An Empirical Study on the Influence of Diversification on the Operating Cost of Commercial Banks

Jing He¹, Ke Zou^{2,*} Xinyi Cai¹

¹College of Finance and Statistics, Hunan University, Changsha, Hunan Province,410079, China ²Key Laboratory of Technologic Finance, Guangdong University of Finance, Guangzhou, Guangdong Province, 510521, China *Corresponding Author.

Abstract

The majority of the literature has focused on the impact of diversification on bank performance, while the research on the impact of diversification on bank costs is inadequate. Therefore, in this paper we empirically analyzed the impact of diversification on operating costs through a panel regression model, collecting the data of 47 Chinese commercial banks from 2005 to 2015. The empirical results showed that an increase in the non-interest income ratio significantly promoted a decrease in the cost–income ratio, and the robustness tests of different time intervals and different types of banks were consistent. This suggests that diversification effectively reduced the operating costs of banks by means of the sharing of information and equipment, the reduction of asset specificity, and the improvement of operation management synergy. This also indicates that excessive competition costs and the agency costs of diversification were lower. Further analysis showed that the diversification of national banks compared with local banks was more significant in reducing operating costs, and, for the national banks, the effects of economies of scope and scale were stronger. Diversified management strategies for local banks should be carefully promoted through the construction of strategic alliances, mergers and acquisitions, etc.

Keywords: Diversification, operating cost, non-interest income ratio, cost-income ratio, scope economy

I.Introduction

After the Third Plenary Session of the 11th Central Committee, diversification was implemented for a period of time in China's financial industry. However, the financial industry was in chaos due to factors, such as the absence of systems, inadequate internal control mechanisms, and imperfect accounting standards. Since 1993, the financial industry of China established a separate operating system through the promulgation of a series of regulations. By 2003, the establishment of "One bank and three commissions" marked the official formation of the separate operation system.

The passing of the Financial Services Modernization Act in 1999 in the United States marked a new era of integral management in financial industry, and China's financial diversification also started to grow rapidly. By the end of 2016, the non-interest income of the four state-owned commercial banks accounted for 28.47%. Major commercial banks have setup a number of financial subsidiaries or financial licenses, of which CITIC Group, Ever bright Group, and Ping An Group have developed rapidly through integrated operations.

Under the regulatory system of China's separate operations, why did the diversification of commercial banks develop so rapidly? There are both objective and external reasons, including the market demands for the financial industry to launch "one-stop" financial services, to broaden the sources of revenue for commercial banks, and to meet the competition from foreign financial institutions. From the motivation of the diversification, it is generally believed that diversification can improve the operating performance of banks through information sharing, cross-selling, and reducing the specialization of assets.

However, there is little literature research on the dynamic mechanism of reducing the operating costs of banks through diversification. Based on this, we investigated the impact of diversification on the operating costs of banks. The structure of this paper is as follows: The first part is the literature review, the second part is our theoretical analysis, the third part is the model construction, the fourth part includes the data sources and descriptive statistics, the fifth part presents our empirical analysis, and the last part is the conclusion and enlightenment.

II. Literature Review

The existing literature studies on diversification focused on the effect of integrated operations on the performance or risk of banks. Among them, most of the research supports that diversification is conducive to improving business performance. The early foreign studies provided empirical evidence. Saunders and Walter (1994) [1]proposed that banking, insurance, and securities portfolios can provide banks with a stable source of profits. Rogers (1998) [2]concluded that non-interest income business was beneficial to improving the bank's operating performance by comparing models with significant differences in non-interest income.

Using the panel data of the Italian banking industry for empirical analysis, Chiorazzo et al.(2008)^I[3]concluded that diversification enhanced the profitability of commercial banks and that those larger banks could obtain more benefits. Wang Ruixue et al. (2016) [4]conducted empirical research using empirical data from the 14-year data of Chinese listed banks and also concluded that the larger the non-interest income, the higher the return on assets. Zhang and Deng (2013) demonstrated that the financial industry can improve the operating performance of financial institutions through the realization of mixed operations and can provide economies of scale and economies of scope. Mixed operations can improve their ability to resist risks and can reduce risk management costs.

However, the impact of diversification on business performance may be nonlinear. Due to the effect of diminishing economies of scale, Nouals and Miller (1990) found that, among the North American banks, only those banks with assets more than 600 million dollars experienced performance improvement with multi-operations. Rossie et al. (2009) [5] proposed that, when the degree of diversification reach a certain range, the marginal costs and risk losses caused by agency cost exceed the marginal revenues, which results in a decrease in the bank operating performance. Alhassan (2015) [6] found that there was a non-linear relationship between income diversification and efficiency in Ghanaian banks.

Li and Li (2014) [7] used panel data of 50 banks in China from 8 years to investigate the influence of diversification on performance by building a panel threshold model. Empirical results indicated that there is a nonlinear relationship between diversification and a bank's performance. The diversification of large banks increases revenue and spreads risk, while the diversification of small banks enhances profitability but raises credit risk. Shang et al. (2016) indicated that diversification can significantly improve the operational performance of China's large-scale commercial banks; however, this is not conducive to the development of small-scale commercial banks in China. Then, does diversification have a significant effect on operating costs?

Indirectly, the reduction of operating costs is conducive to improving business performance. Guo's (2010) research showed that a bank's operating performance was inversely proportional to the cost. Yang and Zhang (2007) indicated that there was a significant positive correlation between the profit efficiency and cost efficiency of commercial banks. According to Wu and Wang (2012) [8], the extent of a bank's new business strategy had a positive impact on performance through the intermediary role of the operating cost and revenue ratio. Feng et al. (2016) [9] found that the performance of commercial banks was significantly negatively correlated with operating costs (cost–income ratio) by using the panel data of 16 listed commercial banks in China from 2007 to 2013.

Does this mean that diversification can reduce operating costs? Previous studies on this topic have not been given appropriate attention. Based on the literature review, there have been many qualitative and in-depth analyses of the

relationship between diversification and operating costs, and many studies have indirectly concluded that integrated operations are conducive to reducing costs. Williamson et al. (1989) [10] proposed that the effect of diversification on bank performance was mainly through information sharing. Aston et al. (1998) [11] indicated that the impact of diversification on bank performance also had financial synergies and a product integration effect.

Another group of researchers (Berger et al., 1987; Clark, 1988) proposed that the impact of diversification on bank performance had a cost-reduction effect. Berger et al. (1987) [12] indicated that diversification can diversify existing fixed and collateral costs, data processing costs, as well as credit review and cashiering costs. Based on research of US Banks, Clark (1988) [13] showed that certain portfolios of financial business products had cost complementarity, and loan information could be used on similar customers, which reduces the cost of information acquisition.

Pulley and Humphrey (1993) indicated that diversification banks can use existing sales channels when selling new products, thus, reducing the cost of sales and saving consumer time and transaction costs. That is, there is a two-way scope economy. Allen and Rai (1996) stated that the operational efficiency of large banks that require separate operations (that is, the prohibition of the integration of commercial banks and investment banks) was much lower than that of other banking groups, and it is clear that banks in the mixed operation industry have economics of scope.

Rogers(1998) [14] analyzed the diversification efficiency of more than 10,000 banks in the United States from 1991 to 1995. The empirical results showed that the bank's profit efficiency and cost efficiency were improved after joining non-interest business, and they concluded that non-interest business in banks had the advantages of profit efficiency and cost efficiency. Santomero et al. (2001) indicated that financial institutions can provide one-stop services for customers through diversification. On the one hand, this can reduce business operating costs, and, on the other hand, this can also save consumer time and transaction costs for information collection.

Laeven and Levine (2007) [15] proposed that diversification can promote the formation of economies of scale and economies of scope in commercial banks, thereby, controlling and reducing the costs and expenses of commercial banks, and improving the business performance of commercial banks. Zou (2016) [16] used the Granger causality test to examine the impact of diversification of Chinese listed banks on operating costs and concluded that diversification is the cause of Granger's costs for large-scale national banks. However, some researchers argued that diversification leads to lower bank efficiency and higher costs because of the growing competition of bank businesses and agency problems.

Allen et al. (2004) [17] proposed that information asymmetry is common in banking operations. In the case of asymmetric information, excessive competition will increase the proportion of banks' high-risk assets. In addition, franchises have a significant impact on a bank's risk exposure. Marcus (1984) indicated that banks with higher franchise value were inclined to low-risk decisions because they feared losing monopoly rent due to bankruptcy. Gonzalez (2005)'s analysis of bank panel data in 36 countries basically reached the same conclusion. Clearly, diversification will reduce the value of a bank franchise [18].

Scharfstein et al. (2000) [19] proposed that the agency problem and the rent-seeking behavior of the branch office will reduce the investment efficiency. Campello (2002)'s further study of financial holding groups found that the friction between the headquarters of the group and the external capital market were the root causes of low investment efficiency in the process of fund allocation [20]. Generally speaking, the cost effect of over-competition and agency problems will only stand out in the case of over-integrated operations. Stiroh and Rumble (2006) studied US financial holding companies and found that the gains from diversification were offset by the risks assumed; therefore, diversified operations did not bring better returns to the banks.

The main reason for improving the performance of commercial banks in diversification is the lower unit cost. Therefore, when analyzing the impact of diversification on the performance of commercial banks, we must focus on the relationship between diversification and operating costs at first. However, few studies directly investigated the

relationship between diversification and operating costs. From this perspective, this paper used the data of 47 Chinese commercial banks to conduct an in-depth analysis regarding the impact of diversification on operating costs using the panel model.

III.Theoretical Analysis and Hypothesis

Existing studies have excessively focused on the impact of diversification on the performance of commercial banks, while ignoring the cost effect of integrated operations. Ji et al. (2000) [21]indicated that diversification will exert economies of scope and reduce operating costs through information sharing and resource sharing. For commercial banks, separated operations and integrated operations differ in terms of regulatory costs, internal bank management costs, and social transaction costs. Although some of the studies are elaborated in theory, it is necessary to further sort out the theoretical basis and influencing mechanism of the impact of diversification on operating costs.

Diversification can reduce operating costs through economies of scope, economies of scale, and the synergy effect. However, these effects are difficult to distinguish completely, and there is a certain degree of cross-over. On the other hand, diversification also aggravated the commercial competition of commercial banks and increased the proportion of high-risk assets of commercial banks. At the same time, the complexity of the organizational structure increased the agency costs between the lower and upper departments of the commercial banks and internal departments. The effect of diversification on the operating costs can be expressed as shown in Figure 1.

3.1.Cost effect based on scope economy

Clark's research based on the Bank of America showed that certain financial business product portfolios have cost complementarity. If the cost of providing a specific financial service portfolio by a commercial bank is lower than the cost of similar financial services provided by a number of professional institutions, such as insurance companies and securities companies, then it is considered that there is scope of the economic effect. The cost effectiveness on the scope economy of diversification is mainly reflected in three aspects.

The first is to reduce costs through the sharing of information, resources, and networks. Information sharing reduces the cost of collecting information and processing information between different financial institutions and achieving economies of scope; resources and network sharing reduce the asset specificity of financial institutions and saves on the fixed cost per unit. The second is cross-selling to save costs. Cost savings are achieved through the sharing of sales, market operations, human resources, and technology.

For example, financial institutions use the same sales network and distribution channels and push multiple services, such as banking, securities, and insurance, which can reduce the unit cost of sales and achieve economies of scope. The third is to reduce the transaction costs from within financial institutions. Diversification also directly reduces the transaction costs of commercial banks. In the form of a comprehensive business organization, the full use of financial resources and different combinations of configurations have replaced some of the market transactions and reduced the transaction costs of the market.



Figure 1. The impact of integrated operations on operating costs.

3.2 Cost effect based on economies of scale

The scale economy effect means that the average cost of the product will decrease when the production scale of a certain product expands, or when the provision of a service and combination of products is constant, and the average cost decreases as the combined production scale increases. Commercial banks, loans, wealth management, and trust products have a significantly homogeneity, and infrastructure and industry information can be shared among banks, securities, and insurance businesses.

When the asset specificity is high, the larger the scale, the lower the unit cost and the higher the return. Through the diversification of banks, the diversification of products can greatly increase the output of banks, apportion the information costs and fixed costs, reduce the average cost, and ultimately achieve economies of scale. In particular for larger commercial banks, diversification has advantages in reducing operating costs. According to Hou and Zeng (2016) [22], with the expansion of the business scale and network outlets, unit operating costs significantly decrease. Compared with other industries, the long-term cost curve of commercial banks is flatter, with more potential for economies of scale.

3.3 Cost effects based on synergy effects

The synergy effects of diversification mainly include operational coordination, customer collaboration, market synergy, financial synergy, management synergy, and geographical cooperation. By comparison, it is difficult to distinguish between the scope economic effect and the synergy effect; however, the content of the former is wider than that of the latter.

Operational coordination mainly refers to the coordination of tangible assets, including office space, fixed asset equipment, management sales personnel, funds, and so on. For example, under the integrated operating conditions, commercial banks can conduct securities and insurance business at the same time, which reduces rental costs or the specificity of assets and improves the efficiency of asset utilization. Market synergy and customer synergy mean that when a commercial bank carries out a new business, it can use existing market resources and customer resources to promote and reduce the market development costs and marketing costs. Financial synergy and management synergy in the group company can more reasonably distribute liquidity among different subsidiaries, reducing capital occupation and capital costs. Management synergy is the diffusion of the group company's advanced management concepts and technologies. This could either be the diffusion of different subsidiaries or of different regions.

3.4 The Over-competition costs and agency costs of diversification

The rising level of diversification means that the financial industry has implemented more mixed operations. Commercial banks continue to face competition from other banks, and to a certain extent, they also have increased competition with the insurance and securities industries. Financial innovation under diversification also aggravates information asymmetry, and commercial banks tend to allocate a higher proportion of high-risk assets. Excessive competition also makes the commercial bank's franchise value drop, and banks will increase risk decision-making.

From the agency perspective, the head office is a risk averter as a principal, and expects to bear the minimum risk after paying the established salary. A branch or integrated business department as an agent responsible for credit risk is risk-neutral, and has more business information. The incompatibility of incentives between the head office, branches, and integrated business department can lead to an increase in operating costs. If the authority of branches or integrated business department is too small, it will increase the head office's cost of searching information. If the head office has excessive operating authority, lease behavior can easily lead to insider control and increase the agency cost.

Based on the above theoretical analysis, the effect of diversification on the operating costs of commercial banks has two effects that are both positive and negative. The following assumptions are proposed in this paper:

H1: Diversification is good for reducing operating costs.

H2: Compared with local commercial banks, the cost effect of the diversification of national commercial banks is more obvious.

The logic of H2: Under the assumption that H1 is established, diversification exerts the advantages of low cost through the scope economy, scale economy effect, and synergy effect. National commercial banks have advantages over local commercial banks in terms of scale, geographical location, and business scope. These advantages will help the nation-wide commercial banks achieve better cost-saving effects in their diversification.

H3: Diversification is not conducive to reducing operating costs.

Next, the hypotheses will be tested with empirical evidence. If the effects of economies of scope, economies of scale and synergies are greater, then H1 and H2 are supported. If the over-competition costs and agency costs of integrated operations are greater, then H3 is supported.

IV.Model Construction

We constructed the following model to test the impact of integrated operations on operating costs:

$$cir_{it} = \alpha_0 + \beta_1 nii_{it} + \beta_2 \ln a_{it} + \beta_3 nim_{it} + \beta_4 npl_{it} + \beta_5 bbl_{it} + \beta_6 car_{it} + \beta_7 gdpr_t + \varepsilon_{it}(1)$$

Where the explained variable cir_{it} is the cost-to-income ratio, which represents the operating cost of the bank; the explanatory variable nii_{it} is the ratio of non-interest income, representing the bank's integrated operations.

The selection of control variables is as follows: $ln a_{it}$ represents the logarithm of the asset scale. It indicates that the greater the size of the bank, the more likely for the bank to have the economies of scale effect, and, the lower the unit cost, the more it can reduce the bank's operating costs; therefore, the expected symbol is negative. nim_{it} represents the net interest margin where, the larger the net interest margin of the bank, the stronger the profitability of the bank's interest-bearing assets, and, the lower the cost of interest expenses, and the lower the operating cost; therefore, the expected sign is negative.

The non-performing loan ratio and provision coverage are npl_{it} and bbl_{it} , respectively. Non-performing loans can generally be offset through profits. Therefore, the higher the non-performing loan ratio, the more profits are used to offset losses. This also means that banks need to accrue more provisions for loan losses and occupy interest-bearing funds, resulting in higher operating costs. Both symbols are expected to be positive. car_{it} is the capital adequacy ratio. The higher the capital adequacy ratio, the more self-owned capital of the bank and the higher the proportion of shareholder commitments when losses are incurred. Therefore, the bank will increase the level of prudent operations to reduce the risk exposure, and the operating costs will be relatively lower. The expected sign is negative.

 $gdpr_t$ is the macroeconomic growth rate. It indicates that the better the macroeconomic environment, the better the operating conditions of the entities, and the lower the bank's loan losses. In addition, due to the rapid growth of credit, the lower the level of competition for deposits and loans between banks, the lower the operating costs. The expected sign is negative.

Through theoretical analysis, we can see that the integrated operation can also exert economies of scale effects of the bank through business expansion, and there may be interactions between the bank scale and the integrated operation. Therefore, the product term of the diversification and asset size is added to the model (1):

 $cir_{it} = \alpha_0 + \beta_1 nii_{it} + \beta_2 \ln a_{it} + \beta_3 nii * ast_{it} + \beta_4 nim_{it} + \beta_5 npl_{it} + \beta_6 bbl_{it} + \beta_7 car_{it} + \beta_8 gdpr_t + \varepsilon_{it}$ (2)

Where $nii * ast_{it}$ is the product item of the non-interest income ratio and the scale of assets, which reflects the interaction between diversification and the scale of the bank. The purpose of not using $ln a_{it}$ for the bank size is to reduce the collinearity between $ln a_{it}$ and $nii * ast_{it}$.

In addition, to test the robustness of the regression results, four sub-models were further constructed for analysis in different time intervals and different types of banks. Among them, the robust regression of some bank types can be used to test Hypothesis 2 (H2).

V.Data Sources and Descriptive Statistics

We selected a wide range of 47 databanks nationwide as the research objects in order to make the samples representative. The 47 commercial banks included five major state-owned commercial banks, 11 joint-stock commercial banks, and 31 city commercial banks. To study the relationship between the banks' integrated operation and operating costs over a long period of time, the time period chosen for this study was 2005–2015. From 2005 to 2015, the missing data became less over time and also became more comprehensive. Although 11-year data were selected, the cross-section individual cases were still much larger than the length of time. The panel data in this paper was unbalanced short-panel data.

The relevant data of all the indicators in this article came from authoritative channels. The bank-related indicator data or its original data were all derived from the Bankscope database. The macroeconomic variable GDP growth rate came from the website of the National Bureau of Statistics.

The descriptive statistics of all indicators in this paper are shown in Table 1. From the observations, the data of some indicators is incomplete, and, at the same time, the GDP growth rate is time series data. The average value of the cost-to-income ratio of 47 commercial banks was 34.77, the minimum was 12.12, and the maximum was 98.57, which indicates that the operating costs of different banks were significantly different. The average value of the non-interest income ratio was 15.39, the minimum value was -4.93, and the maximum value was 73.63, which indicates that different banks had very different levels of integrated operations. Among them, the non-interest income of certain city commercial banks was even negative.

From the time dimension, the operating costs of banks showed a downward trend, while the level of comprehensive operations showed a rising trend of volatility. The results preliminarily support the hypothesis H1. The simple average of the cost-to-income ratio in 2005 was 44.46%, which dropped to 31.37% by 2015 and fell by more than one-third in 11 years.

Commercial bank diversification is greatly affected by regulatory policies and regulations. In 2007, the simple average of the proportion of non-interest income increased to 17.29%, but then declined again in the following years. By 2015, the simple average of non-interest income ratio reached 22.38%. Of course, the above statistics may not be accurate because the missing values of samples in different years are very different.

Table 1. Descriptive analysis of indicators						
Variable	Implication	Obser- vations	Mean value	Standard deviation	Minimum	Maximum
cir	Cost-to-income ratio	399	34.77	9.26	12.12	98.57
nii	Non-interest income ratio	399	15.39	11.20	-4.93	73.63
lna	Logarithm of asset scale	400	17.47	2.12	13.33	21.95
nii*ast	Product of non-interest income ratio and scale of assets	399	5920	13978	-27	81428
nim	Net interest margin	399	3.16	1.00	0.8	6.93
npl	Non-performing loan rate	386	1.79	3.41	0	41.86
bbl	Provision coverage	378	241.28	138.73	20.42	962.61
car	Capital adequacy ratio	374	12.68	4.11	4.13	62.62
gdpr	GDP growth rate	11	9.67	2.22	6.9	14.16

The relationship between integrated operations and operating costs is further presented in the form of a scatter plot. Figure 2 shows that there was a negative correlation between the ratio of the non-interest income to the cost-to-income ratio in state-owned banks and share banks. The correlation coefficient between the non-interest income ratio and cost-to-income ratio of state-owned banks was -0.485, the coefficient of correlation between the non-interest income ratio and cost-to-income ratio of stock banks was -0.332, and the correlation coefficient between the non-interest income ratio and cost-to-income ratio of urban commercial banks was -0.09. It is difficult to see obvious correlations from the correlation coefficients or scatter plots. Next, an accurate analysis of the relationship between the non-interest income ratio and cost-to-income ratio will be made through an econometric model.



Figure 2. Scatter Diagram of the Cost-to-Income Ratio and Non-Interest Income Ratio of National Banks.

VI.Empirical Analysis

Before the empirical analysis, the six regression models (including robust regression models) of this paper were performed with F-tests and Hausman tests to determine whether to use mixed-regression models, fixed-effect models, or random-effect models. The results of the F-test and the Hausman test are shown in Table 2. The test results showed that both the mixed regression model and the random effects model in Models (1)–(5) were rejected at the 1% level of significance. Model (6) rejected the mixed regression model at the 1% significance level and rejected the random effects model at the 10% significance level. Therefore, the empirical results of this paper only report the results of the fixed-effect regression.

				0		
Model	(1)	(2)	(3)	(4)	(5)	(6)
F-test	11.20	11.51	22.11	23.52	28.26	8.92
Value P	0.000	0.000	0.000	0.000	0.000	0.000
Chi2	46.59	49.23	28.32	23.29	41.38	12.65
Value P	0.000	0.000	0.0002	0.000	0.000	0.081
Conclusion	FE Model					

Table 2. F-test and Hausman test results of the regression model

The regression results of the impact of integrated operations on operating costs are shown in Table 3. From the results of model (1), the coefficient of nii was negative and significant at the 1% confidence level. The higher the non-interest income ratio, the lower the cost-to-income ratio of banks. This indicates that diversification significantly reduced the bank's operating costs by exerting economics of scope effects. The results support hypothesis H1 and refute hypothesis H3.

Among other control variables, the coefficient of the logarithm of asset scale (lna) was negative and significant at the 1% confidence level. The larger the scale of the assets, the lower the cost-to-income ratio of the banks, indicating that the banks had reduced unit costs through economics of scale effects and that the coefficient symbol was in line with the expectations. The coefficient of the net interest margin (nim) was negative and significant at the 1% confidence level. The higher the net interest margin, the higher the level of interest income, the stronger the profitability, and the lower the cost-to-income ratio of the bank, consistent with expectations. The coefficient of the non-performing loan rate (npl) was positive and significant at the 5% confidence level. As the non-performing loan ratio increases, banks require more funds to write off non-performing loans, which will push up the banks' operating costs.

The coefficient of bbl was positive and significant at the 15% confidence level. Accrual of loan provision raises the cost of capital holding, which will affect the cost-to-income ratio of the bank. These two coefficient symbols also conform to our common sense. The coefficient of the capital adequacy ratio (car) was negative and significant at the 1% confidence level. The capital adequacy ratio does not increase the bank's operating costs. On the contrary, the higher the capital adequacy ratio indicates that the higher the bank's own capital, the lower the risk of taking risks, and the lower the additional costs, such as loan losses. The coefficient of the GDP growth rate (gdpr) was negative and significant at the 1% confidence level. With the smooth development of the national macro economy, the operating costs of the banks were lower, and the coefficient symbol was in line with the expectations.

In the regression of model (2), the interactive term, product of the non-interest income ratio and the scale of assets (nii*ast) of diversification, was added. The results show that the coefficient of nii was negative and significant at the 5% confidence level. The coefficient of nii*ast was also negative and significant at the 5% confidence level. This indicates that there was a positive correlation between diversification and a bank's size in China's banking industry.

Diversification exerts the economies of scale in different business areas, while large-scale banks are more capable of exerting scope economic effects (in other words, the diversification of large banks can save more costs by reducing

the asset specificity of outlets and equipment). The regression results of the other control variable coefficients were consistent with model (1), where bbl became significant at the 10% confidence level.

8		
	(1)	(2)
nii	-0.228***	-0.194**
	(-3.17)	(-2.46)
lna	-4.980***	-4.917***
	(-4.48)	(-4.49)
nii*ast		-0.0001**
		(-2.55)
nim	-3.308***	-3.117***
	(-3.12)	(-2.78)
npl	0.144**	0.138*
	(2.02)	(1.95)
bbl	0.005	0.005*
	(1.60)	(1.65)
car	-0.330***	-0.286**
	(-2.76)	(-2.52)
gdpr	-1.044***	-1.161***
	(-3.71)	(-3.91)
_cons	148.140***	146.998***
	(7.33)	(7.40)
Туре	Fixed effects	Fixed effects
Sample size	361	361
R2	0.301	0.316
F-statistics	19.07	26.81

Table3	Regression	results of	the impact	of the integ	rated onera	tions on o	nerating	rnsts
Lautes.	Acgi coston	I Courto OI	the impact	or the mice	\mathbf{I} alcu upci a		per aung	CUSIS

VII.Robustness Test

To enhance the credibility of the regression results, different time intervals were chosen for robust regression. The results of the regression are shown in Table 4. The time period for the regression was 2011–2015, and the sample size was 213.

The regression results of model (3) show that the coefficient sign and significance level of nii were essentially consistent with model (1), and even the coefficient values were not significantly different (approximately 10% change), indicating that there is a quite stable relationship between the proportion of the non-interest income and the cost-to-income ratio. The regression results of model (4) also show that the coefficient sign and significance level of nii were essentially consistent with model (1).

The coefficient of nni*ast was also negative and significant at the 1% confidence level. In terms of the control variables, the coefficient sign and significance of nim were essentially consistent with model (1). The net interest margin was calculated based on the interest income and interest expense, which accounts for a large proportion of the operating costs. Therefore, the impact on operating costs was important and significant.

The sign and significance of the non-performing loan rate npl, provision coverage bbl, capital adequacy ratio car, and economic growth rate gdpr changed significantly. Although the impact of the control variables changed significantly, the effect of the non-interest income ratio on the cost income did not change much. This shows that diversification can reduce the operating costs of banks, and this conclusion is rather stable.

CONVERTER MAGAZINE

Volume	2021,	No.	5
--------	-------	-----	---

Tables. Robustless tests with unterent time intervals				
	(3)	(4)		
nii	-0.203***	-0.188***		
	(-3.31)	(-3.26)		
lna	-6.020**	-5.482**		
	(-2.31)	(-2.15)		
nii*ast		-0.0002***		
		(-3.10)		
nim	-3.666***	-3.483***		
	(-5.02)	(-4.90)		
npl	0.107	0.032		
	(0.29)	(0.09)		
bbl	-0.000	-0.002		
	(-0.04)	(-0.63)		
car	-0.346	-0.223		
	(-1.58)	(-0.96)		
gdpr	-0.616	-0.903*		
	(-1.16)	(-1.83)		
_cons	165.004***	157.424***		
	(3.07)	(3.02)		
Туре	Fixed effects	Fixed effects		
Sample size	213	213		
R^2	0.285	0.330		
F-statistics	5.80	7.41		

 Table4. Robustness tests with different time intervals

Based on different types of banks, we further examined the robustness of the regression results of the impact of diversification on operating costs. Referring to the practices of the existing literatures, the banks were divided into national commercial banks and regional commercial banks, and then they were subjected to regression analysis. Among these, national commercial banks included state-owned commercial banks and joint-stock commercial banks; regional commercial banks refers to other city commercial banks.

The regression results of the national commercial banks in model (5) of Table 5 show that the coefficient of nii was -0.226 and significant at the 5% significance level, which is basically consistent with model (1). The regression results for the local commercial banks in model (6) of Table 5 show that the coefficient of nii was -0.170, which is significant at the 10% significance level. Comparing the regression results of (5) and (6), the non-interest income ratio of national commercial banks had a more significant impact on the operating costs, and the influence coefficient was greater, which is consistent with Hypothesis 2 (H2) of this paper. The average size of a nationwide commercial bank is larger and its operating area is wider, which is more beneficial to the scope economy of comprehensive operation.

In the control variables, the coefficient of nim was negative and significant, which is essentially the same as the result as (1); the effect of the non-performing loan rate on the cost-to-income ratio was completely different between the national commercial banks and local commercial banks. The impact of the provision coverage on the cost-to-income ratio was positive but not significant. The capital adequacy ratio was beneficial to reduce the cost-to-income ratio but not significant. The economic growth rate had a significant effect on reducing the cost-to-income ratio and was basically consistent with the results for (1).

/olume	2021	, No.	5
--------	------	-------	---

	(5)	(6)
	national commercial banks	regional commercial banks
nii	-0.226**	-0.170*
	(-2.65)	(-1.89)
lna	-6.861***	-4.524**
	(-3.15)	(-3.65)
nim	-3.377**	-2.988**
	(-2.67)	(-2.34)
npl	-0.819	0.182**
	(-1.34)	(2.43)
bbl	0.005	0.003
	(1.05)	(0.90)
car	-0.387	-0.217*
	(-1.37)	(-1.86)
gdpr	-0.689**	-1.308***
	(-2.91)	(-3.34)
_cons	196.913***	133.340***
	(4.78)	(6.07)
Туре	Fixed effects	Fixed effects
Sample size	129	232
R^2	0.784	0.176
F-statistics	74.76	14.02

Table5 Robustness tests with different bank types

VIII.Conclusion and Inspiration

Based on the theoretical analysis of the operating costs of the integrated operation, in this paper, we used the data of 47 commercial banks from 2005 to 2015 to build an econometric model and empirically examined the impact of diversification on bank costs. The main research conclusions are summarized as follows:

Under the interaction effects of economies of scope and economies of scale, diversification was shown to significantly reduce the operating costs of commercial banks through the sharing of resources and equipment, information sharing, reduction of capital specificity, and operational management synergy. After controlling for the relevant variables, the cost-to-income ratio was reduced by about 0.2% for every 1% increase in non-interest income. On the other hand, the agency costs and excessive competition costs of diversification were relatively small.

Diversification was stable to reduce the operating costs of commercial banks. The robustness of the time interval showed that the regression coefficient of non-interest income in 2011–2015 and 2005–2015 was stable at around -0.2. With a decrease in the cost-to-income ratio, it will be more difficult to further reduce the interest rate. Therefore, it is reasonable that there was a slight decline in the regression coefficient of the proportion of non-interest income from 2011 to 2015.

Judging from the different types of banks, the diversification of national commercial banks played a relatively greater role in reducing operating costs, while the role of city commercial banks was relatively small, and the significance level of regression was also lower. This is because the nation-wide commercial banks have a larger scale and a wider business scope. These two points are more advantageous to the economics of scope and synergy effects of diversification and can effectively reduce the asset specificity and unit costs, thereby, reducing the bank's operating costs.

Urban commercial banks have disadvantages, such as the limitations of scale and business area. There are also gaps in the technologies, levels, and human resources for risk management compared with national commercial banks.

Generally, it is not recommended that they push forward an integrated business strategy. When a city commercial bank does adopt an integrated business strategy, it is recommended to promote diversification indirectly and progressively by establishing strategic alliances with different financial institutions and restructuring mergers and acquisitions.

Author Contributions

Conceptualization, Jing He and Ke Zou; methodology, Jing He and Ke Zou; software, Ke Zou and Xinyi Cai; writing—original draft preparation, Jing He and Ke Zou; writing—review and editing, Jing He and Xinyi Cai.All authors have read and agreed to the published version of the manuscript.

Acknowledgements

This manuscript was supported withGuangdong Provincial Key Laboratory of Technology and Finance & Big Data Analysis (2017B030301010).

Data Availability Statement

Data supporting reported results can be found at https://banks.bvdinfo.com.and http://www.stats.gov.cn.

References

- [1] Saunders, I. Walter, "Universal banking in the United States: what could we gain? What could we lose?" Oup Catalogue, vol. 61, no.1, pp. 231, 1994.
- [2] K. Rogers, Product Mix, "Bank powers, and complementarities at U. S. commercial banks," Journal of Economics and Business, vol. 50, no. 2, pp. 205-218, 1998.
- [3] V. Chiorazzo, C. Milani, F. Salvini, "Income diversification and bank performance: evidence from Italian banks," Journal of Financial Services Research, vol. 33, no. 3, pp. 181-203, 2008.
- [4] R. Wang, Q. Zhang, "Differentiation of commercial banks profit mode: an empirical analysis based on listed banks in China," Economist, no. 02, pp. 50-59, 2016.
- [5] S. Rosie, C. Staikouras, G. Wood, "Non-interest income and total income stability," Bank of England, Working Paper, 2009.
- [6] A.L. Alhassan, "Income diversification and bank efficiency in an emerging market," Managerial Finance, vol. 41, no. 12, pp. 1318-1335, 2015.
- [7] Z. Li, M. Li, "The relationship between diversified operation and performance of China's commercial banks: based on panel data analysis of 50 commercial banks from 2005 to 2012," Nankai Economic Studies, no. 1, pp. 74-86, 2014.
- [8] X. Wu, F. Wang, "An empirical study on the impact factors of new business strategy of bank strategic groups on performance: based on panel data of 16 listed banks in China's banking industry," Journal of Financial Research, no. 9, pp. 48-61, 2012.
- [9] B. Feng, J. Wang, Y. Shi & L. Huo, "An empirical study of the impact of non-interest income on the performance of commercial banks: based on panel data analysis of China's listed commercial banks," Financial Theory & Practice, no. 4, pp. 110-115, 2016.
- [10] O. Williamson, "Transaction cost economies," Handbook of Industrial Organization, no. 1, pp. 135-182, 1989.
- [11] J. Aston, "Cost efficiency, economies of scale and economies of scope in the british retail banking sector," http://eprints.bournemouth.ac.uk/3069/1998, 1998.
- [12] A. Berger, G. Hanweck, D. Humphrey, "Competitive viability in banking: scale, scope, and product mix economies," Journal of Monetary Economics, vol. 20, no. 3, pp. 501-520, 1987.

- [13] J. Clark, "Economies of scale and scope at depository financial institutions: a review of the literature," Economic Review, vol. 73, no. 8, pp. 17-33, 1988.
- [14] K. Rogers, "Non-traditional activities and the efficiency of US commercial banks," Journal of Banking and Finance, vol. 22, no. 4, pp. 467-482, 1998.
- [15] L. Laeven, R. Levine, "Is there a diversification discount in financial conglomerates?" Journal of Financial Economics, vol. 85, pp. 331-367, 2007.
- [16] K. Zou, "Can diversification reduce bank operating costs?——Based on Granger test and VAR analysis," Financial Theory & Practice, vol. 07, pp. 39-45, 2016.
- [17] F. Allen, D. Gale, "Competition and financial stability," Journal of Money Credit & Banking, vol. 36, no. 3, pp. 453-480, 2004.
- [18] F. González, "Bank regulation and risk-taking incentives: An international comparison of bank risk," Journal of Banking and Finance, vol. 29, no. 5, pp. 1153-1184, 2005.
- [19] D. Scharfstein, J. Stein, "The dark side of internal capital markets: divisional rent seeking and inefficient investment," Social Science Electronic Publishing, vol. 55, no. 6, pp. 2537-2564, 2000.
- [20] M. Campello, "Internal capital markets in financial conglomerates: evidence from small bank responses to monetary policy," Journal of Finance, vol. 57, no. 6, pp. 2773-2805, 2002.
- [21] W. Ji, H. Chang, "Analysis of the cost effect of separate operation and integrated management," Journal of Financial Research, no. 10, pp. 53-59, 2000.
- [22] X. Hou, L. Zeng, "The scale economy and scope economic effect of the integrated management of China's commercial banks," South China Finance, no. 10, pp. 38-44, 2016.