Research Article

Analysis of the Impact of Interest Rate Liberalization on Financial Services Management in Chinese Commercial Banks

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With the advancement of China's interest rate marketization reform, commercial banks' net interest margin has narrowed. This paper selects 16 representative listed banks as the research object and conducts an empirical analysis from the two dimensions: profit level and profit structure. The study finds that the marketization of interest rates promoted the narrowing of net interest margins caused by the narrowing of net interest margins, and the profitability of commercial banks was suppressed. The narrowing of net interest spreads forced commercial banks to actively expand their intermediate business activities and adjust business structure correspondingly. The narrowing of net interest spreads has different impacts on the profitability of commercial banks of different sizes.

1. Introduction

Interest rate liberalization means that interest rates are determined by the market factors rather than being set by the regulators. Through market competition mechanisms, financial institutions are allowed to set the price interest rates independently. Monetary authorities can only affect the level of interest rates through macrocontrol prudential policies indirectly. China's interest rate marketization process has adopted a form of gradual reform. With the cancellation of the deposit interest rate ceiling, the marketization of interest rates was accelerated in 2015. In August 2019, the People's Bank of China announced an improvement in the formation mechanism of the basic loan interest rate (LPR), which further deepened the market-based interest rate reform. Interest rate liberalization helps strengthen the market's leading role in resource allocation, optimizes the allocation of financial resources, and further promotes economic growth. Interest rate liberalization will also intensify competitions among financial institutions. The research found that in the process of interest rate liberalization, there is a clear phenomenon of narrowing the deposit and loan spreads. The profitability of commercial banks is affective since the main source income of the traditional business model of China's commercial banks depends on the net interest. As the main intermediary institution in the financial market, China's commercial banks play an important role in the process of capital financing in China. In the context of interest rate liberalization, the spread of deposits and loans is continuously and gradually narrowing, and the profit level and income structure of commercial banks are affected to a certain extent. How commercial banks adjust their business structure and maintain sustained profitability become more and more important and worth to be analyzed. This article will select the panel data of 16 listed commercial banks in China from 2008 to 2018, construct a regression model, reveal the different ways of changing the business structure of commercial banks through empirical researches, and make several recommendations.

2. Literature Review

Regarding net interest margins, interest rate liberalization, and commercial bank profitability, although there have been relevant research results, domestic and foreign scholars still have different research focuses.

The study of net interest spread by foreign scholars started earlier and mainly focused on the affecting factors of

deposit and loan spreads. Ho and Saunders [1] started the research by constructing a market maker model at the beginning and used this empirical research to find the level of interest spread influential by factors such as the bank's own transaction size, the external market structure of the banking industry, and the central bank's interest rate policies. The related model is continuously improved on the basis of the model by scholars including Angbazo [2], Carbó and Rodríguez [3], Claeys and Vander [4], Maudos and Solís [5], and Islam [6]. It is proved in the expanded model that the level of interest spread is affected by monetary policy, institutional factors, market structure, and the bank's own factors. There are not many foreign research materials focusing on the impact of interest spreads on bank profitability, however. Saunders and Schumacher [7], Claassen, Coleman, and Donnelly [8] studied from the perspective of the impact of macro interest rate fluctuations on bank performance. Regarding the impact of interest rate liberalization, foreign scholars have more research results from the perspective of financial deepening and financial liberalization. The existing literatures have not formed a unified conclusion on the advantages and disadvantages of financial market liberalization on a country's economy. As the literature on its merits increases, Dwumfour [9] proposed that financial liberalization helps to diversify risks, monitor agents, and promote the financial system to provide financial services more effectively and believes that in a region with comprehensive economic growth, less competitive reduction will instead lead to inefficiency in the banking market. Brissimis [10] and Shim [11] found out that low interest spreads have an impact on the bank's main income structure. They explored the path of interest rate fluctuations that led to fluctuations in the financial environment and thus affected bank income.

The domestic research on the deposit and loan spreads of commercial banks started relatively late due to China's early strict economic and financial regulations. The marketization of interest rates was launched until the end of the last century, and the issue of net interest spreads gradually attracted the attention of scholars. Regarding the study of bank spreads, scholars' discussions mainly focused on the influencing factors of bank spreads and the trend of spreads. Chinese scholars believe that the factors influencing spreads can be divided into risk factors, quality factors, market environment, and financial policy factors, and they are also related to the heterogeneous characteristics of banks. Zhou [12] believes that for many domestic commercial banks, changes in commercial banks' net interest spreads are mainly affected by capital adequacy regulation, benchmark deposit and loan spreads, and deposit interest rate controls. Wang and Guo [13] found that the relevant interest rate policies have led to a significant reduction in the net interest margin of the banking industry, rather than the development of interest income, which helps banks to cope with the adverse impact of interest rate liberalization on the net interest margin. Zhou [14], Zhang [15], Sui and Xing [16] proposed a bank spread decision model suitable for China's national conditions based on the HS market maker model. The study found that the factors that influence the spread

include default risk, interest rate risk, liquidity level, degree of risk aversion, asset size, last year's net interest spread, management model, market power, and policy support and restrictions. Ding Ning [17] conducted a structural analysis of the high deposit and loan spreads in China 's banking industry and believed that there are two main reasons for the high deposit and loan spreads in China. There is a contradiction between supply and demand in the capital market of "large banks and small enterprises." Yin et al. [18] believe that there is a negative correlation between relatively liberalized economic environment and bank spreads. Domestic scholars have not yet formed a unified view regarding the trend of interest spreads. Xiao and Wu [19] and others believe that market-oriented reforms will lead to a continuous narrowing of net interest margins. However, other scholars, Ba et al. [20], believe that although the current and future net interest spreads are narrowing, from a longer-term perspective, there will be long-term stability or expansion after narrowing trend. Chinese scholars have constructed a system of factors affecting the profitability of banks from different perspectives regarding the profitability of commercial banks.

Scholars such as Zhang [21], Liu [22], and Wang [23] believe that the bank's return on assets is the best variable to measure the bank's profit level. They have reached similar conclusions based on different data and models—the individual characteristics of the banking institution and the macroeconomic and financial structure of the bank's environment are significant factors influencing its profitability. Niu and Qiu [24] believe that the net interest spread has a significant impact on the sustainable development of the bank. The size of the net interest spread affects the bank's ability to continue to obtain cash flow in the future, and thus have an impact on the bank's risk exposure, liquidity level, and capital adequacy factors. Regarding the impact of interest rate liberalization on the operation and development of China's commercial banks, scholars generally agree that interest rate liberalization has brought challenges and opportunities to the traditional business models of commercial banks. Liu [25] believes that the marketization of interest rates will inevitably pose serious challenges to the business model of traditional commercial banks. Banks must consider potential risks, actively adjust the income structure, and implement on diversification strategy after setting up the basis of a traditional asset and liability businesses. Zhu et al. [26] believe that the marketization of interest rates, the entry of foreign banks, and the competition of local peers have made domestic banking operations unprecedentedly grim, but empirical research proves that the improvement of the marketization level and financial marketization level of the locality has a positive impact on bank performance. Wang and Guo [13] proved that the market-based interest rate reforming has lowered the bank's net interest margin and that national banks can meet the challenges by developing noninterest income, but regional banks still have difficulty using this strategy.

Foreign scholars have relatively abundant research materials on the effect of interest spreads, but there are insufficient literature papers on the effect of interest spreads

on the income structure of banks and the differences between commercial banks of different natures. There is a shortage of domestic literature research on how interest spreads are affecting the operating structure of commercial banks. This paper uses a comparative analysis method to analyze the otherness affected by different commercial banks; the research variables are relatively comprehensive, and the corresponding indicators are selected from the two perspectives of business structure and the rate of return, to a certain extent, enhances the comprehensiveness of the bank's profitability research and reliability.

3. Theoretical Analysis and Research Hypothesis of Net Interest Margin and Profit Structure

3.1. Net Interest Spread Narrows in Volatility. In general, interest spreads include spreads between deposit interest rates and loan interest rates of commercial banks, spreads between central bank rediscount rates and commercial bank loan interest rates, and spreads between domestic financial market interest rates and international financial market interest rates. The interest spreads in this article refer to the narrowly defined spreads, that is, the ratio of the bank's interest income to all interest-earning assets minus the ratio of interest expenditure to all interest-paying assets.

The net interest spreads of different commercial banks in China show a narrowing trend in volatility. From the perspective of loans, with the advancement of interest rate liberalization and the enrichment and innovation of financing tools in the capital market, commercial banks' competition in the loan market is getting fiercer. As for deposit interest rates, deposits are important sources of funds for commercial banks and are the basis for banks to carry out all other businesses, resulting in a certain price rigidity in the adjustment of bank deposit rates. Comparing the data of various banks, we can find that the change in the net interest spread of large state-owned commercial banks is smaller than that of joint-stock banks and city commercial banks. The changing trend is similar to that of national joint-stock commercial banks (see Figure 1).

3.2. Revenue Structure. Operating income reflects the operating results of the bank. From the perspective of income structure, the proportion of noninterest income is an important indicator to measure the sustainable development of the bank. From 2008 to 2018, the proportion of the noninterest income of commercial banks in China showed an increasing trend, rising from 15% to 30% on average. China's commercial banks adopt a separate business model and are subject to stricter supervision. Noninterest income mainly comes from basic businesses such as settlement and bank cards and rarely involves complex products or services. Moreover, business development in investment banking, private banking, and financial derivatives is still in its infancy. Therefore, the proportion of noninterest income in banks is relatively small. As the mixed operations dominate foreign commercial banks, intermediary business products and services are rich in variety and have a wide range of coverage, and noninterest income accounts for more than 40% to 60%. China's commercial banks are quite different from mature international banks in terms of income structure, and there is still room for development in the noninterest income business of Chinese banks. After analyzing the data, the proportion of the noninterest income of domestic commercial banks has continued to expand. Among them, joint-stock commercial banks generally have a higher proportion of noninterest income, followed by large state-owned banks, and noninterest income of regional city commercial banks. It is the most dependent part on deposit and loan spread income (see Figure 2).

According to the financial constraints theory, since the government's interest rate control is actually a monopoly privilege granted to banks, this regulation increases the bank's net interest margin. The government's interest rate liberalization is used to make the market play a decisive role in determining the level of interest rates. With the advancement of interest rate marketization reform, commercial banks' independent pricing space has expanded, and market competition has become fierce. According to the theory of interest rate determination, in the money market, the floating range of the benchmark interest rate set by government intervention is cancelled, and the actual interest rate will definitely return to the equilibrium interest rate, which causes the operating cost of commercial banks to rise. However, due to lower barriers to entry and entry of foreign banks, commercial banks have limited room to increase both loan interest rates and business rates as suppliers. In order to attract depositors, expand credit business, high interest rate lending reserves and competing for price lending may also become the normal state of future commercial banks. Therefore, interest rate liberalization has reduced the bank's net interest margin in terms of cost and revenue. At the same time, fierce market competition will force commercial banks to expand noninterest income, reduce their dependence on interest spreads, and optimize the business structure. This paper presents the following research hypotheses:

H1 : according to the theory of financial constraints and the theory of interest rate determination, the market-oriented interest rate policy has changed the pricing mechanism of the money market. The monopoly rents obtained by commercial banks have gradually decreased, the deposit and loan spreads have narrowed, and the profitability of commercial banks has been suppressed.

H2 : according to the financial deepening theory, the marketization of interest rates promotes the narrowing of net interest spreads and the narrowing of net interest spreads, forcing commercial banks to actively expand the intermediate business and increase the proportion of noninterest income, which has a positive effect on the optimization of commercial banks' business structure.

H3 : different commercial banks have different scales. Their development strategies, market positioning, and
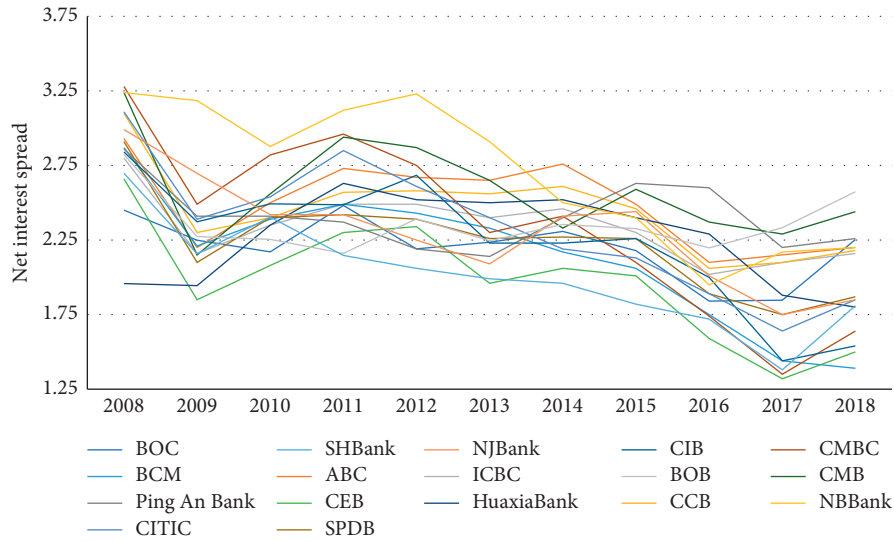
FIGURE 1: Trend chart of narrowing net interest spread fluctuations of commercial banks. Source of data: the annual reports of banks from 2008 to 2018.
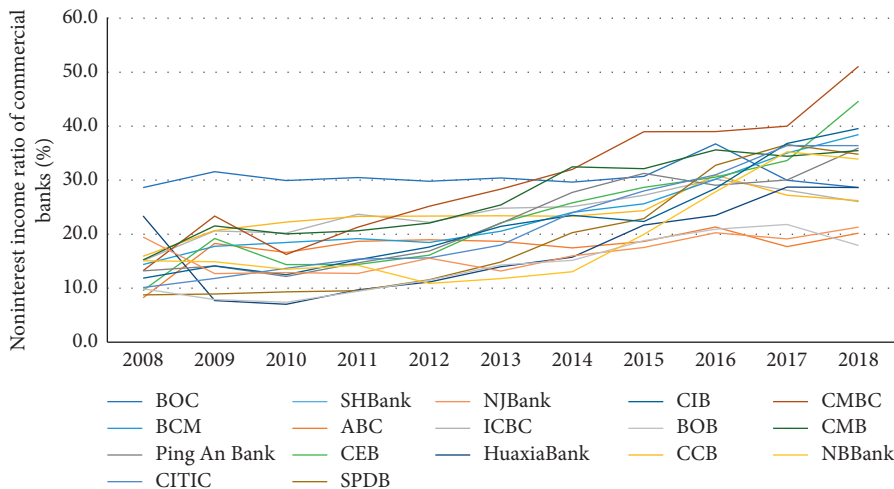

FIGURE 2: Change trend of noninterest income ratio of commercial banks from 2008 to 2018. Source of data: The Bank-scope database and bank annual reports.

business models are heterogeneous. As interest rate liberalization advances, the net interest margin narrows, and there are differences in the degree of impact on the business of commercial banks of different sizes.

4. Selection of Samples, Variables, and Models

4.1. Research Sample. This paper selects 16 listed banks, such as Bank of China and Agricultural Bank of China to be a research sample. The sample data is collected from 2008 to 2018, including the process of China's interest rate marketization. Three different types of institutions were selected to be the samples: large state-owned banks, joint-stock commercial banks, and medium-sized city commercial banks. Financial data such as income, cost, and capital

structure of commercial banks are collected from the Bank-scope database. Economic data such as GDP, total deposits in the banking sector, and the market value of the stock market are collected from the website of the National Bureau of Statistics and the EPS database. Internet financial data such as third-party payment scale and P2P transaction scale come from the "2018 China Third-Party Payment Industry Report" published by i-Research.

4.2. Variable Selection and Description

4.2.1. Explained Variables

(1) Return on Total Assets (ROA). This index is selected according to the core index of DuPont analysis system. The

indicator of the total asset return rate reflects the profitability of an enterprise more comprehensively. The higher the return on total assets shows, the higher the efficiency of the bank's asset utilization and the ability to represent the profitability indicators of commercial banks.

(2) Proportion of Noninterest Income (NIIR). The profitability of a commercial bank is not only reflected in how much profit it generates from the use of assets, but also in its income structure. With the deepening of interest rate marketization, bank interest margin income has gradually decreased. In order to maintain long-term stable development, we must reduce dependence on traditional interest income and explore other business income, and noninterest income variables reflect whether the bank's business structure needs to be optimized or not.

4.2.2. Explanatory Variables. Net interest margin (NIS). Net interest Spread = yield of interest-earning assets-interest-bearing debt interest rate = (interest income/interest-earning assets) – (interest expense/interest-earning assets). The most concerned financial indicators are banks' interest income, interest expenditure, and related assets. Net interest spread is the difference between the average loan interest rate and the average deposit interest rate of the bank, so it is more accurate when examining the efficiency of the bank.

4.2.3. Control Variables

(1) Asset Size (SIZE). Select the natural logarithm of the bank's total assets as a variable to measure the scale of assets and test whether the profitability of larger banks in the interest rate marketization process is better than that of small-scale commercial banks.

(2) Deposit-Loan Ratio (LD). The greater the value of the loan-to-deposit ratio, the greater the profitability of commercial banks. However, if the ratio exceeds a certain range, it will lead to operational risks for the bank, but it will have a negative effect on profitability. Especially in the context of interest rate liberalization, the decline in loan interest rates has a greater impact on loan interest income, causing banks to deviate from expected returns.

(3) Cost-to-Income Ratio (CIR). The cost-to-income ratio is the ratio of operating expenses to operating income of a commercial bank. The lower the ratio, the better the effect of cost and cost control, which in turn means that the bank's operating efficiency is higher and the bank's profitability is higher.

(4) NPL Ratio (RNPL). The nonperforming loan ratio refers to the proportion of subordinated loans, suspicious loans, and loss loans of commercial banks in total loans. This ratio is used to reflect the operating risks of banks.

(5) Capital Adequacy Ratio (CAR). Capital adequacy ratio is the ratio of commercial bank's capital to risk assets, which is used to measure the capital it has to withstand risks such as credit risk, interest rate risk, and political risk in the course of its operations.

(6) NPL Provision Ratio (NPL). The nonperforming loan provision ratio is the ratio of the loan loss provision actually accrued by the bank to the nonperforming loan. This ratio is an important indicator to measure whether the commercial bank can effectively offset the bad debts.

(7) National Economic Development (GDP). The operating conditions of commercial banks will be affected by the different economic cycles they are in, and the GDP growth rate can well reflect the operation of China's macroeconomy.

(8) Bank Deposit Contribution Rate (BDR) and Securitization Ratio (SR). They reflect the importance of the banking industry in the entire economy. For instance, a high ratio of bank deposits to GDP may reflect a high demand for banking services. The securitization rate is the ratio of the total market value of stocks to GDP, which measures the scale of the stock market in the entire economy and reflects the depth of financial market development.

(9) Third-Party Payment (TPP) and P2P Transactions. The securities market is a direct financing market, and there are competing and complementary relationships with commercial banks. The emergence of third-party payments and P2P transactions has weakened the financial intermediary role of commercial banks, and funds have increasingly flowed to other channels, which has hit commercial banks' sources of funds and interest income.

Variable type and description are shown in Table 1.

4.2.4. Model Building. When exploring the determinants of the profitability of commercial banks, refer to the method of Asli Demirgüç-Kunt and Harry Huizinga [27], construct linear equations, and study the impact of various variables such as the bank's own characteristics and external environmental characteristics on the bank's income and return rate.

The macroeconomic operating environment and financial market influencing factors of various commercial banks are basically similar at different time periods. Therefore, the macroeconomic operating indicators and financial market influencing factors were not taken into account the personality characteristics of banks. Based on this, this article draws on the following model:

$$y_{it} = \alpha_0 + \alpha_i A_{it} + \beta_t B_t + \gamma_t C_t + \mu_{it}. \tag{1}$$

In equation (1), i represents different sample banks and t represents the period. The interpreted variable y_{it} represents the profitability index of i bank in period t. The explanatory variable A_{it} represents the internal influencing factors of i bank in period t, B_t represents the index of the external macroeconomic operation of the commercial bank in period t, and C_t represents the external financial market influencing factors of commercial bank in period t; Further, α_0 is a

TABLE 1: Research variables and their meanings.

Variable type	Symbol	Name	Formula	Meaning
Explained variable	ROA	Return on total assets	Net profit/average total assets	Earnings performance
	NIIR	Proportion of noninterest income	Noninterest income/operating income	Profit structure
Explanatory variables	NIS	Net interest spread	Interest income/interest-earning assets-interest expense/interest-paying assets	Interest rate liberalization
Control variable	SIZE	Asset size	LN (total assets)	Commercial bank size
	LD	Loan deposit ratio	Loan amount/deposit amount	Loan proportion
	CIR	Cost-to-income ratio	Operating expenses/operating income	Costs and expenses
	RNPL	NPL ratio	Nonperforming loans/total loans	Costs and expenses
	CAR	Capital adequacy ratio	Total capital/risk assets	Risk prevention
	NPL	NPL provision ratio	Loan loss provision/nonperforming loan	Risk prevention
	GDP	National economic development	GDP annual growth rate	Macroeconomic conditions
	BDR	Bank deposit contribution rate	Total deposits in the banking sector/GDP	Financial industry development
	SR	Securitization rate	Stock market value/GDP	Financial industry development
	TPP	Third-party payment	Third-party payment scale/banking assets	I-finance
	P2P	P2P transaction	P2P transaction volume/banking loan balance	I-finance

constant, and α_i, β_t, and γ_t are coefficients. μ_{it} is a random error term.

According to the research focus and hypothesis of this article, some corrections were made to the above equation. Since this article only considers the domestic macroeconomy, deletes the relevant variables of international trade and international capital markets, and combines the correlation between indicators and the availability of data, this article constructs the following linear regression equation model.

Since the total operating income of commercial banks mainly comes from interest spread income and noninterest income, the profit formula of commercial banks can be expressed as follows:

$$NP = IR + NIR - C. \tag{2}$$

Among them, NP stands for net profit, IR stands for Interest spread income, NIR stands for noninterest income, and C stands for related costs. The interest income can be further expressed as follows:

$$IR = BL \times (1 - NPL) \times LR - BD \times DR. \tag{3}$$

Among them, BL, NPL, LR, BD, and DR represent loan amount, nonperforming loan rate, loan interest rate, deposit amount, and deposit interest rate. Further, if the loan interest rate is the sum of the deposit interest rate and the deposit-loan spread, the spread income can also be expressed as follows:

$$IR = BL \times (1 - NPL) \times (DR + NIS) - BD \times DR. \tag{4}$$

Accordingly, the net profit can be expressed as follows:

$$NP = BL \times (1 - NPL) \times (DR + NIS) - BD \times DR + NIL - C, \tag{5}$$

because

$$ROA = \frac{NP}{SIZE}. \tag{6}$$

SIZE represents total assets, then,

$$
\begin{aligned}
ROA &= \frac{BL \times (1 - NPL) \times (DR + NIS) - BD \times DR + NIL - C}{SIZE}, \\
ROA &= \frac{BL \times (1 - NPL) \times (DR + NIS) - BD \times DR + NIL - C}{SIZE} \\
&= \frac{NIS \times BL \times (1 - NPL) + BL \times DR \times (1 - NPL) - BD \times DR - C}{SIZE}.
\end{aligned}
\tag{7}
$$

Therefore, there is a positive correlation between the deposit-loan spread NIS and the ROA level of total assets.

Similarly, the expression of noninterest income ratio (NIIR) regarding the deposit-loan spread (NIS) is

$$\text{NIIR} = \frac{\text{NIR}}{\text{TR}} = \frac{\text{NP} - \text{IR} + C}{\text{TR}} = \frac{\text{NP} - \text{BL} \times (1 - \text{NPL}) \times (\text{DR} + \text{NIS}) - \text{BD} \times \text{DR} + C}{\text{TR}}$$

$$= \frac{-\text{NIS} \times \text{BL} \times (1 - \text{NPL}) + \text{NP} - \text{BL} \times (1 - \text{NPL}) \times \text{DR} - \text{BD} \times \text{DR} + C}{\text{TR}},$$

(8)

where TR represents total income, because BL > 0, (1 − NPL) > 0. That is, there is a negative correlation between the deposit-loan spread NIS and the proportion of noninterest income NIIR.

Model one is

$$\text{ROA}_{it} = \alpha_0 + \alpha_1 \text{NIS}_{it} + \alpha_2 \text{SIZE}_{it} + \alpha_3 \text{LD}_{it} + \alpha_4 \text{CIR}_{it}$$
$$+ \alpha_5 \text{RNPL}_{it} + \alpha_6 \text{CAR}_{it} + \alpha_7 \text{NPL}_{it} + \beta_1 \text{GDP}_t$$
$$+ \beta_2 \text{BDR}_t + \gamma_1 \text{SR}_t + \gamma_2 \text{TPP}_t + \gamma_3 \text{P2P}_t + \varepsilon_{it}.$$

(9)

Model two is

$$\text{NIIR}_{it} = \alpha_0 + \alpha_1 \text{NIS}_{it} + \alpha_2 \text{SIZE}_{it} + \alpha_3 \text{LD}_{it} + \alpha_4 \text{CIR}_{it}$$
$$+ \alpha_5 \text{RNPL}_{it} + \alpha_6 \text{CAR}_{it} + \alpha_7 \text{NPL}_{it} + \beta_1 \text{GDP}_t$$
$$+ \beta_2 \text{BDR}_t + \gamma_1 \text{SR}_t + \gamma_2 \text{TPP}_t + \gamma_3 \text{P2P}_t + \mu_{it}.$$

(10)

Similarly, i represents the number of sections and t represents the observation period of the section; ROA_{it} is i-commercial bank's total asset return rate in the year, which measures the profit performance of commercial banks. NIIR_{it} represents the proportion of the noninterest income of i-commercial bank in year t and measures its profit structure. NIS_{it} represents the net interest margin of i-commercial bank at time t in order to affect the profitability of commercial banks' explanatory variables. In terms of control variables, $\text{SIZE}_{it}, \text{LD}_{it}, \text{CIR}_{it}, \text{RNPL}_{it}, \text{CAR}_{it}$, and NPL_{it} are the indicators within the bank that may affect profitability. $\text{GDP}_t, \text{BDR}_t, \text{SR}_t, \text{TPP}_t$, and P2P_t represent the external environmental impact factors of commercial banks in period t. $\mu_{it}, \varepsilon_{it}$ are the random error terms of the two models, respectively.

5. Empirical Analysis

5.1. Hausman Test and Correlation Analysis. Empirical research uses panel data. Before regression, we should first figure out whether to choose a fixed-effect model or a random-effect model. This article conducts the Hausman test. The results show that both models should use fixed-effect models. In addition, in order to ensure that there is no serious multicollinearity between the explanatory variables and the control variables, correlation coefficient analysis was performed, and the results showed that the correlation coefficients between the variables were all less than 0.7, basically within a reasonable range. The control variables

selected in this paper are more reasonable and can be used for relevant empirical research.

5.2. Full Sample Regression Results. Using measurement software, the fixed-effect model is used to perform regression on the explanatory variables. The regression results of the two models are shown in Table 2.

On the whole, in the empirical results in Table 2, the R^2 of the two models is 0.64 and 0.78, respectively. The higher the goodness of fitting, the better the fitting effect of the two models. The independent variables can have an effect on the dependent variables. Moreover, both models passed the F test, indicating that the two models as a whole are significant. In both models, the net interest spread (NIS) passed the test at the 1% level, indicating that in the context of interest rate liberalization, the change in spreads can indeed have a significant impact on the profitability of commercial banks. The impact of the profit structure is different. From the empirical results of Model 1, the net interest margin (NIS) has passed the test significantly and is positively correlated with the ROA. The variable coefficient is 0.1704; that is, the larger the net interest spread, the higher the total asset return rate. The relationship between the net interest spread and the return on total assets is consistent with the research assumptions. In model two, the net interest margin (NIS) passed the test at a level of 1%, and the coefficient was -8.4801, which was negatively correlated with the profit structure indicator NIIR. That is, as the net interest margin narrowed, the proportion of noninterest income increased. This result means that it is influenced by the interest rate marketization policy. That is, the relationship between net interest margin and nonincome ratio is consistent with the research hypothesis.

For control variables, in model one, the size of bank assets (SIZE) is significant at the level of 1%, and it is positively correlated with the explanatory variable (ROA), indicating that the larger commercial banks are, the more they are capable of improving profitability. The cost-to-income ratio (CIR) is significant at the 5% level, so it is negatively correlated with the return on total assets. The nonperforming loan ratio (RNPL) passes the test at a level of 10% and has a negative correlation with the return on total assets. Reducing the nonperforming loan ratio helps commercial banks to improve their profitability. Capital adequacy ratio (CAR) has passed the test significantly, and the coefficient is positive, that is, banks with sufficient capital have stronger ability to resist risks and have higher social credibility, which is conducive to the development of businesses such as deposits and loans. Higher levels of profitability are also easier to achieve. The NPL variable has not passed the test, and the explanation for the change in the

TABLE 2: Commercial bank linear regression results.

Variable	Model one (ROA)	Model two (NIIR)
NIS	0.1704***	−8.4801***
	(4.7434)	(−7.3092)
SIZE	0.1075***	5.3488***
	(3.0811)	(3.6392)
LD	−0.0003	0.2621***
	(−0.2335)	(5.4875)
CIR	−0.0051*	−0.3077***
	(−1.8174)	(−3.1732)
RNPL	−0.0574*	2.8694***
	(−1.8489)	(2.8715)
CAR	0.0449***	0.4278**
	(7.3378)	(2.1741)
NPL	0.0030	0.5892
	(0.1675)	(1.0202)
GDP	0.0038	−0.1480
	(1.1434)	(−1.4135)
BDR	1.6426**	−6.1948
	(2.2027)	(−0.2544)
SR	−0.3846***	0.4081
	(−3.3060)	(0.1113)
TPP	−0.0012***	−0.0035
	(−5.8383)	(−0.5311)
P2P	−0.0021	−0.0447
	(−1.3860)	(−0.9596)
R^2	**0.6438**	**0.7826**
F	**20.1448**	**39.9527**

The symbols ***, **, and * indicate significant at 1%, 5%, and 10% levels.

return on total assets in this model is limited. The economic growth rate (GDP) is positively correlated with the return on total assets; that is, the better the macroeconomic operates, the more beneficial it is for commercial banks to obtain profits. The indicator of the BDR is significant at the level of 5%, and the coefficient is positive, indicating that the higher the ratio of total deposits in the banking sector to GDP, the higher the profitability of commercial banks. In other words, the overall rapid development of the banking industry has created a good environment for commercial banks to increase profits. The securitization rate (SR) has passed the significance test. This indicator is also used to measure the development of the financial market. However, unlike the deposit rate, this indicator is the ratio of the total market value of stocks to GDP. The higher the ratio, the greater the share of direct financing in the financial market. It is a market that competes with indirect financing of commercial banks, which has an adverse effect on the profitability of commercial banks. Internet financial development indicators the third-party payment indicator (TPP) is significant at the level of 1% and has a negative correlation with the total asset return of commercial banks. This means that the development of third-party payment platforms has weakened the status of commercial banks as financial intermediaries, diverted some customers, and has a negative impact on the bank's total asset return. P2P transaction scale (P2P), another indicator to measure the development of Internet finance, has not passed the significance test. The empirical results of model two: the size of bank assets (SIZE) has passed the significance test and has a positive correlation

with the variable NIIR, indicating that larger commercial banks are more capable of optimizing their profit structure. The variable loan deposit ratio (LD) coefficient is positive and passes the test at the 1% level; that is, the greater the proportion of loans, the more favorable the improvement of the profit structure of commercial banks. The cost-to-income ratio (CIR) is significant at the level of 1% and has a negative correlation with the proportion of noninterest income, indicating that the lower the cost, the more beneficial it is to expand the noninterest income business and improve the profit structure of commercial banks. The nonperforming loan ratio (RNPL) has passed the significance test and has a positive correlation with the proportion of noninterest income. However, this article believes that the effect of the nonperforming rate on the proportion of noninterest income is due to the loss of loan interest. This increase in the proportion of noninterest income is indeed a dangerous signal, not an improvement in the income structure. The capital adequacy ratio (CAR) is significant at the level of 5%, and the coefficient is 0.4278. That is, a bank with sufficient capital has more human and financial resources to innovate its new business area, expands its intermediate business with a higher social reputation, and thus obtains a higher level of noninterest income, which has a positive role in promoting the improvement of the profit structure. The NPL ratio is also an indicator to measure the risk resistance of commercial banks, but this variable has not passed the significance test, so the interpretation in this model is limited. Economic growth rate (GDP), Bank deposit contribution rate (BDR), and P2P transaction scale have a negative correlation with the proportion of noninterest income. The securitization rate (SR) and third-party payment scale (TPP) are positively correlated with the proportion of noninterest income. However, none of these macroeconomic variables, financial market variables, and Internet financial development variables beyond the bank's own scope have passed the test at a 10% significance level, so the impact is not significant.

5.3. Regression Results of Different Size Samples. From the regression results in the previous section, we have drawn the basic conclusion that there is a positive correlation between asset size and the profit level and profit structure of commercial banks. Then, whether the impact of commercial banks of different sizes in the marketization of interest rates is different will be the focus of the following research. This article divides sixteen commercial banks into three groups of large state-owned commercial banks, medium-sized joint-stock commercial banks, and small urban commercial banks based on the average assets of banks from 2008 to 2018 and performs linear regression on the panel data of the three groups of samples, respectively. Model 1 regression results are shown in Table 3.

In the empirical process of classifying by asset size, the net interest margin (NIS) and the commercial bank 's return on total assets still show a positive correlation. Both large state-owned commercial banks and joint-stock commercial banks passed the test significantly. The third group of small

Table 3: Classification sample model-regression results.

Variables	Large state-owned banks	Medium-sized joint-stock banks	Small city banks
NIS	0.2087**	0.1678***	0.0075
	(2.6952)	(3.2273)	(0.1155)
SIZE	0.0854	0.1893**	0.0032
	(1.0322)	(2.2626)	(0.0452)
LD	−0.0036*	−0.0012	0.0011
	(−1.7169)	(−0.3561)	(0.4351)
CIR	−0.0259***	−0.0104***	0.0136**
	(−4.3733)	(−3.1809)	(2.5885)
RNPL	−0.0951*	−0.1233*	0.3292*
	(−1.7764)	(−1.7216)	(2.052)
CAR	0.0023	0.0222	0.0323***
	(0.1321)	(1.3415)	(3.4033)
NPL	−0.0102	0.0747**	0.0713
	(−0.2156)	(2.128)	(1.6115)
GDP	0.0035	−0.0139**	−0.0014
	(0.6871)	(−2.1673)	(−0.268)
BDR	1.1916	−2.0148	−0.1032
	(0.8737)	(−1.5869)	(−0.0945)
SR	−0.183	0.1674	−0.3476**
	(−0.9344)	(0.8051)	(−2.1596)
TPP	−0.0026***	0.0001	−0.0014***
	(−3.9951)	(0.1934)	(−4.2494)
P2P	−0.0022	−0.0009	−0.0013
	(−0.5087)	(−0.3304)	(−0.5592)
R^2	0.8648	0.5889	0.8629
F	16.5931	12.1856	31.5443

The symbols ***, **, and * indicate a significant level at 1%, 5%, and 10%.

Table 4: Classification sample model two regression results.

Variables	Large state-owned bank	Medium-sized joint-stock banks	Small city bank
NIS	−13.5588***	−3.0516*	−3.1769
	(−5.0734)	(−1.7126)	(−1.0407)
SIZE	2.2315	6.727**	−4.2566
	(0.7817)	(2.3465)	(−1.2982)
LD	0.3563***	−0.0611	0.2572**
	(4.9041)	(−0.5344)	(2.1749)
CIR	0.3669*	−0.2093*	0.8293***
	(1.7929)	(−1.8654)	(3.3456)
RNPL	−2.8703	−1.8772	15.7069**
	(−1.5541)	(−0.7649)	(2.0811)
CAR	1.3169**	−0.5538	0.3452
	(2.1616)	(−0.9755)	(0.7720)
NPL	−2.9247*	−1.1796	6.6129***
	(−1.7831)	(−0.9807)	(3.1785)
GDP	−0.0214	−0.5243**	−0.3699
	(−0.1229)	(−2.3903)	(−1.5030)
BDR	−10.6244	−46.6835	−12.1935
	(−0.2257)	(−1.0731)	(−0.2373)
SR	−10.6243	8.9122	10.8347
	(−1.5719)	(1.2508)	(1.4308)
TPP	−0.017	0.0707***	0.006
	(−1.5509)	(4.3983)	(0.4012)
P2P	−0.0313*	−0.0142	−0.0072
	(−1.8410)	(−0.4511)	(−0.0647)
R^2	0.8526	0.7302	0.7363
F	37.9882	64.7370	10.9137

The symbols ***, **, and * indicate a significant level at 1%, 5%, and 10%.

city commercial banks was not significant. This may be affected by the small sample size, but it can still prove that the narrowing of interest rate spreads in the process of interest rate liberalization. Profitability has a negative impact. After comparing the coefficient, when the net interest margin changes, the large state-owned commercial banks have the biggest impact on the yield. This may be due to the excessive scale of state-owned commercial banks, lower operating efficiency, and greater difficulty in innovation and transformation, and the main source of income is relatively more dependent on interest income. At the same time, the medium-sized joint-stock commercial banks have strong innovation capabilities and can innovate products and services according to market demand in a timely manner, reducing the impact of narrowing spreads.

In the classification regression results of Model 2 (see Table 4), the net interest margin (NIS) still passed the significance test, and the coefficient is negative, which is negatively correlated with the NIIR. It means that due to the interest rate marketization policy, as the net interest margin narrows, the proportion of the noninterest income of commercial banks gradually increases, and the income structure is gradually optimized. And the comparison found that the coefficient of NIS in the regression model of large state-owned banks is significantly larger than that of small and medium-sized bank models. This obvious difference indicates that the proportion of the noninterest income of large banks is more affected. On the one hand, due to the relatively large deposits and loans of state-owned

commercial banks, the degree of dependence on loan interest income is high, resulting in a significant reduction in interest income when interest margins narrow. On the other hand, like other banks, market competition forces banks to actively develop intermediate businesses and optimize their own income structure. The profit structure of small and medium-sized city commercial banks is not significantly affected by the interest rate marketization policy: on the one hand, small and medium-sized banks have been established for a relatively short period of time and established new businesses and innovative products as market competition strategies at the beginning level; on the other hand, small and medium-sized banks, especially small city commercial banks, are mainly market-oriented in their local cities, and their profitability depends largely on local economic development.

5.3.1. Robust Test. In order to test the reliability of the above model results, the method of replacing the explained variables was used to conduct the robustness test, and the ROE and ROA were replaced by the ROE and IH Profit structure indicator noninterest income ratio (NIIR). The rate of return on net assets reflects the level of returns of shareholders' equity, and it can also reflect the level of corporate profits to a larger extent. The Herfindahl Index can be used to measure the degree of corporate diversification. In the study of the income structure of commercial banks, the index combines interest income and commission income to reflect the degree

of diversification of the income structure. The results of the robustness test reproved the robustness of the above models:

$$\text{Hefindar Index IH} = 1 - (\text{proportion of net interest income})^2$$
$$- (\text{commission fee})^2. \tag{11}$$

6. Conclusions and Recommendations

There is a significant positive correlation between the net interest margin and the return on the total assets of commercial banks. With the deepening of marketization, banks' original profit model that mainly relied on deposit and loan spreads to obtain profits has been hit; the main source of profit has been greatly reduced, the return on total assets has fallen, and the narrowing of net interest margins has also had an important impact on the profit structure of commercial banks. The proportion of noninterest income as an important indicator reflecting the profit source structure of commercial banks has gradually increased in the process of interest rate liberalization. The proportion of the noninterest income of commercial banks is increasing since it is affected by the continuous narrowing of net interest margins. Commercial banks should change their business structure and reduce their dependence on income from spreads; facing the challenges and opportunities of marketization, commercial banks should develop noninterest business and increase the proportion of noninterest income actively.

After comparing different sizes of commercial banks, the empirical results show the effect of independent variable changes on the differentiation of dependent variable changes. The net interest spread has a greater impact on large state-owned commercial banks when judged from the absolute value of the coefficient. Large state-owned banks have a larger scale and higher market share in the deposit and loan market. In the process of marketization of interest rates, the narrowing of net interest margins has had a greater impact on these banks. The nationwide joint-stock commercial bank originated from the stage of market competition, with more flexible institutions, larger asset scale, and consciousness and sufficient ability to pursue innovation to respond to market changes. Although urban commercial banks are small in scale and lack innovation capacity since they mainly serve the development of the regional economy, their profit performance depends largely on the regional economy, and the impact of net interest margins is relatively small.

Main recommendations: First, improve the interest rate pricing system and cultivate independent pricing capabilities. Commercial banks should continue to improve interest rate pricing capability as their core decision. In the future, the volatility of market interest rates may be greater. Commercial banks should improve their ability to avoid, diversify, and compensate for interest rate risks to ensure the stability of bank operations and ensure the stability of bank operations. Therefore, commercial banks need to accelerate the improvement of the pricing system and improve the banks' independent pricing capabilities. Second, they need to enhance cost management capabilities and increase

tolerance for narrowing spreads. The traditional model of relying on spread income is not sustainable. In the face of the decline in income growth caused by the narrowing of deposit and loan spreads, commercial banks must refine their extensive operations. Stabilize and expand asset sources and control capital costs; strengthen expense management, control operating costs throughout the process, and increase tolerance for narrowing spreads. Third, they should promote the transformation of integrated service models and improve the income structure. Commercial banks are facing more and more competition from cross-border competition, and accelerating the adjustment of profit structure is the focus of the bank's future transformation and development. We should pay attention to and carry out business and product innovation, integrate the traditional business of commercial banks into securities, funds, insurance, trust, leasing, and other fields, provide customers with new comprehensive financial services through market cross-border and mixed operation, and use technology to build a financial consumer ecosystem and then improve the bank's income structure. Fourth, in order to achieve differentiated operations, banks need to base on their own advantages. For large state-owned banks, they can make full use of their scale advantages and brand advantages, based on traditional business, cross-sell products to existing customers, and provide customers with comprehensive financial services. As for large state-owned commercial banks, the national joint-stock commercial banks have stronger innovation capabilities, are more concerned about market changes, and are more sensitive. They should maintain their advantages, adjust business layout and product characteristics in a timely manner according to market changes, and take the lead in entering the credit blue ocean market. For city commercial banks, their advantage lies in their regionality. The localization strategy is more efficient than the expansion strategy. They should be based on the local area and rely on government support to improve the adhesion of the customer group in the region, Small-scale banks such as city commercial banks should also actively introduce strategic investors, expand the scale of banks, strengthen risk management, improve corporate governance, and enhance the stability of bank operations.

Several other topics remain for further study. The innovation of the commercial bank's intermediary business model is an important direction of research. Further research on the application of modern technologies such as big data, cloud computing, artificial intelligence in the commercial bank's intermediary business development will further enhance the commercial bank's intermediary business capabilities.

Data Availability

All data included in this study are available from the corresponding author upon request. Financial data such as income, cost, and capital structure of commercial banks are collected from Bank-scope database. Economic data such as GDP, total deposits in the banking sector, and the market value of the stock market are collected from the website of

the National Bureau of Statistics and the EPS database. Internet financial data such as third-party payment scale and P2P transaction scale come from the "2018 China Third-Party Payment Industry Report" published by *i*-Research.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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