance. Thus, the first alternative fintech indicator, used in robust check, is defined as the natural logarithm of the city-level PKU-DFIIC. In addition, considering that PKU-DFIIC is constructed primarily based on Ant Group's data, information related to other organizations, tech companies, and platforms may be omitted. To increase the robustness of our results, we also use the number of fintech companies and the number of patents as alternative fintech proxies for testing. *FintechFirm* is the natural logarithm of the number of fintech firms established in province  $p$  for the year  $t$  (Phan et al., 2020). *FintechPatent* is computed as the natural logarithm of the cumulative number of fintech patents, where fintech patents are defined as the patents with International Patent Classification (IPC) codes belonging to G06Q40/02 (banking), G06Q40/06 (investment), or G06Q40/08 (insurance) (Wen et al., 2023).

### 3.2. Data source and sample construction

We utilize financial data for listed Chinese firms from the China Stock Market & Accounting Research Database (CSMAR), and WIND Database. Data on the fintech development index is provided by the research team from the Institute of Digital Finance at Peking University and the Research Institute at Ant Group. Data on fintech companies and patents are available from the CSMAR database and the China National Intellectual Property Administration (CNIPA), respectively.

The sample for our study consists of Chinese A-share firms listed on the Shanghai Stock Exchange and Shenzhen Stock Exchange from 2011 to 2021. To be consistent with existing studies (Guo, Li et al., 2023; Li et al., 2024), we drop firms in the financial sector, firms that receive special treatment (ST), firms with significant missing financial data, and firms with negative pre-tax income from the sample. The final dataset includes 21,810 firm-year observations. Table 1 provides the descriptive statistics for the main variables.

### 3.3. Model

To investigate the effects of fintech development on corporate tax avoidance, we estimate the following regression model:

$$GETR_{i,t} \text{ or } CETR_{i,t} = \alpha + \beta \times Fintech_{p,t} + \gamma \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{it} \quad (1)$$

where  $p$ ,  $i$ ,  $t$  and  $j$  denote province, firm, year, and industry, respectively. The dependent variable is the GAAP effective tax rate ( $GETR_{i,t}$ ) or cash effective tax rate ( $CETR_{i,t}$ ) for firm  $i$  in year  $t$ .  $Fintech_{p,t}$  refers to the fintech development level of province  $p$  in year  $t$ .  $Control_{i,t}$  is a vector of firm-specific control variables. We control for the industry ( $\phi_j$ ) and year ( $\mu_t$ ) fixed effects in all regression analyses. The robust standard errors are clustered at the firm level. The definitions of all variables are given in Appendix A.

## 4. Empirical results

### 4.1. Fintech development and tax avoidance

Table 2 shows the impacts of fintech development on corporate tax avoidance. Columns (1) and (2) report the regression results without the addition of control variables. Columns (3) and (4) present the

<sup>1</sup> The detailed compilation method of this index can be seen: <https://en.idf.pku.edu.cn/docs/20190610145822397835.pdf>.

**Table 1**  
Descriptive statistics.

Variable	Obs	Mean	Std. dev.	Min	Median	Max
GETR	21,810	0.181	0.103	0.000	0.155	0.968
CETR	21,810	0.188	0.128	0.000	0.157	1.000
Fintech	21,810	5.508	0.561	2.786	5.690	6.129
Tobin's Q	21,810	1.914	1.030	0.641	1.588	9.197
SIZE	21,810	22.245	1.343	19.309	22.029	28.636
MB	21,810	3.327	1.610	0.775	2.930	9.993
CAP	21,810	0.053	0.048	0.000	0.039	0.397
GROW	21,810	0.190	0.379	-0.875	0.129	5.925
AGE	21,810	3.194	0.226	2.079	3.219	4.190
LEV	21,810	0.062	0.094	0.000	0.119	0.696
INTANG	21,810	0.047	0.061	0.000	0.033	0.852

Note: This table shows descriptive statistics for the main variables, including mean, standard deviation, median, maximum, and minimum values. *GETR* is calculated as income tax expense divided by pretax income. *CETR* is defined as cash tax paid divided by pretax income. Cash tax paid equals the sum of tax expense and beginning income tax payable minus ending income tax payable. We truncate *GETR* and *CETR* between 0 and 1. *Fintech* is the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China. *Tobin'sQ* is defined as the ratio of the sum of total liabilities, book value of preferred stock, and market value of equity to the total assets. *SIZE* refers to the natural logarithm of total assets. *MB* is the market-to-book ratio, computed as the market value of equity scaled by the book value of equity. *CAP* is measured by the ratio of capital expenditures to total assets. *GROW* is the growth rate of total revenue. *AGE* is defined as the natural logarithm of firm's duration. *LEV* represents the leverage ratio, calculated as long-term debt scaled by total assets. *INTANG* is the ratio of intangible assets to total assets.

estimated coefficients of Eq. (1). We control industry-fixed effects and year-fixed effects and errors are clustered at the firm level in all models. As can be observed, *Fintech* has a negative and statistically significant coefficient in the first two columns, indicating that fintech development is related to a higher degree of tax avoidance. In Columns (3) and (4), the coefficients on the fintech variables are significant and -0.016 and -0.029, respectively. In terms of economic significance, these coefficients suggest that a one-standard-deviation increase in *Fintech* is related to a decrease of 4.959% in *GETR* or 8.654% in *CETR* relative to their means.<sup>2</sup> These results support our hypothesis one (H1) that fintech development is conducive to increasing the level of corporate tax avoidance.<sup>3</sup>

#### 4.2. Fintech development, tax avoidance and firm value

Next, we further analyze how firm shareholders perceive the impact of fintech on corporate tax avoidance, that is, whether the positive relation between fintech and corporate tax avoidance is beneficial to firm valuation. Following Cantrell and Yust (2018) and Shahriar et al. (2020), we examine the mediating effect of tax avoidance on the association between fintech and firm value using Baron and Kenny (1986)'s mediation model. The regression model is specified as follows:

$$Tobin'sQ_{i,t} = \alpha_2 + \beta_2 \times Fintech_{p,t} + \gamma_2 \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{it} \quad (2)$$

$$GETR_{i,t} \text{ or } CETR_{i,t} = \alpha + \beta \times Fintech_{p,t} + \gamma \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{it} \quad (3)$$

$$Tobin'sQ_{i,t} = \alpha_3 + \beta_3 \times Fintech_{p,t} + \delta_3 \times GETR_{i,t} \text{ or } CETR_{i,t} + \gamma_3 \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{it} \quad (4)$$

<sup>2</sup> The economic significance is computed as follows:  $(-0.016 \times 0.561)/0.181 = -0.04959$  or  $(-0.029 \times 0.561)/0.188 = -0.086537$ . where -0.016 or -0.029 is the coefficient on *Fintech*. 0.561 refers to the standard deviation of *Fintech*. 0.181 and 0.188 are the mean values of *GETR* and *CETR*, respectively.

<sup>3</sup> In Appendix C, we also provide further evidence that easing financial constraints is unlikely to be the channel through which fintech development affects tax avoidance.

**Table 2**  
Fintech development and tax avoidance.

	(1)	(2)	(3)	(4)
Variables	GETR	CETR	GETR	CETR
Fintech	-0.021*** (0.007)	-0.034*** (0.008)	-0.016** (0.006)	-0.029*** (0.007)
SIZE			0.004*** (0.001)	0.002** (0.001)
MB			0.002** (0.001)	0.000 (0.001)
CAP			-0.152*** (0.018)	-0.137*** (0.020)
GROW			-0.009*** (0.002)	-0.045*** (0.003)
AGE			0.020*** (0.005)	0.025*** (0.005)
LEV			0.082*** (0.017)	0.095*** (0.019)
INTANG			0.075*** (0.024)	0.083*** (0.027)
Constant	0.162*** (0.043)	0.204*** (0.041)	-0.011 (0.050)	0.067 (0.050)
Industry F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Observations	21,810	21,810	21,810	21,810
Adjusted R-squared	0.180	0.124	0.197	0.151

Note: This table shows the effects of fintech development on tax avoidance. The dependent variables are *GETR* in Columns (1) and (3) and *CETR* in Columns (2) and (4). The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

where *Tobin'sQ* is calculated as the ratio of the sum of total liabilities, book value of preferred stock, and market value of equity to the total assets. Eq. (2) estimates the effects of fintech on firm value. Eq. (3) estimates the effects of fintech on mediating variables (*GETR* or *CETR*). Eq. (4) estimates the effects of mediating variables (*GETR* or *CETR*) on firm value after controlling the fintech variable. For the estimation results, if the coefficients  $\beta_3$  and  $\delta_3$  are significant and have the expected symbols, and the value of  $\beta_3$  is smaller than  $\beta_2$ , there exists a certain level of mediation effect. If the coefficient  $\beta_3$  is not significant while  $\delta_3$  is significant, the mediator variable has fully mediated.

Table 3 presents the estimation results of using tax avoidance as a mediating variable in the impact of fintech development on firm value. In Column (1), *Fintech* is significant and positive (coefficient = 0.241), meaning that the fintech growth contributes to an increase in firm value. This is in line with the study of Tang, Hou et al. (2024), which finds a strong relationship between the development of fintech and a firm's market valuation. Columns (2) and (4) show a negative relationship between *Fintech* and two effective tax rates, *GETR* and *CETR*. In Columns (3) and (5), *GETR* and *CETR* are significant and negative, indicating that tax avoidance facilitates the increase in firm value. This result is consistent with the view of previous studies (Guo, Li et al., 2023; Hasan et al., 2021) that tax avoidance can be considered a value-enhancing activity. Moreover, the coefficients on *Fintech* (0.229 and 0.227) are significant and less than 0.241. These results clearly do not reject the hypothesis that fintech development improves firm value by increasing corporate tax avoidance.

#### 4.3. Potential mechanisms

We then discuss the potential mechanisms through which fintech development drives corporate tax avoidance and predict three possible channels: enhancing corporate digitalization, reducing cash flow uncertainty, and promoting regional economic development.

##### 4.3.1. Digital transformation

As mentioned in the above discussion, fintech development increases tax avoidance, as it promotes corporate digital transformation,

**Table 3**  
Fintech development, tax avoidance and firm value.

	(1)	(2)	(3)	(4)	(5)
Variables	Tobin's Q	GETR	Tobin's Q	CETR	Tobin's Q
Fintech	0.241*** (0.047)	-0.016** (0.006)	0.229*** (0.046)	-0.029*** (0.007)	0.227*** (0.047)
GETR			-0.760*** (0.065)		
CETR					-0.501*** (0.045)
SIZE	-0.198*** (0.008)	0.004*** (0.001)	-0.195*** (0.008)	0.002** (0.001)	-0.197*** (0.008)
MB	0.459*** (0.009)	0.002** (0.001)	0.460*** (0.009)	0.000 (0.001)	0.459*** (0.009)
CAP	0.503*** (0.127)	-0.152*** (0.018)	0.387*** (0.126)	-0.137*** (0.020)	0.435*** (0.126)
GROW	-0.023** (0.012)	-0.009*** (0.002)	-0.031*** (0.011)	-0.045*** (0.003)	-0.046*** (0.012)
AGE	-0.087** (0.035)	0.020*** (0.005)	-0.072** (0.035)	0.025*** (0.005)	-0.075** (0.035)
LEV	-2.339*** (0.106)	0.082*** (0.017)	-2.277*** (0.103)	0.095*** (0.019)	-2.292*** (0.104)
INTANG	0.369*** (0.112)	0.075*** (0.024)	0.426*** (0.109)	0.083*** (0.027)	0.411*** (0.109)
Constant	4.149*** (0.314)	-0.011 (0.050)	4.140*** (0.319)	0.067 (0.050)	4.182*** (0.317)
Industry F.E.	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	21,810	21,810	21,810	21,810	21,810
Adjusted R-squared	0.722	0.197	0.727	0.151	0.726

Note: This table shows the relation between fintech development, tax avoidance, and tax avoidance. The dependent variables are *Tobin's Q* in Columns (1), (3), and (5), *GETR* in Column (2) and *CETR* in Column (4), respectively. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

therefore improving the firm's information processing capabilities and internal controls. If this view is valid, the impacts of fintech development on tax avoidance should be more pronounced among firms with lower levels of digital transformation. To exploit this conjecture, we categorize the whole sample into the high and low digital transformation subgroups. The level of digital transformation is measured by the technology-driven index (*TD*) and the digital application index (*DA*). We obtain these two indexes from the CSMAR database.<sup>4</sup> *TD* index reflects the acceptance of firms to digital technologies. *DA* indicates the degree of enterprise innovation driven by digital technology. The high digital transformation group consists of firms with *TD* or *DA* larger than the sample median, while the low digital transformation group consists of those with *TD* or *DA* smaller than the sample median.

As shown in Table 4, the coefficients on the fintech variable are larger in magnitude and more significant in the low digital transformation group than the high digital transformation group, which supports that fintech improves tax avoidance via the corporate digital transformation channel.

<sup>4</sup> From the user guide of the CSMAR database, we obtain the *TD* and *DA* index construction methods. For the technology-driven (*TD*) index construction, they first calculate the frequency of AI technology's characteristic words, blockchain technology's characteristic words, cloud computing technology features, and big data's characteristic words in the firm's annual report.  $TD = 0.5504 \times \text{artificial intelligence technology frequency} + 0.1298 \times \text{blockchain technology frequency} + 0.1832 \times \text{cloud computing technology frequency} + 0.1366 \times \text{big data technology frequency}$ . For the digital application (*DA*) index construction, they first calculate the frequency of technological innovation, process innovation, and business innovation in the firm's annual report.  $DA = 0.6342 \times \text{technological innovation} + 0.2378 \times \text{process innovation} + 0.128 \times \text{business innovation}$ .

**Table 4**  
The digitalization channel.

Panel A: The digital technology driven.				
Variables	Low technology-driven		High technology-driven	
	(1)	(2)	(3)	(4)
Fintech	-0.042*** (0.015)	-0.048*** (0.016)	-0.008 (0.006)	-0.022*** (0.007)
Constant	0.079 (0.090)	0.158* (0.095)	-0.012 (0.040)	0.055 (0.045)
Controls	Yes	Yes	Yes	Yes
Industry F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Observations	12,164	12,164	9646	9646
Adjusted R-squared	0.184	0.156	0.209	0.145
Panel B: The digital adoption.				
Variables	Low digital application		High digital application	
	(1)	(2)	(3)	(4)
Fintech	-0.037** (0.015)	-0.041*** (0.016)	-0.011* (0.006)	-0.025*** (0.007)
Constant	0.118 (0.091)	0.170* (0.097)	-0.077* (0.040)	0.005 (0.045)
Controls	Yes	Yes	Yes	Yes
Industry F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Observations	11,758	11,758	10,052	10,052
Adjusted R-squared	0.184	0.155	0.208	0.146

Note: This table shows the effects of fintech development on tax avoidance for firms with different levels of digital transformation. Panels A and B present the results using *DT* and *DTA* as sample cut off lines, respectively. The dependent variables are *GETR* in Columns (1) and (3), and *CETR* in Columns (2) and (4), respectively. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

#### 4.3.2. Cash flow uncertainty

The increased cash flow uncertainty of firms can lead to higher tax avoidance costs and difficulties for firms. As Gallemore and Labro (2015) argued, uncertainty is detrimental to business tax planning because it blurs tax opportunities and complicates the prediction of potential tax outcomes. Fintech has important implications in increasing firms' access to external finance, reducing the instability of investment income, and improving their market sensitivity, which contributes to reducing cash flow volatility. Given the negative role of cash flow uncertainty on tax avoidance, we expect fintech development to affect tax avoidance by diminishing cash flow volatility. Therefore, the impact of fintech on tax avoidance should be more pronounced when firms' cash uncertainty is higher. To test whether cash flow uncertainty is a plausible channel, we deploy *CashflowV* as the uncertainty indicator, defined as the standard deviation of cash flow over three years. We adopt the median value for *CashflowV* as the cut-off to classify the full sample into a high-uncertainty group (above the median) and a low-uncertainty group (below the median).

Results in Table 5 present that fintech development significantly reduces two measures of the effective tax rate in the high-uncertainty group. The corresponding effects of fintech are insignificant in Column (3) and weak in Column (4) for the low-uncertainty group. These findings are consistent with our expectation that the impact of fintech on tax avoidance is achieved by reducing cash flow uncertainty.

#### 4.3.3. Regional economic development

We argue that fintech affects tax avoidance because it can drive regional economic development, which eases the fiscal pressure on local officials and increases the likelihood of them implementing preferential tax policies. To investigate the plausibility of this channel, we partition the full sample into two subgroups based on the growth rate of GDP per

**Table 5**  
The cash flow uncertainty channel.

Variables	High cashflow uncertainty		Low cashflow uncertainty	
	(1)	(2)	(3)	(4)
	GETR	CETR	GETR	CETR
Fintech	-0.020** (0.008)	-0.034*** (0.010)	-0.013 (0.008)	-0.024*** (0.009)
SIZE	0.004*** (0.001)	0.000 (0.001)	0.005*** (0.001)	0.004*** (0.001)
MB	0.002** (0.001)	-0.000 (0.001)	0.001 (0.001)	0.000 (0.001)
CAP	-0.174*** (0.025)	-0.164*** (0.029)	-0.126*** (0.022)	-0.098*** (0.026)
GROW	-0.008*** (0.003)	-0.041*** (0.004)	-0.012*** (0.003)	-0.054*** (0.005)
AGE	0.021*** (0.006)	0.034*** (0.007)	0.019*** (0.005)	0.015** (0.006)
LEV	0.076*** (0.020)	0.119*** (0.024)	0.095*** (0.023)	0.075*** (0.025)
INTANG	0.102*** (0.035)	0.097** (0.042)	0.060** (0.027)	0.082*** (0.029)
Constant	0.034 (0.067)	0.129* (0.068)	-0.060 (0.052)	0.002 (0.055)
Industry F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Observations	11,662	11,662	10,148	10,148
Adjusted R-squared	0.191	0.150	0.204	0.153

Note: This table shows the effects of fintech development on tax avoidance for firms with different levels of cash flow uncertainty. The dependent variables are *GETR* in Columns (1) and (3) and *CETR* in Columns (2) and (4). The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in [Appendix A](#).

capita (*GDP<sub>p</sub>*) in the province where the sample firms are located: the high local economic development group (above the median) and the low local economic development group (below the median). [Table 6](#) shows the estimated coefficients of *Fintech* in two sub-samples. We find that the coefficient on *Fintech* is smaller in magnitude and less significant among the high local economic development group than the low regional economic development group, which suggests that the facilitating impacts of fintech on tax avoidance are more prominent for firms located in the province with slow economic development, providing support for regional economic development channel.

#### 4.4. Further analysis

##### 4.4.1. Future cash flow and after-tax earnings

Tax avoidance can reduce the tax burden and generate financial benefits for firms. Such benefits involve the increase in cash flow and after-tax income, which is conducive to enhancing the firm's value ([Edwards et al., 2016](#)). We investigate whether tax avoidance driven by fintech development can raise future cash flows and generate more after-tax income by using a regression model specification as follows:

$$Cashflow_{i,t+1} \text{ or } ROA_{i,t} = \alpha_4 + \beta_4 \times Fintech_{p,t} + \gamma_4 \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{it} \quad (5)$$

$$GETR_{i,t} \text{ or } CETR_{i,t} = \alpha + \beta \times Fintech_{p,t} + \gamma \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{it} \quad (6)$$

$$Cashflow_{i,t+1} \text{ or } ROA_{i,t} = \alpha_5 + \beta_5 \times Fintech_{p,t} + \delta_5 \times GETR_{i,t} \text{ or } CETR_{i,t} + \gamma_5 \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{it} \quad (7)$$

where *Cashflow* is measured as income before extraordinary items minus common dividends scaled by total assets. *Cashflow<sub>i,t+1</sub>* refer to *Cashflow* of firm *i* in year *t* + 1. *ROA* is calculated as the after-tax

**Table 6**  
The regional economic development channel.

Variables	Low economic development region		High economic development region	
	(1)	(2)	(3)	(4)
	GETR	CETR	GETR	CETR
Fintech	-0.043*** (0.013)	-0.051*** (0.015)	-0.001 (0.006)	-0.015* (0.008)
SIZE	0.004*** (0.001)	0.002 (0.001)	0.004*** (0.001)	0.002* (0.001)
MB	0.002** (0.001)	0.000 (0.001)	0.002** (0.001)	0.000 (0.001)
CAP	-0.157*** (0.022)	-0.144*** (0.027)	-0.146*** (0.022)	-0.130*** (0.026)
GROW	-0.010*** (0.004)	-0.048*** (0.005)	-0.009*** (0.003)	-0.042*** (0.004)
AGE	0.022*** (0.005)	0.024*** (0.006)	0.019*** (0.005)	0.025*** (0.006)
LEV	0.073*** (0.020)	0.090*** (0.024)	0.090*** (0.021)	0.095*** (0.023)
INTANG	0.047 (0.029)	0.068** (0.035)	0.094*** (0.028)	0.091*** (0.030)
Constant	0.084 (0.073)	0.168** (0.084)	-0.067 (0.053)	-0.003 (0.054)
Industry F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Observations	11,124	11,124	10,686	10,686
Adjusted R-squared	0.194	0.148	0.206	0.158

Note: This table shows the effects of fintech development on tax avoidance for firms in regions with different levels of economic growth. The dependent variables are *GETR* in Columns (1) and (3) and *CETR* in Columns (2) and (4). The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in [Appendix A](#).

income scaled by total assets. The definitions of the remaining variables are consistent with [Eq. \(1\)](#).

[Table 7](#) shows the regression results. We use *Cashflow<sub>i,t+1</sub>* and *ROA* as the dependent variables in Panel A and B, respectively. In Column (1) of Panel A, *Fintech* is significantly and positively correlated to future cash flow. Moreover, the significant positive coefficients on *Fintech* are smaller in Columns (3) and (5) than in Column (1), which indicates that the promotion role of fintech for tax avoidance increases future cash flows. For Panel B, the estimated coefficients in Column (1) show that fintech development significantly raises *ROA*. Meanwhile, *Fintech* has smaller significant positive coefficients in Column (3) and (5) than in Column (1), meaning that fintech increases the ratio of after-tax income to total assets by raising tax avoidance. Taken together, tax avoidance driven by fintech causes an increase in cash flow and after-tax income, which could be the potential channel for tax avoidance driven by fintech to improve firm value.

##### 4.4.2. Fintech development and tax risks

As mentioned above, tax avoidance can generate benefits, but also create risk. Some tax avoidance activities are highly risky and adverse to the long-term development of enterprises ([Hanlon & Slemrod, 2009](#)). We posit that advances in fintech provide more opportunities for firms to increase the effectiveness and compliance of their planning and reduce potential tax risks. To provide evidence of this view, we employ four proxies for tax risk and confirm the negative relationship between fintech development and tax risk. First, following [Gallemore and Labro \(2015\)](#), we use the standard deviation of tax avoidance variables (*GETR* or *CETR*) over the current five-year period as the tax risk measures and generate the variables *TaxRisk<sub>GV</sub>* and *TaxRisk<sub>CV</sub>*. Furthermore, we follow [Guo, Li et al. \(2023\)](#) and use two other measures of future tax volatility, namely *TaxRisk<sub>GR</sub>* and *TaxRisk<sub>CR</sub>*. *TaxRisk<sub>GR</sub>* is calculated as the standard deviation of *GETR* over year *t* to year *t* + 2, divided by the mean of *GETR* over year *t* to year *t* + 2. *TaxRisk<sub>CR</sub>* is calculated as the standard deviation of *CETR* over year *t* to year *t* + 2, divided by the mean of *CETR* over year *t* to year *t* + 2. The results are

**Table 7**  
Future cash flow and after-tax earnings.

Panel A: Fintech, tax avoidance and further cash flow.					
	(1)	(2)	(3)	(4)	(5)
Variables	Cashflow <sub>t+1</sub>	GETR	Cashflow <sub>t+1</sub>	CETR	Cashflow <sub>t+1</sub>
Fintech	0.017*** (0.004)	-0.011* (0.006)	0.0166*** (0.004)	-0.023*** (0.007)	0.016*** (0.004)
GETR			-0.017** (0.007)		
CETR					-0.020*** (0.005)
Constant	-0.120*** (0.026)	-0.039 (0.047)	-0.121*** (0.026)	0.011 (0.051)	-0.120*** (0.026)
Industry F.E.	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	16,626	16,626	16,626	16,626	16,626
Adjusted R-squared	0.126	0.205	0.126	0.154	0.127

Panel B: Fintech, tax avoidance and after-tax incomes.					
	(1)	(2)	(3)	(4)	(5)
Variables	ROA	GETR	ROA	CETR	ROA
Fintech	0.014*** (0.003)	-0.016** (0.006)	0.013*** (0.003)	-0.029*** (0.007)	0.012*** (0.003)
GETR			-0.100*** (0.003)		
CETR					-0.084*** (0.002)
Constant	-0.009 (0.019)	-0.011 (0.050)	-0.010 (0.017)	0.067 (0.050)	-0.004 (0.017)
Industry F.E.	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	21,810	21,810	21,810	21,810	21,810
Adjusted R-squared	0.191	0.197	0.240	0.151	0.248

Note: Panel A of this table shows the association between fintech development, tax avoidance, and future cash flow. The dependent variables are *Cashflow<sub>t+1</sub>* in Columns (1), (3), and (5), *GETR* in Column (2), and *CETR* in Column (4), respectively. Panel B of this table shows the association between fintech development, tax avoidance, and after-tax income. The dependent variables are *ROA* in Columns (1), (3), and (5), *GETR* in Column (2), and *CETR* in Column (4), respectively. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

**Table 8**  
Fintech development and tax risk.

	(1)	(2)	(3)	(4)
Variables	TaxRisk <sub>GV</sub>	TaxRisk <sub>CV</sub>	TaxRisk <sub>GR</sub>	TaxRisk <sub>CR</sub>
Fintech	-0.023*** (0.007)	-0.038*** (0.009)	-0.028* (0.017)	-0.055*** (0.019)
SIZE	-0.002** (0.001)	-0.002** (0.001)	-0.015*** (0.002)	-0.018*** (0.003)
MB	0.001*** (0.000)	0.001* (0.001)	0.006*** (0.002)	0.005*** (0.002)
CAP	-0.151*** (0.013)	-0.197*** (0.017)	-0.282*** (0.053)	-0.176*** (0.063)
GROW	-0.003** (0.001)	-0.006*** (0.002)	-0.030*** (0.005)	-0.007 (0.006)
AGE	0.021*** (0.003)	0.030*** (0.004)	0.031** (0.013)	0.051*** (0.015)
LEV	0.070*** (0.010)	0.077*** (0.013)	0.285*** (0.037)	0.228*** (0.042)
INTANG	0.028* (0.015)	0.038* (0.021)	0.031 (0.051)	-0.000 (0.059)
Constant	0.104*** (0.039)	0.158*** (0.052)	0.879*** (0.104)	1.114*** (0.117)
Industry F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Observations	18,337	18,337	17,908	17,908
Adjusted R-squared	0.078	0.088	0.060	0.052

Note: This table shows the association between fintech development and tax risk. The dependent variables for Columns (1) to (4) are *TaxRisk<sub>GV</sub>*, *TaxRisk<sub>CV</sub>*, *TaxRisk<sub>GR</sub>*, and *TaxRisk<sub>CR</sub>*, respectively. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

**Table 9**  
Fintech development and tax preferences.

	(1)
Variables	TaxRebate
Fintech	0.109*** (0.022)
SIZE	0.008** (0.003)
MB	0.002 (0.002)
CAP	0.223*** (0.065)
GROW	-0.024*** (0.005)
AGE	0.034* (0.019)
LEV	0.192*** (0.038)
INTANG	-0.044 (0.049)
Constant	-0.532*** (0.140)
Industry F.E.	Yes
Year F.E.	Yes
Observations	21,810
Adjusted R-squared	0.245

Note: This table shows the association between fintech development and tax preferences. The dependent variable is *TaxRebate*, calculated as the tax rebates received by the firm divided by the sum of tax rebates and taxes paid. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

presented in Table 8. In Columns (1) to (4), the coefficients on *Fintech* are statistically significant and negative, suggesting that fintech growth promotes tax avoidance without increasing tax risk.

#### 4.4.3. Fintech development and tax preferences

If a company is unable to effectively and legally take advantage of tax preferences, then it will face a heavier tax burden (Li et al., 2024). The advancement of fintech can promote corporate digital transformation to increase innovation (Li et al., 2023). The government may support enterprises to increase investments in innovative activities by providing more tax preferential policies, such as providing R&D tax credits or deductions. Furthermore, fintech increases the potential for local governments to implement preferential tax policies by stimulating local economic development and increasing the fiscal resources of local governments. Referring to Li et al. (2024), we use the tax refunds received by firms (*TaxRebate*) as a measure of the degree of the tax preferences enjoyed by firms. *TaxRebate* is calculated as the tax rebates received by the firm divided by the sum of tax rebates and taxes paid. A higher *TaxRebate* denotes a higher degree of taking advantage of tax preferences by the firm.

We investigate the association between fintech development and the degree of the tax preferences enjoyed by firms and use *TaxRebate* as the dependent variable. The results are presented in Table 9. The significant and positive coefficient on the fintech variable indicates that fintech growth is conducive to increasing the tax-reducing opportunities seized by firms.

#### 4.5. Cross-sectional analysis

In this section, we further investigate cross-sectional heterogeneity in the connection between fintech development and tax avoidance.

##### 4.5.1. Internal information quality

In firms with high internal information quality, managers can keep abreast of the actual financial situation and accurately access specific information, which allows them to effectively plan and implement tax

**Table 10**  
The impact of internal information quality.

Panel A: Management forecast inaccuracy.				
Variables	High MFI		Low MFI	
	(1)	(2)	(3)	(4)
	GETR	CETR	GETR	CETR
Fintech	-0.017** (0.008)	-0.029*** (0.009)	-0.014 (0.009)	-0.028*** (0.010)
Constant	-0.028 (0.059)	0.085 (0.067)	-0.011 (0.061)	0.025 (0.059)
Controls	Yes	Yes	Yes	Yes
Industry F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Observations	11,759	11,759	10,051	10,051
Adjusted R-squared	0.194	0.156	0.205	0.148

Panel B: Earnings announcement.				
Variables	High EA		Low EA	
	(1)	(2)	(3)	(4)
	GETR	CETR	GETR	CETR
Fintech	-0.019* (0.010)	-0.030** (0.012)	-0.013* (0.007)	-0.027*** (0.008)
Constant	-0.024 (0.057)	0.048 (0.068)	-0.014 (0.061)	0.066 (0.057)
Controls	Yes	Yes	Yes	Yes
Industry F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Observations	11,135	11,135	11,144	11,144
Adjusted R-squared	0.196	0.152	0.207	0.155

Note: This table shows the association between fintech development and tax avoidance among firms with different levels of internal information quality. The dependent variables are *GETR* in Columns (1) and (3) and *CETR* in Columns (2) and (4). The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

avoidance strategies. In this case, the benefits of improved information processing capabilities through fintech adoption for tax avoidance would not be as obvious.

According to Gallemore and Labro (2015), we construct two variables for internal information quality. The first proxy is management forecast inaccuracy (*MFI*), computed as the absolute value of management's last available estimate of earnings per share before fiscal year-end minus the firm's actual earnings per share, divided by the stock price at the end of the year. And, the second proxy, earnings announcement (*EA*), is defined as the number of days between the end of the fiscal year and the earnings announcement date, divided by 365. A lower value of *MFI* or *EA* indicates a higher internal information quality. We use the sample median value of *MFI* and *EA* as cut-offs and classify firms with *MFI* and *EA* values below the median into the high internal information quality group and the others into the low internal information quality group. We predict that when firms' internal information quality is relatively weak, the promotion of tax avoidance by fintech development is more pronounced.

Panels A and B in Table 10 report the estimated results using *MFI* and *EAS* to capture the quality of firms' internal information, respectively. *Fintech* has greater magnitude coefficients in the low internal information quality group (with higher *MFI* or *EA*) than another group, which supports our prediction.

#### 4.5.2. Internal control

Strong internal controls provide an enabling environment for efficient company-specific business processes and systems to help companies better analyze and capitalize on differences in tax rates, tax breaks, tax exemptions, tax deductions, and tax credits (Hasan et al., 2021). The planning and implementation of tax strategies rely on good internal communication mechanisms, and weak internal controls reduce the promptness and effectiveness of information exchange and

**Table 11**  
The impact of internal control.

Variables	Low internal control		High internal control	
	(1)	(2)	(3)	(4)
	GETR	CETR	GETR	CETR
Fintech	-0.023* (0.013)	-0.039*** (0.015)	-0.010* (0.006)	-0.019*** (0.007)
SIZE	0.009*** (0.002)	0.007*** (0.002)	0.004*** (0.001)	0.004*** (0.001)
MB	0.004*** (0.001)	0.003*** (0.001)	0.000 (0.001)	-0.002** (0.001)
CAP	-0.186*** (0.027)	-0.159*** (0.033)	-0.107*** (0.018)	-0.089*** (0.021)
GROW	-0.018*** (0.003)	-0.062*** (0.006)	0.002 (0.003)	-0.025*** (0.003)
AGE	0.020*** (0.007)	0.023*** (0.008)	0.014*** (0.005)	0.015*** (0.005)
LEV	0.059** (0.024)	0.072** (0.028)	0.072*** (0.017)	0.067*** (0.019)
INTANG	0.078** (0.032)	0.080** (0.036)	0.058*** (0.021)	0.063** (0.026)
Constant	-0.113 (0.070)	0.017 (0.083)	-0.001 (0.052)	0.016 (0.046)
Industry F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Observations	9957	9957	11,856	11,856
Adjusted R-squared	0.192	0.156	0.231	0.161

Note: This table shows the association between fintech development and tax avoidance in firm with different degrees of internal control. The dependent variables are *GETR* in Columns (1) and (3) and *CETR* in Columns (2) and (4). The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

communication between company departments. Fintech development reduces the cost of information acquisition, improves the information processing and data integration capabilities of enterprises, optimizes automated processes, enhances risk identification and management, and in turn enhances the quality and efficiency of internal controls. Thus, we believe that the effects of fintech on tax avoidance are greater for firms with weak internal control.

We incorporate the internal control indicator, *IC*, which equals the natural logarithm of the DIB internal control indexes (Lu & Cao, 2018; Wen et al., 2020). The DIB index is disclosed by the China Shenzhen DIB Company to reflect the internal control and risk management of firms. This index is available in the DIB Internal Control and Risk Management Database. The greater *IC* means the better internal control quality. We use the sample median value of *IC* as a cut-off and divide the sample into two sub-samples, one with high internal control and the other with low internal control. After re-estimating the model of Eq. (1), we find that in Table 11, the coefficient on *Fintech* is larger in magnitude among the low internal control group than in the other group, which is consistent with our expectation.

#### 4.5.3. Dispersion of operations

Corporate tax planning is the outcome of the coordination and cooperation of multiple departments within a company. When companies spread their business across multiple regions, the complexity of internal structures can lead to friction in organizational operations and insufficient information sharing between departments, thus reinforcing the need for cross-departmental communication and collaboration (Gallemore & Labro, 2015). Gallemore and Labro (2015) argue that firms with high levels of dispersed operations can gain more benefits from improved coordination. Fintech growth contributes to the reduction of information asymmetry by improving the ability of firms to integrate and analyze data and increasing the immediacy of information sharing and transparency. As such, it is reasonable to believe that fintech is instrumental in mitigating the internal friction associated with operating across geographies and facilitating close and

**Table 12**  
The impact of dispersion of operations.

Variables	High geographic dispersion		Low geographic dispersion	
	(1)	(2)	(3)	(4)
	GETR	CETR	GETR	CETR
Fintech	-0.018** (0.008)	-0.029*** (0.009)	-0.013 (0.009)	-0.027** (0.011)
SIZE	0.004*** (0.002)	0.005*** (0.002)	0.004*** (0.001)	0.000 (0.001)
MB	0.003*** (0.001)	0.002* (0.001)	0.000 (0.001)	-0.001 (0.001)
CAP	-0.179*** (0.025)	-0.156*** (0.029)	-0.125*** (0.023)	-0.113*** (0.027)
GROW	-0.011*** (0.003)	-0.047*** (0.005)	-0.008** (0.003)	-0.044*** (0.004)
AGE	0.020*** (0.006)	0.024*** (0.007)	0.019*** (0.005)	0.023*** (0.006)
LEV	0.121*** (0.025)	0.117*** (0.028)	0.053** (0.022)	0.078*** (0.025)
INTANG	0.122*** (0.039)	0.155*** (0.041)	0.046* (0.026)	0.045 (0.031)
Constant	0.013 (0.080)	0.021 (0.075)	-0.036 (0.047)	0.091 (0.060)
Industry F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Observations	10,183	10,183	11,627	11,627
Adjusted R-squared	0.192	0.145	0.211	0.163

Note: This table shows the effects of the degree of geographic separation of a firm's businesses on the association between fintech development and tax avoidance. We use *Dispersion* as a measure of the geographical dispersion of operations. The results for the high geographical dispersion group are presented in Columns (1) and (2), while the results for the low geographical dispersion group are presented in Columns (3) and (4). The dependent variables are *GETR* in Columns (1) and (3) and *CETR* in Columns (2) and (4). The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

efficient cross-functional collaboration. Given this context, we expect fintech to have a stronger positive effect on tax avoidance in firms with a high degree of geographical dispersion of operations.

Following Bushman et al. (2004), we first calculate the Hirfindahl-Hirschman index (*HHI*) based on regional revenue segmentation for enterprises, to assess the corporate business concentration. Then, we construct a variable, *Dispersion*, which equals to one minus *HHI*. The greater value of *Dispersion* indicates the higher degree of the firm operations dispersion. We classify the full sample into two sub-groups according to the industry median value of *Dispersion*. The formula for calculating the *HHI* is as follows:

$$HHI_{i,t} = \sum_{n=1}^N (Income_{n,t} / Income_{i,t})^2 \quad (8)$$

where *i* and *t* denote firm and industry, respectively. *n* means the geographic region covered by the enterprise's business. *N* is the total number of geographical regions covered by the enterprise's operations. *HHI<sub>i,t</sub>* is the Hirfindahl-Hirschman index for firm *i* in year *t*. *Income<sub>n,t</sub>* refers to the firm's income in each geographic segment in year *t*. *Income<sub>i,t</sub>* reflects total company income for firm *i* in year *t*.

The results are reported in Table 12. In the high geographic dispersion group, the coefficients on *Fintech* are -0.018 and -0.029, with significance, respectively. In contrast, for the low geographic dispersion group, *Fintech* is negative but insignificant in Column (3) and lower in magnitude in Column (4) than in Column (2), which provides evidence for our prediction that fintech has greater effects on tax avoidance in firms with highly dispersed operations.

### 5. Robustness tests and endogenous concerns

To assess the robustness of our evidence and mitigate potential endogenous concerns, we conduct a battery of additional tests on the

**Table 13**  
Addressing endogeneity: instrumental variable approach.

Variables	First stage	Second stage	
	(1)	(2)	(3)
	Fintech	GETR	CETR
Internet	0.002*** (0.000)		
Fintech		-0.043*** (0.016)	-0.087*** (0.020)
SIZE	0.006*** (0.002)	0.004*** (0.001)	0.003** (0.001)
MB	-0.003*** (0.001)	0.002** (0.001)	0.000 (0.001)
CAP	0.028 (0.035)	-0.151*** (0.018)	-0.133*** (0.021)
GROW	-0.002 (0.003)	-0.009*** (0.002)	-0.045*** (0.003)
AGE	-0.018** (0.009)	0.020*** (0.005)	0.023*** (0.005)
LEV	-0.140*** (0.028)	0.078*** (0.017)	0.085*** (0.019)
INTANG	-0.028 (0.034)	0.074*** (0.024)	0.081*** (0.027)
Constant	3.688*** (0.052)	0.088 (0.074)	0.286*** (0.086)
F test of excluded instruments	1762.000		
Kleibergen-Paap rk LM test		989.724	989.724
Industry F.E.	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes
Observations	21,810	21,810	21,810
Adjusted R-squared	0.938	0.196	0.147

Note: This table shows results of the 2SLS regressions. The dependent variables are *Fintech*, *GETR* and *CETR* in Columns (1) to (3), respectively. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

relationship between fintech development, tax avoidance, and firm value.

#### 5.1. Instrumental variable approach

To mitigate the potential endogeneity concerns, we employ an instrumental variable approach and undertake the two-stage least squares (2SLS) regressions. We follow Fang et al. (2023) and adopt internet penetration (*Internet*) in each province as an instrumental variable for fintech development. The penetration of the Internet provides the underlying platform and a broad user base for the innovation and development of fintech. Hence, the internet penetration rate is closely associated with fintech development but is not directly linked to corporate tax avoidance. Thus, *Internet* is a reasonable instrumental variable for *Fintech*.

Table 13 reports the 2SLS estimation results. Column (1) shows the first-stage regression results, where the dependent variable is *Fintech*. The results suggest that the instrumental variable, *Internet*, is significantly and positively associated with the fintech variable. The value of the F-test is greater than the critical values for the Stock and Yogo (2005) weak instrument test. The second-stage regression is presented in Columns (2) and (3). *Fintech* still maintains a significantly negative association with *GETR* and *CETR*, confirming that our findings are not driven by the potential endogeneity issue.

#### 5.2. Propensity score matching (PSM) approach

To eliminate sample selection bias, we adopt the propensity score matching (PSM) method to match our sample. First, following Ding et al. (2024), we classify the sample firms in a province where the fintech index is in the top 50% in a given year into a high fintech group (treatment group) and the others into a low fintech group (control group). Next, we construct the dummy variable, *HighFintech*, equal

**Table 14**  
Propensity score matching approach.

Panel A: Balance test.			
	High Fintech group	Low Fintech group	Difference and
	Mean	Mean	Significance
SIZE	22.251	22.233	0.013
MB	3.285	3.303	-0.012
CAP	0.054	0.055	-0.023
GROW	0.188	0.188	-0.000
AGE	3.186	3.183	0.014
LEV	0.058	0.059	-0.004
INTANG	0.046	0.047	-0.008
Panel B: PSM			
	(1)	(2)	
Variables	GETR	CETR	
Fintech	-0.023** (0.010)	-0.043*** (0.012)	
SIZE	0.003** (0.001)	0.002 (0.002)	
MB	0.001 (0.001)	0.000 (0.001)	
CAP	-0.170*** (0.029)	-0.161*** (0.034)	
GROW	-0.006 (0.005)	-0.043*** (0.006)	
AGE	0.020*** (0.006)	0.022*** (0.008)	
LEV	0.099*** (0.026)	0.101*** (0.030)	
INTANG	0.095*** (0.035)	0.107*** (0.038)	
Constant	0.038 (0.075)	0.124* (0.069)	
Industry F.E.	Yes	Yes	
Year F.E.	Yes	Yes	
Observations	6247	6247	
Adjusted R-squared	0.191	0.149	

Note: This table shows the results of the propensity score matching (PSM) test. Panel A presents the results of the balance test. Panel B reports the results based on the PSM sample. The dependent variables are *GETR* and *CETR*. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

to one if the sample firm is in the high fintech group and zero otherwise. Based on the logit model regression, we estimate the propensity score using *HighFintech* as the treatment variable and the firm-level control variables as covariates. Then, we match each treated firm with one control firm according to the propensity score using the nearest neighbor method. Panel A of Table 14 shows the balance test results. The results confirm that the propensity score matching procedure has effectively minimized differences between treated and control groups across key financial indicators. Panel B presents the regression results using the PSM sample. We observe that the coefficient on fintech remains significantly negative after conducting the regression with the matched sample, which indicates that our results are robust to selection bias.

### 5.3. Difference-in-differences (DID) method

Next, we perform a difference-in-difference (DID) test to establish the causal relation between fintech development and tax avoidance. As in Cheng and Qu (2020), we consider the “Guiding Opinions on Promoting the Healthy Development of Internet Finance” jointly issued by the People’s Bank of China, the Ministry of Finance, and other government departments in July 2015 as a policy shock related to the fintech development. This guidance proposes policy measures and a regulatory framework for fintech development, which is vital for promoting the long-term and healthy growth of fintech. We conduct DID analyses based on this guidance and use the median of the fintech

**Table 15**  
Robustness checks: DID method.

	(1)	(2)
Variables	GETR	CETR
Treat × Post	-0.007** (0.003)	-0.009** (0.004)
SIZE	0.004*** (0.001)	0.002* (0.001)
MB	0.002*** (0.001)	0.000 (0.001)
CAP	-0.150*** (0.018)	-0.134*** (0.020)
GROW	-0.009*** (0.002)	-0.045*** (0.003)
AGE	0.020*** (0.005)	0.025*** (0.005)
LEV	0.083*** (0.017)	0.097*** (0.019)
INTANG	0.076*** (0.024)	0.084*** (0.027)
Constant	-0.074 (0.045)	-0.045 (0.043)
Industry F.E.	Yes	Yes
Year F.E.	Yes	Yes
Observations	21,810	21,810
Adjusted R-squared	0.197	0.151

Note: This table shows the results using the DID method. The dependent variables are *GETR* and *CETR* in Columns (1) and (2), respectively. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

development index in 2015 of the province where the sample firms are located as the cut-off line, and divide the firms whose fintech development index in 2015 is higher than the median into the treatment group, and those lower than the median into the control group. For the DID analysis, we estimate the following model specifications:

$$GETR_{i,t} \text{ or } CETR_{i,t} = \alpha_0 + \beta_0 \times Treat_{i,t} \times Post_{i,t} + \gamma_0 \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{it} \quad (9)$$

where  $Treat_{i,t}$  is a dummy variable that equals to one if the sample firm belongs to the treatment group and zero otherwise.  $Post_{i,t}$  is a dummy variable equal to one if the sample observation is after the policy promulgation and zero otherwise. The definitions of the remaining variables are consistent with Eq. (1).

We display the estimated results using the DID method in Table 15. Similar to the main regression,  $Treat \times Post$  has significant negative coefficients in Columns (1) and (2), which suggest that the issuance of this fintech-related guidance improves tax avoidance. The above results confirm the robustness of our findings.

### 5.4. Alternative measures of corporate tax avoidance

At first, we deploy two alternative proxies of tax avoidance to examine the robustness. The first is *AETR*, defined as the applicable statutory income tax rate minus the effective tax rate. We also apply the book-tax difference (*BT D*) as the second alternative measure of tax avoidance, which is calculated as pretax income minus taxable income, scaled by total assets. A greater value of *AETR* or *BT D* means a higher level of tax avoidance. Appendix D reports the empirical results. The estimated coefficients on *Fintech* are statistically significant and positive in both models, indicating that the fintech growth is conducive to improving tax avoidance. This result supports the robustness of our main results.

### 5.5. Alternative measures of fintech development

As robustness tests, we also apply three alternative definitions of the fintech variables to re-estimate the main regression in Eq. (1).

Columns (1) to (6) of Appendix E adopt *CityFintech*, *FintechFirm*, and *FintechPatent* as independent variables, respectively. *CityFintech* refers to the city-level PKU-DFIIC index, computed as the natural logarithm of the city-level aggregated PKU-DFIIC index. *FintechFirm* is calculated as the natural logarithm of the number of fintech firms established in province  $p$  for year  $t$  (Phan et al., 2020). *FintechPatent* is measured by the natural logarithm of the cumulative number of fintech patents, where fintech patents are defined as the patents with International Patent Classification (IPC) codes belonging to G06Q40/02 (banking), G06Q40/06 (investment), or G06Q40/08 (insurance) (Wen et al., 2023). As shown in Appendix E, the coefficient on *Fintech* is statistically significant and negative in all models, which is consistent with the main findings.

### 5.6. Alternative measure of firm value

Subsequently, we consider an alternative measure of firm value. An alternative firm value indicator is *MV*, defined as the natural logarithm of the market value of the firm. Appendix F shows that *Fintech* is significantly related to *MV* with a coefficient of 0.104 in Column (1) and the coefficient on *Fintech* is significantly positive with a value less than 0.104 in both Columns (3) and (5), which is consistent with the results reported in Table 3.

## 6. Conclusion

As fintech continues to grow in maturity, its role in promoting economic development and shaping new features of the market structure is becoming increasingly prominent. The debate on the relationship between fintech and corporate development strategic planning and business decision-making is gradually gaining attention from policymakers and market participants. In this context, the in-depth discussion of the impact of fintech on the real economy is crucial.

In this paper, we explore the role of fintech development on corporate tax avoidance and the value-implication of such tax avoidance behavior. Using the sample data from Chinese A-share listed firms, the regression results indicate that fintech is negatively associated with the corporate effective tax rate, suggesting that fintech development increases the degree of tax avoidance. Our results also suggest that tax avoidance benefits the firm's valuation growth and fintech increases firm market valuation by improving tax avoidance. Further analysis shows that the fintech-driven tax avoidance activities increase a firm's future cash flows and after-tax income, which could be a potential channel through which it drives firm valuation. We also find a negative correlation between fintech and tax risk, and a positive correlation between fintech and the effectiveness of tax incentives utilized by firms. This finding suggests that promoting the role of fintech in corporate tax avoidance is achieved by helping companies develop compliant tax avoidance policies, optimize tax structures, and identify unrecognized tax-reduction opportunities, rather than encouraging companies to pursue overly risky tax policies. Moreover, the effects of fintech on tax avoidance are more pronounced among firms with low internal information quality, weak internal control, and more geographically dispersed operations. We also provide supporting evidence that fintech development facilitates digital transformation, lowers cash flow uncertainty, and promotes regional economic development, thus promoting tax avoidance. Our findings are robust to alternative variables. Finally, we conduct several tests to address endogenous concerns (e.g., the use of an instrumental variable approach, DID method, and PSM approach). We confirm that endogeneity issues do not appear to be driving our results.

Overall, our study deepens the understanding of corporate tax decision-making and highlights the significant impact and potential value of fintech on real economic development. The findings have significant practical implications and provide valuable insights for policymakers, regulators, and corporate managers. Policymakers should

recognize the positive contributions of fintech in enhancing firm value and stimulating economic vitality, meanwhile fully utilizing the novel technology in optimizing the tax system to improve the efficiency and transparency of tax administration and promote the economic allocation of resources. In addition, policymakers should establish and implement appropriate policy and regulatory measures to promote the healthy development of fintech and avoid its potential negative impacts, while maximizing the positive effects of fintech. Market regulators should heed the changes in corporate tax avoidance behavior in the fintech era to ensure that tax planning undertaken by firms complies with tax laws and regulations. Moreover, corporate managers should actively capitalize on the advantages of fintech to optimize the tax structure and promote corporate value-added under the premise of legality and compliance, thereby ensuring the long-term sustainable development of enterprises.

A limitation of this study is that the empirical analyses are conducted only for the Chinese market. However, the Chinese market has a unique economic environment and regulatory system. There may be heterogeneity in the impact of fintech on tax avoidance among different countries or regions. Therefore, future research could use cross-national samples to explore the economic consequences of fintech. By conducting comparative analyses of the application and impact of fintech across different markets, future research can explore the impact of fintech on the global economic system more comprehensively and draw conclusions that are more general and widely applicable. Such conclusions will be of great interest to researchers and policymakers in the fintech field.

## Appendix A. Variable definitions

Variable	Definition
<b>Tax avoidance variables</b>	
GETR	Income tax expense divided by pretax income. We truncate GETR between 0 and 1.
CETR	Cash tax paid divided by pretax income. We truncate CETR between 0 and 1. Cash tax paid equals the sum of tax expense and beginning income tax payable minus ending income tax payable.
AETR	Applicable statutory income tax rate minus the effective tax rate; Effective tax rate (GTER) = income tax expense/pretax income.
BTD	Book-tax difference, defined as the ratio of pretax income minus taxable income to total assets; Taxable income = (the income tax expense – deferred tax expense)/the applicable statutory income tax rate.
<b>Fintech development variables</b>	
Fintech	Natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC).
CityFintech	Natural logarithm of the city-level Peking University Digital Financial Inclusion Index of China (PKU-DFIIC).
FintechFirm	Fintech firms, defined as the natural logarithm of the number of fintech firms established in province $p$ for year $t$ .
FintechPatent	Fintech-related patents, measured as the natural logarithm of the number of fintech patents.
<b>Firm value variables</b>	
Tobin's Q	Tobin's Q ratio, defined as the ratio of the sum of total liabilities, book value of preferred stock, and market value of equity to the total assets.



	Proportion of number of “Zhima Credit as deposit” cases (to number of full-deposit cases)
	Proportion of total amount of “Zhima Credit as deposit” (to amount of full-deposit)
Convenience	Proportion of number of QR code payments by users
	Proportion of As above, please clarify with “Average amount” or “total amount”, of QR code payment by users

Note: This table shows the specific indicators of the digital financial inclusion index of China (PKU-DFIIC).

### Appendix C. The effect of financial constraints

Our main result that fintech has a significant positive association with tax avoidance does not support the financial constraint channel (H4). In this section, we further explore this channel using the financial constraint measure, the WW index. Following the existing study (Whited & Wu, 2006), the WW index is calculated as follows:

$$WW = -0.091 * CF - 0.062 * DIV + 0.021 * TLTD - 0.044 * LNNTA - 0.035 * SG + 0.102 * ISG \quad (C.1)$$

where WW is the WW index; CF refers to the ratio of cash flow to total assets; DIV is a dummy variable that equals one if the company pays cash dividends and zero otherwise; TLTD is the ratio of long-term debt to total assets; LNNTA is computed as the natural log of total assets; SG is the sales growth of firm; ISG refers to the firm’s three-digit industry sales growth.

Based on the sample median of WW, we divide the full sample into a high financial constraint group and a low financial constraint group. If alleviating financial constraints is the mechanism by which fintech affects tax avoidance, fintech development is expected to generate greater impacts on tax avoidance among firms with high financial constraints. The results are shown in the following table. We observe that fintech variables have larger and more significant coefficients in the low financial constraints group than in the high financial constraints group. These results confirm that the financial constraint channel is unlikely to be the main reason why fintech development impacts tax avoidance.

Variables	High financial constraints		Low financial constraints	
	(1)	(2)	(3)	(4)
	GETR	CETR	GETR	CETR
Fintech	-0.011 (0.007)	-0.023** (0.009)	-0.020* (0.010)	-0.032*** (0.011)
SIZE	0.009*** (0.002)	0.008*** (0.002)	0.005*** (0.001)	0.006*** (0.002)
MB	0.002** (0.001)	0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)
CAP	-0.152*** (0.021)	-0.116*** (0.024)	-0.155*** (0.028)	-0.150*** (0.032)
GROW	-0.010*** (0.003)	-0.068*** (0.005)	-0.007** (0.003)	-0.032*** (0.004)
AGE	0.017*** (0.005)	0.020*** (0.006)	0.022*** (0.007)	0.026*** (0.007)
LEV	0.146*** (0.029)	0.161*** (0.032)	0.070*** (0.020)	0.077*** (0.022)
INTANG	0.161*** (0.045)	0.141*** (0.054)	0.054** (0.026)	0.070** (0.029)
Constant	-0.147***	-0.072	-0.013	0.007

	(0.056)	(0.063)	(0.083)	(0.082)
Industry F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Observations	10,905	10,905	10,905	10,905
Adjusted R-squared	0.188	0.148	0.200	0.167

Note: This table shows results using the alternative measures of tax avoidance. The dependent variables are AETR and BTD in Columns (1) and (2), respectively. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

### Appendix D. Robustness checks: Alternative measures of corporate tax avoidance

Variables	(1)	(2)
	AETR	BTD
Fintech	0.026*** (0.007)	0.004** (0.002)
SIZE	0.003*** (0.001)	0.000* (0.000)
MB	-0.002*** (0.001)	0.000 (0.000)
CAP	0.108*** (0.017)	0.016*** (0.005)
GROW	0.006*** (0.002)	0.000 (0.001)
AGE	-0.001 (0.005)	0.003** (0.001)
LEV	-0.075*** (0.016)	-0.018*** (0.004)
INTANG	-0.063*** (0.022)	-0.018*** (0.006)
Constant	-0.057 (0.046)	-0.003 (0.013)
Industry F.E.	Yes	Yes
Year F.E.	Yes	Yes
Observations	21,810	21,810
Adjusted R-squared	0.066	0.086

Note: This table shows results using the alternative measures of tax avoidance. The dependent variables are AETR and BTD in Columns (1) and (2), respectively. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

### Appendix E. Robustness checks: Alternative measures of fintech development

See Table E.1.

### Appendix F. Robustness checks: Alternative measure of firm value

See Table F.1.

### Data availability

Data will be made available on request.

Table E.1

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	GETR	CETR	GETR	CETR	GETR	CETR
CityFintech	-0.020** (0.010)	-0.042*** (0.011)				
FintechFirm			-0.003*** (0.001)	-0.003*** (0.001)		
FintechPatent					-0.002*** (0.001)	-0.003*** (0.001)
SIZE	0.004*** (0.001)	0.002* (0.001)	0.004*** (0.001)	0.002** (0.001)	0.004*** (0.001)	0.002** (0.001)
MB	0.002** (0.001)	0.000 (0.001)	0.002** (0.001)	0.000 (0.001)	0.002*** (0.001)	0.000 (0.001)
CAP	-0.152*** (0.019)	-0.137*** (0.021)	-0.150*** (0.018)	-0.134*** (0.020)	-0.149*** (0.018)	-0.133*** (0.020)
GROW	-0.010*** (0.002)	-0.046*** (0.003)	-0.009*** (0.002)	-0.045*** (0.003)	-0.009*** (0.002)	-0.045*** (0.003)
AGE	0.020*** (0.005)	0.025*** (0.005)	0.020*** (0.005)	0.025*** (0.005)	0.020*** (0.005)	0.025*** (0.005)
LEV	0.085*** (0.018)	0.099*** (0.020)	0.082*** (0.017)	0.096*** (0.019)	0.083*** (0.017)	0.096*** (0.019)
INTANG	0.073*** (0.024)	0.082*** (0.027)	0.076*** (0.024)	0.084*** (0.027)	0.076*** (0.024)	0.084*** (0.027)
Constant	0.012 (0.063)	0.124* (0.064)	-0.073 (0.045)	-0.044 (0.043)	-0.073 (0.045)	-0.044 (0.043)
Industry F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes	Yes
Observations	20,572	20,572	21,810	21,810	21,810	21,810
Adjusted R-squared	0.198	0.153	0.198	0.151	0.198	0.151

Note: This table shows the results using alternative measures of fintech development. The dependent variable is *GETR* or *CETR*. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

Table F.1

	(1)	(2)	(3)	(4)	(5)
Variables	MV	GETR	MV	CETR	MV
Fintech	0.104*** (0.019)	-0.016** (0.006)	0.098*** (0.019)	-0.029*** (0.007)	0.096*** (0.019)
GETR			-0.386*** (0.026)		
CETR					-0.265*** (0.018)
SIZE	0.891*** (0.003)	0.004*** (0.001)	0.893*** (0.003)	0.002** (0.001)	0.892*** (0.003)
MB	0.177*** (0.003)	0.002** (0.001)	0.178*** (0.003)	0.000 (0.001)	0.177*** (0.003)
CAP	0.319*** (0.051)	-0.152*** (0.018)	0.260*** (0.050)	-0.137*** (0.020)	0.283*** (0.050)
GROW	-0.000 (0.005)	-0.009*** (0.002)	-0.004 (0.005)	-0.045*** (0.003)	-0.012*** (0.005)
AGE	-0.039*** (0.014)	0.020*** (0.005)	-0.031** (0.014)	0.025*** (0.005)	-0.032** (0.014)
LEV	-0.979*** (0.041)	0.082*** (0.017)	-0.947*** (0.040)	0.095*** (0.019)	-0.954*** (0.040)
INTANG	0.118** (0.048)	0.075*** (0.024)	0.147*** (0.046)	0.083*** (0.027)	0.140*** (0.046)
Constant	2.099*** (0.123)	-0.011 (0.050)	2.095*** (0.125)	0.067 (0.050)	2.117*** (0.124)
Industry F.E.	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes
Observations	21,810	21,810	21,810	21,810	21,810
Adjusted R-squared	0.970	0.197	0.971	0.151	0.970

Note: This table shows the results using alternative measures of firm value. The dependent variable is *GETR* or *CETR*. The standard errors are shown in parentheses. \*, \*\*, and \*\*\* indicate statistical significance at the 10%, 5%, and 1% levels, respectively. The definitions of the variables are presented in Appendix A.

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## **Chapter 5**

# **Fintech and corporate risk-taking: Evidence from China**

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## Fintech and corporate risk-taking: Evidence from China

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### ABSTRACT

This paper explores the relationship between Fintech and corporate risk-taking using data from Chinese listed companies over the period 2011 to 2020. The results show that Fintech development advances corporate risk-taking. Further analysis demonstrates that the facilitating effect of Fintech is more pronounced among young, small, and non-state-owned firms. We further identify two potential channels through which Fintech promotes corporate risk-taking, that is, intervening in the relations of agency costs and financial constraints with corporate risk profiles. Furthermore, we find that Fintech benefits firm value through its positive effect on corporate risk-taking. Our results are robust to miscellaneous tests.

### 1. Introduction

Fintech can be understood as financial innovation driven by novel technologies. The application of emerging technologies in the financial sector is modifying the operation of the traditional financial industry, improving the efficiency, accessibility, and inclusiveness of financial services (Zhao et al., 2022). Fintech is widely recognized as a key driver for firms to grow, innovate, and remain competitive (Lai et al., 2023). Existing literature has illustrated the role of Fintech on firm behavior from the perspective of innovation (Ding et al., 2022), investment efficiency (Huang, 2022), stock crash risk (Dai et al., 2023), profitability (Mirza et al., 2023) and competitiveness (Tang et al., 2023). However, few studies have systematically examined the impacts of Fintech on corporate risk-taking.

The level of corporate risk-taking reflects the risk appetite of a company in making business decisions that is, the willingness of firms to incur costs in the pursuit of high returns (Boubakri et al., 2013). Corporate risk-taking is critical to the value creation and growth of the company (John et al., 2008). Prior studies have shown that Firms' risk-taking behavior is influenced by a series of factors, such as the external environment (Zhang et al., 2021; Tran and Le, 2022), internal governance (John et al., 2008), and management characteristics (Kim and Lu, 2011). Fintech promotes the financial markets development and creates new opportunities and challenges for enterprises (Ding et al., 2022), which has an important impact on corporate growth strategies and investment decisions. Given this context, a thorough investigation into the impact of Fintech on corporate risk-taking is meaningful. Using financial data from the Chinese listed companies, this paper attempts to explore a pivotal question as to whether Fintech affects corporate risk-taking decisions. Further, we examine the reasoning behind such an effect and how it may vary across heterogeneous firm characteristics. We also explicate whether the impact of Fintech on corporate risk-taking benefits firm value.

Our study contributes to the literature in the following folds. First, our study enriches the empirical results unveiled thus far as to the role of Fintech on the real economy (Nie et al., 2023; Wen et al., 2023). Our paper provides new evidence of the impact of Fintech on firms' risk-taking decisions as to their investments, emphasizing the importance of Fintech to real economic growth. Furthermore, studies on the relationship between Fintech and corporate risk are scarce. Most of the prior studies have focused on

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the effect of Fintech on risk-taking behavior in the banking sector (bank risk-taking) (Li et al., 2022; Zhao et al., 2023). However, the banking industry is different in the business model, regulatory environment, and profitability model compared to the other industries. Therefore, it is imperative to extend the discussion to the effect of Fintech on corporate risk-taking in other sectors. Henceforth, our study addresses this gap by revealing new evidence as to the role-playing of Fintech that is pertinent to the wider business community. Lastly, our study contributes to the knowledge of the determinants of corporate risk-taking behavior in emerging markets by identifying Fintech as an important influential factor.

## 2. Literature review and hypothesis development

The Fintech advancement optimizes corporate internal management and improves the external market environment, increasing the chance of the risk-taking of the companies. First, Fintech facilitates the reduction of agency costs due to information asymmetries and conflicts of interest between shareholders and firm managers. The own interests of managers influence their risk selection in investment decisions. For example, Hirshleifer and Thakor (1992) argue that managers avoid risks and even abandon value-added risky projects to protect their careers. John et al. (2008) believe that managers may even expend firm resources to mitigate operational risks motivated by occupational safety concerns. Furthermore, managers may siphon off firm resources in pursuit of self-interest. To disguise such action, managers would reduce value-generating risky investments to maintain cash flow. Due to information asymmetry, it is difficult for traditional institutions and retail investors to adequately identify the improper motives of managers for personal interests (Sun and Zhang, 2023). Fintech improves the quality of information disclosure and corporate operational transparency (Wang et al., 2023), which mitigates the overly conservative behavior of managers in their investments driven by private interests. Additionally, Fintech strengthens the ability of companies to monitor financial processes and utilization of funds, thereby curbing managerial opportunism (Wen et al., 2023). When managers' behavior is more effectively monitored, the cost of pursuing their private interests increases, which helps to ensure that management considers more of the firm stakeholders' interests, rather than their ones, when making risky investment decisions. Second, Fintech eases the financing constraints of companies. Financial constraints affect the risk preferences of firms' investment decisions (Zhang et al., 2021). Financially constrained firms are inclined to adopt more conservative investment policies to control the overall risk level of the firm. Fintech alleviates information asymmetry between firms and lenders and increases competition for bank loans, making it easier for firms to obtain finance (Ding et al., 2022). Adequate capital raising strengthens the ability of firms to grow in value. Enterprises are more motivated to invest in high-risk projects that have the potential to yield high returns.

In this research, we propose the following hypothesis.

**Hypothesis 1 (H1).** Fintech development has a positive effect on corporate risk-taking.

## 3. Research design

### 3.1. Data

Our sample includes A-share listed firms in the Shanghai and Shenzhen stock exchanges from 2011 to 2020. We drop the firms in the financial industry, firms with special treatment (ST), and firms for which data are unavailable. The corporate financial data are collected from the China Stock Market & Accounting Research (CSMAR) database. We focus on a sample of Chinese firms as Fintech-related data are offered by a research team from the Institute of Digital Finance at Peking University and the Research Institute at Ant Group. Additionally, Fintech is comparatively more advanced in China and so our results will have broad relevance.

### 3.2. Variables

Following Cao et al. (2023), we employ two earnings volatility-related indicators, *Risk1* and *Risk2*, to measure corporate risk-taking. *Risk1* represents the standard deviation of the rolling three-year period of industry-adjusted ROA (*AdjROA*). *Risk2* is the range of the rolling three-year period of *AdjROA*. The formula is as follows:

$$AdjROA_{i,t} = ROA_{i,t} - \frac{1}{n} \sum_{t=1}^n ROA_{i,t} \quad (1)$$

$$Risk1_{i,t} = \sqrt{\frac{1}{T-1} \sum_{t=1}^T (AdjROA_{i,t} - \frac{1}{T} \sum_{t=1}^T AdjROA_{i,t})^2}, T = 3 \quad (2)$$

$$Risk2_{i,t} = Max(AdjROA_{i,t}) - Min(AdjROA_{i,t}) \quad (3)$$

where *i* and *t* indicate firm and year, respectively. *ROA* is the ratio of net income to total assets. *AdjROA* denotes the industry-adjusted *ROA*. In the robustness test, we construct *Risk3* and *Risk4* as alternative risk-taking measures by computing  $ROA_{EBIT}$  as the ratio of earnings before interest and taxes (EBIT) to total assets (Boubakri et al., 2013) and calculating its standard deviation and range differential via a rolling window procedure.

We use the Fintech development index (*Fintech*) as a main independent variable. *Fintech* is measured by the natural logarithm of the provincial aggregate index from the Peking University Digital Financial Inclusion Index of China (PKU-DFIIC), which involves aggregation, coverage breadth, usage depth and digitization level, and is widely used as a measure of fintech in the existing

**Table 1**  
Summary statistics.

Variable	N	Mean	Std. dev.	Min	Max
Fintech	17,876	5.413	0.559	2.786	6.068
Risk1	17,876	0.029	0.044	0.000	0.689
Risk2	17,876	0.055	0.080	0.000	1.233
ROA	17,876	0.040	0.059	-0.965	0.542
SIZE	17,876	22.232	1.287	19.078	28.257
PM	17,876	0.085	0.137	-0.998	0.986
Growth	17,876	0.171	0.428	-0.953	5.985
CF	17,876	0.047	0.070	-0.744	0.664

Note: This table shows descriptive statistics for the sample. Our sample includes 17,876 firm-year observations.

literature (Ding et al., 2022; Yang and Zhang, 2022).<sup>1</sup> We also adopt the data from the provincial coverage breadth (*FintechC*), usage depth (*FintechU*) and digitization level (*FintechD*) index, as well as the city-level composite index (*CityFintech*) to conduct robustness tests.

Based on corporate risk-taking related studies, we select a set of control variables, including *ROA*, computed as the ratio of net income to total assets; *SIZE*, defined as the natural logarithm of total assets; Profit margin (*PM*), calculated by dividing net income by total incomes; Sale growth (*Growth*), referring to the growth rate of sales; and Cash flow (*CF*), measured as the ratio of net cash flow from operating activities to total assets.<sup>2</sup>

### 3.3. Model

To investigate the impact of Fintech on corporate risk-taking behavior, we use the following model:

$$Risk_{i,t} = \beta_0 + \beta_1 Fintech_{s,t} + \beta_2 Control_{i,t} + \phi_j + \mu_t + \varepsilon_{i,t} \quad (4)$$

where  $s$ ,  $i$ ,  $t$  and  $j$  indicate province, firm, year and industry, respectively.  $Risk_{i,t}$  denotes the level of corporate risk-taking.  $Fintech_{s,t}$  is the Fintech development index of province  $s$  at year  $t$ .  $Control_{s,t}$  represents a set of control variables. We also control the industry ( $\phi_j$ ) and year ( $\mu_t$ ) fixed effects. Robust standard errors are clustered at the firm level.

## 4. Empirical results

### 4.1. Descriptive statistics

Table 1 presents the descriptive statistics for our major variables. As shown, *Risk1* and *Risk2* have mean values of 0.029 and 0.055, respectively. The mean and standard deviation of *Fintech* are 5.413 and 0.559, respectively. The range of the variable runs from 2.786 to 6.068, suggesting that the degree of Fintech development varies across China's provinces.

### 4.2. Main results

Table 2 presents the impact of Fintech on corporate risk-taking. Columns (1) and (2) show the regression results without control year and industry fixed effects, whereas Columns (3) and (4) provide the estimates of Eq. (4). As demonstrated, the coefficients of *Fintech* are positive and significant in Columns (1) to (4), which supports Hypothesis 1 that Fintech development increases corporate risk-taking. This result is consistent with Tian et al. (2022), who argue that the adoption of new technologies facilitates firms to improve their risk-taking capacity.

### 4.3. Robustness tests

#### 4.3.1. Alternative measures

For robustness, we repeat the main regressions by accounting for alternative measures. The alternative risk-taking variables considered here are *Risk3* and *Risk4*. Additionally, we use four Fintech proxy variables, including *FintechC*, *FintechU*, *FintechD* and *CityFintech* which are mentioned in the previous section. The estimates in Table 3 show that Fintech has significant and positive effects in Columns (1) to (10), indicating that our main findings are robust to alternative proxies.

<sup>1</sup> The PKU-DFIIC Index is created by a team of researchers from the Digital Finance Institute of Peking University and Ant Financial Services Group based on data from Ant Financial Services Group, which can effectively reflect the overall development trend of digital finance in China.

<sup>2</sup> We control for several firm-specific variables that may determine the risk-taking capacity of firms. *ROA* reflects the profitability of firms and is related to their risk-taking ability. *SIZE* reflects a firm's market share and access to capital, which affects its risk management efficiency and adaptability to market changes. *PM* reflects the proportion of profit retained by a company from sales and is an important indicator for assessing a company's long-term sustainable growth and risk management capabilities. *GROW* is an important measure of the expansion rate and ability of a firm to gain market share and reflects the current operating conditions of the firms, which may affect the attitude and ability of firms to invest in risky investments. Cash flow (*CF*) is related to a firm's liquidity and short-term solvency and affects a firm's ability to cope with risk.

**Table 2**  
Baseline regression results.

Variables	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
Fintech	0.011*** (0.000)	0.020*** (0.001)	0.006*** (0.001)	0.012*** (0.003)
ROA	-0.186*** (0.021)	-0.343*** (0.039)	-0.202*** (0.022)	-0.373*** (0.041)
SIZE	-0.005*** (0.000)	-0.009*** (0.000)	-0.004*** (0.000)	-0.007*** (0.000)
PM	-0.002 (0.005)	-0.006 (0.010)	0.004 (0.006)	0.006 (0.011)
Growth	0.007*** (0.001)	0.013*** (0.002)	0.005*** (0.001)	0.010*** (0.002)
CF	0.045*** (0.007)	0.085*** (0.012)	0.045*** (0.007)	0.085*** (0.012)
Constant	0.082*** (0.005)	0.153*** (0.008)	0.102*** (0.009)	0.193*** (0.016)
Year fixed effect	No	No	Yes	Yes
Industry fixed effect	No	No	Yes	Yes
Observations	17,876	17,876	17,876	17,876
Adjusted R-squared	0.093	0.095	0.142	0.146

Note: This table reports the estimates of the effect of Fintech on corporate risk-taking. The dependent variables are firm risk-taking variables, *Risk1* and *Risk2*. *Risk1* equals the standard deviation of the rolling three-year period of industry-adjusted ROA. *Risk2* is measured by the range of the rolling three-year period of industry-adjusted ROA. The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

**Table 3**  
Robustness tests: Alternative measures.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Risk3	Risk4	Risk1	Risk2	Risk1	Risk2	Risk1	Risk2	Risk1	Risk2
Fintech	0.006*** (0.001)	0.012*** (0.003)								
FintechC			0.003*** (0.001)	0.006*** (0.001)						
FintechU					0.006*** (0.001)	0.011*** (0.002)				
FintechD							0.005*** (0.001)	0.009*** (0.002)		
CityFintech									0.004* (0.002)	0.008** (0.004)
Constant	0.106*** (0.009)	0.200*** (0.017)	0.114*** (0.008)	0.215*** (0.015)	0.102*** (0.009)	0.192*** (0.016)	0.106*** (0.008)	0.200*** (0.016)	0.109*** (0.011)	0.205*** (0.021)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,875	17,746	17,876	17,876	17,876	17,876	17,869	17,869	17,876	17,876
Adjusted R-squared	0.128	0.141	0.142	0.146	0.142	0.146	0.142	0.146	0.141	0.145

Note: This table reports the results with alternative measures as dependent or independent variables. The dependent variables are firm risk-taking, *Risk1*, *Risk2*, *Risk3* and *Risk4*. *Risk1* is equal to the standard deviation of the rolling three-year period of industry-adjusted ROA. *Risk2* is measured by the range of the rolling three-year period of industry-adjusted ROA. *Risk3* is computed as the standard deviation of the rolling three-year period of industry-adjusted  $ROA_{EBIT}$ . *Risk4* is the range over a rolling 3-year period of industry-adjusted  $ROA_{EBIT}$ . The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

#### 4.3.2. Endogeneity concerns

To mitigate endogeneity concerns, we employ the two-stage least square (2SLS) regression and use the internet penetration rate (*Internet*) as an instrumental variable for the Fintech index (Nie et al., 2023). Internet penetration accelerates the digitization of financial services, provides a platform for the expansion of Fintech, and thus has a close connection to Fintech. However, it is rarely associated with corporate risk-taking. Panel A of Table 4 reports the estimates from the 2SLS regression. Both the unidentifiable test and the weak instrumental variable test suggest the validity of the proposed *Internet* as an instrumental variable. Column (1) of Panel A shows the first-stage regression results, which confirms a significant positive correlation between *Fintech* and *Internet*. The second-stage regression results in Columns (2) and (3) suggest that the coefficients on the instrumental-variable-based Fintech index are significantly positive, consistent with our earlier findings.

Furthermore, we also adopt the one- and two-period lagged values of the Fintech index as independent variables to alleviate the endogeneity issue. The results presented in Panel B of Table 4 confirm the robustness of our main results in terms of endogeneity.

**Table 4**  
Robustness tests: Endogeneity concerns.

Panel A: Instrumental variable approach.				
Variables	Stage one	Stage two		
	(1)	(2)	(3)	
	Fintech	Risk1	Risk2	
Internet	0.008*** (0.000)			
Fintech		0.011*** (0.003)	0.021*** (0.005)	
Constant	3.531*** (0.029)	0.083*** (0.013)	0.155*** (0.024)	
Kleibergen-Paap Wald rk F statistic	2811.114			
Control variables	Yes	Yes	Yes	
Year fixed effect	Yes	Yes	Yes	
Industry fixed effect	Yes	Yes	Yes	
Observations	16,146	16,146	16,146	
Adjusted R-squared	0.954	0.140	0.144	
Panel B: Lagged Fintech variables.				
Variables	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
L.Fintech	0.007*** (0.001)	0.013*** (0.003)		
L2.Fintech			0.008*** (0.002)	0.015*** (0.003)
Constant	0.113*** (0.010)	0.212*** (0.018)	0.116*** (0.010)	0.218*** (0.019)
Control variables	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Observations	15,483	15,483	13,324	13,324
Adjusted R-squared	0.152	0.156	0.158	0.162

Note: This table reports the results of endogeneity tests. Panel A shows the results of the instrumental variable approach, while Panel B presents the estimates with lagged Fintech variables. Dependent variables include Fintech variables (*Fintech*) and firm risk-taking variables (*Risk1* and *Risk2*). *Fintech* refers to the Fintech development index. *Risk1* equals the standard deviation of the rolling three-year period of industry-adjusted ROA. *Risk2* is measured by the range of the rolling three-year period of industry-adjusted ROA. The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

#### 4.4. Channel analysis

We extend our study to discuss the underlying mechanisms of how Fintech affects corporate risk-taking. In the aforementioned analysis, we conjecture that Fintech improves corporate risk-taking by easing financial constraints and reducing agency costs. To explore the plausibility of these two channels, we employ the proportion of overheads to total assets to measure the agency cost (Deng et al., 2023) and construct the dummy variable, *ME*, which equals to 1 if the agency cost of the firm is above the median and 0 otherwise. Furthermore, following Dang and Phan (2016), we introduce the *WW* and *SA* index to proxy the corporate financial constraints<sup>3</sup> and construct two dummy variables, namely *WW* and *SA*, being equal to one if the *WW* or *SA* index of firms is above the sample median and zero otherwise.

Table 5 reports the results. In Columns (1) to (6), the coefficients of the interaction terms, *Fintech \* ME*, *Fintech \* WW*, and *Fintech \* SA*, are significantly positive, indicating that the positive effect of Fintech on risk-taking is greater in firms with higher agency costs or higher financial constraints. That is, Fintech promotes corporate risk-taking by mediating the roles of agency costs and financial constraints in corporate risk profiles.

<sup>3</sup> The *WW* index and *SA* index are calculated as follows:

$$WW = -0.091 * CF - 0.062 * DIV + 0.021 * TLTD - 0.044 * LNNTA - 0.035 * SG + 0.102 * ISG \quad (5)$$

where *CF* is the ratio of cash flow to total assets; *DIV* is a dummy variable which equals to one if the company pays cash dividends and zero otherwise; *TLTD* is the ratio of long-term debt to total assets; *LNNTA* is the natural log of total assets; *SG* refers to the sales growth of firm; *ISG* refers to the firm's three-digit industry sales growth. The *WW* index is drawn from Whited and Wu (2006) and a higher *WW* index indicates a higher level of financial constraints.

$$SA = -0.737 * SIZE + 0.043 * SIZE^2 - 0.040 * Firmage \quad (6)$$

where *SIZE* is defined as the natural log of total assets and *Firmage* presents the number of years since the firm was listed. The *SA* index (Hadlock and Pierce, 2010) is a size-age index and firms with a higher *SA* index are more likely to be financially constrained.

**Table 5**  
Channel analysis.

Variables	Agency costs		Financial constraints			
	(1)	(2)	(3)	(4)	(5)	(6)
	Risk1	Risk2	Risk1	Risk2	Risk1	Risk2
Fintech*ME	0.039** (0.019)	0.074** (0.035)				
ME	-0.187** (0.092)	-0.357** (0.170)				
Fintech*WW			0.005*** (0.001)	0.009*** (0.002)		
WW			-0.021*** (0.005)	-0.038*** (0.008)		
Fintech*SA					0.004*** (0.001)	0.007*** (0.002)
SA					-0.017*** (0.004)	-0.032*** (0.008)
Fintech	0.004*** (0.002)	0.008*** (0.003)	0.004*** (0.001)	0.008*** (0.003)	0.004*** (0.001)	0.008*** (0.003)
Constant	0.109*** (0.010)	0.206*** (0.018)	0.083*** (0.009)	0.158*** (0.017)	0.111*** (0.009)	0.208*** (0.017)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Observations	17,708	17,708	17,876	17,876	17,876	17,876
Adjusted R-squared	0.142	0.146	0.146	0.150	0.144	0.148

Note: This table reports the results of the channel analysis. The dependent variables are firm risk-taking variables, *Risk1* and *Risk2*. *Risk1* is equal to the standard deviation of the rolling three-year period of industry-adjusted ROA. *Risk2* is measured by the range of the rolling three-year period of industry-adjusted ROA. The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

#### 4.5. Heterogeneity analysis

This section examines the heterogeneity in the role of Fintech for corporate risk-taking across the perspectives of firm age, size and ownership structure. First, we use the natural logarithm of the firm's duration<sup>4</sup> to measure the firm's age and use the median as a cut-off criterion. Young businesses generally lack the credit history, reliable financial track record, and asset collateral required by traditional sources of financing. Fintech broadens access to financing for young businesses, by allowing them to more easily gain start-up and growth capital, which strengthens their ability to pursue more risky growth opportunities. That is, Fintech may have a stronger facilitating effect on risk-taking among young businesses. Second, we divide the sample firms into two subgroups based on the firm size, which is computed by the total assets. Small businesses typically have relatively simple organizational structures that allow them to more flexibly adapt to novel technologies, so fintech provides them with more effective improvements. Last, we separate the full sample in terms of ownership structure into two groups of state-owned (SOEs) and non-state-owned firms (Non-SOEs). In China, the development strategies of SOEs are driven by political factors, which may limit their ability to adopt Fintech and make venture capital investments. In contrast, non-SOEs have more flexible operational and management strategies and thus can adapt to and use Fintech more rapidly, resulting in more effective grasping of market opportunities.

The results in Panel A of Table 6 show that the coefficients on *Fintech* are larger and more significant in the young group. In Panel B, *Fintech* is significantly positive among small firms but nonsignificant for large firms. In Panel C, *Fintech*'s coefficients are larger in SOEs than in Non-SOEs. These results align with the aforementioned discussions.

#### 4.6. Fintech, corporate risk-taking and firm value

We further discuss whether the facilitating role of Fintech for corporate risk-taking is conducive to firm value growth. Based on the mediation model from Baron and Kenny (1986), we examine the mediating effect of risk-taking on the relationship between Fintech and firm value.

$$Value_{i,t} = \alpha_0 + \alpha_1 Fintech_{s,t} + \alpha_2 Control_{i,t} + \phi_j + \mu_t + \varepsilon_{i,t} \quad (7)$$

$$Risk_{i,t} = \beta_0 + \beta_1 Fintech_{s,t} + \beta_2 Control_{i,t} + \phi_j + \mu_t + \varepsilon_{i,t} \quad (8)$$

$$Value_{i,t} = \lambda_0 + \lambda_1 Fintech_{s,t} + \lambda_2 Risk_{i,t} + \lambda_3 Control_{i,t} + \phi_j + \mu_t + \varepsilon_{i,t} \quad (9)$$

<sup>4</sup> the number of years since its establishment.

**Table 6**  
Heterogeneity analysis.

Panel A: The effect of different firm age.				
Variables	Mature firms		Young firms	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
Fintech	0.003* (0.002)	0.006* (0.003)	0.008*** (0.002)	0.016*** (0.004)
Constant	0.120*** (0.012)	0.226*** (0.023)	0.081*** (0.014)	0.152*** (0.026)
Control variables	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Observations	8,907	8,907	8,969	8,969
Adjusted R-squared	0.144	0.147	0.150	0.154

Panel B: The effect of different firm size.				
Variables	Large firms		Small firms	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
Fintech	0.003 (0.002)	0.005 (0.003)	0.011*** (0.002)	0.020*** (0.004)
Constant	0.123*** (0.010)	0.229*** (0.019)	0.008 (0.024)	0.022 (0.044)
Control variables	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Observations	8,937	8,937	8,939	8,939
Adjusted R-squared	0.130	0.133	0.152	0.157

Panel C: The effect of different firm ownership.				
Variables	SOEs		Non-SOEs	
	(1)	(2)	(3)	(4)
	Risk1	Risk2	Risk1	Risk2
Fintech	0.003** (0.001)	0.006*** (0.003)	0.007*** (0.002)	0.013*** (0.004)
Constant	0.077*** (0.008)	0.145*** (0.015)	0.077*** (0.014)	0.147*** (0.027)
Control variables	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Observations	7,073	7,073	10,803	10,803
Adjusted R-squared	0.150	0.153	0.145	0.150

Note: This table reports the results of the heterogeneity analysis. The dependent variables are firm risk-taking variables, *Risk1* and *Risk2*. *Risk1* equals the standard deviation of the rolling three-year period of industry-adjusted ROA. *Risk2* is measured by the range of the rolling three-year period of industry-adjusted ROA. Panel A examines the differential in the effect of Fintech on corporate risk-taking due to firm age. Panel B presents the results on how the effect of Fintech varies across firm size. Panel C shows how the role of Fintech differs across two typical ownership structures in China. The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

where *Value* is measured by Tobin's Q, calculated as the ratio of the sum of total liabilities, book value of preferred stock, and market value of equity to the total assets.

The results are shown in Table 7. In Columns (1) to (3), *Fintech* is positively associated with *Value*, *Risk1* and *Risk2*, suggesting that Fintech increases the firm value and facilitates the ability of firms to take risks. Moreover, *Risk1* and *Risk2* have significant positive estimates in the latter two columns, and the coefficients of *Fintech* in Columns (4) and (5) are significant with smaller magnitudes compared to that in Column (1), meaning that risk-taking is a key channel through which Fintech improves the value of firms.

## 5. Conclusions

Recently, the impact of Fintech on corporate management and development has attracted considerable attention from the wider financial community. We use data from the Chinese listed firms between 2011 and 2020 to investigate the impact of Fintech on corporate risk-taking behavior. It is unveiled that the development of Fintech reinforces corporate risk-taking. Via the heterogeneity analysis, we find that such an effect is more pronounced among young, small, and non-state-owned firms. Moreover, channel analysis further reveals that agency costs and financial constraints are the important drivers for the effect. Finally, we also find that the

**Table 7**  
Fintech, corporate risk-taking and firm value.

Variables	(1)	(2)	(3)	(4)	(5)
	Value	Risk1	Risk2	Value	Value
Fintech	0.115** (0.052)	0.006*** (0.001)	0.012*** (0.003)	0.102** (0.051)	0.101** (0.051)
Risk1				2.077*** (0.325)	
Risk2					1.160*** (0.178)
Constant	12.901*** (0.326)	0.102*** (0.009)	0.193*** (0.016)	12.703*** (0.328)	12.693*** (0.328)
Control variables	Yes	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	17,508	17,876	17,876	17,508	17,508
Adjusted R-squared	0.442	0.142	0.146	0.445	0.445

Note: This table reports the relationship between Fintech, corporate risk-taking and firm value. The dependent variables are firm value and risk-taking variables namely *Value*, *Risk1* and *Risk2*. *Value* is measured by Tobin's Q. *Risk1* is equal to the standard deviation of the rolling three-year period of industry-adjusted ROA, while *Risk2* is measured by the range of the rolling three-year period of industry-adjusted ROA. The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

facilitating effect of fintech on risk-taking is conducive to the growth of firm value. Our findings have important implications for local stakeholders and regulators as they shed light on how the local development of Fintech can be directed and governed efficiently to improve corporate values. A better risk profile of local firms may be controlled via Fintech. Given the rapid development of Fintech and the emphasis placed by policymakers on financial inclusion and innovation, there may be a convergence trend in the financial structure among China's provinces. As inspired by Sever (2022), future research could further explore the impact of fintech development on firm behavior in the context of financial structure convergence.

#### CRedit authorship contribution statement

**Mengxuan Tang:** Data curation, Writing – original draft, Formal analysis, Conceptualization. **Yang (Greg) Hou:** Formal analysis, Conceptualization. **John W. Goodell:** Writing – review & editing. **Yang Hu:** Writing – original draft, Formal analysis, Conceptualization.

#### Data availability

Data will be made available on request.

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## **Chapter 6**

# **Does Fintech innovation impact corporate fraud? Evidence from China**

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# Does fintech innovation impact corporate fraud? Evidence from China

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## ABSTRACT

This study examines the effect of fintech innovation on corporate fraud using data from Chinese listed companies. The empirical results show that fintech innovation negatively influences corporate fraud. Reducing information asymmetry and alleviating financial constraints are two plausible channels. The results of the heterogeneity tests reveal that this negative impact is more pronounced for firms with high internal performance pressures, poor internal governance, and lenient external regulatory environments. Moreover, we analyze the relationship between fintech innovation and different types of fraud and confirm that fintech significantly inhibits disclosure and operational fraud.

## 1. Introduction

Corporate fraud occupies an essential position in the field of corporate governance. With the deepening of the market economy, corporate fraud not only undermines the credibility and financial health of companies and infringes on the interests of investors, not also creates an adverse impact on the stability and high-quality development of the real economy (Chen et al., 2023). Particularly in emerging economies, where the market regulation and governance systems are immaturely developed and the protection of investor rights is relatively inadequate, precipitating a conducive environment for fraudulent activities and exacerbating the challenges in their identification and mitigation (Zhao et al., 2023b). Preventing and inhibiting corporate fraud is a very important and complex issue.

Fintech denotes the combination of finance and technology, which refers to innovative changes in the financial industry driven by advanced technology. Existing literature (Ding et al., 2022; Lv and Xiong, 2022; Zhao et al., 2023a; Tang et al., 2024b) has analyzed the impact of fintech on the development of the real economy from multiple perspectives, involving innovation, efficiency, and risk management and confirmed that by adopting cutting-edge technologies, fintech advancements have dramatically alleviated information asymmetries and increased the accessibility and efficiency of financial services (Zhao et al., 2022). Such innovative transformations may create new opportunities to enhance the monitoring and prevention of corporate fraud. Nevertheless, a few studies have paid attention to how fintech influences corporate fraud. Our study attempts to fill this gap.

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Using Chinese data,<sup>1</sup> we investigate the association between fintech and corporate fraud and demonstrate that fintech significantly reduces corporate fraud. Reducing information asymmetry and alleviating financial constraints are two plausible channels. Our results also confirm that fintech dampens corporate information disclosure fraud and operational fraud activities. Moreover, the heterogeneity tests show the negative impacts of fintech on fraud in firms with poor internal governance, lenient external regulatory environments and high internal performance pressures become more apparent.

This study contributes to the literature in the following aspects. Firstly, our results extend the literature in fintech and deepen the understanding of the connection between fintech and real economy development. By examining the impact of fintech on corporate fraud, we highlight the positive role of fintech innovation on corporate performance, governance, and regulation. Our findings offer valuable perspectives for policymakers to improve the regulatory system, promote market development, and enhance investor protection. Secondly, our study enriches the literature on the determinants of corporate fraud. Previous studies (Johnson et al., 2009; Khanna et al., 2015; Liang et al., 2022) have discussed the determinants of corporate fraud from different perspectives, including corporate governance, legal environment, market competition, and financial condition. Few studies have explored the relationship between fintech and corporate fraud, and this paper fills this important gap. We provide empirical evidence on the inhibitory role of fintech on corporate fraud and further analyze the heterogeneous effects of fintech on different types of fraud, which provides novel insights into preventing and curbing corporate fraud in practice and has important practical implications.

## 2. Hypothesis development

The conduct of fraud by firms can be seen as the result of a trade-off between benefits and costs for managers (Dyck et al., 2010; Chen et al., 2023). When managers perceive that the short-term benefits of fraud are substantial and the likelihood of detection is low, they have a greater incentive to commit the fraudulent activity.

Fintech innovation raises the costs associated with fraud activities and reduces the benefits they generate, therefore lowering the motivations for corporations to commit fraud. As argued in Wen et al. (2023), fintech triggers a deterrent effect and increases the cost of financial misreporting. More specifically, fintech innovations compensate for weaknesses in internal governance and strengthen the effectiveness of external monitoring by reducing information frictions, thus discouraging managerial opportunism and making it more difficult to hide any misbehavior. Jünger and Mietzner (2020) mention that fintech improves information transparency, which enables stakeholders and regulators to more easily track money flows and monitor trading activities, thereby reducing the likelihood of fraud. Additionally, Guo et al. (2023) and Faccia (2023) believe that fintech innovation lowers the cost of acquiring and processing information, helping to reduce information asymmetry, which strengthens market regulatory capacity and reduces costs. A strict regulatory environment would raise the costs of fraud, which in turn reduces their propensity to commit fraud. Moreover, fintech alleviates corporate performance pressure by lowering financial constraints, which reduces the probability of potentially fraudulent behavior. Based on the fraud triangle theory, when managers face stronger performance pressure, they are more likely to engage in inappropriate behavior to conceal the true financial position and avoid the adverse consequences of poor financial performance. Fintech improves the scale of credit available to firms and reduces financing costs, which enables firms to capture high-return investment projects and thus improve performance (Li et al., 2024; Tang et al., 2024a). Reduced internal performance weakens management's incentives to engage in fraudulent activities. This leads to the following hypothesis:

**Hypothesis 1 (H1).** Fintech innovation is negatively related to corporate fraud.

## 3. Research design

### 3.1. Sample construction and data source

The initial sample includes all Chinese A-share firms listed on the Shanghai and Shenzhen stock exchanges between 2011 and 2022. We eliminate financial firms, special treatment (ST) firms, and firms with a severe lack of financial information. Our final sample includes 28,367 firm-year observations. We manually collected patent data from the China National Intellectual Property Administration (CNIPA).<sup>2</sup> Firm-level data are sourced from the China Stock Market & Accounting Research (CSMAR) database. Table 1 shows the summary statistics of the main variables.

### 3.2. Model

To empirically investigate the association between fintech innovation and corporate fraud, we construct the following model:

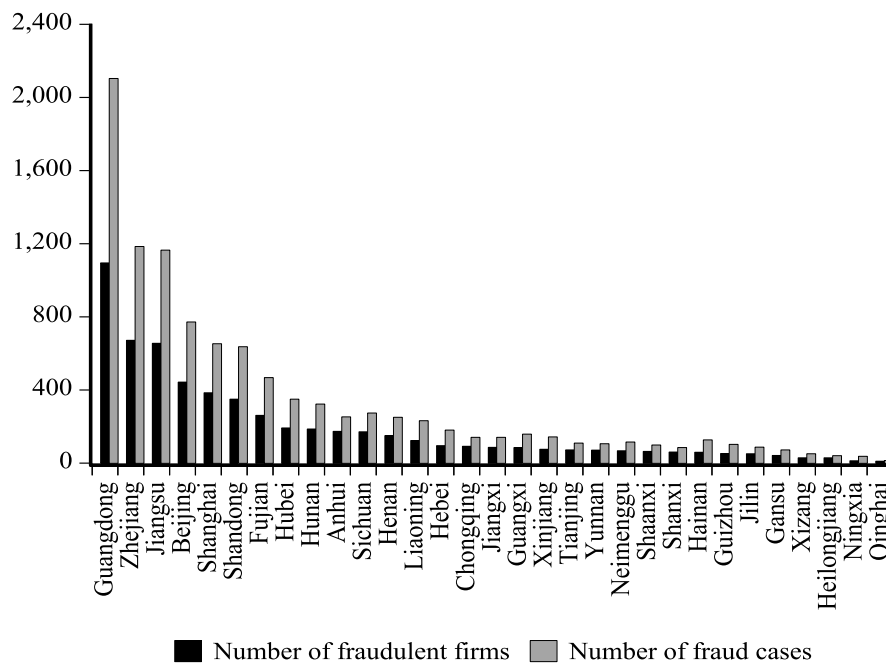
<sup>1</sup> The development of the fintech sector is unique and significant in China. Compared with other economies, China's fintech development is globally remarkable (Guo et al., 2023). Such development is attributed to the large and diversified market demand, fast-growing investment, the emergence of fintech unicorns, and relevant policy support in China. In particular, China's traditional financial system is relatively underdeveloped, which provides more opportunities and space for fintech innovation and development (Goldstein et al., 2019). Hence, China provides an interesting context for us to explore the relationship between fintech and real economic development.

<sup>2</sup> CNIPA provides detailed patent information, including patent name, patent content, patent application date, International Patent Classification (IPC) code, and applicant's registered address.

**Table 1**  
Summary statistics.

Variable	Obs	Mean	Std. dev.	Min	Max
Fraud	28,367	0.208	0.406	0.000	1.000
Fintech	28,367	0.071	0.199	0.000	1.322
SIZE	28,367	22.241	1.331	19.251	28.636
ROA	28,367	0.052	0.045	-0.217	0.550
MB	28,367	3.296	1.616	0.775	9.993
CAP	28,367	0.052	0.049	0.000	0.642
ROE	28,367	0.084	0.071	-0.493	0.717
GROW	28,367	0.205	0.767	-1.000	5.978
LEV	28,367	0.390	0.194	0.008	0.899

Note: This table represents the summary statistics of the main variables. *Fraud* captures corporate fraudulent activity, which equals one if the firm commits fraud in year  $t$ , and zero otherwise. *Fintech* refers to the ratio of the number of fintech patents for each province to the provincial population (10,000 people). *SIZE* is firm size, measured by the natural logarithm of total assets. *ROA* is the ratio of net income to total assets. *MB* is the market-to-book ratio, measured by the ratio of firms' market value to their book value. *CAP* is the ratio of capital expenditures to total assets. *ROE* is computed by dividing net income by shareholders' equity. *Growth* refers to the growth rate of revenue. *LEV* is the ratio of total liabilities to total assets.



**Fig. 1.** Sample provincial distribution in the number of fraudulent firms and fraud incidents. Note: This figure shows the cumulative number of fraudulent firms and fraudulent incidents in each province over the period 2011–2022.

$$Fraud_{i,t} = \beta_0 + \beta_1 \times Fintech_{p,t} + \beta_2 \times Control_{i,t} + \phi_j + \mu_t + \epsilon_{i,t} \tag{1}$$

where  $p$ ,  $i$ , and  $t$  indicate province, firm, and year, respectively. The key dependent variable is  $Fraud_{i,t}$ , which equals one when a firm commits fraud in year  $t$ , and zero otherwise.  $Fintech_{p,t}$  is the regional fintech innovation indicator in province  $p$  at year  $t$ .  $Control_{i,t}$  refers to a set of control variables. Additionally, we control the industry fixed effects ( $\phi_j$ ) and year fixed effects ( $\mu_t$ ).  $\epsilon_{i,t}$  is the residual. Robust standard errors are clustered at the firm level for all estimates.

We also use the logit model in robust tests.

### 3.3. Variables construction

#### 3.3.1. Measure of corporate fraud

Following [Conyon and He \(2016\)](#) and [Chen et al. \(2018\)](#), we construct a proxy, *Fraud*, to capture corporate fraudulent activity. *Fraud* is a dummy variable with a value of one if the firm commits fraud in year  $t$  and zero otherwise. We obtain the data from the corporate fraud database in the CSMAR, which aggregates data on the fraudulent activities of Chinese listed companies and provides comprehensive information including the type of fraud, the year in which the fraud occurred, and the type of penalty. [Fig. 1](#) shows the cumulative number of fraudulent firms and fraud incidents in each province from 2011 to 2022.

**Table 2**  
The effect of fintech on corporate fraud.

Variables	(1) Fraud	(2) Fraud	(3) Fraud	(4) Fraud
Fintech	-0.059*** (0.014)	-0.045*** (0.015)	-0.058*** (0.014)	-0.044*** (0.015)
SIZE			-0.012*** (0.003)	-0.010*** (0.004)
ROA			-0.239 (0.222)	-0.343 (0.220)
MB			0.018*** (0.002)	0.016*** (0.002)
CAP			-0.031 (0.066)	-0.047 (0.067)
ROE			-0.501*** (0.134)	-0.460*** (0.132)
GROW			0.018*** (0.004)	0.015*** (0.004)
LEV			0.082** (0.032)	0.115*** (0.033)
Constant	0.212*** (0.004)	0.366*** (0.060)	0.449*** (0.066)	0.530*** (0.095)
Year FE	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes
Observations	28,367	28,367	28,367	28,367
Adjusted R <sup>2</sup>	0.001	0.013	0.021	0.034

Note: This table represents the regression results of the relation between fintech and corporate fraud. The dependent variable is corporate fraud (*Fraud*), which equals one if the firm commits fraud in year  $t$ , and zero otherwise. The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

For robustness, we use two alternative fraud measures, *Fraud2* and *Fraud3* (Liang et al., 2022, 2023). *Fraud2* measures fraud frequency and is defined as the natural logarithm of the sum of one plus the number of frauds. *Fraud3* represents the severity of fraud, measured by the intensity of penalties imposed on firms for fraud.<sup>3</sup>

### 3.3.2. Measure of fintech development

Following Wen et al. (2023), we use the number of fintech patents for each province to measure regional fintech innovation. Particularly, our regional fintech innovation indicator (*Fintech*) is computed as the cumulative number of patents with IPC codes belonging to G06Q40/02 (banking), G06Q40/06 (investment), or G06Q40/08 (insurance) for province  $p$  in year  $t$ , scaled by the provincial population (10,000 people).

### 3.3.3. Control variables

Firm-level control variables include firm size (*SIZE*) is computed as the natural logarithm of total assets; *ROA* is the ratio of net income to total assets; the market-to-book ratio (*MB*) is the ratio of firms' market value to their book value; *CAP* is the ratio of capital expenditures to total assets; *ROE* is calculated by dividing net income by shareholders' equity; *Growth* is the growth rate of revenue and *LEV* is the ratio of total liabilities to total assets.

## 4. Empirical results

### 4.1. Main results

Table 2 presents the estimation results on the relation between fintech and corporate fraud. Column (1) shows the estimates with only the main variables *Fraud* and *Fintech*. In Columns (2) and (3), we introduce industry and year-fixed effects and firm control variables, respectively. Column (4) reports the results of Eq. (1). As shown, the coefficient on *Fintech* is negative and significant in all models, suggesting that fintech innovation is conducive to inhibiting corporate fraud. This finding is consistent with the view of Karpoff (2021) that technological developments increase the cost of fraud and thus reduce the likelihood of fraud, as Karpoff (2021) states that in the US market, the application of big data can be effective in identifying fraud.

<sup>3</sup> The variable *Fraud3* is calculated as follows: we first quantify the penalty severity. Specifically, the types of penalties are the cancellation of market entry or revocation of business license, which is recorded as 5 points, fine or confiscation of illegal income is recorded as 4 points, condemnation is recorded as 3 points, warning or criticism is recorded as 2 points, there are other fraudulent acts is recorded as 1 point, and the absence of any fraudulent acts is recorded as 0 points. Then, we calculate *Fraud3* as the natural logarithm of the sum of one plus the cumulative score of the enterprise.

**Table 3**  
The logit model.

Variables	(1) Fraud	(2) Fraud	(3) Fraud	(4) Fraud
Fintech	-0.400*** (0.109)	-0.332*** (0.122)	-0.407*** (0.109)	-0.333*** (0.122)
SIZE			-0.081*** (0.021)	-0.066*** (0.023)
ROA			-3.736*** (1.342)	-4.215*** (1.363)
MB			0.099*** (0.012)	0.092*** (0.013)
CAP			-0.145 (0.413)	-0.221 (0.429)
ROE			-1.719** (0.731)	-1.620** (0.746)
GROW			0.097*** (0.020)	0.081*** (0.020)
LEV			0.356* (0.182)	0.585*** (0.195)
Constant	-1.310*** (0.024)	-0.605** (0.256)	0.310 (0.434)	0.543 (0.545)
Year FE	No	Yes	No	Yes
Industry FE	No	Yes	No	Yes
Observations	28,367	28,291	28,367	28,291
Pseudo. R <sup>2</sup>	0.001	0.016	0.021	0.036

Note: This table represents the regression results of the relation between fintech and corporate fraud by applying the logit model. The dependent variable is corporate fraud (*Fraud*), which equals one if the firm commits fraud in year  $t$ , and zero otherwise. The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

## 4.2. Robustness checks

### 4.2.1. Logit model

Then, we employ the logit model and report the result in [Table 3](#). The logit model results support our main findings that fintech reduces the likelihood of fraud. In untabulated tests, we use the logit model to examine the robustness of all the following regression analysis results with *Fraud* as the dependent variable. The results obtained from the logit model are consistent with the results based on Eq. (1).

### 4.2.2. Alternative measures

Next, we use the alternative measures of fraud and fintech to test robustness. Two alternative fraud proxies are fraud frequency (*Fraud2*) and the severity of fraud (*Fraud3*). The alternative definition of fintech is the number of fintech firms established in province  $p$  in year  $t$  (*FintechFirm*), scaled by the provincial population (10,000 people) ([Phan et al., 2020](#)). In [Table 4](#), the coefficients on Fintech-related variables are significantly negative across Columns (1) to (3), which are consistent with the baseline results.

### 4.2.3. Endogeneity concerns: Instrumental variable approach

To mitigate the potential endogeneity issue, we apply the two-stage least squares (2SLS) regression analysis. Technology development is closely linked to the mobility of professional technical labor. Provinces with higher income levels tend to take advantage of the talent competition. Talent concentration in the fintech sector is conducive to a favorable environment for knowledge sharing and innovation, which is extremely beneficial to the development of the fintech industry in the corresponding provinces but is not directly related to corporate fraud. Hence, referring to [Cheng and Qu \(2020\)](#), we employ the average income level of the province where the firm is located as an instrumental variable for fintech.

[Table 5](#) shows the results of 2SLS estimator. In the first-stage regression, *Income* is significantly and positively correlated with *Fintech*. The F-test value is greater than the critical values for the weak instrument test of [Stock and Yogo \(2005\)](#). In the second-stage regression, the coefficient on *Fintech* remains negative and significant at the 1% level, which confirms the robustness of our main results.

## 4.3. Further analysis

### 4.3.1. Fintech innovation and the different types of fraud

The China Securities Regulatory Commission (CSRC) officially classifies corporate fraud into three categories: disclosure fraud (*FraudD*), operational fraud (*FraudO*), and personal fraud by executives (*FraudE*). We further estimate the impact of fintech on the different types of fraud.

**Table 4**  
Alternative measures for corporate fraud or fintech development.

Variables	(1) Fraud2	(2) Fraud3	(3) Fraud
Fintech	-0.081** (0.035)	-0.243*** (0.088)	
FintechFirm			-0.565*** (0.160)
SIZE	-0.016** (0.008)	-0.042* (0.023)	-0.010*** (0.003)
ROA	-0.269 (0.598)	1.856 (1.941)	-0.327 (0.220)
MB	0.031*** (0.005)	0.061*** (0.018)	0.016*** (0.002)
CAP	-0.033 (0.163)	-0.152 (0.584)	-0.046 (0.067)
ROE	-1.577*** (0.386)	-5.393*** (1.295)	-0.460*** (0.132)
GROW	0.028*** (0.008)	0.047* (0.025)	0.015*** (0.004)
LEV	0.266*** (0.085)	0.883*** (0.284)	0.116*** (0.033)
Constant	0.977*** (0.246)	2.136*** (0.773)	0.527*** (0.095)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Observations	28,367	28,367	28,367
Adjusted R <sup>2</sup>	0.037	0.026	0.034

Note: This table presents regression results with alternative measures for fintech innovation or corporate fraud. In Column (1), the dependent variable is *Fraud2*. *Fraud2* measures fraud frequency and is computed as the natural logarithm of the sum of one plus the number of frauds. In Column (2), the dependent variable is the severity of fraud (*Fraud3*), measured by the intensity of penalties imposed on firms for fraud. Specifically, the types of penalties are the cancellation of market entry or revocation of business license is recorded as 5 points, fine or confiscation of illegal income is recorded as 4 points, condemnation is recorded as 3 points, warning or criticism is recorded as 2 points, there are other fraudulent acts is recorded as 1 point, and the absence of any fraudulent acts is recorded as 0 points. *Fraud3* is computed as the natural logarithm of the sum of one plus the cumulative score of the enterprise. In Column (3), the dependent variable is *Fraud*, which equals one if the firm commits fraud in year  $t$  and zero otherwise, and the independent variable is *FintechFirm* computed as the number of fintech firms established in province  $p$  in year  $t$ . The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

Fintech optimizes the quality and credibility of disclosure and improves the efficiency of analysis and monitoring of disclosure and financial management. Thus, fintech should have significant dampening effects on disclosure or operational fraud. However, the personal violations by executives activities involve complex personal decisions and secretive trading behaviors, which typically have a high level of concealment, making such frauds difficult to monitor and identify fully. That is, fintech may have higher weakening effects on disclosure or operational fraud than on personal fraud by executives.

Table 6 presents the results. The coefficients on *Fintech* are larger in magnitude and more significant in Columns (1) and (2) relative to Column (3), which supports our predictions.

#### 4.3.2. Long-term impact of fintech innovation

Due to the time-lag effect of fintech patent applications, we investigate the long-term impact of fintech on fraud and use one-period lagged (*L.Fintech*) and two-period lagged (*L2.Fintech*) of *Fintech* as independent variables. In Table 7, the coefficients on *L.Fintech* and *L2.Fintech* are -0.047 and -0.067 respectively, implying that Fintech has long-term mitigating effects on fraud and this effect strengthens with the number of years lagged.

#### 4.4. Mechanism analyses

We further explore the mechanisms through which fintech affects fraud and expect mitigating information asymmetry and financial constraints to be two channels. If these channels are plausible, fintech should has greater impacts on fraudulent activity in firms with high information asymmetry and high financial constraints.

**Table 5**  
Endogeneity concerns: Instrumental variable approach.

Variables	First stage (1) Fintech	Second stage (2) Fraud
Wage	0.260*** (0.007)	
Fintech		-0.187*** (0.041)
SIZE	0.016*** (0.002)	-0.007* (0.004)
ROA	-0.243** (0.106)	-0.393* (0.220)
MB	0.002* (0.001)	0.017*** (0.002)
CAP	-0.124*** (0.029)	-0.059 (0.068)
ROE	-0.044 (0.058)	-0.456*** (0.132)
GROW	0.001 (0.001)	0.015*** (0.004)
LEV	-0.069*** (0.017)	0.095*** (0.034)
Constant	-2.886*** (0.088)	0.465*** (0.096)
F test of excluded instruments	1267.736***	
Kleibergen–Paap rk LM test		692.258***
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	28,367	28,367
Adjusted R <sup>2</sup>	0.317	0.030

Note: This table reports the results of 2SLS regression. Column (1) reports the estimates of the first-stage regression and the dependent variable is the fintech variable (*Fintech*). Column (2) shows the second-stage regression results and the dependent variable is corporate fraud (*Fraud*), which equals one if the firm commits fraud in year  $t$ , and zero otherwise. The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

**Table 6**  
Fintech innovation and three types of frauds.

Variables	(1) FraudD	(2) FraudO	(3) FraudE
Fintech	-0.036*** (0.012)	-0.044*** (0.012)	-0.003 (0.010)
SIZE	-0.010*** (0.003)	-0.007** (0.003)	-0.002 (0.002)
ROA	-0.202 (0.190)	-0.201 (0.189)	-0.134 (0.138)
MB	0.012*** (0.002)	0.007*** (0.002)	0.011*** (0.002)
CAP	-0.096 (0.059)	-0.003 (0.059)	0.030 (0.040)
ROE	-0.484*** (0.117)	-0.447*** (0.116)	-0.056 (0.084)
GROW	0.011*** (0.003)	0.008*** (0.003)	0.004* (0.002)
LEV	0.108*** (0.029)	0.100*** (0.029)	-0.009 (0.020)
Constant	0.469*** (0.076)	0.381*** (0.091)	0.086 (0.052)
Year FE	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes
Observations	28,367	28,367	28,367
Adjusted R <sup>2</sup>	0.035	0.025	0.011

Note: This table shows the relation between fintech and three types of corporate fraud. In Column (1), the dependent variable is disclosure fraud (*FraudD*), which equals one if the firm has information disclosure fraud in year  $t$ , and zero otherwise. In Column (2), the dependent variable is operational fraud (*FraudO*), which equals one if the firm commits operational fraud in year  $t$ , and zero otherwise. In Column (3), the dependent variable is personal fraud by executives (*FraudE*), which equals one if the firm commits executives' personal fraud in year  $t$ , and zero otherwise. The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

**Table 7**  
Long-term impact of fintech innovation.

Variables	(1) Fraud	(2) Fraud
L.Fintech	-0.047** (0.022)	
L2.Fintech		-0.067** (0.031)
SIZE	-0.014*** (0.004)	-0.021*** (0.004)
ROA	-0.310 (0.272)	0.008 (0.272)
MB	0.011*** (0.003)	0.011*** (0.003)
CAP	-0.045 (0.078)	-0.063 (0.090)
ROE	-0.358** (0.167)	-0.580*** (0.161)
GROW	0.015*** (0.004)	0.013*** (0.004)
LEV	0.120*** (0.039)	0.189*** (0.041)
Constant	0.706*** (0.103)	0.824*** (0.111)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	21,720	18,713
Adjusted R <sup>2</sup>	0.028	0.036

Note: This table shows the long-term impact of fintech on corporate fraud. The dependent variable is corporate fraud (*Fraud*), which equals one if the firm commits fraud in year  $t$ , and zero otherwise. The independent variable is one-period lagged (*L.Fintech*) of *Fintech* in Column (1) and two-period lagged (*L2.Fintech*) of *Fintech* in Column (2). The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

We apply two information asymmetry proxies: the dispersion of analysts' forecasts (*DAF*) (Drobetz et al., 2010) and firm age (*AGE*) (Lei et al., 2018).<sup>4</sup> A higher *DAF* or smaller *AGE* indicates higher information asymmetry. Moreover, following Ding et al. (2022), we use the *WW* index<sup>5</sup> to measure financial constraints. A higher *WW* means higher financial constraints. We take the industry year median of *DAF*, *AGE*, and *WW* as the cut-off criterion. The results shown in Table 8 demonstrate the plausibility of the information asymmetry and financial constraint channels.

#### 4.5. Heterogeneity test

The above analysis confirms that fintech reduces fraud by mitigating information opacity and financial constraints. Based on this, we expect that fraudulent activities of firms with poor internal governance, loose external regulation, and high-performance pressure should be more sensitive to fintech developments. We conduct the heterogeneous analyses to verify our prediction.

##### 4.5.1. Corporate internal governance

We use the separation of ownership and control (*SOC*) to measure internal governance problems. *SOC* is defined as the difference between control and cash flow rights (Claessens et al., 2002).<sup>6</sup> A higher *SOC* means a weaker internal governance. We adopt the industry year median of *SOC* as the cut-off criterion. Panel A of Table 9 shows that *Fintech* has greater impacts on fraud in the high *SOC* subgroup than another subgroup, confirming our prediction.

<sup>4</sup> Following Drobetz et al. (2010), *DAF* is computed as follows way:

$$DAF = \ln\left(1 + \frac{\text{Standard deviation of analysts' forecasts}}{|\text{Median forecasts}|}\right) \quad (2)$$

where  $|\text{Median forecasts}|$  represents the absolute median earnings per share forecast. *Standard deviation of analysts' forecasts* is calculated as the standard deviation of the earnings per share estimate of all analysts for the firm. Moreover, *AGE* is measured by the number of years since the firm's inception.

<sup>5</sup> Following Whited and Wu (2006), the *WW* index is computed as follows:

$$WW = -0.091 \times CF - 0.062 \times DIV + 0.021 \times TLTD - 0.044 \times LNTA - 0.035 \times SG + 0.102 \times ISG \quad (3)$$

where *CF* refers to the cash flow to total assets ratio; *DIV* is a dummy variable which equals to 1 if the company pays cash dividends and 0 otherwise; *TLTD* represents the long-term debt to total assets ratio; *LNTA* is the natural log of total assets; *SG* refers to the sales growth of firm; *ISG* is the firm's three-digit industry sales growth.

<sup>6</sup> Separation of ownership and control exacerbates the tendency of the largest shareholders to use their control to expropriate minority shareholders (Zhao et al., 2023b). To cover up such misbehavior, large shareholders have stronger incentives to engage in fraudulent activities.

**Table 8**  
Mechanism analyses.

Panel A: Information asymmetry				
Variables	(1) High DAF Fraud	(2) Low DAF Fraud	(3) Low AGE Fraud	(4) High AGE Fraud
Fintech	−0.043** (0.018)	−0.041* (0.023)	−0.082*** (0.019)	−0.004 (0.022)
Constant	0.850*** (0.126)	0.228* (0.123)	0.429*** (0.132)	0.634*** (0.129)
Firm control variables	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	13,392	14,975	12,755	15,612
Adjusted R-squared	0.025	0.049	0.037	0.037
Panel B: Financial constraints				
Variables	(1) High WW Fraud	(2) Low WW Fraud		
Fintech	−0.046** (0.022)	−0.037** (0.018)		
Constant	−0.138 (0.160)	0.837*** (0.118)		
Firm control variables	Yes	Yes		
Year FE	Yes	Yes		
Industry FE	Yes	Yes		
Observations	14,508	13,859		
Adjusted R-squared	0.045	0.033		

Note: This table reports the results of mechanism analyses. Panels A and B show the effects of information asymmetry and financial constraints mechanisms, respectively. The dependent variable in all models is corporate fraud (*Fraud*), which equals one if the firm commits fraud in year  $t$ , and zero otherwise. For brevity, the coefficients on the firm-level control variables are not reported in the table. The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

#### 4.5.2. Corporate external regulation

As information intermediaries and active proponents of residual claims, financial analysts play an essential role in improving the quality of a company's external regulation. Fewer analysts following means a lenient external regulatory environment. Analyst coverage (*Analyst*) is the number of financial analysts tracking the firm. We divide the sample into two subsamples according to the industry year median of *Analyst*. The results shown in Table 9 Panel B are consistent with our expectations.

#### 4.5.3. Corporate internal performance pressure

We apply the ROA ratio to measure corporate performance and cut off the full sample as the industry year median of ROA. Lower values of ROA denote higher internal performance pressures. Panel C of Table 9 reports that fintech has greater impacts in firms with stronger internal performance pressure.

## 5. Conclusion

This study investigates the impact of fintech innovation on corporate fraud. We find that fintech significantly reduces the propensity of corporate fraud. Fintech innovation affects fraud by reducing information asymmetry and easing financial constraints. The heterogeneity test indicates that the inhibiting effect of fintech on corporate fraud is more pronounced among firms with high internal performance pressures, poor internal governance, and lenient external regulatory environments. We also confirm that fintech significantly inhibits disclosure and operational fraud.

Our research demonstrates the contribution of fintech to the healthy growth in the real economy and provides new insights into market regulation, corporate governance, and investor protection in the new economic system. The results emphasize the importance of fintech for market regulation and governance by demonstrating the potential of fintech in curbing corporate fraud. Policymakers should actively promote the fintech application, enact appropriate laws and regulations, and implement policy incentives to facilitate its development. Due to the limitation of the research data, our study only focuses on the Chinese market. Future research can further explore the impact of fintech on corporate behavior in different contexts.

**Table 9**  
Heterogeneity test.

Panel A: Corporate governance		
Variables	(1) Low SOC	(2) High SOC
Fintech	−0.012 (0.019)	−0.088*** (0.021)
Constant	0.720*** (0.113)	0.225 (0.153)
Firm control variables	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	16,073	12,294
Adjusted R <sup>2</sup>	0.033	0.043
Panel B: External regulation		
Variables	(1) Low analyst	(2) High analyst
Fintech	−0.042** (0.023)	−0.039** (0.018)
Constant	0.113 (0.153)	0.738*** (0.113)
Firm control variables	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	15,422	12,945
Adjusted R <sup>2</sup>	0.044	0.026
Panel C: Internal performance pressure		
Variables	(1) Low ROA	(2) High ROA
Fintech	−0.043** (0.021)	−0.039** (0.018)
Constant	0.789*** (0.124)	0.314** (0.133)
Firm control variables	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	14,421	13,946
Adjusted R <sup>2</sup>	0.037	0.019

Note: This table reports the results of heterogeneity tests. Panel A shows the results for firms with different levels of corporate governance. Panel B presents the results on how external regulation influences the relationship between fintech and fraud. Panel C reports the results for firms with different degrees of internal performance pressure. The dependent variable in all models is corporate fraud (*Fraud*), which equals one if the firm commits fraud in year  $t$ , and zero otherwise. For brevity, the coefficients on the firm-level control variables are not reported in the table. The standard errors are reported in parentheses. \*\*\*, \*\* and \* demonstrate significance at the 1%, 5% and 10% levels, respectively.

### CRedit authorship contribution statement

**Mengxuan Tang:** Writing – original draft, Data curation. **Yang Hu:** Writing – original draft, Supervision, Formal analysis, Data curation, Conceptualization. **Yang (Greg) Hou:** Writing – original draft, Supervision, Conceptualization. **John W. Goodell:** Writing – review & editing.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### Data availability

Data will be made available on request.

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## **Chapter 7**

# **Fintech development and corporate financial policy: Evidence from corporate financing and investment**

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# Fintech development and corporate financial policy: Evidence from corporate financing and investment<sup>☆</sup>

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## HIGHLIGHTS

- Fintech development has a positive effect on corporate investment and financing.
- Fintech development diminishes information asymmetry and improves corporate governance, which increases corporate investment and financing.
- The positive effects are more pronounced among non-state-owned firms or firms with higher financial constraints.
- Shareholders view the increase in financing and investment driven by fintech developments as value-enhancing.

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## ABSTRACT

This study examines the nexus between fintech development and corporate financial policy, with a particular focus on the role of corporate financing and investment in shaping these policies. Through the analysis of data from Chinese A-share listed firms, we find that fintech development increases investment and financing in firms. Mechanism analyses show that the reduction of information asymmetry and the improvement of corporate governance represent two plausible channels through which fintech development affects corporate financing and investment. Furthermore, the effects of fintech on corporate financial policy are more pronounced among non-state-owned firms or firms with higher financial constraints. We also provide evidence that fintech development can reduce the cost of debt and improve investment efficiency. In addition, we confirm that shareholders view the increase in financing and investment driven by fintech developments as value-enhancing.

## 1. Introduction

In recent years, the fintech sector has emerged rapidly. Relying on emerging technologies such as big data, blockchain, artificial intelligence, and cloud computing, fintech is conducive to improving the operational efficiency and transparency of financial markets and expanding the accessibility and inclusiveness of financial services. The development of fintech also promotes the acceleration of information flow and the optimization of data processing in numerous areas, therefore shaping the information environment in financial markets (Dong and Yu, 2023; Lai et al., 2023; Wen et al., 2023; Fan et al., 2024). By accelerating the speed of information dissemination in financial markets, improving the quality of information, and reducing the cost of information acquisition, fintech is

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emerging as an effective way to reduce information friction among market participants in traditional financial activities (Guo et al., 2023). Moreover, the prominent contribution of fintech in improving the information environment in financial markets enhances the ability of external regulators and investors to monitor corporate managers (Zhou and Chen, 2021; Lv and Xiong, 2022; Wen et al., 2023). Wen et al. (2023) argue that fintech may have a deterrent effect, undermining the potential gains from managerial misconduct and constraining managerial opportunistic behavior, which is conducive to alleviating the agency dilemma of firms. The penetration of fintech in the financial fields such as payment, lending, wealth management, and insurance technology not only meets the growing economic needs of firms (Yang and Zhang, 2022; Tang et al., 2024), but also constructs a reliable information base for corporate development and decision-making, and thus contributes to improving the accuracy and responsiveness of financial decisions. Given the rapid developments in the fintech sector and its far-reaching impact on the economic system, many existing studies attempt to understand the economic consequences of fintech development (see, e.g., Wang et al., 2021; Ding et al., 2022; He et al., 2023; Cai et al., 2024; Liu and Hu, 2024). However, the role of fintech development in corporate financial policies remains a relatively unexplored area of research. Our study expands the existing literature by empirically exploring the impact of fintech developments on corporate finance and investment policies.

Investment and financing strategies are of critical importance to the development of corporations. Effective investment decisions contribute to leading expansion into high-growth areas and maximizing value (Xu et al., 2024), while a robust financing policy ensures that the enterprise maintains adequate financial support and manages risk during expansion. The combination of the two lays the basis for sustainable growth and enables firms to keep a competitive edge in the market. Therefore, the discussion of the key factors influencing firms' financial strategies is of great significance. Existing literature suggests that information asymmetry and agency conflicts are two key factors that impede firms from acquiring external and undertaking investment activities (Mauer and Sarkar, 2005; Chen et al., 2011; Tsai et al., 2021). Specifically, information asymmetry makes it difficult for external investors and financial institutions to accurately assess a firm's credit risk and financial position, leading to firms facing higher financing costs, lower credit rationing, and lower capital availability (Ascioglu et al., 2008; Drobetz et al., 2010). In addition, agency conflicts can be observed as a consequence of management's pursuit of personal interests at the expense of shareholders' interests, which has the potential to result in a discrepancy between their decisions and the firm's long-term strategy, as well as the failure to maximize shareholder value. These issues restrict the capacity of firms to secure the necessary external financial assistance, leading to inadequate investment or inefficient investment practices that diminish the value growth and advancement of the enterprise (Jiang and Yuan, 2018; Chen et al., 2021; Xu et al., 2024). Based on the above discussion, we propose that fintech can influence corporate financing and investment activities in the following two ways. The first way is through the information channel. Information asymmetry increases the cost of capital, leading to a higher cost of raising external finance than utilizing internal finance, and a decrease in the profitability of investment projects (Stewart et al., 1984; Derrien and Kecskés, 2013). Firms facing financial constraints will be more cautious in choosing investment projects and will reduce the amount of capital invested in investment projects (Han and Qiu, 2007; Denis and Sibilkov, 2010). Fintech has an outstanding potential to improve the information environment in financial markets (Liu et al., 2025). Many existing studies (Ding et al., 2022; Lai et al., 2023; Li et al., 2024) confirm that the evolution of fintech can alleviate the information asymmetry problem, reduce the cost of obtaining capital, and broaden the financing channels of firms. Higher accessibility and lower cost of external finance can improve a firm's ability to raise finance for more value-increasing investment projects. Second, fintech can impact corporate investment and financing by improving external regulation and corporate governance. We refer to this as the governance channel. The prominence of fintech in information access and integration enhances the monitoring capabilities of external regulators and can effectively curb managerial opportunism (Wen et al., 2023), thereby facilitating access to investment capital.

Using the financial data from Chinese A-share listed firms, we provide evidence that fintech development is positively associated with external financing and investment, that is the growth of fintech leads to an increase in investment and financing. Specifically, one standard deviation increase in the fintech development variable leads to an increase in external financing by approximately 17.243 % and an 18.939 % rise in corporate investment relative to their mean. Our results are robust in the application of alternative measures of fintech development, corporate finance, and investment, as well as in the introduction of macro variables in the baseline model. To mitigate potential endogeneity concerns, we utilize the instrumental variable approach. Following Cheng and Qu (2020), we use the average income level of the sample firm's location as an instrument for the fintech development variable. The results of the two-stage least square (2SLS) analysis indicate that a significant positive correlation between fintech development and firm investment and financing variables is maintained after instrumentation.

Next, we examine the channels through which fintech development affects firms' financial strategies. The results suggest that the fintech development influences corporate financing and investment by reducing information asymmetry and improving corporate governance. We also investigate the effects of financial constraints and ownership structure and confirm that the effects of fintech on corporate policy are more pronounced among non-state-owned firms or firms with higher financial constraints. Moreover, fintech development can reduce the costs of debt financing, and improve investment efficiency. Finally, we document that shareholders view the increase in financing and investment affected by fintech development as value-enhancing.

This study makes important contributions to the literature in several different ways. First, we extend the large body of the economic literature on the real effects of fintech growth. Prior studies have discussed the macro-level or micro-level impact of fintech development. For example, some studies (Yang and Zhang, 2022; Cai et al., 2024; Chen et al., 2024; Su et al., 2024; Tang et al., 2024) demonstrate the promoting effect of fintech on rural economic development, rural e-commerce development, household consumption, and the financial inclusion of village and township banks from a macro perspective. Other empirical studies examine the relationship between fintech and firms' strategic decision-making and development planning in the areas of risk management (Wang et al., 2021; Tang et al., 2024), ESG performance (Ding et al., 2024), liquidity (Fang et al., 2023), and innovation (Ding et al., 2022), etc. However, the relevant research in the fintech field is still insufficiently explored in the context of current literature. In this paper,

we further reveal the economic consequences of fintech development by exploring the relationship between fintech and corporate financing and investment strategies.

Second, this paper adds to the empirical research on the determinants of corporate policies. Financing strategies and investment decisions are two important components of corporate policy. Existing studies (Javakhadze et al., 2016; Ferris et al., 2017; Dak-Adzaklo and Wong, 2024) explore the factors that drive firms' investment and financing policies, such as firm characteristics, management characteristics, and the market environment. The fintech development is a relatively new phenomenon. Currently, there is a lack of research examining the potential role of fintech in influencing corporate investment and financing policies. Our results extend the existing literature by confirming that fintech can be viewed as a new driver towards increased financing and investment. In addition, this study offers a novel perspective for policymakers seeking to stimulate growth in the real economy.

Third, we enrich the existing studies on information asymmetry. The existence of information asymmetry is one of the primary challenges in developing effective financial strategies for any given firm. Information friction between market participants may impede the efficient allocation of resources and increase transaction costs, leading to lower market efficiency, which influences firms' investment decisions and financing behavior (Guo et al., 2023; Xu et al., 2024). Our study contributes to the existing literature by highlighting the importance of fintech development in mitigating information frictions and improving the market information environment.

The remainder of this paper is organized as follows. Section 2 describes the background of the study, reviews the literature, and develops our hypotheses. Section 3 presents the data sources, variables, and model specification. Section 4 shows the empirical results, and Section 5 concludes.

## 2. Background, literature review and hypothesis development

### 2.1. Fintech development in China

The growth of the fintech sector in China over the past decade has been particularly remarkable (Yang and Zhang, 2022). Many large fintech companies such as Ant Group, Lufax, Tencent, and ZhongAn Insurance provide services in a variety of financial areas involving online lending, digital payments, financial management, and insurance, which are influencing consumer behavior and increasing the reach and accessibility of financial services in China. Compared to more developed countries, the fintech sector in China has relatively more room to evolve and less resistance to innovation (Goldstein et al., 2019; Guo et al., 2023). Chinese financial system is centered on the traditional banking sector. However, given the imperfections of its financial system, issues such as information opacity and ownership discrimination affect the efficiency of credit allocation by traditional financial institutions, resulting in some SMEs and individual customers with financing needs being neglected (Allen et al., 2022). Cost and risk factors also make it difficult for traditional financial institutions to reach clients in remote areas, with low incomes or incomplete credit information. The underdevelopment of the financial industry means that it is not bound by traditional financial infrastructure, and instead can more easily innovate through financial technology to skip traditional financial development stages and even disrupt traditional financial models (Goldstein et al., 2019). This phenomenon provides a meaningful background for research in the financial field, especially research on how to promote economic development through fintech innovation.

The rise of fintech in China is filling the deficiencies of the traditional financial market. From penetrating market segments neglected by traditional financial institutions to gradually capturing major market shares, the emergence of fintech companies has lowered the barrier to access to financial services and filled the credit gap. For example, Ant Group has launched its 'Huabei' and 'Jiebei' services through Alipay, providing consumers with credit payments and microcredit services. FinVolution Group, formerly known as PPDai, one of the early P2P lending platforms in China, provides lending services to individual consumers and small and medium-sized enterprises (SMEs). In addition, China's online payment sector is growing dramatically (Luo et al., 2022). Alipay, WeChat Pay and other online payment services have become popular at all levels of society. As of 2023, Alipay had more than 1 billion active users. The innovation of payment methods not only changes consumers' payment habits but also provides an information base for building the entire fintech ecosystem. By analyzing non-traditional data such as users' transaction records, social behavior, and consumption habits, fintech companies are able to reduce the impact of information asymmetries and effectively assess the credit risk of borrowers. For example, Ant Group's Sesame Credit is a credit scoring system based on big data and payment behavior. Users' daily spending, loan repayment records, and frequency of using Alipay all affect their Sesame Credit score. Users with higher credit scores can enjoy higher credit limits and more convenient financial services. Traditional financial institutions in China are also actively embracing and integrating fintech. An increasing number of banks are applying fintech to their business processes (Cheng and Qu, 2020). According to the 'Listed banks in China: 2023 review and Outlook'<sup>1</sup> report by EY, the amount of investment in fintech as a percentage of operating income and the proportion of fintech personnel in overall FTEs of listed Chinese banks continue to grow. In 2023, 25 listed banks disclosed their investment in fintech/IT, with a total of RMB170.1 billion. Many banks, including the Bank of China, China Construction Bank, and Industrial and Commercial Bank of China, have built fintech smart service platforms with the enabling effect of advanced digital technologies (Tang et al., 2024).

<sup>1</sup> [https://assets.ey.com/content/dam/ey-sites/ey-com/en\\_cn/news/2024/05/ey-listed-banks-in-china-2023-review-and-outlook-en.pdf](https://assets.ey.com/content/dam/ey-sites/ey-com/en_cn/news/2024/05/ey-listed-banks-in-china-2023-review-and-outlook-en.pdf).

## 2.2. Literature review

Information asymmetry and agency issues are important factors affecting corporate financial strategies (Chen et al., 2011; Xu et al., 2024). In the context of information asymmetry, funding providers (e.g., traditional financial institutions and investors) are unable to fully comprehend the actual financial information of firms and accurately assess the associated risks. To compensate for the potential risk, the capital providers may impose limitations on the amount of credit supply or demand higher interest rates or rates of return as a form of risk compensation. This risk premium directly increases the firm's capital cost. Therefore, when confronted with increased financing costs, firms may demonstrate a tendency to reduce their reliance on external financing. Derrien and Kecskés (2013) argue that a decrease in analyst coverage increases information asymmetry, which leads to an increase in the cost of capital and a further reduction in corporate investment and financing. Furthermore, the elevated cost of capital erodes the rate of return on a firm's investment projects and increases financial vulnerability (de Guevara et al., 2021). As a result, in light of the limitations imposed by financial constraints, firms are more cautious in choosing investment projects, and may even forego investment opportunities that have potential strategic value but lower rates of return (Han and Qiu, 2007; Huang and Zhang, 2024). The cost of capital limits firms' ability to invest. Agency conflicts can also affect the cost of capital for firms, which in turn affects corporate financing and investment policies (Mauer and Sarkar, 2005). Information frictions between management and investors exacerbate the adverse selection issue, which may ultimately result in a lack of sufficient investment (Chen et al., 2011; Tsai et al., 2021). Moreover, management may take advantage of inside information to issue overpriced shares and to time the market, which benefits existing shareholders but hurts new shareholders. The timing behavior of management may cause potential investors to be cautious about new share issues and may result in new issues being discounted regardless of their intrinsic value. As a consequence, firms are unable to access equity finance at a reasonable cost and therefore fail to fund all of their investment projects (Stewart et al., 1984). Dak-Adzaklo and Wong (2024) find that due to the information asymmetry issue and agency dilemma, selfish managers may pursue their personal interests over those of shareholders. This inappropriate behavior raises the cost of capital raising for the firms (Jensen and Meckling, 2019). Managers' career protection or preference for a "quiet life" can increase moral hazard (Bertrand and Mullainathan, 2003). In addition, Tsai et al. (2021) believe that managers will tend to adopt overly conservative financial strategies, avoiding profitable but risky investment opportunities and aversion to managerial effort. This can adversely affect the firm's investment and financing decisions, thereby harming firm value.

Fintech is a financial innovation relying on emerging technologies (such as big data, artificial intelligence, blockchain, and cloud computing). The emergence of fintech has brought about tremendous changes and opportunities for the financial sector and the broader market. The development of fintech has greatly reshaped the operational paradigm and informational landscape of the conventional financial market, making financial services smarter and inclusive, improving the efficiency of services, and reducing costs, thus promoting the digital transformation and innovative development of the financial industry (Ding et al., 2022; Yang and Zhang, 2022; Jia, 2024). A substantial body of research has demonstrated the crucial role of fintech in the domains of financial data collection, transmission, and analysis (Wen et al., 2023; Jia, 2024). Fintech employs technologies such as big data, artificial intelligence, and blockchain to reduce the cost of information, improve the speed of corporate dissemination, and enhance the speed and accuracy of information processing (Guo et al., 2023). For example, the decentralized and tamper-proof nature of blockchain technology provides transparent and secure transaction records and enhances market trust (Li et al., 2024). Big data technologies can retrieve valuable information from massive data sources, and quickly process and integrate various forms of unstructured data. This type of non-traditional information data is often ignored or difficult to use in an effective way by traditional financial institutions. This capacity of fintech to integrate and process non-traditional information diminishes the information asymmetry issue in the financial market and considerably advances the development of inclusive finance (Yang and Zhang, 2022). The advancement of fintech provides a new basis for credit assessment for enterprises and individuals who lack traditional credit records or financial history, thus increasing their access to credit (Lai et al., 2023). Additionally, the development of fintech is conducive to improving the degree of financial market informativeness. Wen et al. (2023) highlight the major role of fintech advancement in facilitating the credit screening and monitoring capabilities of financial institutions. They argue that fintech developments enhance information production and external monitoring, thereby increasing the cost of managers' misconduct and strengthening the deterrence of management opportunism. He et al. (2023) and Lai et al. (2023) point out that fintech improves the accessibility of corporate information, improves the monitoring capacity of financial institutions, and reduces agency costs for firms.

## 2.3. Hypothesis development

Fintech may affect corporate investment and financing strategies through two mechanisms. First, information asymmetries between investors and firms can indeed lead to a higher cost of capital, thus limiting the ability of firms to obtain external financing (Derrien and Kecskés, 2013). When firms are unable to fund all promising investment projects, they may miss out on these opportunities, which could lead to a decline in the overall value of the firm (Han and Qiu, 2007). The application of fintech can alleviate the information asymmetry between companies and financial markets. The fintech development improves the information processing capability of financial institutions, especially in the acquisition and screening of unstructured information that is typically challenging for traditional financial institutions to access or process (Wen et al., 2023). Improvements in screening technology by fintech lenders have effectively mitigated the information friction issues that existed in the traditional credit process. By constantly optimizing their screening models, fintech lenders increase information transparency and improve investor monitoring mechanisms, effectively easing the problem of lender moral hazard caused by information asymmetry. It is noteworthy that the multi-dimensional credit approval information accumulated by fintech platforms not only serves their own risk management system but also has an information spillover

effect on traditional financial intermediaries such as banks. In particular, when there is a great disparity in the information sets of borrowers used by fintech lenders and traditional banks, banks can optimize their own decision-making with information on loan approvals from fintech platforms (Balyuk, 2023). This information complementarity is important for alleviating the problem of information incompleteness in the credit market and enhancing resource allocation efficiency. Moreover, fintech innovations create new sources of valuable information in financial markets and have become an important complement to traditional information channels, which contributes to reducing the information gap between institutional and retail investors. The intensification of competition in information production reduces the reliance of investors on the sell-side and induces analysts to change their forecasting behavior and reduce their strategic bias, thus indirectly improving the information structure of the market (Jame et al., 2022). These improvements can assist in reducing the inefficiency of credit allocation due to information asymmetry and enhance the accuracy of credit assessment of firms by financial institutions or investors. A stable and efficient financial market can facilitate the alleviation of financing difficulties (Nie et al., 2023). Hence, the advent of fintech is expected to result in a reduction in the cost of accessing capital, an increase in the accessibility of external financing for firms, and an optimization of the financial position of firms, thereby enabling them to undertake more valuable investment opportunities.

Second, the development of fintech facilitates enhanced external monitoring and improved corporate governance (Wen et al., 2023), which in turn encourages high levels of corporate investment and financing. Information asymmetry can potentially exacerbate adverse selection costs or moral hazards. In the process of corporate financing and investment decision-making, agency conflicts have the potential to influence management behavior in a manner that deviates from the best interests of shareholders. Such behavior may consequently impact the efficiency of capital allocation and the long-term value of the enterprise. Fintech developments have enhanced the monitoring capabilities of external regulators, which play an important role in improving corporate governance (He et al., 2023). Financial institutions are the main external monitoring force for companies. With the deep penetration of fintech in the financial sector, the ability of financial institutions to monitor corporate behavior, identify potential risks and improve governance efficiency has been further enhanced. Fintech, relying on technical means such as big data and cloud computing, improves the ability of financial institutions to capture and process massive amounts of corporate information, strengthens their identification of hidden corporate information, and thus reduces the moral hazard of managers (Sun and Zhang, 2023). In addition, the application of fintech in the banking sector can effectively identify and discourage managerial misconduct (Liu and Hu, 2024). Enhanced external monitoring will increase the cost for management to commit misconduct, thereby reducing the self-interested motivation of corporate managers, mitigating agency conflicts, and strengthening corporate governance (He et al., 2022; Heese et al., 2022). Wen et al. (2023) suggest that fintech may also have governance effects on firms through external monitoring mechanisms, which improve the quality of financial information disclosed by firms and reduce agency costs. The increased transparency of information in the financial market alleviates investors' concerns about corporate insiders' misuse of private information for improper operations, thus enhancing their confidence and willingness to participate in the stock market (Dak-Adzaklo and Wong, 2024). Overall, fintech development improves corporate governance and therefore has a positive impact on a firm's access to external capital and its investment capacity. In light of the aforementioned discussion, the following hypotheses are proposed for consideration in our paper.

**Hypothesis 1 (H1).** *Fintech development has a positive effect on corporate financing and investment.*

**Hypothesis 2 (H2).** *Fintech can influence corporate investment and financing strategies by reducing information asymmetry and improving corporate governance.*

### 3. Research design

#### 3.1. Data

The preliminary sample includes all Chinese firms listed on the Shenzhen and Shanghai stock exchanges from 2013 to 2022. We drop firms with incomplete data, firms in the financial sector, and firms under special treatment (ST) conditions. The final sample for our empirical analysis contains 24,313 firm-year observations, involving 3899 Chinese listed firms. The data employed in this study were obtained from a number of different sources. The sources of firm-level data are the China Stock Market & Accounting Research (CSMAR) database and sample firms' annual reports. The Peking University Digital Financial Inclusion Index of China (PKU-DFIIC) is provided by a research team from the Institute of Digital Finance at Peking University and the Research Institute at Ant Group. We manually collected fintech patent information from the China National Intellectual Property Administration (CNIPA). Macroeconomic data come from the CSMAR database and China's National Bureau of Statistics.

#### 3.2. Variables

##### 3.2.1. Fintech development

Fintech development is measured by the Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). This index is constructed by a research team from the Institute of Digital Finance at Peking University and the research institute at Ant Group, based on data from the Ant Financial Service Group, which can capture the development and adoption of fintech in China. Among the existing fintech-related studies (Ding et al., 2022; Yang and Zhang, 2022; Wang et al., 2023; Liu et al., 2025), PKU-DFIIC is widely used to proxy for regional fintech development in China. Our main independent variable is *Fintech*, defined as the natural logarithm of the provincial aggregated PKU-DFIIC. In the robustness tests, the natural logarithm of the city-level aggregated PKU-DFIIC is adopted to proxy for fintech development. In addition, following Wen et al. (2023), we construct two fintech indicators (*FPatent* and *FPatentT*)

based on fintech-related patents. Specifically,  $FPatent$  is defined as the natural logarithm of the number of fintech patents with IPC code belonging to G06Q40/02, G06Q40/06, or G06Q40/08, while  $FPatentT$  is measured by the natural logarithm of the number of fintech patents with IPC belonging to G06Q40/02, G06Q40/04, G06Q40/06, or G06Q40/08.

### 3.2.2. External financing and investment

To measure external financing, we use the sum of equity and debt issuance scaled by total assets following Derrien and Kecskés (2013). Equity issuance equals the amount raised from the sale of common and preferred stock. Debt issuance equals the sum of change in short-term debt and change in long-term debt. Furthermore, as in Gertner et al. (2002), Jiang et al. (2020), we adopt the ratio of capital expenditures to total assets to proxy for investment. In the robustness tests, we consider several alternative indicators for financing and investment, which are commonly adopted in relevant studies (e.g., Derrien and Kecskés, 2013; Javakhadze et al., 2016; Shroff, 2020; Bhandari et al., 2022).

### 3.2.3. Firm-level control variables

Following prior literature (Dak-Adzaklo and Wong, 2024; Guevara and Riutort, 2024), we control a set of firm-level variables that may affect corporate financial policy:  $ROA$  is the ratio of net income to total assets;  $CF$  refers to the ratio of net operating cash flow to total assets;  $LEV$  is defined as the ratio of total liabilities to total assets;  $MB$  represents market-to-book ratio, equals the ratio of the market value to the book value of equity;  $SIZE$  is computed as the natural logarithm of total assets;  $CASH$  is measured by the ratio of cash and cash equivalents to total assets;  $GROW$  represents growth rate of total revenue;  $PPE$  is calculated as the net properties, plants, and equipment divided by total assets.

### 3.3. Model specification

We construct the following regression model to examine the impact of fintech development on corporate financing and investment policies:

$$FINANCING_{i,t} \text{ or } INVESTMENT_{i,t} = \beta_0 + \beta_1 \times Fintech_{p,t} + \beta_2 \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{i,t} \quad (1)$$

where  $i$ ,  $t$  and  $p$  denote firm, year and province, respectively.  $FINANCING_{i,t}$  represents external financing for firm  $i$  in year  $t$ , while  $INVESTMENT_{i,t}$  proxies for the investment for firm  $i$  in year  $t$ .  $Fintech_{p,t}$  captures the fintech development in province  $p$  in year  $t$ .  $Control_{i,t}$  denotes a set of firm-specific control variables that may influence corporate investment and financing policies.  $\varepsilon$  is the error term. Details of all variable definitions are reported in Appendix A. The model includes industry ( $\phi_j$ ) and year ( $\mu_t$ ) fixed effects to control for unobservable heterogeneity. We cluster the standard errors at the firm level.

The coefficient on the fintech variable ( $\beta_1$ ) reflects the association between the fintech development and corporate financial policies. Our hypothesis predicts that fintech development causes an increase in financing and investment. Based on this, we expect  $\beta_1$  to be positive.

## 4. Empirical results

### 4.1. Descriptive statistics

Table 1 reports summary statistics for the main variables. In our sample, the total number of observations is 24,313. The mean value of  $FINANCING$  is 0.037, with a minimum value of  $-0.930$  and a maximum value of  $0.673$ . The average capital expenditures account for 4.900 % of total assets in a firm, with a standard deviation of 0.047. Moreover, the maximum, minimum, and mean values of the fintech variable are 6.133, 4.746, and 5.746, respectively, indicating that there are notable disparities in fintech development across different regions in China.

### 4.2. Main results

The results presented in Table 2 demonstrate the impact of fintech development on corporate financial policies. The first two columns present the results for external financing, whereas the latter two columns report estimates for investment policy. All the regression models control for year and industry fixed effects. Without considering the control variables, the coefficients on the fintech variable are 0.017 ( $p$ -value  $< 0.01$ ) and 0.024 ( $p$ -value  $< 0.01$ ), respectively. The significant positive coefficient on  $Fintech$  demonstrates that higher levels of fintech development are correlated with higher degrees of external financing and investment in firms. Then, we further introduce the firm-level control variables in the models and report the estimation results in Columns (2) and (4). As can be seen, the coefficient on  $Fintech$  is positive and statistically significant at the 1 % level across these two models. In terms of economic significance, one standard deviation increase in the  $Fintech$  leads to an increase in external financing by approximately 17.243 % and an 18.939 % rise in corporate investment relative to their mean.<sup>2</sup> These results provide empirical evidence for our hypothesis that fintech development significantly increases external financing and investment in firms.

<sup>2</sup> This is calculated as follows: (Coefficient on  $Fintech \times$  Standard deviation of  $Fintech$ )/Mean of  $FINANCING = (0.022 \times 0.290)/0.037 = 0.17243$ ; (Coefficient on  $Fintech \times$  Standard deviation of  $Fintech$ )/Mean of  $INVESTMENT = (0.032 \times 0.290)/0.049 = 0.18939$ .

**Table 1**  
Descriptive statistics.

Variable	N	Mean	Std. Dev.	Min	Median	Max
FINANCING	24,313	0.037	0.087	-0.930	0.010	0.673
INVESTMENT	24,313	0.049	0.047	0.000	0.036	0.642
Fintech	24,313	5.746	0.290	4.746	5.813	6.133
ROA	24,313	0.042	0.057	-0.348	0.039	0.550
CF	24,313	0.052	0.067	-0.744	0.050	0.664
LEV	24,313	0.404	0.189	0.008	0.399	0.890
MB	24,313	3.354	1.510	0.775	3.002	8.696
SIZE	24,313	22.355	1.320	19.295	22.136	28.636
CASH	24,313	0.159	0.118	0.002	0.127	0.887
GROW	24,313	0.154	0.377	-0.982	0.104	6.431
PPE	24,313	0.206	0.155	0.000	0.175	0.954

Note: This table reports the descriptive statistics of our main variables. *FINANCING* is measured by the sum of equity issuance and debt issuance scaled by total assets. Equity issuance equals the amount raised from the sale of common and preferred stock. Debt issuance equals the sum of change in short-term debt and change in long-term debt. *INVESTMENT* is computed by the capital expenditures scaled by total assets. *Fintech* is the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). *ROA* is the ratio of net income to total assets. *CF* is the ratio of net operating cash flow to total assets. *LEV* is the ratio of total liabilities to total assets. *MB* is the Market-to-book ratio, which equals the ratio of the market value to the book value of equity. *SIZE* is the natural logarithm of total assets. *CASH* is the ratio of cash and cash equivalents to total assets. *GROW* refers to the growth rate of total revenue. *PPE* is the ratio of net properties, plants, and equipment to total assets.

**Table 2**  
Baseline regression results.

VARIABLES	External financing		Investment	
	(1)	(2)	(3)	(4)
	FINANCING	FINANCING	INVESTMENT	INVESTMENT
Fintech	0.017*** (0.006)	0.022*** (0.006)	0.024*** (0.005)	0.032*** (0.005)
ROA		0.132*** (0.015)		0.091*** (0.007)
CF		-0.375*** (0.014)		0.030*** (0.006)
LEV		0.048*** (0.005)		0.010*** (0.004)
MB		-0.001* (0.000)		0.001*** (0.000)
SIZE		0.002*** (0.001)		-0.003*** (0.001)
CASH		0.090*** (0.007)		-0.024*** (0.003)
GROW		0.035*** (0.002)		0.006*** (0.001)
PPE		0.013** (0.006)		0.083*** (0.005)
Constant	-0.042 (0.035)	-0.131*** (0.036)	-0.060** (0.029)	-0.073*** (0.027)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	24,313	24,313	24,313	24,313
Adj. R-squared	0.025	0.122	0.130	0.199

Note: This table shows the effect of fintech development on corporate investment and financing policies. The dependent variables are *FINANCING* and *INVESTMENT*. *FINANCING* is calculated as the sum of equity issuance and debt issuance divided by total assets. *INVESTMENT* refers to the ratio of capital expenditures to total assets. *Fintech* is measured by the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). Standard errors are reported in parentheses. \*\*\*, \*\*, and \* indicate significance at the 1%, 5%, and 10% levels, respectively. The definitions of the variables are given in Appendix A.

### 4.3. Heterogeneity tests

#### 4.3.1. Information asymmetry channel

Information asymmetry problems can inhibit a company's access to external financing (Drobotz et al., 2010). A reduction in the supply of capital will consequently influence a company's investment strategy (Hoshi et al., 1991; Han and Qiu, 2007). It is anticipated that the development of fintech will reduce information friction between firms and financial markets. This is due to the fact that it improves the availability of high-quality information in financial markets and increases market transparency and efficiency. Therefore, we argue that fintech can influence firms' investment and financing decisions by alleviating information asymmetry. It is

expected that for firms experiencing severe information asymmetry, the positive impact of fintech on their financial policies will be pronounced, whereas the impact of fintech on the financing and investment strategies of firms with weak information asymmetry issues will be less pronounced.

To verify the plausibility of this underlying mechanism, we use the error and dispersion in analysts' earnings forecasts to capture the level of the firm's information asymmetry. A higher value of the error in analysts' forecasts or dispersion of analysts' forecasts implies a higher level of information asymmetry. Two proxies for information asymmetry are constructed in accordance with the methodology proposed by Kovacs et al. (2010) and Drobetz et al. (2010). The first information asymmetry proxy, *ERROR*, is built based on the error in analysts' forecasts. The error in analysts' forecasts is defined as the natural logarithm of one plus the absolute difference between analysts' forecasts of earnings per share and actual earnings per share, scaled by the absolute median earnings per share forecast. *ERROR* is equal to one if the firm's analyst forecast error is below the industry year median, and zero otherwise. The second proxy is *DISP*, which indicates the dispersion of analysts' forecasts. Forecast dispersion is the natural logarithm of one plus the standard deviation of analysts' annual earnings forecasts of the earnings per share in a given year divided by the absolute median forecast. The dummy variable, *DISP*, takes the value of one if the firm's dispersion of analysts' forecasts is lower than the industry year median, and zero otherwise.

The empirical results of the information asymmetry channel analysis are reported in Table 3. Across all models, the coefficient on interaction term *Fintech* × *ERROR* or *Fintech* × *DISP* is negative, whereas *Fintech* has a significant positive coefficient. The findings indicate that the impact of fintech on corporate investment and financing is more pronounced in firms experiencing greater

**Table 3**  
Information asymmetry channel.

VARIABLES	External financing		Investment	
	(1)	(2)	(3)	(4)
	FINANCING	FINANCING	INVESTMENT	INVESTMENT
Fintech × <i>ERROR</i>	−0.010*** (0.004)		−0.009*** (0.002)	
Fintech × <i>DISP</i>		−0.007* (0.004)		−0.007*** (0.002)
Fintech	0.026*** (0.006)	0.023*** (0.006)	0.036*** (0.005)	0.034*** (0.005)
<i>ERROR</i>	0.050** (0.021)		0.044*** (0.012)	
<i>DISP</i>		0.021* (0.021)		0.029** (0.013)
ROA	0.130*** (0.015)	0.116*** (0.014)	0.089*** (0.007)	0.080*** (0.007)
CF	−0.374*** (0.014)	−0.373*** (0.014)	0.032*** (0.005)	0.032*** (0.005)
LEV	0.050*** (0.005)	0.055*** (0.005)	0.013*** (0.004)	0.014*** (0.004)
MB	−0.001** (0.000)	−0.002*** (0.000)	0.001* (0.000)	0.000 (0.000)
SIZE	0.001* (0.001)	−0.001 (0.001)	−0.004*** (0.001)	−0.004*** (0.001)
CASH	0.089*** (0.007)	0.088*** (0.007)	−0.024*** (0.003)	−0.025*** (0.003)
GROW	0.035*** (0.002)	0.034*** (0.002)	0.005*** (0.001)	0.005*** (0.001)
PPE	0.012** (0.006)	0.011** (0.006)	0.082*** (0.005)	0.082*** (0.005)
Constant	−0.136*** (0.037)	−0.072** (0.036)	−0.069** (0.028)	−0.041 (0.028)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	24,313	24,313	24,313	24,313
Adj. R-squared	0.123	0.130	0.208	0.212

Note: This table reports the results of the information asymmetry channel analysis. The dependent variables are *FINANCING* and *INVESTMENT*. *FINANCING* is calculated as the sum of equity issuance and debt issuance divided by total assets. *INVESTMENT* refers to the ratio of capital expenditures to total assets. *Fintech* is measured by the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). *ERROR* is an information asymmetry proxy, which is built based on the error in analysts' forecasts. The error in analysts' forecasts is defined as the natural logarithm of one plus the absolute difference between analysts' forecasts of earnings per share and actual earnings per share, scaled by the absolute median earnings per share forecast. *ERROR* takes value of one if the firm's analyst forecast error is below the industry year median, and zero otherwise. *DISP* measures the dispersion of analysts' forecasts. Forecast dispersion is the natural logarithm of one plus the standard deviation of analysts' annual earnings forecasts of the earnings per share in a given year divided by the absolute median forecast. The dummy variable, *DISP*, takes the value of one if the firm's dispersion of analysts' forecasts is lower than the industry year median and zero otherwise. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1 %, 5 %, and 10 % levels, respectively. The definitions of the variables are given in Appendix A.

information asymmetry and less evident in firms where such information asymmetry is less pronounced. These results align with our expectation that fintech influences corporate financial strategies via information asymmetry channels.

#### 4.3.2. Corporate governance channel

Fintech is expected to enhance firms' external governance. Fintech enhances the ability of external stakeholders to monitor and constrain the behavior of corporate management by increasing the transparency of a firm's financial position and operational dynamics, optimizing information flows, and enhancing monitoring mechanisms (Wen et al., 2023). Effective corporate governance not only enhances the accessibility of financing channels but also stimulates corporate investment. Therefore, we argue that enhancing corporate governance represents a channel through which fintech can influence firms' investment and financing strategies. If this channel is valid, then it would be reasonable to expect that fintech will have a more pronounced effect on firms characterized by poorer governance, while the impact will be less pronounced in firms with better governance.

Our proxies that are used to measure the degree of corporate governance are the separation of control and ownership as well as the size of the board. The separation of corporate control and ownership increases the risk of expropriation of minority shareholders by large shareholders (Claessens et al., 2002). Such a disconnect may weaken the alignment of the personal interests of the majority shareholder with those of the company and other shareholders. In this case, large shareholders may have a stronger incentive to control the company's resources for personal gain and to expropriate minority shareholders. The separation of control and ownership is measured by the difference between control rights and cash flow rights (Zhao et al., 2024). *SEPAR* takes the value of one if the separation of ownership and control in the firm is less than the sample industry year median and zero otherwise. In addition, based on Li et al. (2023), board size is computed as the natural logarithm of the number of directors on the board. Moreover, the size of

**Table 4**  
Corporate governance channel.

VARIABLES	External financing		Investment	
	(1)	(2)	(3)	(4)
	FINANCING	FINANCING	INVESTMENT	INVESTMENT
Fintech × SEPAR	−0.009** (0.004)		−0.011*** (0.003)	
Fintech × BOARD		−0.011** (0.005)		−0.008** (0.004)
Fintech	0.026*** (0.006)	0.023*** (0.006)	0.038*** (0.005)	0.033*** (0.005)
SEPAR	0.049** (0.022)		0.062*** (0.015)	
BOARD		0.060** (0.029)		0.041** (0.020)
ROA	0.132*** (0.015)	0.131*** (0.015)	0.090*** (0.007)	0.090*** (0.007)
CF	−0.375*** (0.014)	−0.375*** (0.014)	0.030*** (0.006)	0.030*** (0.006)
LEV	0.048*** (0.005)	0.047*** (0.005)	0.010*** (0.004)	0.010*** (0.004)
MB	−0.001* (0.000)	−0.001* (0.000)	0.001*** (0.000)	0.001*** (0.000)
SIZE	0.002*** (0.001)	0.002*** (0.001)	−0.003*** (0.001)	−0.002*** (0.001)
CASH	0.089*** (0.007)	0.090*** (0.007)	−0.024*** (0.003)	−0.023*** (0.003)
GROW	0.035*** (0.002)	0.035*** (0.002)	0.006*** (0.001)	0.006*** (0.001)
PPE	0.013** (0.006)	0.013** (0.006)	0.083*** (0.005)	0.084*** (0.005)
Constant	−0.158*** (0.038)	−0.145*** (0.036)	−0.107*** (0.029)	−0.082*** (0.028)
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	24,313	24,313	24,313	24,313
Adj. R-squared	0.122	0.122	0.200	0.200

Note: This table reports the results of the corporate governance channel analysis. The dependent variables are *FINANCING* and *INVESTMENT*. *FINANCING* is calculated as the sum of equity issuance and debt issuance divided by total assets. *INVESTMENT* refers to the ratio of capital expenditures to total assets. *Fintech* is measured by the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). *SEPAR* takes the value of one if the separation of ownership and control in the firm is less than the sample industry year median and zero otherwise. The separation of control and ownership is measured by the difference between control rights and cash flow rights. *BOARD* is a dummy variable that takes the value of one if the board size of the sample firm is greater than the industry year median and zero otherwise. The board size is calculated as the natural logarithm of the number of directors on the board. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1 %, 5 %, and 10 % levels, respectively. The definitions of the control variables are given in Appendix A.

the board is also employed as a proxy for the level of corporate governance. In accordance with Li et al. (2023), the size of the board is calculated as the natural logarithm of the number of directors on the board. A larger board size implies higher levels of corporate governance. *BOARD* is a dummy variable that takes the value of one if the board size of the sample firm is greater than the industry year median, and zero otherwise.

We show the estimates in Table 4 and the regression results confirm the validity of the governance channel. In Columns (1) and (3), the coefficients on the interaction between *Fintech* and *SEPAR* are significantly negative at the 5 % level, indicating that the financing and investing policies are less sensitive to fintech development in firms with a lower separation of ownership and control. The results in Columns (2) and (4) show that in companies with a larger board of directors, the impact of fintech on their investment and financing is relatively low. In sum, the impact of fintech development on firms' financial strategies is greater in firms with lower levels of governance and weaker in firms with better governance. Based on these findings, we confirm that fintech development can increase corporate financing and investment by improving the level of governance. These results are consistent with the findings of Wen et al. (2023) that fintech can strengthen external regulation and compensate for the lack of internal governance of firms thus having a stronger impact on the strategic decisions of poorly governed firms.

#### 4.3.3. The effect of financial constraints

A flexible financial position is the basis for a company to adjust its financial strategy (Xie et al., 2022; Xu et al., 2024). Financially constrained firms tend to have prominent information asymmetries and are perceived by investors as bearing high credit risks. This perception of high risk leads to a higher cost of capital and stricter conditions for financing. As a result, these firms relatively lack external financial resources and are more cautious in their investment decisions. Han and Qiu (2007) believe that financially constrained firms create intertemporal trade-offs between current and future investments and may even forego potentially profitable current investment projects for more future investments. If fintech can effectively mitigate issues related to information asymmetry and alleviate financial pressure faced by firms, it may have a greater positive impact on the financing and investment strategies of financially constrained firms.

**Table 5**  
Financial constraints.

VARIABLES	(1)	(2)
	FINANCING	INVESTMENT
Fintech × KZ	0.007* (0.004)	0.008*** (0.002)
Fintech	0.016** (0.007)	0.027*** (0.005)
KZ	-0.060*** (0.021)	-0.051*** (0.013)
ROA	0.112*** (0.015)	0.088*** (0.007)
CF	-0.432*** (0.015)	0.018*** (0.006)
LEV	0.071*** (0.005)	0.015*** (0.004)
MB	0.000 (0.001)	0.001*** (0.000)
SIZE	0.002*** (0.001)	-0.003*** (0.001)
CASH	0.072*** (0.007)	-0.027*** (0.004)
GROW	0.035*** (0.002)	0.006*** (0.001)
PPE	0.016*** (0.006)	0.084*** (0.005)
Constant	-0.092** (0.038)	-0.043 (0.028)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	24,313	24,313
Adj. R-squared	0.130	0.201

Note: This table reports the effects of financial constraints on the relationship between fintech and corporate investment financing policies. The dependent variables are *FINANCING* and *INVESTMENT*. *FINANCING* is calculated as the sum of equity issuance and debt issuance divided by total assets. *INVESTMENT* refers to the ratio of capital expenditures to total assets. *Fintech* is measured by the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). *KZ* takes the value of one if the firm's *kz* index is higher than the sample industry year median and 0 otherwise. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1 %, 5 %, and 10 % levels, respectively. The definitions of the variables are given in Appendix A.

To verify our predictions, we employ the *kz* index to capture the degree of financial constraints of firms. A higher value of the *kz* index is correlated with a higher degree of financial constraint. Following Guariglia and Yang (2016) and Ding et al. (2022), the *kz* index is calculated as follows:

$$kz_{i,t} = -1.002 \times \frac{CF_{i,t}}{Assets_{i,t-1}} + 0.283 \times Q_{i,t} + 3.139 \times \frac{Debt_{i,t}}{Assets_{i,t-1}} - 39.368 \times \frac{DIV_{i,t}}{Assets_{i,t-1}} - 1.315 \times \frac{CASH_{i,t}}{Assets_{i,t-1}} \quad (2)$$

where *i* and *t* and *p* denote firm and year, respectively. *kz*<sub>*i,t*</sub> refers to the *kz* index for firm *i* in year *t*. *CF* means cash flow. *Assets* is total assets. *Q* is Tobin's *Q*. *Debt* represents total debt. *DIV* denotes dividends. *CASH* refers to cash and cash equivalents. We construct the dummy variable *KZ* to take the value of one if the firm's *kz* index is higher than the sample industry year median and 0 otherwise.

We add the dummy variable *KZ* and the interaction term between *KZ* and *Fintech* to the baseline model and present the results in Table 5. In Columns (1) and (2), the interaction term *KZ* × *Fintech* and *Fintech* have significant positive coefficients, meaning that fintech developments exert a greater influence on the investment and financing strategies of financially constrained firms. This is consistent with our predictions. In addition, this result further suggests that the development of fintech is conducive to alleviating the problem of inefficient resource allocation in the traditional financial system, enabling firms with limited access to financing and in a disadvantaged position in the traditional financial system to gain more benefits (Ding et al., 2022), which is a finding that highlights the key role of fintech in promoting financial inclusion (Yang and Zhang, 2022; Vuković et al., 2024).

#### 4.3.4. The effect of ownership structure

In the Chinese market, credit accessibility is unfairly tilted towards State-owned enterprises (SOEs). Such a phenomenon has been referred to as “ownership discrimination” and received widespread attention (Liu et al., 2021). More specifically, SOEs have stronger government connections and may have access to more lenient financing conditions. This advantage stems from the government's implicit guarantees and policy favoritism towards SOEs, making traditional financial institutions more willing to provide funding to them. In contrast, non-state-owned enterprises (non-SOEs) may face greater financing challenges due to information asymmetry

**Table 6**  
Ownership structure.

VARIABLES	(1)	(2)
	FINANCING	INVESTMENT
Fintech × OWNER	-0.007* (0.004)	-0.005* (0.003)
Fintech	0.017*** (0.006)	0.030*** (0.005)
OWNER	0.014 (0.022)	0.013 (0.015)
ROA	0.124*** (0.014)	0.086*** (0.007)
CF	-0.384*** (0.014)	0.025*** (0.005)
LEV	0.053*** (0.005)	0.013*** (0.004)
MB	-0.001* (0.000)	0.001*** (0.000)
SIZE	0.004*** (0.001)	-0.001** (0.001)
CASH	0.101*** (0.007)	-0.017*** (0.003)
GROW	0.034*** (0.002)	0.005*** (0.001)
PPE	0.020*** (0.006)	0.088*** (0.005)
Constant	-0.156*** (0.036)	-0.090*** (0.028)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	24,313	24,313
Adj. R-squared	0.135	0.216

Note: This table estimates the effects of ownership structure on the relationship between fintech and corporate investment financing policies. The dependent variables are *FINANCING* and *INVESTMENT*. *FINANCING* is calculated as the sum of equity issuance and debt issuance divided by total assets. *INVESTMENT* refers to the ratio of capital expenditures to total assets. *Fintech* is measured by the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). *OWNER* is equal to one if the firm is state-owned and zero otherwise. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1 %, 5 %, and 10 % levels, respectively. The definitions of the variables are given in Appendix A.

and higher credit risk (Ge and Qiu, 2007). The lack of stable financing sources can lead to higher costs and impair the value of non-SOEs. Moreover, these differences can affect firms' capital allocation efficiency and investment decisions. The evolution of fintech can ease the information friction between non-SOEs and traditional financial institutions, thereby increasing the availability of funds to enterprises and reducing financing costs (Guo et al., 2023). The rise of fintech financing platforms also provides more diversified financing channels for non-SOEs (Bollaert et al., 2021). Given the important role of fintech in mitigating information opacity and improving the corporate financing environment, we expect that fintech development should have different impacts on the financial strategies of SOEs and non-SOEs. In this section, we investigate the impact of fintech developments on the financial policies of firms with different ownership structures.

The ownership variable (*OWNER*) is equal to one if the firm is state-owned and zero otherwise. We introduce *OWNER* and an interaction term between *OWNER* and fintech variables in our baseline model. The estimated coefficients are reported in Table 6. From the table, we can observe that the coefficients on *Fintech* × *OWNER* are  $-0.007$  and  $-0.005$  in Columns (1) and (2), with both significant at the 10 % level. Nevertheless, *Fintech* is significantly and positively correlated with *FINANCING* and *INVESTMENT*, which suggests that the impact of fintech on investment and financing strategies is greater among non-SOEs relative to SOEs. This finding implies that the Fintech development has a significant positive effect on improving the financing environment for enterprises, especially for non-SOEs. The alleviation of financing pressure further boosts the investment strategies of non-SOEs.

#### 4.4. Further analysis

##### 4.4.1. Fintech development and cost of debt

A severe information asymmetry problem leads to a higher cost of external finance for firms. As a result, firms may be more cautious in their financing and investment decisions. The high cost of external financing will limit the amount of capital raised by firms, and firms may choose to reduce their investments and even forgo positive NPV investment projects to retain liquidity and ease financial pressures. Such behavior may cause firms to lose potential growth opportunities. As presented in Section 4.3.1, we show the important role of fintech development in mitigating the information asymmetry problem. Therefore, we argue that fintech development may facilitate the reduction of the cost of debt. We construct a cost of debt variable (*COST*) measured by the ratio of a firm's annual interest expense to total liability (Dak-Adzaklo and Wong, 2024). To examine the impact of fintech development on cost of debt, we construct the following model:

$$COST_{i,t} = \beta_0 + \beta_1 \times Fintech_{p,t} + \beta_2 \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{i,t} \quad (3)$$

**Table 7**  
Fintech development and cost of debt.

VARIABLES	(1)	(2)
	COST	COST
Fintech	$-0.011^{***}$ (0.002)	$-0.005^{***}$ (0.002)
ROA		$-0.038^{***}$ (0.003)
CF		$0.009^{***}$ (0.002)
LEV		$0.020^{***}$ (0.001)
MB		$-0.000^{***}$ (0.000)
SIZE		$-0.000$ (0.000)
CASH		$-0.019^{***}$ (0.001)
GROW		$-0.001^{***}$ (0.000)
PPE		$0.011^{***}$ (0.001)
Constant	$0.081^{***}$ (0.010)	$0.046^{***}$ (0.009)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	24,313	24,313
Adj. R-squared	0.167	0.333

Note: This table shows the relationship between fintech development and the cost of debt financing. The dependent variable is *COST*, calculated as the firm's annual interest expense divided by total liability. *Fintech* is measured by the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1 %, 5 %, and 10 % levels, respectively. The definitions of the variables are given in Appendix A.

where  $i$ ,  $t$  and  $p$  denote firm, year and province, respectively.  $COST$  refers to the cost of debt financing, measured by the ratio of a firm's annual interest expense to total liability. The remaining variables are consistent with Eq.(1).

Table 7 shows the relationship between fintech development and the cost of debt. Columns (1) and (2) report the estimation results of the model without and with firm-level control variables, respectively. In both models,  $Fintech$  is significantly negatively associated with  $COST$ . This result is consistent with the findings of Girardone et al. (2024), which suggests that developments in the fintech sector are conducive to reducing the cost of financing for firms.

#### 4.4.2. Fintech development and investment efficiency

Fintech can facilitate the accessibility of external capital resources to firms by reducing information opacity. Consequently, firms can utilize more flexible funds to mitigate the impact of external shocks, grasp investment opportunities, and adjust investment strategies in a timely manner, thereby enhancing the efficiency of their investment processes (Naeem and Li, 2019). Furthermore, agency conflict represents a key factor contributing to the inefficiency of corporate investment. Management may pursue private interests that result in the misallocation of corporate resources and a reduction in overall investment efficiency. Fintech plays an important role in enhancing external regulation, which allows external regulators and investors to identify management misbehavior more easily, thereby promoting the effectiveness of corporate governance. Efficient corporate governance can increase a firm's investment efficiency (Chen et al., 2017). Based on the above analysis, fintech development may have a positive impact on firms' investment efficiency. Referring to Xu et al. (2024), we use the following estimation model to test the relationship between the fintech development and efficiency of corporate investment:

$$INVESTMENT_{i,t} = \beta_0 + \beta_1 Fintech_{p,t-1} \times Q_{i,t-1} + \beta_2 Fintech_{p,t-1} + \beta_3 Q_{i,t-1} + \beta_4 Control_{i,t-1} + \phi_j + \mu_t + \varepsilon_{i,t} \quad (4)$$

where  $i$ ,  $t$  and  $p$  denote firm, year and province, respectively.  $INVESTMENT_{i,t-1}$  proxies for the investment for firm  $i$  in year  $t-1$ .  $Q_{i,t-1}$  is Tobin's Q for firm  $i$  in year  $t-1$ .  $Fintech_{p,t-1}$  captures the fintech development in province  $p$  in year  $t-1$ .  $Control_{i,t-1}$  denotes

**Table 8**  
Fintech development and investment efficiency.

VARIABLES	(1)	(2)
	INVESTMENT	INVESTMENT
Fintech <sub>t-1</sub> × Q <sub>t-1</sub>	0.003*** (0.001)	
Fintech <sub>t-1</sub> × Q1 <sub>t-1</sub>		0.003*** (0.001)
Fintech <sub>t-1</sub>	0.016*** (0.005)	0.021*** (0.004)
Q <sub>t-1</sub>	-0.019*** (0.006)	
Q1 <sub>t-1</sub>		-0.021*** (0.007)
ROA <sub>t-1</sub>	0.088*** (0.009)	0.087*** (0.009)
CF <sub>t-1</sub>	0.048*** (0.006)	0.048*** (0.006)
LEV <sub>t-1</sub>	0.002 (0.005)	0.002 (0.004)
MB <sub>t-1</sub>	0.001** (0.000)	0.001** (0.000)
SIZE <sub>t-1</sub>	-0.003*** (0.001)	-0.003*** (0.001)
CASH <sub>t-1</sub>	0.009** (0.004)	0.008** (0.004)
GROW <sub>t-1</sub>	0.000 (0.000)	0.000 (0.000)
PPE <sub>t-1</sub>	0.059*** (0.005)	0.059*** (0.005)
Constant	0.030 (0.027)	0.000 (0.025)
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	23,577	23,577
Adj. R-squared	0.176	0.176

Note: This table shows the relationship between fintech development and investment efficiency. The dependent variable,  $INVESTMENT$ , is measured by the ratio of capital expenditures to total assets.  $Fintech$  is measured by the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC).  $Q$  refers to Tobin's Q. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1 %, 5 %, and 10 % levels, respectively. The definitions of the variables are given in Appendix A.

a set of firm-specific control variables for firm  $i$  in year  $t - 1$ , which are consistent with Eq.(1). We are interested in the coefficient ( $\beta_1$ ) on the interaction terms  $Q_{i,t-1} \times Fintech_{p,t-1}$ . If  $\beta_1$  is positive, fintech development can improve the efficiency of corporate investment.

The Column (1) of Table 8 presents the estimates of Eq. (4). In Column (2), we define  $Q_{i,t-1}$  as the industry-adjusted Tobin's Q and label it as  $Q1$ . The results in Table 8 show that the coefficient on the interaction term ( $Fintech_{p,t-1} \times Q_{i,t-1}$  or  $Fintech_{p,t-1} \times Q1_{i,t-1}$ ) is positive and statistically significant in both two models. These findings support our expectation that the advent of fintech enhances corporate investment efficiency.

#### 4.4.3. Fintech, corporate financial policies, and firm value

Prior studies (Ding et al., 2022; Tang et al., 2024) demonstrate that fintech development favors the development of the real economy and the growth of firm value. We argue that the advent of fintech has the capacity to facilitate a crucial role in corporate finance and investment, representing a notable source of value addition for firms. To validate our predictions, we follow Xie et al. (2022) and adopt the natural logarithm of Tobin's Q to measure firm value ( $VALUE$ ). The model is constructed as follows:

$$VALUE_{i,t} = \alpha_0 + \alpha_1 \times Fintech_{p,t} + \alpha_2 \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{i,t} \quad (5)$$

$$VALUE_{i,t} = \beta_0 + \beta_1 \times Fintech_{p,t} + \beta_2 \times FINANCING_{i,t} \text{ or } INVESTMENT_{i,t} + \beta_4 \times Control_{i,t} + \phi_j + \mu_t + \varepsilon_{i,t} \quad (6)$$

where  $i$ ,  $t$  and  $p$  denote firm, year and province, respectively.  $VALUE_{i,t}$  is calculated by the natural logarithm of Tobin's Q. The remaining variables are consistent with Eq. (1).

The results are shown in Table 9. Column (1) reports the direct impact of fintech on firm value. The coefficient on the independent variable, *Fintech*, is positive with significance at least at the 1 % level, suggesting that fintech development can significantly enhance firm value. In Columns (2) and (4), the significant and positive coefficient on the fintech variable indicates a boost to corporate finance and investment from fintech development. In Columns (2) and (4), we report the estimated coefficients of Eq.(6). The coefficients on *Fintech* are significantly positive in both Columns (3) and (5), and they are smaller than the coefficients on the fintech variable in the first column (0.048). This indicates that the development of fintech can improve the availability of external financing for firms, providing them with the opportunity to pursue more value-added investment initiatives and consequently foster growth in firm value.

**Table 9**  
Fintech, corporate financial policies, and firm value.

VARIABLES	Firm value		External financing		Investment	
	(1)	(2)	(3)	(4)	(5)	
	VALUE	Financing	VALUE	Investment	VALUE	
Fintech	0.048*** (0.017)	0.022*** (0.006)	0.047*** (0.017)	0.032*** (0.005)	0.044** (0.017)	
Financing			0.043*** (0.011)			
Investment					0.112*** (0.028)	
ROA	0.348*** (0.025)	0.132*** (0.015)	0.342*** (0.025)	0.091*** (0.007)	0.338*** (0.025)	
CF	0.058*** (0.018)	-0.375*** (0.014)	0.074*** (0.019)	0.030*** (0.006)	0.055*** (0.018)	
LEV	-1.414*** (0.013)	0.048*** (0.005)	-1.416*** (0.013)	0.010*** (0.004)	-1.416*** (0.013)	
MB	0.237*** (0.002)	-0.001* (0.000)	0.237*** (0.002)	0.001*** (0.000)	0.236*** (0.002)	
SIZE	-0.036*** (0.002)	0.002*** (0.001)	-0.036*** (0.002)	-0.003*** (0.001)	-0.035*** (0.002)	
CASH	-0.015 (0.013)	0.090*** (0.007)	-0.019 (0.013)	-0.024*** (0.003)	-0.012 (0.013)	
GROW	0.006** (0.003)	0.035*** (0.002)	0.005 (0.003)	0.006*** (0.001)	0.006* (0.003)	
GROW	0.031** (0.014)	0.013** (0.006)	0.031** (0.014)	0.083*** (0.005)	0.022 (0.014)	
Constant	0.864*** (0.098)	-0.131*** (0.036)	0.870*** (0.098)	-0.073*** (0.027)	0.872*** (0.098)	
Year FE	Yes	Yes	Yes	Yes	Yes	
Industry FE	Yes	Yes	Yes	Yes	Yes	
Observations	24,313	24,313	24,313	24,313	24,313	
Adj. R-squared	0.913	0.122	0.913	0.199	0.913	

Note: This table shows the relationship between fintech, corporate financial policies, and firm value. In Columns (1), (3) and (5), the dependent variable is *VALUE*, measured by the natural logarithm of Tobin's Q. In Columns (2) and (4), the dependent variables are *FINANCING* and *INVESTMENT*, respectively. *FINANCING* is calculated as the sum of equity issuance and debt issuance divided by total assets. *INVESTMENT* refers to the ratio of capital expenditures to total assets. *Fintech* is measured by the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1 %, 5 %, and 10 % levels, respectively. The definitions of the variables are given in Appendix A.

**Table 10**  
Robustness tests: alternative measures for fintech development.

Panel A: External financing			
VARIABLES	(1)	(2)	(3)
	FINANCING	FINANCING	FINANCING
CityFintech	0.015** (0.007)		
FPatent		0.001*** (0.000)	
FPatentT			0.002*** (0.000)
Constant	-0.095** (0.040)	-0.022 (0.018)	-0.022 (0.018)
Firm controls	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
Observations	22,003	24,313	24,313
Adjusted R-squared	0.117	0.122	0.122
Panel B: Investment			
VARIABLES	(1)	(2)	(3)
	INVESTMENT	INVESTMENT	INVESTMENT
CityFintech	0.026*** (0.006)		
FPatent		0.002*** (0.000)	
FPatentT			0.002*** (0.000)
Constant	-0.043 (0.032)	0.090*** (0.014)	0.089*** (0.014)
Firm controls	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes
Observations	22,003	24,313	24,313
Adjusted R-squared	0.202	0.201	0.201

Note: This table shows the results of adopting alternative proxies of fintech development as the independent variable. The dependent variable is *FINANCING* in Panel A. *FINANCING* is calculated as the sum of equity issuance and debt issuance divided by total assets. The dependent variable is *INVESTMENT* in Panel B. *INVESTMENT* refers to the ratio of capital expenditures to total assets. *CityFintech* is measured by the natural logarithm of the city-level PKU-DFIIC. *FPatent* is computed as the Natural logarithm of the number of fintech-related patents. Fintech-related patents, including patents with IPC code belonging to G06Q40/02, G06Q40/06, or G06Q40/08. *FPatentT* is calculated as the Natural logarithm of the number of fintech-related patents. Fintech-related patents, including patents with IPC code belonging to G06Q40/02, G06Q40/04, G06Q40/06, or G06Q40/08. For brevity, the coefficients on firm-level control variables are not shown in the table. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1 %, 5 %, and 10 % levels, respectively. The definitions of the variables are given in [Appendix A](#).

#### 4.5. Robustness tests

In this section, we conduct a series of tests to assess the robustness of the main results. The coefficients of the firm-level control variables in several robustness tests are not reported for brevity.

##### 4.5.1. Alternative measures of fintech development

We investigate the robustness of the main findings by exploring three alternative definitions of fintech development. First, following [Ding et al. \(2022\)](#), we utilize the natural logarithm of city-level PKU-DFIIC as a fintech proxy (*CityFintech*). The PKU-DFIIC system includes a city-level aggregated index and a provincial aggregated index. In our main analysis, we use the provincial index as a measure of fintech development. Considering the possible heterogeneity between different cities located in the same province, the adoption of provincial PKU-DFIIC may miss certain valuable information. In this section, we use the city-level index as an alternative variable to capture fintech development in China. Second, as opposed to relying on existing indices related to fintech development, we also construct fintech variables based on fintech-related patents. As in [Wen et al. \(2023\)](#), we use the number of fintech-related patents to measure fintech development. [Wen et al. \(2023\)](#) define the fintech-related patents as the patents with International Patent Classification (IPC) code belonging to G06Q40/02 (banking), G06Q40/06 (investment), or G06Q40/08 (insurance). This approach to defining fintech patents focuses on the scenarios in which fintech patents are applied. The use of fintech patents has improved the ability of financial institutions to acquire information, benefiting banks, institutional investors and other market participants with a high degree of specialisation. They also consider the patent with IPC as G06Q40/04 (trading) as fintech-related patents and construct a

fintech variable based on patents in four categories: banking, investment, insurance, and trading. Patents in the G06Q40/04 (trading) category typically serve short-term quantitative investments. Compared to the previous three categories of fintech patents, this type of patent has a lower potential to uncover fundamental information about a company. Based on this, our second alternative fintech measure,  $F Patent$ , is computed as the natural logarithm of the number of fintech patents with IPC code belonging to G06Q40/02, G06Q40/06, or G06Q40/08. The third fintech proxy,  $F PatentT$ , is the natural logarithm of the number of fintech patents with IPC belonging to G06Q40/02, G06Q40/04, G06Q40/06, or G06Q40/08.

We re-estimate Eq.(1) with these three fintech proxies and report the results in Table 10. From Panels A and B, we find that the coefficients on alternative proxies for fintech development remain positive and significant across all models, which means that our findings stay unchanged when adopting the alternative definitions of fintech development.

#### 4.5.2. Alternative measures for financing and investment

Next, we employ alternative measures of external financing and investment policy to examine our hypothesis. Panel A of Table 11 uses alternative proxies of corporate financing policies as dependent variables. The first alternative financing indicator is  $FinancingL$ , measured by the ratio of the sum of equity issuance and debt issuance to lag total assets (Bhandari et al., 2022). Second, as in Shroff (2020) and Dak-Adzaklo and Wong (2024), we use the ratio of the sum of equity issuance and the net amount of long-term debt issued in a year or the change in total debt if debt issuance is missing, to lag total assets to measure external financing. The third alternative financing definition is the total loans scaled by total assets (Jiang et al., 2020). In Panel B of Table 11, we adopt four alternative investment measures, including  $InvestmentL$ ,  $InvestmentAC$ ,  $InvestmentAD$  and  $InvestmentRD$ .  $InvestmentL$  is calculated as capital expenditure divided by lagged total assets (Javakhadze et al., 2016).  $InvestmentAC$  refers to the ratio of the sum of capital expenditures, R&D expenditures, and acquisitions expenditures scaled by total assets (Derrien and Kecskés, 2013). We define  $InvestmentAD$  as the sum of capital expenditures, R&D expenditures, and advertising expenses scaled by total assets (Lei et al., 2018).  $InvestmentRD$  equals to the sum of R&D expenditures and capital expenditures, divided by total assets (Anderson et al., 2012).

**Table 11**  
Robustness tests: alternative measures for external financing and investment of firms.

Panel A: External financing				
VARIABLES	(1)	(2)	(3)	
	FinancingL	FinancingEL	FinancingLoan	
Fintech	0.033*** (0.009)	0.021** (0.008)	0.018*** (0.004)	
Constant	-0.171*** (0.053)	-0.117** (0.048)	-0.255*** (0.034)	
Firm controls	Yes	Yes	Yes	
Year FE	Yes	Yes	Yes	
Industry FE	Yes	Yes	Yes	
Observations	24,313	24,313	24,313	
Adj. R-squared	0.118	0.080	0.345	
Panel B: Investment				
VARIABLES	(1)	(2)	(3)	(4)
	InvestmentL	InvestmentAC	InvestmentAD	InvestmentRD
Fintech	0.040*** (0.006)	0.051*** (0.006)	0.039*** (0.008)	0.044*** (0.006)
Constant	-0.101*** (0.035)	-0.135*** (0.034)	-0.081* (0.042)	-0.116*** (0.032)
Firm controls	Yes	Yes	Yes	Yes
Year fixed effect	Yes	Yes	Yes	Yes
Industry fixed effect	Yes	Yes	Yes	Yes
Observations	24,313	24,313	24,313	24,313
Adj. R-squared	0.185	0.218	0.261	0.240

Note: This table reports the results of the robustness tests using alternative measures of the dependent variable. In Columns (1) to (3) of Panel A, the dependent variables are  $FinancingL$ ,  $FinancingEL$ , and  $FinancingLoan$ , respectively.  $FinancingL$  equals the sum of equity issuance and debt issuance scaled by lag total assets.  $FinancingEL$  is measured by the sum of equity issuance and the net amount of long-term debt issued in a year or the change in total debt if debt issuance is missing, scaled by lag total assets.  $FinancingLoan$  refers to the ratio of total loans to lag total assets. In Panel B, we use the alternative variable of investment policy as the dependent variable, including  $InvestmentL$ ,  $InvestmentAC$ ,  $InvestmentAD$ , and  $InvestmentRD$ .  $InvestmentL$  is calculated as the capital expenditures scaled by lag total assets.  $InvestmentAC$  is measured by the sum of capital expenditures and research and development expenditures, and acquisitions expenditures scaled by total assets.  $InvestmentAD$  is computed as the sum of capital expenditures and research and development expenditures, and advertising expenses scaled by total assets.  $InvestmentRD$  is measured by the sum of capital expenditures and research and development expenditures scaled by total assets.  $Fintech$  is measured by the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1 %, 5 %, and 10 % levels, respectively. The definitions of the variables are given in Appendix A.

The results in panels A and B of Table 11 report the regression results using alternative financing indicators and alternative investment indicators as dependent variables, respectively. In Panel A, *Fintech* is significantly and positively linked to all alternative corporate financing measures. In Panel B, the coefficients on *Fintech* remain positive with significance at the 1 % level across all models. These findings confirm that our main results remain robust to the alternative definitions of corporate financing and investment policy.

#### 4.5.3. Controlling for regional macroeconomic variables

Fintech development is closely linked to regional development. The advantages of relatively developed regions in terms of economic resources, market demand, talent and technology, and financial ecosystems are expected to shape a more favorable development environment for the local fintech sector (Ding et al., 2022). To control the effects of regional characteristics, we add a set of regional macroeconomic variables in the baseline model (Ding et al., 2022; Wu et al., 2024; Yang and Zhou, 2024), involving the economic development level (*GDP*) that equals the GDP growth rate of the province; the population density (*POP*), defined as the total population of the province over land area; the science and technology expenditures (*TECH*), defined as the ratio of government expenditure on science and technology to the GDP of the province; the province's degree of marketization (*MARKET*), calculated as the ratio between total retail sales of consumer goods to GDP of the province; the education level (*EDU*), measured as the proportion of high school students to the total population of the province; the industrial structure (*INDSTR*), defined as the proportion of secondary and tertiary industries' added value in GDP of the province.

We show the estimation results in Table 12. After incorporating province-level control variables in Eq.(1), the coefficients on *Fintech* are still positive at the 1 % significance level. These results further demonstrate that our findings remain unchanged after controlling for province characteristics.

#### 4.5.4. Instrumental variable approach

To alleviate the potential endogeneity concern, we conduct a two-stage least square (2SLS) regression model. Referring to Cheng and Qu (2020), the average income level for the province in which the firm is situated is employed as an instrument for fintech development, with the instrumental variable *INCOME* subsequently constructed. The transfer of relevant skilled labor, in particular the transfer of skilled workers and the entry of emerging talent, has a far-reaching impact on the development of fintech. Cheng and Qu (2020) measure the attractiveness of the region to the relevant talent in terms of income level. Regions with high-income levels should be more attractive to talent, which provides a more favorable environment for local fintech development. Moreover, the income level of the region is less likely to influence corporate financial policy.

Table 13 reports the estimation results of 2SLS analysis. In the first-stage regression, *INCOME* is significantly and positively correlated with the fintech variable, suggesting that the development of fintech is better in regions with high-income levels. In

**Table 12**  
Robustness tests: controlling for regional macroeconomic variables.

VARIABLES	(1)	(2)
	FINANCING	INVESTMENT
Fintech	0.035*** (0.013)	0.038*** (0.010)
GDP	0.032*** (0.012)	0.014* (0.007)
POP	-0.000*** (0.000)	-0.000*** (0.000)
TECH	-0.292 (0.279)	0.122 (0.207)
MARKET	0.033** (0.013)	0.004 (0.010)
EDU	0.075 (0.070)	0.069** (0.034)
INDSTR	0.024 (0.028)	0.012 (0.023)
Constant	-0.234*** (0.054)	-0.115*** (0.042)
Firm controls	Yes	Yes
Year FE	Yes	Yes
Industry FE	Yes	Yes
Observations	24,266	24,266
Adj. R-squared	0.123	0.201

Note: The table reports the results obtained after adding the province-level control variables to the baseline model. In Columns (1) and (2), the dependent variables are *FINANCING* and *INVESTMENT*, respectively. *FINANCING* is calculated as the sum of equity issuance and debt issuance divided by total assets. *INVESTMENT* refers to the ratio of capital expenditures to total assets. *Fintech* is measured by the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). For brevity, the coefficients on firm-level control variables are not shown in the table. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1 %, 5 %, and 10 % levels, respectively. The definitions of the variables are given in Appendix A.

**Table 13**  
Instrumental variable approach.

VARIABLES	First stage		Second stage	
	(1)	(2)	(3)	
	Fintech	FINANCING	INVESTMENT	
INCOME	0.266*** (0.001)			
Fintech		0.019*** (0.007)	0.029*** (0.005)	
ROA	0.032*** (0.007)	0.132*** (0.015)	0.091*** (0.007)	
CF	0.016*** (0.005)	-0.375*** (0.014)	0.030*** (0.005)	
LEV	0.001 (0.004)	0.048*** (0.005)	0.010*** (0.004)	
MB	0.000 (0.000)	-0.001* (0.000)	0.001*** (0.000)	
SIZE	-0.001*** (0.000)	0.002*** (0.001)	-0.003*** (0.001)	
CASH	-0.004 (0.004)	0.090*** (0.007)	-0.024*** (0.003)	
GROW	0.001 (0.001)	0.035*** (0.002)	0.006*** (0.001)	
PPE	-0.005 (0.004)	0.013** (0.006)	0.083*** (0.005)	
Constant	2.447*** (0.019)	-0.120*** (0.039)	-0.060** (0.029)	
F test of excluded instruments	36274.060***			
Kleibergen-Paap rk LM test		1232.451***	1232.451***	
Year FE	Yes	Yes	Yes	
Industry FE	Yes	Yes	Yes	
Observations	24,313	24,313	24,313	
Adj. R-squared	0.983	0.122	0.199	

Note: This table presents the estimation results of two-stage least square (2SLS) analysis. The instrumental variable is *INCOME*, defined as the average wage for the province where the firm is located. In Column (1), the dependent variable is *Fintech*, measured by the natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC). In Columns (2) and (3), the dependent variable is *FINANCING* and *INVESTMENT*, respectively. *FINANCING* is calculated as the sum of equity issuance and debt issuance divided by total assets. *INVESTMENT* refers to the ratio of capital expenditures to total assets. Standard errors are reported in parentheses. \*\*\*, \*\*, and \* denote significance at the 1 %, 5 %, and 10 % levels, respectively. The definitions of the variables are given in [Appendix A](#).

addition, the results of the *F*-test further confirm that *INCOME* is a valid instrumental variable for fintech. In the second-stage regression, *Fintech* has a positive coefficient with significance at 1 % level in both Columns (2) and (3), which simply that our results are not driven by endogeneity issues.

## 5. Conclusion

This paper discusses the impact of fintech development on corporate financing and investment policies in the Chinese market. We use a sample of A-share companies listed on China's Shanghai and Shenzhen stock exchanges between 2013 and 2022. We provide empirical evidence that fintech development significantly increases firms' external financing and investment. This positive impact is more pronounced in firms with high levels of financial constraints and non-state-owned firms. Moreover, we explore the economic channels through which fintech affects corporate finance and investment. The results show that mitigating information asymmetry and enhancing corporate governance are two valid channels. In further analyses, we demonstrate that fintech development has an attenuating effect on the cost of debt financing and a significant improvement in investment efficiency. Finally, we find that shareholders view the increase in financing and investment impacted by fintech development as value-enhancing. Our results are not driven by endogeneity issues, alternative definitions of fintech development, alternative measures of dependent variables, and controlling for regional macro variables.

The findings of this study have significant academic and practical implications. First, the study fills the research gap on how fintech affects corporate financial decision-making and helps to further improve the new theoretical framework on the relationship between fintech and corporate financial behavior. Through empirical analyses, we provide new theoretical perspectives for promoting corporate finance and investment. Second, the research results provide practical advice on how to use fintech to optimize financing and investment for enterprises, especially those facing serious information asymmetry problems and financing constraints. Furthermore, our research adds to the relevant literature on the economic consequences of fintech and provides policymakers with a theoretical rationale for supporting the development of fintech. Policymakers should pay attention to the role of fintech in driving the development of China's real economy at this stage and formulate more targeted policies to encourage fintech innovation as well as to ensure the healthy growth of the market.

This paper focuses on the Chinese market and explores the economic consequences of fintech development in the Chinese market environment and regulatory framework. However, given the differences in financial systems, regulatory policies and institutional environments across countries, the impact of fintech on corporate behavior may exhibit significant heterogeneity. Therefore, future research can expand the research context to the international market and deeply analyse the mechanisms and real effects of fintech in different economies. Cross-country research can help to more comprehensively reveal the economic impact of fintech on a global scale and provide empirical evidence for international regulatory coordination and policy formulation.

### CRedit authorship contribution statement

**Mengxuan Tang:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Yang Hu:** Supervision, Conceptualization. **Yang (Greg) Hou:** Writing – review & editing, Supervision, Investigation. **Les Oxley:** Writing – review & editing, Supervision, Investigation. **John W. Goodell:** Writing – review & editing, Supervision, Project administration, Conceptualization.

### Appendix A. Variable definitions

Variables	Definitions
Finance policy variables	
FINANCING	Sum of equity issuance and debt issuance scaled by total assets. Equity issuance equals the amount raised from the sale of common and preferred stock. Debt issuance equals the sum of change in short-term debt and change in long-term debt.
INVESTMENT	Capital expenditures scaled by total assets.
FinancingL	Sum of equity issuance and debt issuance scaled by lag total assets.
FinancingEL	Sum of equity issuance and the net amount of long-term debt issued in a year or the change in total debt if debt issuance is missing, scaled by lag total assets.
FinancingLoan	Ratio of total loans to lag total assets.
InvestmentL	Capital expenditures scaled by lag total assets.
InvestmentAC	Sum of capital expenditures and research and development expenditures and acquisitions expenditures scaled by total assets.
InvestmentAD	Sum of capital expenditures and research and development expenditures and advertising expenses scaled by total assets.
InvestmentRD	Sum of capital expenditures and research and development expenditures scaled by total assets.
Fintech variables	
Fintech	Natural logarithm of the provincial Peking University Digital Financial Inclusion Index of China (PKU-DFIIC).
CityFintech	Natural logarithm of the city-level PKU-DFIIC.
FPatent	Natural logarithm of the number of fintech-related patents. Fintech-related patents including patents with IPC code belonging to G06Q40/02, G06Q40/06, or G06Q40/08.
FPatentT	Natural logarithm of the number of fintech-related patents. Fintech-related patents including patents with IPC code belonging to G06Q40/02, G06Q40/04, G06Q40/06, or G06Q40/08.
Firm-level control variables	
ROA	Ratio of net income to total assets.
CF	Ratio of net operating cash flow to total assets.
LEV	Ratio of total liabilities to total assets.
MB	Market-to-book ratio, equals the ratio of the market value to the book value of equity.
SIZE	Natural logarithm of total assets.
CASH	Ratio of cash and cash equivalents to total assets.
GROW	Growth rate of total revenue.
PPE	Ratio of net properties, plants, and equipment to total assets.
Province-level control variables	
GDP	Economic development level, defined as the GDP growth rate of the province.
POP	Population density, calculated as the ratio of the total population of each province to land area.
TECH	Science and technology expenditures, computed as the ratio of government expenditure on science and technology to the GDP of the province.
MARKET	Market size, defined as the ratio between total retail sales of consumer goods to GDP of the province.
EdU	Education level, measured as the proportion of high school students to the total population of the province.

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(continued)

Variables	Definitions
INDSTR	Industrial structure, defined as the proportion of secondary and tertiary industries' added value in the GDP of the province.
Other variables	
ERROR	Dummy variable, equals one if the firm's analyst forecast error is below the industry year median, and zero otherwise.
DISP	Dummy variable, equals one if the firm's dispersion of analysts' forecasts is lower than the industry year median, and zero otherwise.
SEPAR	Dummy variable, equals one if the separation of ownership and control in the firm is less than the sample industry year median and zero otherwise.
BOARD	Dummy variable, equals one if the board size of the sample firm is greater than the industry year median, and zero otherwise.
KZ	Dummy variable, equals one if the firm's kz index is higher than the sample industry year median and 0 otherwise.
ONWER	Dummy variable, equals one if the firm is state-owned and zero otherwise.
COST	Ratio of a firm's annual interest expense to total liability.
VALUE	Natural logarithm of Tobin's Q.
INCOME	The average income level for the province where the firm is located.

Note: This table presents the detailed definitions of the variables used in this paper.

### Data availability

Data will be made available on request.

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# Chapter 8

## Conclusion

### 8.1 Overview

Fintech is the outcome of the deep integration of emerging technologies and finance, and the innovative reforms it triggers are causing a disruptive impact on the global financial market. The rapid development in the field of Fintech is not only the result of technological advancement but can also be regarded as an inevitable product of the deep transformation of the traditional financial industry. Relying on novel technologies, such as big data, blockchain, Internet of Things, and artificial intelligence, Fintech shows great potential in improving the diversity of financial products and increasing the efficiency and coverage of financial services. Especially in terms of financial inclusion, the emergence of Fintech contributes to helping customer groups that are often neglected by traditional financial institutions to access financial resources and obtain financial services. The digital transformation of the traditional financial system driven by emerging technologies has enabled it to better adapt to the demands of modern economic development. Numerous studies have suggested that the Fintech development has not only driven innovation and change in the global financial industry but has also generated far-reaching impacts on the development of national economic systems, global capital liquidity, and market stability. As the rapid expansion of the Fintech industry worldwide, there has been an increasing surge in Fintech-related research. The discussion of the potential impact of Fintech development on the financial system and the real economy not only contributes to a deeper understanding of its economic consequences but also provides policymakers with a theoretical framework for formulating adaptive

policies.

This thesis aims to discuss the impact and implications of the Fintech development on the financial system and the real economy. With the rapid expansion of the Fintech sector, especially in the emerging market of China, Fintech is creating a remarkable influence on the growth strategies of companies, the behavioral patterns of market participants, and the overall market environment. By using data from listed firms in China, this paper has examined the real impact of Fintech development from several important perspectives, including liquidity creation, diversification, risk-taking, fraud, investment, and financing policies, and reveals the impact mechanisms. Notably, this thesis constructs and applies a variety of Fintech measurement indexes to quantify the trend of Fintech development. The construction of these metrics involves various methods, such as employing text mining and factor analysis to construct the indexes, using existing Fintech-related indexes, and constructing indexes based on Fintech-related patents. Through these quantitative indicators, this paper provides empirical data to support the understanding of how Fintech affects the financial market and economic environment. This thesis not only adds to the relevant research on Fintech development but also provides strategic recommendations for policymakers and financial institutions on how to adapt to this emerging field. The main findings of this thesis are presented in detail in Chapters 3 to 7.

## **8.2 Key results**

In China, traditional banks are the main liquidity providers in the economic system, supporting businesses and individuals with access to financing. Meanwhile, to meet the challenges of increased market competition and reduce risks, many commercial banks are actively pursuing diversification strategies and optimizing their revenue structure. The rise of Fintech has intensified competition in the credit market, but it has also created new opportunities for the transformation and development of the traditional financial industry. By analyzing Chinese banks between 2011 and 2021, Chapter 3 provides strong empirical evidence that the development of Fintech has a significant negative impact on bank liquidity creation and is significantly and positively correlated with bank diversification. We also confirm that these correlations are heterogeneous. Both

state-owned and smaller banks have responded weakly to Fintech development. The study finds that the outbreak of the COVID-19 pandemic has exacerbated the dampening effect of Fintech on banks' liquidity creation and weakened its contribution to bank diversification. The greatest contribution of this chapter is that I construct a new Fintech development index by combining the multidimensional information that involves advanced technologies and Fintech-related areas.

By alleviating information asymmetry, facilitating financial market informativeness, and optimizing resource allocation, Fintech has injected a strong impetus into the development and growth of Chinese companies, especially in supporting small and medium-sized enterprises and emerging industries. Chapters 4 to 7 discuss the impact of Fintech on the development strategies and financial planning of Chinese-listed companies from multiple perspectives. With the support of financial data from Chinese A-share listed companies, Chapter 4 discusses the nexus between the Fintech development, tax avoidance, and firm value, and provides empirical results to demonstrate that Fintech development contributes to an increase in corporate tax avoidance and, consequently, an improvement in firm value. Moreover, this chapter confirms that the positive role of Fintech development in tax avoidance is more salient among firms with low internal information quality, weak internal control, and more geographically dispersed operations. Fintech development mitigates tax risk and improves firms' effectiveness in capitalizing on tax preferences. Chapter 4 makes important contributions to the existing research by offering new channels and perspectives for firm value enhancement and further confirming the important real impact of Fintech on firm development.

Chapter 5 provides an analysis of the impact of Fintech on corporate strategy from the aspect of risk-taking. We find that Fintech development has a positive effect on corporate risk-taking. This impact is more pronounced in companies with a short establishment period, smaller size, and non-state ownership structure. The study further explores the possible channels through which the development of Fintech affects corporate risk-taking, that is, intervening in the relations of agency costs and financial constraints with corporate risk profiles. Moreover, the results show that Fintech promotes the growth of firm value by enhancing corporate risk-taking.

In Chapter 6, we examine the association between Fintech innovation and corporate

fraud. Empirical results show that Fintech innovation can inhibit corporate fraud. Mitigating information asymmetry and alleviating funding constraints are plausible channels through which Fintech innovation influences corporate fraud. This impact is heterogeneous across firms with different characteristics. Furthermore, Fintech innovation has a more pronounced weakening effect on fraud activities of companies with greater internal performance pressure, poorer internal governance, and a more lenient external regulatory environment. Finally, the findings of this study demonstrate that Fintech greatly reduces information disclosure and operational fraud.

Chapter 7 investigates the implications of Fintech development on corporate financial strategies from the perspective of corporate financing and investment. Empirical results support the view that the development of Fintech can improve the investment and financing of companies. Mechanism analyses suggest that reducing information asymmetry and improving corporate governance represent two plausible channels through which Fintech development affects corporate financing and investment. Moreover, further research confirms that the impact of Fintech on the financial policies of non-state-owned companies or companies with higher financial constraints is more pronounced. The study also shows evidence that the Fintech development can reduce the cost of debt and improve investment efficiency. In addition, we prove that shareholders believe that the increase in financing and investment brought about by the Fintech development has a value-added effect.

### **8.3 Future research**

Future research can further broaden the scope of the thesis and deepen the exploration of related topics to more comprehensively reveal the economic impact of Fintech development. First, future research can extend the context of the study to international markets. Numerous existing studies (Chen et al., 2019; Goldstein et al., 2019; Murinde et al., 2022) argue that innovations driven by Fintech developments are creating a disruptive impact on the global financial system. Cross-country research can contribute to an in-depth analysis of the heterogeneity of the impact on Fintech development in different economic systems, especially in contexts with different financial systems, regulatory policies, and institutional environments.

Second, a worthwhile direction for future research is to construct a new Fintech development index that includes richer information. Existing literature uses a variety of methods to capture Fintech development trends, such as building a Fintech index based on the text mining method (Cheng & Qu, 2020; Wang et al., 2021a; Lee et al., 2023; Tang et al., 2024), using the Peking University Digital Financial Inclusion Index of China compiled by a research team from the Institute of Digital Finance at Peking University and Ant Financial Services Group (Ding et al., 2022; Yang & Zhang, 2022; Wang et al., 2023; Guo et al., 2024), or calculating the number of Fintech patents (Corbet et al., 2023; Fang et al., 2023; Wen et al., 2023). Although the existing methods can measure certain dimensions of the Fintech field, there is still room for further optimisation and expansion, as well as opportunities for refinement. Constructing a more comprehensive indicator is conducive to a more accurate assessment of the development of the Fintech sector.

Third, research related to corporate strategy involves a variety of areas. This thesis analyses the impact of Fintech on corporate finance strategies from a number of perspectives. However, there are alternative channels that can be explored. Future research could explore the economic consequences of the rise of Fintech from more perspectives, such as the impact of Fintech on corporate governance, capital structure, or innovation investment. Expanding this area of research will contribute to a more comprehensive understanding of the role of Fintech on a company's corporate finance strategy and its impact on firm value growth.

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Yang, T., & Zhang, X. (2022). FinTech adoption and financial inclusion: Evidence from household consumption in China. *Journal of Banking & Finance*, 145, 106668.

## **Chapter 9**

### **Appendix: Co-Authorship form**



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## Co-Authorship Form

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Chapter 2 is published as:

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Nature of contribution by PhD candidate

Writing original draft, methodology, data collection, data analysis, results interpretation

Extent of contribution by PhD candidate (%)

70%

### CO-AUTHORS

Name	Nature of Contribution
Yang Hu	Guidance, feedback, methodological discussion, supervision
Shaen Corbet	Guidance, feedback, review & editing
Yang (Greg) Hou	Guidance, feedback, methodological discussion, supervision
Les Oxley	Supervision, guidance, critical feedback, assistance with paper preparation

### Certification by Co-Authors

The undersigned hereby certify that:

- ❖ the above statement correctly reflects the nature and extent of the PhD candidate's contribution to this work, and the nature of the contribution of each of the co-authors; and
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Nature of contribution by PhD candidate

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Les Oxley	Review & editing, Formal analysis, Investigation
John W. Goodell	Review & editing, Supervision, Investigation

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70%

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Chapter 6 is currently under review.

Fintech development and corporate financial policy: Evidence from corporate financing and investment

Nature of contribution  
by PhD candidate

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Extent of contribution  
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Yang (Greg) Hou	Review & editing, Methodology, Investigation
Les Oxley	Review & editing, Visualization, Supervision
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