The impact of internet finance on the risk-taking level of Chinese commercial banks: Mediation effect based on deposit structure

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Abstract
Purpose: Examine the relationship between Chinese commercial banks' degree of risk-taking and Internet finance, as well as the effect's channel of transmission.
Design/methodology/approach: This paper uses the Peking University Digital Financial Inclusion Index of China (PKU_DFIIC) to measure the degree of Internet finance development, and panel data of Chinese commercial banks listed on the A- and H-share markets from 2010 to 2021 as a sample. The model is constructed, and the overall effect validation, non-linear influence relationship test, and intermediary effect test are carried out. Bank deposit structure, or the ratio of time deposits to demand deposits, is used as the intermediary variable.
Findings: The level of development of Internet finance and the capacity of commercial banks to take on risk have a non-linear, inverted U-shaped relationship; the impact of Internet finance on the capacity to take on risk is mediated by the deposit structure, which acts as an intermediary in the process; the effect of Internet finance development on the capacity to take on risk is diverse, with the most notable effects being felt by commercial banks located in rural areas and the central region of the commercial banks.
Research limitations/implications: Considering the availability and representativeness of data, this study selects Chinese listed commercial banks as the research object. Non-listed banks are not included for the time being. The deposit structure in this study refers to the term structure only, i.e. the ratio of demand deposits to time deposits. Customer structure is not included. In terms of intermediation effects, this study focuses on the deposit structure end and other influence paths are not included in the focus.
Practical implications: This document offers guidance to commercial banks on how to monitor and promptly address hazards, as well as how to upgrade their risk early warning systems.
Originality/value: The difference between this study and previous studies is mainly reflected in the choice of mediating variables. The mediating variable selected in this paper is the term structure of commercial bank deposits, i.e. the ratio of demand deposits to time deposits. Some scholars use deposit structure as a mediating variable to study the impact of Internet finance on bank profitability. There are fewer studies that use deposit structure as a mediating variable to explore the relationship between Internet finance and commercial bank risk-taking.

Keywords: Internet finance, risk-taking, intermediation effects, Chinese commercial banks.

Introduction

Internet Finance

Since the twenty-first century, the world's information technology industry has developed rapidly. An "invisible net" connects everything together. The arrival of new technologies has prompted many industries to change their traditional mode of operation and seek new development. The financial industry is no exception. The combination of information technology and finance has brought a lot of convenience to people, but also made the traditional financial industry face great challenges. People's access to information has become more diversified. Investment and lending methods are also facing more choices. The emergence of new technologies such as the Internet of Things, e-money and mobile payment has significantly changed the path of moving, collecting and settling funds. They have increased the speed of funds flow and reduced the time it takes for funds to settle between banks.

Although China's Internet finance started late, it has developed rapidly in recent years by virtue of its latecomer advantages such as technology, equipment, talents and policy support, as well as the vast market brought by its huge population base. The lucrative capital market is also attracting more and more non-financial institutions to join. The payment habits and financial management practices of the Chinese populace have undergone a permanent transformation owing to businesses such as online payment and financial services.

Commercial Banks in China

Commercial banks play a significant role in China's financial sector and are essential to the country's economic growth. They undertake the important task of absorbing surplus funds from society and adjusting the supply and demand of funds. Changes in interest rates not only affect commercial banks' business development, but also their profitability and risk-taking level (Chen, R., and Chen, F., 2022). It has been over thirty years since the market-oriented interest rate reform in China was first proposed during the Third Plenary Session of the 14th Central Committee in 1993. While the monetary authority indirectly influences and determines the level of market interest rates by using monetary policy tools to achieve monetary policy objectives, interest rate marketization refers to the monetary authority giving the market the power to decide interest rates and allowing market players to make their own decisions (Cheng et al., 2021). China's interest rate market reform upholds the general idea of "first liberalizing money market interest rates and bond market interest rates, and then gradually promoting the marketization of deposit and loan interest rates", and follows the order of "foreign currency first, then local currency; loans first, then deposits; long-term and large amounts first, then short-term and small amounts" in the marketization reform of deposit and loan interest rates (People's Bank of China, 2015). Formally speaking, China's interest rate marketization process is nearly over. Interest rates have been more variable since China's interest rates were gradually deregulated and made more market driven. The link between supply and demand for funds in the market ultimately determines the price of funds (Cheng and Yao, 2021). In this context, commercial banks' deposit-taking rates and lending rates fluctuate more frequently and in a greater range. Subsequently, all major commercial banks chose to raise deposit rates to cope with the huge impact brought by Internet finance. The cheap funds available for commercial banks to absorb decreased rapidly and the cost of funds rose sharply. Banks' deposit and loan spreads narrowed, yields fell, income growth slowed, capital adequacy ratio decreased, and risk-taking levels weakened.

Commercial Bank Risk Taking and Bank Risk

The act of commercial banks taking chances or making hazardous investments originally gave rise to the idea of risk-taking in the 1980s. In a more general sense, bank risk-taking refers to commercial banks' readiness to take on all the risk associated with their business operations. In a more restricted meaning, bank risk-taking primarily refers to commercial banks' active and direct risk-taking investing behaviour. "Bank risk" is the term most used to conflate commercial bank risk-taking with gains and losses that happen outside of the bank's expectations, regardless of whether the bank makes money or loses it. Bank risk and bank risk-taking are related to each other, but they are also different from one another. While general bank risk is a dynamic concept that is subject to different portfolio development under different conditions, bank risk-taking is a dynamic measure of the bank's risky assets at a given point in time.

The bank's willingness to take certain risks, or the amount of risk exposure the bank is ready to tolerate, is the subject of this paper's analysis of bank risk-taking. Because they are unique businesses, commercial banks must assume some risk to operate. Research has indicated that commercial banks may enhance their company operations and foster growth by taking calculated and suitable risks. Conversely, unmanageable risks that are too great might hinder bank growth and perhaps lead to systemic financial concerns. The term "commercial bank risk-taking" describes a commercial bank's effort to generate a specific amount of income by assuming a portion of the risk in accordance with the terms of the applicable laws and policies. Commercial bank risk-taking can be divided into two parts, one is risk-taking before the onset of risk, refers to commercial banks to prevent the occurrence of financial risks, before the onset of risk to make preparatory measures, through a series of preventive measures to minimize the future risk may encounter. The bank's actions to lessen its own risk exposure considering the incoming risk are referred to as the second strategy, or acceptance of risk. Commercial banks' readiness to take on risk is determined by several factors, including their size, management, appetite for risk, and position in the market. Depending on the specifics of their case, various banks will select different courses of action.

Deposit Structure

Different banks have different sources of deposits and differences in deposit maturity between them. This is the deposit structure of banks (Yu and Pan, 2014; Zhang, 2016; Zhang and Cao, 2017). Bank deposit structures can be categorized in several ways. There are two common approaches to classification: A. It is separated into corporate deposits and savings deposits (personal deposits) based on customer structure. based on the segmentation that the People's Bank of China used for its statistics reports on the country's banking sector. It may be separated into demand deposits and time deposits based on maturity structure. This is still based on the categorization used in the People's Bank of China data reports (www.pbc.gov.cn) for the Chinese banking industry. Demand deposits are those that are available for access at any time and do not have a specified duration. According to Lu (2013), time deposits are those in which the depositor and the bank decide on the period and interest rate up front and deduct the principal and interest at maturity. Deposit structure is not only a reflection of a bank's deposit taking strength, but also has a constraining effect on the bank's cost control, investment development, risk management and other businesses. The term "deposit structure" in this paper refers to the term structure of deposits, i.e., the ratio of demand deposits to time deposits (Guo and Shen, 2019; Yu and Zheng, 2021; Chen, 2021).

Currently, the momentum of Internet finance development remains strong, and the financial market landscape is still in turmoil. Under such a background, how will the operational risk level of traditional commercial banks be affected? Does this impact vary among different regions and types of banks? Does the deposit structure act as a "transmission intermediary" in

this impact? How should commercial banks set regulatory guidelines and raise risk awareness in the face of these effects? In this paper, we present qualitative and empirical analyses on the above questions and propose feasible suggestions. It is hoped that it will help commercial banks to face up to the threats and seize the potential opportunities for better risk management.

Literature Review

The existing literature is not clear about the boundary determination of the scope of Internet finance. A consistent analytical framework has not been formed as to whether Internet finance is a self-constructed financial industry outside the traditional financial system, or an evolution of a new industry based on the traditional financial industry including the digital transformation of commercial banks. Conversely, though, there are differences in the selection of indicators for commercial banks' risk-taking. Some scholars choose positive indicators to reflect the risk-taking ability of commercial banks. Other scholars choose negative indicators such as the proportion of risky assets to indicate the risks faced by banks. The above differences largely determine the differences in the landing points and core findings of the existing research literature.

Internet finance in this paper includes both the new financial industry represented by fintech companies, which compete in parallel with traditional commercial banks' service systems in the fields of deposits, loans, payments, wealth management, insurance, investment and credit; and the traditional financial institutions represented by commercial banks, which absorb and integrate financial high technology, innovate and transform traditional financial business through various ways such as scenario grafting, technical cooperation and data sharing to achieve transformation and upgrading.

Empirical review related to the risk-taking of banks by internet finance

Current research on Internet finance focuses on the impact of fintech on the real economy, commercial banks, and the macroeconomy. Tian Xiujuan (2021) used a provincial dynamic panel model to verify the positive effect of Internet finance on the real economy and analyzed the difference between the role of two channels, financial innovation and technological innovation. Xiong Jian (2021) found an inverted U-shaped relationship between Internet finance and bank business performance. Yan Jingrui (2022) empirically tested the role of Internet finance in promoting commonwealth based on theoretical derivation.

In conclusion, the majority of academic study on Internet finance focuses on the micro level, with a particular emphasis on the profitability and operational performance of commercial banks. Further comprehensive study on the influence of Internet finance on banks' risk-taking and the mechanism behind its involvement is still required.

There are two dialectical ways to look at how Internet finance affects banks' risk-taking: from an increase in risk-taking to a decrease in risk-taking.

Internet finance reduces the level of risk-taking of banks

Some scholars have questioned whether digital finance will challenge commercial banks' position in financial intermediation because it serves as a conduit and facilitator for social financing (Ozili P, 2021). Digital finance can simultaneously enhance operational effectiveness and optimize internal governance; externally, it can adapt to changes in the environment and resolve financing issues; and, to some extent, it can successfully lower the risk of a stock market crash (Wu, Xiang, and Liu, 2020).

In terms of playing the function of digital finance, Zhan, Ming-Hua et al. argue that digital finance improves the financial market, improves the financial structure as well as reduces financial frictions and promotes financial market stability (Zhan et al., 2020). Customers also

spread the asset-liability business to other business areas, increasing the variety of risks but also resilience to unexpected losses (Tang et al., 2020).

Additionally, despite their differences in language, money is still at the core of digital finance, and both traditional commercial banks and digital finance carry concerns related to operations and morality. Without taking fintech and governmental monitoring into account, Zheng et al. contend that fintech can dramatically lower the amount of bank risk-taking (Zheng and Ren, 2022).

Digital finance raises banks' risk-taking level

Digital finance presents new risk issues to the financial system and the Internet financial system, even as it increases efficiency, lowers costs, and encourages financial transparency. According to Gong et al., inclusive digital finance can assist lower commercial bank risk when they reach return coverage of risk, but it still increases bank risk-taking overall (Gong and Li, 2020). However, Liang Hanshu et al. contend that while digital finance often has some negative effects during the early stages of disorderly development, these effects typically diminish and give rise to new financial risks as regulation and supervision grow (Liang and Zhang, 2021). In addition, fintech development intensifies bank competition, which in turn improves the credit structure and maturity structure of credit, and further research finds that digital finance and bank competition drive the credit structure and maturity structure of credit to adjust, thus increasing the level of bank risk-taking.

Wu, Shiwei, et al. contend that from the standpoint of interest rate marketization, digital finance will not only directly drive bank risk-taking, but it may also compel interest rate marketization, which tends to raise the risk of bankruptcy and non-performing loan rate for commercial banks, thus driving bank risk-taking even more (Wu, Zhu and Li, 2015). Interest rate marketization will force banks to increase their risk-taking levels, but the negative effects will gradually decrease as financial markets improve.

Factors influencing the risk-taking of commercial banks

First, market competition. Regarding the assumption of risks by commercial banks, market competition is an important factor that is commonly focused on by domestic and foreign researchers. However, researchers have different views on the results of the effect of market competition on bank risk-taking. Jiménez et al. (2013) found a non-linear relationship (U-shaped) between bank market competition and bank risk-taking based on franchise value theory and "risk transfer effect ". Ye Zhou et al. (2022) point out that bank competition can indirectly act on bank risk-taking by changing the level of liquidity.

Second, macro policy. Meng Weifu et al. (2022) argue that capital constraints and financial innovation can inhibit the facilitating effect of monetary easing on bank competition. From the perspective of monetary policy uncertainty, Li et al. (2022) finds that a rise in monetary policy uncertainty increases commercial banks' nonperforming loan ratios. In addition, related studies show that regulatory capital (Ahmad et al., 2007), deposit structure (Tsao et al., 2021), and asset securitization behavior (Su, Mingzheng et al., 2021) all affect commercial banks' risk-taking.

Third, other factors. Guo Liao et al. (2020) empirically verify the mitigating effect of banks' total financial derivatives use and risk-taking level, which is more significant in a high interest rate environment. In addition differences in information capturing ability within banking institutions (Jin et al., 2020), credit structure alienation, market value management (Liu et al., 2022), business diversification and management costs (Liu and Wang, 2022), and bank attribute categories (Hu et al., 2020; Li and Xu, 2020) have been used as begging the question

of how fintech changes the risk-taking of banking institutions level of transmission intermediaries and channels.

All things considered, market rivalry is the most contentious and extensively studied element influencing the risk-taking of commercial banks in academics. Monetary policy, on the other hand, is a relatively new research perspective and has great research potential. These factors tend to intensify competition among commercial banks, and the results of this competition are reflected in the relevant performance indicators such as pricing ability, credit decisions and daily management in commercial banks' operations, which make commercial banks show different levels of risk-taking.

The impact path of Internet finance on commercial banks' risk-taking

First, the influence of commercial banks' external financial technology is primarily responsible for the liability side impact. Qiu Han et al. (2018) find that money market funds such as balance of payments crowd out the market share that originally belonged to bank deposits, banks passively adopt bank wealth management to participate in the competition, the channel of bank deposit loss is strengthened, banks rely more and more on the funding source of interbank liabilities, and the overall cost of liabilities rises, and combined with the general trend of declining net interest margin of various types of commercial banks in recent years, banks do not shift their costs to loan customers Instead, they have shifted to allocate higher risk assets. At the same time, banks also actively penetrate Internet wealth management products to participate in the competition.

Overall, the impact of Internet finance on the liability side is mainly reflected in the balance sheet transmission effect brought by the competition from external fintech companies, which has the tendency to increase the operational risk of commercial banks.

Second, from the asset side, fintech empowers commercial banks to transform their asset business services, and various underlying technologies can effectively process the massive transaction data of traditional banks, thereby enhancing their convenience, perfection and rate of accessing customer information, accurately grasping the progress of customer loan projects (Demertzis et al., 2018). At the same time, modern information systems can improve the credit system and empower commercial banks to control the credit status of long-tailed high-risk customers, which helps to effectively identify credit risks, strengthen the whole process of risk control, and reduce risk taking (Berg et al., 2020).

In general, two factors will ultimately determine how Internet finance affects commercial banks' willingness to take on risk through asset-side business: the degree of competition in commercial banks' asset-side business brought by Internet finance companies on the one hand, and the credit facilitation brought by fintech for commercial banks' asset-side business transformation on the other.

Third, from the perspective of intermediate business, Internet fintech can generate scale effect in credit card and distribution, which in turn reduces banks' risk taking. According to the latest accounting standards, credit card instalment income has been classified into credit category, but the fees are still part of the intermediate business income. Banks use new technological tools for credit card approval, which can reduce risk compared to traditional methods. And Gu, Haifeng and Yan, Jun (2019) note the positive impact of third-party payments on commercial banks' deposit structure and customer expansion, both of which have a comprehensive impact on operating income and ultimately affect banks' risk control ability.

Taken together, the overall impact of third-party payments is likely to be positive, while Internet investment is also beneficial to banks' business expansion, which constitutes the impact of fintech external to banks. Internally, credit card approvals and asset side create

linkages, which, together with various types of reselling and new expansion businesses, may indirectly reduce the risks faced by banks.

Research gap
Considering the availability and representativeness of data, listed commercial banks in China are chosen as the research subjects in this study. Unlisted banks are temporarily excluded. Although representative, it is not comprehensive enough. It is hoped that the sample size will be further expanded in future studies. The deposit structure in this study refers to the term structure only, i.e., the ratio of demand deposits to time deposits. Customer structure is not included. In terms of intermediation effects, this study focuses on the deposit structure end, and other impact paths are not included in the focus, and the author still needs further research in the follow-up. In terms of conceptual definition, the existing literature does not clearly define the boundaries of the scope of Internet finance. A consistent analytical framework has yet to be formed as to whether Internet finance is a self-constructed financial industry outside the traditional financial system, or a new industrial evolution based on the traditional financial industry, including the digital transformation of commercial banks. Different scholars often differ in defining the scope when discussing the topics of Internet finance/digital finance/financial technology. There is also a lot of overlap in literature citation and data selection. And in the real world, the three are not separated from each other. Therefore, no strict distinction is made at this stage, and the accuracy needs to be improved.

The difference between this study and previous studies is mainly reflected in the choice of mediating variables. Previous studies have tended to focus more on bank operating performance and profitability levels when exploring the impact of Internet finance on commercial banks. There is still room for in-depth research on the impact of Internet finance on commercial bank risk-taking and its specific path. The mediating variable selected in this paper is the term structure of commercial bank deposits, i.e. the ratio of demand deposits to time deposits. The impact of the development of Internet finance on the proportion of demand deposits has been more widely discussed in the academic community (Shen & Guo, 2019; Sun & Wang, 2020; Zhou & Wang, 2022). Some scholars use deposit structure as a mediating variable to study the impact of Internet finance on bank profitability (Zhang X. Q.,2020; Chen Y.Y., 2021). Studies exploring the relationship between Internet finance and commercial bank risk-taking using deposit structure as a mediating variable are limited.

Hypothesis Development

The relationship between Internet finance and bank risk-taking
Commercial banks are impacted by the growth of Internet finance in both good and bad ways. Depending on how these two factors are related to one another, commercial banks' ability to take on risk may be increased or decreased.

Fintech might, on the one hand, discourage commercial banks from taking on too much risk. Marcus (1984) presented the "franchise value hypothesis," which holds that government limits on banking industry access led to monopolistic profits for commercial banks. Nevertheless, as information technology advances, commercial banks' monopolistic strength wanes and so does the franchise's worth. A portion of the payment activity of commercial banks has decreased, and demand deposits have been displaced in part by the swift growth of third-party payments. Take Alipay as an example, it accumulates big data and user traffic through e-commerce, and quickly attracts people's daily payment needs in a fast and convenient way, resulting in a large amount of demand deposits of banks flowing into the Alipay platform. Fintech has intensified the competition among commercial banks in the liability business, leading to higher deposit

rates for banks. Funding for individuals has been squeezed, prompting commercial banks to increase interbank lending to meet their funding needs. Higher funding costs have forced banks to choose higher risk businesses to increase profits, thus increasing the risk they must take.

On the other hand, Internet finance may also have a positive effect on commercial banks' risk-taking. In the face of the market crowding brought by fintech, commercial banks have started to pay attention to the use of fintech for their own transformation and development, creating a "catfish effect". Among them, technologies such as artificial intelligence, cloud computing and blockchain can quickly process massive and comprehensive data in a short period of time, helping banks to improve their data processing capabilities, understand customer information in a comprehensive manner and alleviate information asymmetry, thus prompting banks to innovate credit technology, reduce pricing costs in loan business and reduce bank risk-taking. At the same time, the development of financial technology also has a "technology spillover effect". The use of advanced information technology in commercial banks improves the management efficiency of banks' liability, asset, and intermediate businesses, and enables banks to realize Informa ionization, process, intensification, and efficiency in business management. Based on the above theory, hypothesis 1 is formulated:

H1: There is a positive relationship between the level of Internet finance development and banks' risk-taking ability, and a higher total index will enhance banks' risk resistance.

The strength of the positive and negative effects at various times in the development of fintech is not clear. Jiménez et al. (2013) find a non-linear relationship (U-shaped) between bank market competition and bank risk taking based on the franchise value theory and the "risk transfer effect". Liu, Mengfei et al. (2021) suggest an inverted "U" shaped relationship between fintech, and the risk faced by commercial banks. It is found that as the technology related to fintech matures, it will reduce the bank's management cost and enhance the bank's risk control ability, thus reducing the risk faced by the bank. The above theories are integrated, and the following hypothesis is proposed:

H2: There may be a non-linear inverted U-shaped influence relationship between the level of Internet finance development and banks' risk-taking ability, and when the level of the total index exceeds a specific threshold, the increase of the total index will instead reduce the anti-risk ability of enterprises.

Internet finance and deposit structure

The impact of Internet finance on the structure of bank deposits has been more consistently discussed in academia: Yu Yanlei, Pan Xuhua (2014) argue that the significant reduction of demand deposits is affected by online financial goods. Zhang, J. (2016), Zhang, Q. S., and Cao, B. Y. (2017) explore the changes of bank demand deposits in different development stages. Some scholars build linear regression models using monthly data of M0, M1, and Balance of Payments from June 2013-February 2014 and April 2013-June 2014, respectively (Shen and Yang, 2015; Luo and Chen, 2017)

This paper makes the following arguments about the relationship between Internet finance and commercial banks' deposit structures: first, because Internet finance money funds offer flexible redemption options, low initial investment requirements, higher interest rates than bank deposits, and convenience, some customers may decide to modify their payment and investment strategies, diverting demand deposits from commercial banks. Secondly, time deposits offered by banks often have restrictions such as starting threshold and maturity, and often provide higher quality services for state-owned enterprises and large customers. Individual customers and micro and small business customers are often not given much attention. Internet finance, which is also inclusive, provides differentiated services to micro and small customers and low-income groups, seeking more convenient and higher-yielding

investment channels for the idle funds of such "long-tail" groups. In turn, it has eroded some of the time deposits of banks. But at the same time, after the Internet financial companies diverted the time deposits of commercial banks, they will use large time certificates of deposit, interbank deposits and high interest rate entrusted wealth management, etc. to deposit funds back into the banking system in the form of time deposits, resulting in changes in the share of time deposits of banks. The combined effect of the two causes the ratio of demand deposits to time deposits in commercial banks to decline. Therefore, this paper argues that deposit competition between Internet finance and banks changes the deposit structure of commercial banks. Based on the above analysis, hypotheses are proposed.

H3: Internet finance changes the deposit structure of commercial banks, and the ratio of demand deposits to time deposits decreases.

Intermediary effects
Alipay and WeChat wallets are quickly taking over the retail payment industry thanks to the growth of Internet finance, which may influence banks' willingness to take on risk through the deposit business channel. (Sun and Yu, 2022) The development of fintech makes banks' deposit competition intensify, their liability structure tends to increase toward the interbank lending ratio, and higher funding costs lead to higher risk-taking preferences of banks (Qiu et al., 2018). Guo Pin et al. (2019) found that the development of Internet finance has raised the risk faced by commercial banks in China, which is due to the deterioration of deposit structure and higher funding costs due to Internet finance. Based on the above study, the hypothesis was formulated.

H4: Internet finance may affect the ability of banks to take risks through the deposit structure. The deposit structure plays a mediating effect in this process.

Commercial bank heterogeneity
Currently, the key elements of the institutional system's evolutionary changes in China's commercial banking industry include huge state-owned banks, joint-stock commercial banks, urban commercial banks, and rural commercial banks. Diverse types of commercial banks have distinctive characteristics. Large commercial banks are large in scale with nationwide network; joint-stock commercial banks are flexible in system, with strong incentives for innovation and high operational efficiency; urban commercial banks have geographical advantages, with concentrated business areas and difficulty in risk diversification; rural commercial banks focus on rural inclusive finance and reach high-risk long-tail customers. Based on this, this paper argues that diverse types of commercial banking institutions have different levels of their own risk-taking and behavioural approaches, and the risk-taking effects brought about by the development of Internet finance may also differ significantly (Wen et al., 2022). Furthermore, because China is a huge country, there are significant regional variations in the natural environment, economic growth, industrial structure, and financial structure. The effect of Internet finance on banks' degree of risk-taking may vary depending on the location due to the influence of regional variables. Based on this, this paper proposes research hypothesis five.

H5: The correlation between the level of Internet finance development and banks' risk-taking ability may be influenced by the type of banks and geographical areas.

Methods

Data sources and sample selection
This paper selects data from 59 commercial banks listed on China's A-shares (Shanghai Stock Exchange and Shenzhen Stock Exchange) and H-shares (Hong Kong Stock Exchange) for the study period of 2010 to 2021. The selection process and rationale are as follows. First, listed

banks are the benchmark of China's banking industry. Analysing and judging the development status of listed banks is an important method and means to understand the overall development of China's banking industry. According to the report released by the China Banking Association, there are 68 listed banks in China as of the end of 2022. According to the Analysis of China's Listed Banks' Performance in the Third Quarter of 2022 released by PricewaterhouseCoopers, listed commercial banks are equivalent to 78.98% of the total assets and 94.12% of the net profit of commercial banks in China. And compared to non-listed companies, listed companies are subject to more levels of regulation. Their data disclosure also has higher timeliness, accuracy and completeness. Therefore, listed commercial banks are selected as the research subjects. Secondly, considering that the political and economic system in Hong Kong differs significantly from that in mainland China. The Peking University Digital Financial Inclusion Index of China, the core explanatory variable selected in this paper, does not include data from Hong Kong, so 9 banks in Hong Kong are removed. Finally, 59 listed commercial banks were selected. They include 6 large state-owned banks, 9 joint-stock commercial banks, 31 urban commercial banks, and 13 rural commercial banks. The data sources of banks are annual reports of banks and authoritative databases such as Wind, CSMAR and RESSET. The Peking University Digital Financial Inclusion Index of China was published by Peking University Digital Finance Research Centre in August 2022. For individual missing data this paper uses linear interpolation to complete. Since the levels of individual indicators vary from each other, when the original indicators are directly used for analysis, the indicators with larger values, the absolute role in the evaluation model becomes more prominent and important. Therefore, in order to unify the standards of comparison and ensure the reliability of the results, the authors used the default standardized processing method of STATA software for the original variables before analysing the data and adjusted the units of some variables.

Selection of variables

Explanatory variables
The explanatory variable of this paper, commercial bank risk-taking, refers to the size of commercial banks' risk-taking capacity. Regarding its measurement indicator this paper chooses Z-score, one of the current mainstream views. z-score is one of the most used indicators to measure commercial banks' risk-taking. Zhang Jianhua and Wang Peng (2012) and other scholars also use it in their studies. Z-score (Z) is calculated by Ln (the sum of return on assets (ROA) and capital adequacy ratio (CAR) divided by the standard deviation of return on assets (σROA)) and is used to measure the size of commercial banks' insolvency risk (Roy, 1952). And the size of commercial banks' insolvency risk can measure its own stability and safety. Z-score is a positive indicator, and its larger value indicates that commercial banks are more stable, less risky, and more risk-taking ability.
In the robustness test, the explanatory variable is replaced with the ratio of risk-weighted assets to total assets in this paper. Qiu Han et al. (2018) and He Li et al. (2022) use it to measure banks' risk-taking. The measure considers both ex ante risk control and regulatory capital implications. The indicator is negative. Its higher value indicates that commercial banks actively take greater risks and need to rely on internal resources to cover losses. It is the result of a commercial bank's business choices based on profit maximization.

Core explanatory variables
The core explanatory variable of this paper is the Peking University Digital Inclusive Finance Index (PKU-DFIIC). There are many methods to measure the level of Internet finance, but no unified authoritative measurement has been formed. Among the existing studies, the following

types of measures of the level of development of Internet finance are available: (1) Using third-party payment data indicators (Wang, Yajun, 2016; Yang, Deyong, 2017); (2) Establishing an Internet finance-related word bank and constructing an index using text analysis to measure fintech (Guo, Pin, and Shen, 2015; Liu, Zhonglu, 2016); Wu, Fei, et al. (2021) used this technique along with the Java PDFbox library's text extraction feature to create a keyword bank for fintech-enabled banking. (3) Using the sum of third-party payment volume, P2P transaction volume and crowdfunding volume to the total assets ratio index of banks (Yang, Yawen, Li, Xuejing, Zhao, Jinting and Yuan, Mei). (4)Peking University Digital Inclusive Finance Index. Most scholars use the data of third-party payment amount and transaction amount of various Internet financial products as the estimated and predicted values released by Avery Consulting or other consulting organizations. However, when reading the relevant literature and obtaining the data, the author found that using a single third-party payment amount to measure the development of Internet finance and using it as the core explanatory variable is thin and unconvincing. At the same time, the existing data on third-party payment volume and P2P network lending scale are incomplete and unofficial statistics, which do not truly reflect the level of development of Internet finance in China. The Chinese government rectified and stopped about 90% of P2P companies in 2019 due to the frequent thunderstorms of P2P companies in recent years, which brought great harm to China's financial system and citizens. Thus, the "Peking University Digital Financial Inclusion Index," which is created by the Digital Finance Research Centre of Peking University and the Research Institute of Ant Financial Services Group in collaboration with the vast user data of Ant Financial Services, is chosen by this paper as the primary explanatory variables in order to guarantee the reliability of the explanatory variables based on the desirability, persuasiveness, and comprehensive authority of the selected indicators.

Although China's digital finance industry has grown significantly in the last few years and had a significant worldwide influence, there is currently no mechanism in place to gauge the industry's overall degree of growth. Using desensitized large data on digital financial inclusion from Ant Group, a research team from Peking University Digital Finance Research Centre and Ant Group Research Institute created the Peking University Digital Financial Inclusion Index of China (PKU_DFIIC). Currently, the Digital Inclusive Finance Index is made up of 33 other indicators in addition to the three dimensions mentioned above. Using the index methodology mentioned above and the hierarchical analytic approach frequently employed in related literature, the team created it for 31 Chinese provinces, 337 cities, and almost 2800 counties. The index is composed of both horizontal and vertical dimensions. Both horizontally and vertically, the index is comparable. Along with the payment, insurance, money fund, credit service, investment, and credit indices under the Digital Financial Usage Depth Index, the group also offers the Digital Financial Coverage Index, Digital Financial Usage Depth Index, and Digital Inclusion Index, all of which are based on the overall index. This collection of indices was put together with the intention of providing a set for all industries without revealing the financial institutions' trade secrets or the confidential information of their clients. The purpose of the index is to provide a set of instrumental data reflecting the status and evolution of digital financial inclusion without compromising the privacy of financial consumers and the commercial confidentiality of financial institutions. Considering the wide distribution of bank branches and the feasibility of the research proposal, this study selects the provincial-level data of commercial banks' registered locations as the core explanatory variables for the empirical analysis.

Mediating variable
Combined with the influence mechanism in this paper, the ratio of demand to time deposits of commercial banks is chosen as a mediating variable to reflect the deposit structure of commercial banks. Based on the rapid development of Internet information technology, major Internet financial institutions take advantage of their low fees, fast and convenient business processing, complete user information, and high deposit interest rates to rapidly attract customers with demand deposits, which are not valued in the banking system under the "two-eight law", resulting in the loss of demand deposits. The amount of demand deposits taken by major commercial banks dropped accordingly during the same period. At the same time, Internet financial institutions packaged the funds after absorbing a large amount of idle funds and re-deposited them back to banks in the form of large time certificates of deposit, with a view to earning high time interest income. This leads to an increase in the proportion of high-cost time deposits in banks. This variable is the one that Yue-Yi Chen (2021) uses to investigate how Internet financing affects commercial banks' profitability mechanisms.

Control variables
The risk-taking ability of commercial banks is subject to the combined effect of internal factors and external market environment of banks. Combined with the literature analysis, this paper selects GDP and M2 as macroeconomic level control variables; asset size, net profit, NPL ratio, and capital adequacy ratio as banks' internal control variables.

(1) External macro variables
In this paper, GDP, and broad money M2 are chosen as external macro variables. Using M2 and GDP as macro variables is widely available in domestic and international academia (Li, H. M., 2022; Barth, Lin, Ma, Seade, and Song, 2013).
GDP is the result of all resident units' productive activities during a certain time in a country (or area) at market prices. The GDP is the primary indicator of national economic accounting and a crucial piece of information used to assess the economic health and degree of growth of a nation or territory. It reflects the market size and strength of a country (or region). The change in this statistic indicates whether the economy of a country or area is growing or contracting.
Broad money（M2) is an economic concept that corresponds to narrow money. It is the total of time deposits held by commercial banks and narrow money (M1). M2 represents both the potential and actual purchasing power in the economy, whereas M1 represents the real purchasing power. The end market and consumption are active when M1 increases more quickly, whereas the intermediate market and investments are active when M2 expands more quickly.

(2) Internal control variables
Total assets, net profit, non-performing loan ratio, and capital adequacy ratio are chosen as control indicators at the bank level based on two viewpoints of operational efficiency and asset quality, with reference to the emphasis of banks' financial reports stated by Tang (2017).
Total assets: The sum of all resources owned or controlled by a commercial bank that have economic value and can be converted to cash. Includes both current and long-term assets. In the context of financial statements, it is usually listed on the balance sheet and can be used to evaluate the liquidity, solvency, and general financial health of an organization.
Net profit: Net profit, also known as net income, refers to a commercial bank's total revenues minus all expenses. Net profit is an important indicator of a business. It is a measure of a company's overall profitability because it represents the amount of revenue earned by the company after all costs and expenses are considered.

Non-Performing Loan Ratio: The NPL ratio is an indicator of the safety of a commercial bank's credit assets. A low NPL ratio indicates that the bank's loan risk control is stringent, and its profitability is not easily damaged.

Capital Adequacy Ratio: The higher the capital adequacy ratio of a commercial bank, the less risky and safer the operation is, which is conducive to the bank's anti-risk ability. It also brings banks higher expectations of future earnings. However, it may also lead to weaker profitability due to the reduction of available capital

Variables

Variable Type	Variable Name	Symbols	Definition
Explained variables	Risk Taking	Z-score	Ln（（ROA+CAR）/σ（ROA））(Roy,1952)
		Risk_taking	Risk-weighted assets/total assets (Qiu, 2018; He, 2022)
Core explanatory variables	The Peking University Digital Financial Inclusion Index of China	PKU_DFIIC	PKU_DFIIC Total Index (Chen,2021;He,2022)
	Coverage breadth	Breadth	PKU_DFIIC Coverage breadth
	Use depth	Depth	PKU_DFIIC Use depth
	Digitization level	DL	PKU_DFIIC Digitization level
Intermediate variables	Deposit Structure	DS	Total demand deposits / Total time deposits (Zhang X. Q.,2020; CHEN Y.Y., 2021)
Control variables	Macroeconomic development level	GDP	Nominal Gross Domestic Product
	Monetary Policy Indicators	M2	Broad money supply
	Asset Size	Asset	Total Assets
	Profitability	Profit	Net Profit
	Risk Control Level	NLR	Non-performing loan ratio×100
	Capital Adequacy Ratio	CAR	Capital adequacy ratio×100

Descriptive statistics

VarName	Obs	Mean	SD	Min	Median	Max
Z_score	708	3.65	0.154	3.163102	3.637922	4.895079
PKU_DFIIC	708	273.73	76.845	112.49	260.535	458.97
Coverage breadth	708	218.51	117.593	0.1877602	227.77	433.42
Use depth	708	237.35	126.777	1.89	236.5	510.69

Digitization level	708	278.83	143.872	0.5132785	324.69	462.23
Deposit Structure	708	1.02	1.627	0.33	0.8672658	4.06
Total Assets	708	25512	54112	513.4824	4330.11	351713.8
Net Profit	708	243.10	553.10	2.516228	37.109	3481.1
Non-Performing Loan Rate	708	1.31	0.818	0.09	1.26	13.97
Capital Adequacy Rate	708	13.46	2.885	8.01	13.14	50.33
GDP	708	684488.47	2.19e+05	320102.6	669753.7	1099198
M2	708	1490006	5.14e+05	725851.8	1471172	2382900

At the macro level, China's GDP growth is always positive from 2010 to 2021. So the maximum and minimum values correspond to the data of 2021 and 2010, respectively. In recent years, China has gradually shifted the focus of economic development from quantity to quality and efficiency. While the GDP as a whole has been growing, the growth rate has been declining annually. In late 2019, a new coronavirus emerged and swept the world rapidly, bringing immeasurable and huge losses to economies around the world. And for three long years, the Chinese government has been pursuing epidemic prevention measures based on a long-term, extensive and strict blockade. The production operations of every industry were affected to varying degrees. It was not easy to maintain positive economic indicators in this context.

In the past 10 years, China's broad monetary aggregate M2 has always maintained a growth rate of about 10%. Since the financial crisis in 2008, a large number of articles have appeared in various domestic media attacking China's sky-high M2 figures and using them as a weapon to argue that China's finance is heavily deflated, and that China's inflation is serious. Unlike the United States and other service industry-based development model, China is an industrial manufacturing-based country with fixed asset investment as the main economic development model. The Chinese model means that the base money put in by the Chinese central bank enters the production and construction sector in the form of loans through the financial system dominated by commercial banks, and a large amount of money is solidified by trillions of trillion level fixed assets instead of pouring into the consumption sector. In the process of solidifying money into assets, enterprises gain cash flow and profits, which in turn improve their technology to gain more market share. At the same time, the company's employees receive wages, which in turn are spent on food, clothing, housing and transportation, including fixed assets. The money is spent and then circulates again in the wider economy.

At the micro level, there is a great variability in the business philosophy, operation model and corporate culture of different banks, which determines the differences in the indicators of each commercial bank. Regarding the deposit structure, the maximum value is 4.06, indicating that the bank's demand deposits accounted for more than 80% of the total deposits in that year; the minimum value is 0.33, indicating that the bank's demand deposits accounted for less than 1/4 of the total deposits in that year. the median value is 0.87, which is closer to the average value of 1.02. It indicates that most banks have demand deposits and time deposits close to 1:1 in size. demand deposits pay low interest and have less financing costs. Therefore, major banks are taking demand deposits while providing asset business to enterprises. At the same time, demand deposits have a positive effect on reducing the ratio of long-term liabilities of banks,

optimizing the structure of liabilities and the efficiency of capital use, so demand deposits are particularly important for commercial banks.

In terms of total assets and net profit, large state-owned banks have a greater advantage due to their long history, numerous outlets, policy support and strong credibility. The maximum value of total assets is 351,713.38 billion yuan for ICBC, which has the largest volume, and the minimum value is 51,348.24 billion yuan for Ruifeng Bank (a rural commercial bank). The variance of both variables is large, indicating that there are large differences in asset size among different commercial banks. And the mean is much higher than the median, indicating that some banks with higher total assets/net profit pull up the mean.

The percentage of non-performing loans to the total loan number of financial institutions is known as the NPL ratio. Bank loans are evaluated for quality by assigning a risk score to each of the following five categories: normal, concern, subordinated, questionable, and loss (the latter three being referred to as non-performing loans). The current international standard states that financial institutions' warning line for the ratio of non-performing assets is 10%. China's NPL rate is declining year by year, but NPLs still threaten the financial security and stability. From the table, the median NPL ratio is 1.26, the average is 1.31, and the maximum is 13.97, indicating that most commercial banks meet the regulatory requirements for this indicator. However, because of the different strategies of ex ante risk-taking coupled with the differences in risk management level, customer industry, and customer type, there are still some commercial banks with NPL ratios higher than the alert line. The capital ratio required to guarantee banks' and other financial institutions' regular operations and growth is known as the capital adequacy ratio. As the table shows, Chinese listed banks meet the regulatory requirements with an average capital adequacy ratio of 13.46% and a median of 13.14%, both of which significantly exceed the international standard of 8%. The minimum value is 8.01%, which also meets the basic requirements.

Methodology

Fixed effects model
The Hausman test is utilized to decide between using a fixed-effects model and a random-effects model because this study employs panel data. Since the initial hypothesis is strongly rejected and the random-effects model is deemed to be inapplicable, the p-value is 0.0000. Furthermore, it was concluded that the model did not match the mixed regression model based on the F-test findings. Therefore, the fixed-effects model is chosen. Since the disturbance terms between different years of the same bank are usually autocorrelated, the two-way fixed-effects model is selected.

Mediating effects
The link between variables (X→Y) that is known as the mediating effect is not a direct causal chain relationship; rather, it is produced by the indirect impact of one or more variables (M), wherein variable M influences variable X, which in turn effects variable Y. The mediating variable is another name for the mediating effect. The indirect effect of X on Y via M is referred to as the mediating effect in this instance, and M is called the mediating variable. The following equation represents the connection between the variables in the mediating effect model scenario.

$$Y = cX + e1 \quad ①$$
$$M = aX + e2 \quad ②$$
$$Y = c'X + bM + e3 \quad ③$$

This study used the stepwise test regression coefficients' causal stages technique, which consists of three phases, to assess mediating effects (Baron & Kenny, 1986; Judd & Kenny, 1981; Wen Zhonglin et al., 2004).

The most popular technique for determining if the mediation effect is the causal stages approach method as it is straightforward and simple to comprehend. Despite the fact that some academics contend that the stepwise test has the lowest test power of all the techniques (Fritz & MacKinnon, 2007; Hay, 2009; MacKinnonet al., 2002). In other words, using stepwise testing of regression coefficients to look for significant mediating effects is challenging when the mediating impact is small. On the other hand, low test power becomes irrelevant if the researcher has used sequential testing to get meaningful results (Wen, Chung-Lin et al. 2014). Moreover, the precondition that the total effect c is significant has been argued to be unnecessary because it is entirely possible that there is a mediating effect when the coefficient c is insignificant. Shrout and Bolger (2002) show that when ab and c' are in opposite directions, it may lead to a nonsignificant coefficient c. Preacher and Hayes (2008) show that in a model with two mediating variables, if the two mediating effects are in opposite directions, it may also lead to a nonsignificant coefficient c.

The appropriateness of the distinction between partial and full intermediaries has been widely debated in academic circles. While the original purpose of full versus partial intermediation was to describe and explain the number of intermediary effects, many researchers have since questioned the appropriateness of this distinction. The main reasons include.

First, the presence or absence of complete mediation depends on the significance of the regression coefficient c', which is influenced by the sample size. It is more probable that c' will be significant the greater the sample size and the lower the standard error. As a result, the differences between full and partial mediation could not be very noticeable, and if a sufficiently big sample is collected, the full mediation conclusion might turn into partial mediation.

Second, complete mediation does not imply that the mediating variable is the only one; additional mediating factors could exist. Full mediation may be better understood as "primary mediation" from this angle as it may easily deter researchers from investigating further mediating variables. (Hayes and Preacher, 2008)

In this paper, we choose to follow the above-mentioned view and interpret full mediation as the main mediation, i.e., the independent variable X influences the dependent variable Y through the mediating variable M.

Heterogeneity detection

(1) Segmentation according to bank types
Heterogeneity analysis of banks can be analysed by dividing the economic cycle according to time series or by dividing the sample type according to cross-section. The sample data in this paper has a brief time span, and choosing to divide it on the time span may lead to problems such as unreliable statistical tests. As a result, the banks are initially divided in this article based on the sample cross-section. The business model, ownership structure, value idea, market size, and market position of major state-owned banks, joint-stock commercial banks, urban commercial banks, and rural commercial banks in China differ significantly from one another. After analysing the full-sample data, with reference to the traditional practices of Haifeng, Yan Jun (2018); Chen Estrun, Ning Yang (2018); Ye Juan, Huang Yongxing (2019); In order to do a heterogeneity analysis, this article separates the entire sample into four categories: major state-owned banks, joint-stock commercial banks, urban commercial banks, and rural commercial banks （Yu B., Zhou & Huo ,2020). Explore whether the differences between

banks in terms of business model and market size can be reflected in the impact of Internet finance on risk-taking level.

(2) Geographical division
China is a vast country with significant differences in natural environment, economic development, industrial structure, and financial structure in different regions. Due to the siphoning effect of economically developed regions, regional differences have tended to expand in recent years. In this case, geographical variables may cause variations in the effect of Internet financing on banks' willingness to take on risk. In this paper, following the traditional method (Wei, 2021; Wang et al., 2020), the full sample is divided into eastern, western, and central according to their registered locations and categorized as the second type of banks for heterogeneity analysis to explore whether regional differences among banks can be reflected in the impact of Internet finance on risk-taking levels.

Model Construction
The following models are developed based on the five hypotheses presented above.
Model 1：
$$Z-\text{score}_{it} = a + a_1\text{PKU}_{\text{DFFIC}_{it}} + a_2\text{Breadth}_{it} + a_3\text{Depth}_{it} + a_4\text{DL}_{it} + a_5\text{Asset}_{it} + a_6\text{Profit}_{it} + a_7\text{NLR}_{it} + a_8\text{CAR}_{it} + a_9\text{GDP}_{it} + a_{10}\text{M2} + \varepsilon_{it}$$
Model 2：
$$Z-\text{score}_{it} = \beta + \beta_1\text{PKU\_DFFIC}_{it} + \beta_2\text{PKU\_DFFIC}_{it}^2 + \beta_3\text{Asset}_{it} + \beta_4\text{Profit}_{it} + \beta_5\text{NLR}_{it} + \beta_6\text{CAR}_{it} + \beta_7\text{GDP}_{it} + \beta_8\text{M2} + \varepsilon_{it}$$
Model 3：
$$DS_{it} = \gamma + \gamma_1\text{PKU\_DFIIC} + \gamma_2\text{Asset}_{it} + \gamma_3\text{Profit}_{it} + \gamma_4\text{NLR}_{it} + \gamma_5\text{CAR}_{it} + \gamma_6\text{GDP}_{it} + \gamma_7\text{M2}_{it} + \varepsilon_{it}$$
Model 4：
$$Z-\text{score}_{it} = \lambda + \lambda_1\text{PKU\_DFIIC} + \lambda_2\text{DS}_{it} + \lambda_3\text{Asset}_{it} + \lambda_4\text{Profit}_{it} + \lambda_5\text{NLR}_{it} + \lambda_6\text{CAR}_{it} + \lambda_7\text{GDP}_{it} + \lambda_8\text{M2} + \varepsilon_{it}$$
Model 5:
$$Z-\text{score}_{it} = \lambda + \lambda_1\text{PKU\_DFIIC} + \lambda_2\text{Asset}_{it} + \lambda_3\text{Profit}_{it} + \lambda_4\text{NLR}_{it} + \lambda_5\text{CAR}_{it} + \lambda_6\text{GDP}_{it} + \lambda_7\text{M2} + \varepsilon_{it}$$
"i, t" stands for the specific bank and year in the equation above, respectively. The "z-score" indicates the bank "i"'s ability to take on risk in the given year "t." The unobservable random error term is indicated by "εit". The province in which a bank is registered is matched when utilizing PKU_DFIIC for measurement.

Findings
Basic regression

	(1) Z_score	(2) Z_score	(3) Z_score	(4) Z_score
PKU_DFIIC total index	2.092*			
	(1.89)			
Coverage breadth		5.693***		
		(3.57)		
Use depth			1.868**	

			(2.09)	
Digitization level				0.490
				(0.64)
Total Assets	-0.114***	-0.083**	-0.120***	-0.113***
	(-2.80)	(-2.03)	(-2.92)	(-2.69)
Net Profit	0.221***	0.160***	0.215***	0.222***
	(3.86)	(2.71)	(3.75)	(3.83)
Non-Performing Loan Rate	-0.174***	-0.182***	-0.189***	-0.186***
	(-4.56)	(-4.93)	(-5.09)	(-4.94)
Capital adequacy	2.629***	2.629***	2.625***	2.628***
	(246.69)	(248.62)	(242.48)	(243.93)
GDP_billion	0.501	2.002*	1.382	1.285
	(0.42)	(1.65)	(1.15)	(0.94)
M2_billion	-0.162***	-0.444***	-0.213***	-0.150*
	(-2.63)	(-4.07)	(-2.86)	(-1.66)
_cons	3.503***	5.320***	4.107***	3.665***
	(17.12)	(9.57)	(11.24)	(10.00)
N	708	708	708	708
R^2	0.991	0.991	0.991	0.991

Based on the Hausman test results, the fixed effects panel regression model was selected. The table displays the regression results for the primary regression model. The table indicates that at the 1%, 5%, and 10% levels of significance, the main explanatory variables and most of the control variables are significant. Among these, the "depth of use" and "breadth of coverage" indicators of the core explanatory variable PKU_DFIIC total index have a noteworthy positive influence on the risk-taking behaviour of commercial banks. Banks' willingness to take on more risk increases with the depth and scope of their online financial offerings. This predicts a positive macro-environment as well as a higher degree of Internet financial deepening will lead banks to increase their risk tolerance and thus choose riskier financial services. The higher the bank's own asset size, profitability and operational efficiency, the higher the bank's level of risk-taking, which is because banks tend to adopt more aggressive development strategies when they have better resources and operating conditions. From the bank's individual characteristics control variables, the bank's asset size regression coefficient is negative, the main reason is that the commercial bank's asset size in the early stage of the existence of the advantage, can regulate the funds, and has the confidence and ability to deal with the possible credit risk. On the other hand, as the commercial bank grows, precautions must be taken to avoid significant risks that could affect the bank as a whole. It tends to tighten its credit standards and will no longer increase its investment in risky assets at will, thus commercial banks reduce their level of risk-taking as their asset size grows. The significantly positive coefficient on bank profits suggests that sustained profitability increases banks' appetite for risk assets and may further increase risk-taking by ignoring the cost of capital and focusing excessively on the growth rate of total profits. In conclusion, there is a positive correlation between the development of Internet finance and the risk-taking capacity of commercial banks. The ability of the banks to withstand risk is positively correlated with a higher total index.

Non-linear impact relationship detection

	(1) Z_score	(2) Z_score	(3) Z_score	(4) Z_score
PKU_DFIIC total index	-0.337			
	(-0.26)			
total index_squared term	-2.478***			
	(-3.42)			
Coverage breadth		3.114		
		(1.59)		
Coverage breadth_squared term		-1.944**		
		(-2.26)		
Use depth			-1.424	
			(-0.77)	
Use depth_squared term			-2.086**	
			(-2.04)	
Digitization level				-9.375***
				(-4.46)
Digitization level_squared term				-7.432***
				(-5.03)
Total Assets	-0.162***	-0.120***	-0.143***	-0.129***
	(-3.77)	(-2.72)	(-3.36)	(-3.12)
Net Profit	0.246***	0.183***	0.237***	0.228***
	(4.30)	(3.07)	(4.07)	(4.01)
Non-Performing Loan Rate	-0.169***	-0.177***	-0.181***	-0.176***
	(-4.45)	(-4.80)	(-4.87)	(-4.73)
Capital adequacy	Capital adequacy2.622***	2.623***	2.623***	2.634***
	(244.27)	(241.81)	(241.57)	(247.87)
GDP_billion	-0.673	0.596	0.011	-2.455
	(-0.55)	(0.44)	(0.01)	(-1.60)
M2_billion	-0.110*	-0.338***	-0.078	0.182*
	(-1.76)	(-2.85)	(-0.78)	(1.65)
_cons	4.030***	5.214***	3.706***	2.625***
	(15.82)	(9.38)	(8.95)	(6.33)
N	708	708	708	708
R^2	0.991	0.991	0.991	0.992

In summary, the degree of Internet financial development and bank risk-taking ability clearly exhibit a non-linear, inverted U-shaped influence relationship; that is, the enterprise's anti-risk ability both increases and decreases as the level of Internet financial development surpasses a given critical value. Among the reasons that might apply are as follows: Commercial banks must confront the competitive power of financial technology to further its growth, as its benefits outweigh its drawbacks. Financial technology advancements have reduced management costs and increased bank management efficiency in the preliminary stages of the modest rate of Internet finance development. They have also lessened information asymmetry in the lending process and improved bank pricing power. The use of financial technology by commercial banks is still in its infancy, and even as Internet finance advances in maturity, the competition it creates is driving up the cost of bank funding. Commercial banks are more negatively impacted by the financial technology development than positively.

Intermediary effect detection

	(1) Step1	(2) Step2	(3) Step3
PKU_DFIIC total index	2.092*	-0.887**	0.525
	(1.89)	(-2.00)	(0.71)
M			0.062***
			(3.91)
Total Assets	-0.114***	0.053***	-0.077**
	(-2.80)	(2.70)	(-2.23)
Net Profit	0.221***	-0.024	0.117***
	(3.86)	(-1.09)	(3.10)
Non-Performing Loan Rate	-0.174***	-0.023	-0.190***
	(-4.56)	(-1.11)	(-5.08)
Capital adequacy	2.629***	0.029***	2.634***
	(246.69)	(5.11)	(249.27)
GDP_billion	0.501	0.424	0.867
	(0.42)	(0.65)	(0.73)
M2_billion	-0.162***	-0.046	-0.112**
	(-2.63)	(-1.46)	(-1.97)
_cons	3.503***	1.594***	3.333***
	(17.12)	(13.00)	(13.82)
N	708	708	708
R^2	0.991	0.987	0.992

The contents of the table demonstrate how Internet financing modifies the deposit structures of commercial banks and lowers the ratio of demand deposits to time deposits, in line with the introduction of the intermediation impact in the preceding theory. Internet finance affects the willingness of commercial banks to take on risk through deposit structure. A mediating role for the deposit structure is played in this process.

Heterogeneity test
bank type grouping

	(1) Large state-owned banks	(2) Joint Stock Bank	(3) City Commercial Bank	(4) Rural Commercial Bank
PKU_DFIIC total index	7.089***	2.817**	-1.021	11.240***
	(4.49)	(2.01)	(-0.79)	(3.88)
Total Assets	-0.076***	-0.404***	-1.956***	0.191
	(-4.17)	(-9.40)	(-6.41)	(0.34)
Net Profit	-0.006	0.391***	2.633***	1.443*
	(-0.27)	(10.61)	(7.85)	(1.82)
Non-Performing Loan Rate	-0.032	-0.219*	-0.069*	-0.914***
	(-0.30)	(-1.98)	(-1.69)	(-5.70)
Capital adequacy	2.858***	2.594***	2.628***	2.725***
	(89.71)	(103.38)	(231.81)	(71.76)
GDP_billion	0.585	-0.854	0.692	-0.918
	(0.79)	(-1.16)	(0.43)	(-0.34)
M2_billion	-0.311***	-0.046	-0.029	-0.483***
	(-4.77)	(-0.84)	(-0.37)	(-3.30)
_cons	0.494	2.964***	2.810***	4.434***
	(1.44)	(11.54)	(10.05)	(7.59)
N	72	108	372	156
R^2	0.999	0.998	0.995	0.979

The table shows the type of bank has an impact on the correlation between the degree of development in Internet finance and the ability of banks to take on risk. Large state-owned banks, joint-stock banks, and urban commercial banks are less affected than rural commercial banks. This is most likely because, despite having smaller assets and a lower overall size than the other three types of banks, the rural bank is more flexible and willing to take on more risks.

Geographical grouping

	(1) Eastern Region	(2) Middle Region	(3) Western Region
PKU_DFIIC total index	3.129**	1.187***	0.947*
	(2.40)	(4.61)	(1.92)
Total Asset	-0.129***	-0.218	0.333
	(-4.08)	(-0.15)	(0.22)
Net Profit	0.193***	-0.667	5.492***
	(4.39)	(-0.53)	(3.67)
Non-Performing Loan Rate	-0.112***	-1.210***	0.454*
	(-3.62)	(-4.15)	(1.99)
Capital adequacy	2.645***	2.748***	2.585***

	(191.42)	(70.49)	(128.99)
GDP_billion	0.243	-5.113	3.717
	(0.23)	(-1.34)	(1.10)
M2_billion	-0.166***	-0.477**	-0.152
	(-2.74)	(-2.46)	(-0.86)
_cons	2.750***	6.253***	3.897***
	(12.69)	(7.39)	(5.32)
N	492	108	108
R^2	0.991	0.992	0.997

The table indicates that banks' geographic location has an impact on the correlation between their level of development in Internet finance and their ability to take on risk. At the 1% level, there is a significant positive correlation between the development of Internet finance and the ability of commercial banks to take on risk in the central region. The degree of Internet financial development and the willingness of commercial banks to take on risk are positively correlated in the eastern region at the five percentiles. Both the level of development of Internet finance and the willingness of commercial banks to take on risk are positive at the 10% level in the western region.

Discussion and Conclusion
Based on the theoretical analysis and practical study, the following findings are drawn in this paper: the level of Internet financial development and bank risk-bearing capacity is positively correlated, a higher total index will enhance the bank's ability to resist risk. This conclusion is like the findings of He Li et al. 2022. The degree of advancement in online banking and the bank's capacity for taking on risk There exists a non-linear inverted U-shaped relationship (Fan, 2020 Li, 2021). If the degree of Internet finance development surpasses a particular critical value, the level of development will decrease, thereby lowering the enterprise's resistance. The ratio of demand deposits to time deposits declines because of changes in the deposit structure of commercial banks brought about by Internet finance. The deposit structure also plays an intermediary role in the relationship between Internet finance and banks' ability to take on risk, and the type of bank and the region have an impact on how much of a role it plays in this relationship.

Commercial banks should create thorough, methodical development plans, keep a close eye on the financial development trajectory, and gradually lower the marginal cost of managing and operating their banks. First and foremost, banks should always keep an eye on the current state of economic development, recognize the crisis that is emerging in digital finance, and take note of the chaotic growth and fierce competition that are currently present in the Internet finance industry (Yu and Li, 2023). Additionally, each bank's unique digital finance development scenario should be taken into consideration when deciding how best to gradually reduce operating costs through technical and managerial methods, all the while responsibly managing the risk associated with digital finance. Second, to effectively connect with the Internet financial business, commercial banks should fully utilize their advantages in terms of customer base, network layout, brand utility, etc. They should also rely on the advantages of digital finance, which include being innovation-driven and market-sensitive. Finally, they should gradually expand their multi-dimensional business channels in order to realize economies of scale by increasing their user base and service scope.

Theoretical Implications

Regarding theoretical significance, most current research on Internet finance focuses on its individual benefits and drawbacks, as well as its current state of use and future directions. There is currently a dearth of research on how Internet finance affects commercial banks' risk tolerance. Thorough investigation and enhancement are still needed. This study begins with Internet finance and the degree of risk-taking exhibited by commercial banks. It then uses both qualitative and quantitative research methods, such as information reviews, literature summaries, and data analysis, to analyse the correlation and internal transmission mechanism that exist between the two from multiple levels. It broadens the theoretical research framework on the risk-taking of commercial banks and Internet finance.

Practical and Social Implications

For depositors, the study is beneficial to their more systematic understanding of the impact and opportunities brought by Internet finance to the banking industry and a more reasonable prediction of the future trend of their chosen bank. Thus, according to the current market environment, they can make more reasonable and efficient investment plans for their funds and generate greater returns. For banks, the study is beneficial to their proper understanding of Internet finance, maintaining lending rates at normal levels, adjusting their assets and liabilities, avoiding liquidity risks, promoting smooth business transition, and avoiding vicious competition. Internet finance has the potential to be a beast, but it also has the potential to be a catfish in the catfish effect. Lastly, commercial banks are the backbone of the financial sector and are essential to the smooth operation of the Chinese economy and the stability of the country's financial system since they manage and prevent risk.

Limitations and Suggestions for Future Research

This research focuses on the mechanism by which Internet finance alters the mediating variable of commercial bank deposit structure, hence influencing the risk-taking behavior of commercial banks through empirical investigations. Other influence paths are not included in this study and need to be further explored. In addition, Internet finance is an emerging field, and compared with financial institutions such as commercial banks, the development is characterised by uncertainty and high speed. How to construct or select indicators to reflect the degree of development of Internet finance more comprehensively and accurately needs to be further explored by scholars. Based on the data's relative accessibility and completeness, this paper selects the panel data of listed banks from 2010 to 2021 as its sample. There is room for further improvement in terms of time span and sample capacity.

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