

# Research on the Impact of Financial Disintermediation on Operational Performance

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**Abstract:** This study explores the impact of financial disintermediation on the operational performance of commercial banks, leveraging a panel dataset of 357 Chinese commercial banks spanning 2010–2023. Return on Assets (ROA) serves as the dependent variable to measure operational performance, while the ratio of securities financing to assets (TM) is the core explanatory variable representing financial disintermediation. Empirical results indicate that financial disintermediation exerts a significant positive impact on commercial banks' operational performance, which is robust to sample adjustments (excluding 2020–2023 pandemic periods) and core explanatory variable lag term tests. Heterogeneity analysis reveals that this positive impact is more pronounced for banks with low asset turnover, as disintermediation drives business diversification and efficiency improvements to offset traditional operational pressures. In contrast, the impact is insignificant for high asset turnover banks due to their stronger adaptive capabilities. Additional findings show that total asset turnover positively correlates with performance, while average salary and non-performing loan ratio have negative effects. This study provides empirical evidence for the positive value of financial disintermediation in promoting commercial bank development, offering insights for banks to optimize asset allocation and business structures amid market transformation

**Keywords:** Commercial Banks; Financial Disintermediation; Operational Performance

## 1. Introduction

From a macroeconomic perspective, the in-depth transformation of the global financial market has driven the expansion of the direct

financing market. The scale of bond, stock, and private equity markets has been constantly climbing. Enterprises obtain funds by bypassing banks through methods such as bond issuance and IPOs, and the proportion of direct financing in the total social financing scale has continued to rise. At the same time, the reform of interest rate marketization has further narrowed the interest rate spread between bank deposits and loans, prompting capital to flow into the direct financing field with higher returns and accelerating the process of financial disintermediation.

From a technological innovation perspective, the vigorous development of internet finance and financial technology has reshaped the financial landscape. New forms such as P2P lending and crowdfunding platforms directly connect the supply and demand sides of funds. Technologies like blockchain and big data have reduced information asymmetry, making "disintermediation" possible. In 2024, the global digital lending scale exceeded 1.2 trillion US dollars, and the proportion of financing for small and medium-sized enterprises (SMEs) through internet platforms reached 40%, which fully demonstrates the rapid momentum of disintermediation driven by technology.

From an enterprise perspective, large enterprises seek to reduce financing costs, while SMEs face high credit thresholds from banks. Both are actively pursuing diversified financing channels. From supply chain finance to cross-border direct financing, the transformation of corporate financing behavior and financial disintermediation have formed a two-way promotion. In addition, changes in the regulatory environment are also affecting the trend of disintermediation. The regulation of shadow banking and internet finance by regulatory authorities has promoted the development of disintermediation towards compliance and transparency.

These factors are intertwined, jointly forming a

complex background for studying the impact of financial disintermediation on operational performance, and also highlighting the urgency and necessity of relevant research.

## **2. Literature Review**

The phenomenon of financial disintermediation first emerged in the United States in the 1960s and 1970s. Hester (1969) was the first scholar to define financial disintermediation. He defined it as the behavior where savers no longer rely on banks as intermediaries for financial investment, but directly conduct financing transactions with fund demanders [1]. In subsequent studies, some scholars also elaborated on the meaning of financial disintermediation. Harmes and Adam (2001) defined financial disintermediation as the behavior where both fundraisers and investors bypass commercial banks as intermediaries to conduct direct financing activities [2]. Maudos (2017) further expanded the scope of intermediaries, arguing that financing intermediaries include not only banks but also other financial institutions. Financial disintermediation merely shifts the intermediary role in financing activities from commercial banks to other financial institutions, and it transforms financing activities from single bank services to multi-level financial market services [3]. With the advent of the information age, relevant research based on the digital context has also emerged in the past 10 years. Blockchain technology is the core of the digital economy. Geva (2018) believed that financial disintermediation supported by blockchain technology is a decentralized process that transforms from a central trust mechanism to social mutual trust [4].

In China, research on financial disintermediation started relatively late. Xin Qi (1990) was the first to introduce the concept of "financial disintermediation" into China. He defined it as a phenomenon where the capital-deficient and capital-surplus parties bypass financial intermediaries to conduct direct capital transactions, replacing the indirect financing market with the direct financing market [5]. After research, Song Wang and Zhong Zhengsheng (2010) believed that financial disintermediation refers to the direct asset-debt relationship formed by the flow of funds between the supply and demand sides [6]. In the research of Zhang Hongliang and Feng Sixian (2016), the "intermediary" in financial

disintermediation is divided into broad and narrow senses. The narrow sense of "intermediary" refers to commercial banks, while the broad sense refers to all financial institutions [7].

Due to the different definitions of financial disintermediation, scholars at home and abroad have adopted different measurement methods. Schmidt et al. (1999) used securitization ratio and intermediation ratio for measurement [8]. When measuring financial disintermediation in Canada, Roldos (2006) mainly used two ratios: one is the ratio of capital raised by non-financial enterprises through securities issuance to the total funds they raised; the other is the ratio of funds raised by non-financial enterprises through securities issuance to bank loans [9]. Arshed et al. (2017) also used the above two ratios as indicators to measure financial disintermediation [10]. On the basis of existing research, Suo Yanfeng (2013) further refined the measurement method of financial disintermediation and divided it into three dimensions: asset-side disintermediation, liability-side disintermediation, and technological disintermediation [11]. Wang Yanan (2019) selected liability intermediation ratio and asset intermediation ratio to measure the degree of financial disintermediation of commercial banks [12]. Yin Yuwen (2019) proposed that the indicators used to measure financial disintermediation can be divided into two categories: one is the macro indicators of financial disintermediation based on the macro statistical data of national financial departments; the other is the micro indicators of financial disintermediation extracted from the statistical data of the banking industry [13].

There is no doubt that financial disintermediation has a huge impact on commercial banks. Foreign scholars began to study the impact of financial disintermediation on commercial banks as early as the last century. Bond et al. (1997) believed that financial disintermediation would weaken the role of banks in the financial system [14]. However, Nissen (2000) and Tse (2003) argued that financial disintermediation brings not only negative impacts to commercial banks but also a "corrective effect", which can promote commercial banks to optimize their business operations and enhance their innovation capabilities [15,16]. Against the backdrop of the information age, Lee (2018) pointed out that the

rapid development of digital technology has intensified financial disintermediation while "purifying" financial intermediaries [17]. In recent years, Chinese scholars have also conducted research on this impact. When studying the impact of financial disintermediation on banks' asset and liability business, Xiao Qi and Zhao Yunning (2017) found that financial disintermediation has a significant negative impact on banks' traditional asset and liability business, but a significant positive impact on banks' emerging asset and liability business [18]. The research of Feng Ximing et al. (2016) found that financial disintermediation has a great impact on the asset and liability structure of China's commercial banks, weakening the status of commercial banks as fund suppliers and at the same time eroding their cost advantage in absorbing funds [19]. By analyzing the way financial disintermediation affects the operation of commercial banks in combination with the current situation and development trend of the capital market, Zhou Weihao (2016) proposed an optimization path for the future development of commercial banks [20]. Financial disintermediation intensifies competition among financial intermediaries and urges them to optimize their service quality and improve their operational level, which undoubtedly promotes the sound development of commercial banks.

The functional attributes of commercial banks give them an important and special position in the entire financial system. The sound development of commercial banks is of great significance to the stability of China's national

economy and society. When examining the overall status of banks, operational performance is a comprehensive and effective indicator. Therefore, it is crucial to study the operational performance of commercial banks. At present, the academic community does not have a completely unified definition of the operational performance of commercial banks, and there are also differences in the measurement of bank operational performance. Some scholars (Liu Jiasong et al., 2019; Xiong Jian et al., 2021; Zhang Hui et al., 2021) [21-23] believe that bank performance mainly describes the input-output ratio of banks in economic activities, with a focus on profitability. Other scholars (Jia Ruirui et al., 2018) [24] argue that in addition to profitability, factors such as the quality of bank development and risk prevention and control capabilities should also be included in the measurement of bank operational performance.

### 3. Variable Indicators and Definitions

Based on the research hypotheses, this chapter further explores the extent to which financial disintermediation affects the operational performance of commercial banks and conducts an empirical analysis. In the empirical process, this study sets the Return on Assets (ROA), which is the ratio of net profit to average total assets, as the explained variable to measure the operational performance level of commercial banks. The core explanatory variable is defined as the ratio of total loans to assets (representing financial disintermediation), with a focus on analyzing its impact on operational performance.

**Table 1. Overview of Variable Definitions**

Variable Type	Variable Symbol	Variable Name	Specific Meaning
Explained Variable	ROA	Return on Assets	The ratio of net profit to average total assets
Core Explanatory Variable	TM	Financial Disintermediation	The ratio of securities financing to assets
Control Variables	PJ	Average Salary	The ratio of total employee compensation paid to the number of employees
	ZF	Asset-Liability Ratio	The ratio of total liabilities to total assets
	ZZ	Total Asset Turnover	The ratio of net income to average total assets
	ZC	Capital Adequacy Ratio	The ratio of total capital to risk-weighted assets
	CG	Largest Shareholder's Shareholding Ratio	The shareholding percentage of the largest shareholder
	BL	Non-Performing Loan Ratio	The ratio of non-performing loans to total loans
	EPS	Earnings Per Share	The ratio of net income to the average number of tradable shares
	FS	Non-Interest Income	The ratio of (operating income - net interest income) to operating income
	M2	Broad Money Supply	The logarithm of (M1 + urban and rural household

		savings deposits + time deposits + other deposits)
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With reference to various factors influencing the operational performance of commercial banks and the findings of previous related studies, this paper selects the following variables as control variables to construct a panel regression model: average salary, asset-liability ratio, total asset turnover, capital adequacy ratio, largest shareholder's shareholding ratio, non-performing loan ratio, earnings per share, non-interest income, and broad money supply (M2). To ensure the accuracy and replicability of the study, the symbols, names, and specific meanings of each variable in the model have been clearly defined and are detailed in Table 1.

#### 4. Establishment of the Empirical Model

There are various empirical models available for researchers to explore the relationships between variables, among which spatial econometric regression models and panel regression models are widely favored and commonly used. However, spatial econometric regression models have certain limitations in spatial analysis of individuals. They often struggle to accurately capture spatial correlation, and improper application may easily lead to deviations in analysis results.

In view of this, this paper comprehensively weighs the advantages and disadvantages of various regression models and ultimately decides to construct a panel regression model. During the model construction process, full consideration is given to controlling for firm-specific effects and year effects, minimizing interference from other factors to significantly enhance the credibility of the research results. This model is then used to conduct rigorous empirical analysis, and finally, regression conclusions with economic significance are drawn. These conclusions not only provide solid data support for this study but also lay a stable theoretical foundation. The specific model construction process is as follows:

$$ROA_{it} = \beta_0 + \beta_1 TM_{it} + \sum v_j controls_{jit} + m_i + \lambda_t + \mu_{it} \quad (1)$$

Where: ROA represents the operational performance of commercial banks; TM represents financial disintermediation; Controls represents control variables;  $\beta_1$  and  $v_j$  respectively denote the coefficients of the core explanatory variable (financial

disintermediation) and control variables;  $m_i$  represents firm-specific effects;  $\lambda_t$  represents year effects;  $\mu_{it}$  represents the random error term. To deeply explore the empirical influencing factors of the operational performance of commercial banks in the context of financial disintermediation, this study fully considers data availability. After screening, the final sample consists of data from 357 commercial banks over the time span of 2010 to 2023. In terms of sample coverage, the data from these 357 commercial banks can comprehensively reflect the impact of financial disintermediation on operational performance, helping to improve the reliability and generalizability of the research results.

Specifically, the collected data covers multiple key indicators of 357 commercial banks in China, including Return on Assets (ROA), average salary, asset-liability ratio, total asset turnover, capital adequacy ratio, largest shareholder's shareholding ratio, non-performing loan ratio, earnings per share, non-interest income, and broad money supply (M2). The data used in this study is sourced from reliable information channels such as the annual reports publicly released by commercial banks and the Wind Database. To ensure the stability of each variable in the model and effectively eliminate the potential interference of outliers on the research results, a 1% winsorization treatment is applied to all relevant variables. This effectively removes any potential abnormal data and further optimizes data quality.

To further analyze the impact of financial disintermediation on the operational performance of commercial banks, this paper conducts descriptive statistics on various indicators of 357 commercial banks in China from 2010 to 2023, and the statistical results are detailed in Table 2. These descriptive statistics provide important basic information for subsequent empirical analysis, facilitating a more intuitive understanding of the basic characteristics and distribution of each variable.

**Table 2. Descriptive Statistics**

Statistic	Observation	Mean	Std. Dev.	Min	Max
ROA	4850	0.9782	0.6394	-2.3239	11.1627
TM	4850	51.9357	11.1894	20.9877	80.2247
PJ	4850	12.6531	0.6669	9.0651	16.0114
ZF	4850	91.4855	4.4747	24.5148	101.5343
ZZ	4850	0.0321	0.0121	-0.0360	0.0862
ZC	4850	12175	12.4845	-11.1400	446.5600
CG	4850	21.6128	21385	0.2400	100.0000

BL	4850	1.8035	1.3586	0.0050	19.5400
EPS	4850	0.4316	0.4396	-0.7700	7.1400
FS	4850	19.1932	2.2561	11.2122	26.2530
M2	4850	32.6685	0.4153	31.9158	33.3087

Based on the descriptive statistical information of variables in Table 2, the characteristics of variables can be comprehensively understood from both temporal and individual dimensions. For the 357 commercial banks selected between 2010 and 2023, the data exhibits the following characteristics:

**Operational Performance (ROA):** The maximum value reaches 11.1627, the minimum value is -2.3239, the mean is 0.9782, and the standard deviation is 0.6394.

**Financial Disintermediation (TM):** The maximum value is 80.2247, the minimum value is 20.9877, the mean is 51.9357, and the standard deviation is 11.1894. To further investigate whether there is a multicollinearity

issue in the variable selection of the model, this paper conducts correlation coefficient tests and variance inflation factor (VIF) tests for each variable in the model. According to the results of Table 3 (Correlation Coefficient Test), in the model examining the impact of financial disintermediation on the operational performance of commercial banks, the absolute values of the correlation coefficients between variables are maintained at a low level (the maximum value is 0.7016, observed between ZF and ZC). This indicates that there is no significant multicollinearity between variables, and thus a corresponding regression model can be constructed for analysis, ensuring the reliability and validity of the model estimation results. This test result provides important statistical support for subsequent empirical analysis.

**Table 3. Correlation Coefficient Test**

	ROA	TM	PJ	ZF	ZZ	ZC	CG	BL	EPS	FS	M2
<b>ROA</b>	1.0000										
<b>TM</b>	0.0054	1.0000									
<b>PJ</b>	-0.1737	-0.0787	1.0000								
<b>ZF</b>	-0.1055	0.1602	-0.1781	1.0000							
<b>ZZ</b>	0.5197	0.2253	-0.1620	-0.1522	1.0000						
<b>ZC</b>	0.0988	-0.1534	0.0785	-0.7016	0.0553	1.0000					
<b>CG</b>	-0.1772	-0.2261	0.2413	-0.3270	-0.2170	0.2349	1.0000				
<b>BL</b>	-0.2831	0.1290	-0.0810	0.1249	0.0263	-0.1060	-0.1787	1.0000			
<b>EPS</b>	0.1727	-0.0272	0.0268	0.1149	0.0149	-0.0682	-0.1170	-0.1962	1.0000		
<b>FS</b>	-0.1754	-0.2134	0.2556	0.1556	-0.4548	-0.1011	0.1488	-0.1659	0.3746	1.0000	
<b>M2</b>	-0.3910	0.1008	0.4091	0.0067	-0.4696	-0.0421	0.0059	0.0707	0.0105	0.2615	1.0000

**5. Selection of the Benchmark Model**

This paper randomly selects 357 commercial banks nationwide to construct a panel regression model for regression analysis.

Further analysis of the regression results in Table 4 shows that the t-test results for financial disintermediation (TM), average salary (PJ), total asset turnover (ZZ), capital adequacy ratio (ZC), non-performing loan ratio (BL), earnings per share (EPS), and broad money supply (M2) are highly significant. This result strongly indicates that in this model, the aforementioned

variables have a strong explanatory power for the operational performance (ROA) of commercial banks. However, the t-test results for the asset-liability ratio (ZF), the largest shareholder's shareholding ratio (CG), and non-interest income (FS) are not satisfactory and insignificant. This means that these indicators have a relatively limited role in explaining the operational performance of commercial banks and cannot effectively account for the changes in the operational performance of commercial banks like the previously significant variables.

**Table 4. Statistical Table of Regression Results**

	Model (1)	Model (2)	Model (3)
ROA(-1)	---	---	0.6098***(0.0099)
TM	0.0023***(0.0009)	0.0024*(0.0010)	0.0014(0.0008)
PJ	-0.1007*** (0.0229)	-0.1133*** (0.0232)	-0.0558*** (0.0175)
ZF	-0.0016(0.0032)	-0.0014(0.0032)	-0.0058*(0.0024)
ZZ	19.5787*** (1.0632)	17.9722*** (1.1056)	12.5550*** (0.8173)
ZC	0.0042*** (0.0008)	0.0043*** (0.0008)	-0.0049*** (0.0007)

CG	-0.0005(0.0011)	-0.0005(0.0011)	0.0004(0.0008)
BL	-0.1149***(0.0060)	-0.1099***(0.0061)	-0.0623***(0.0045)
EPS	0.3004***(0.0279)	0.2910***(0.0071)	0.1582***(0.0197)
FS	0.0127(0.0070)	0.0201**(0.0072)	0.0003(0.0052)
M2	-0.2638***(0.0279)	-0.1881***(0.0315)	-0.0925***(0.0249)
C	10.0499***(0.8725)	7.5794***(0.9905)	4.3137***0.7944
Adj.R <sup>2</sup>	0.3986	0.4085	0.7095
F-statistic	297.18	140.38	448.53
Prob(F-stat)	0.0000	0.0000	0.0000
N	4850	4850	4850
Individual Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes

Note: Standard errors are shown in parentheses. Significance levels are marked with asterisks: indicates significance at the 10% level, indicates significance at the 5% level, and indicates significance at the 1% level. Table 4 presents the regression results of Model (1), Model (2), and Model (3). Through in-depth analysis of the regression results, the following conclusions can be drawn:

### 5.1 The Impact of Average Salary (PJ) on Operational Performances

The coefficients of average salary (PJ) in the three models are all negative and significant (Model (1): -0.1007\*\*\*; Model (2): -0.1133\*\*\*; Model (3): -0.0558\*\*\*). This indicates that a higher average salary may increase the operating costs of banks, thereby having a negative impact on operational performance. However, an excessively low salary level may also lead to talent loss and affect the long-term competitiveness of banks. Therefore, banks need to find a balance between salary level and operational performance.

### 5.2 The Impact of Total Asset Turnover (ZZ) on Operational Performance

The coefficients of total asset turnover (ZZ) in the three models are all positive and highly significant (Model (1): 19.5787\*\*\*; Model (2): 17.9722\*\*\*; Model (3): 12.5550\*\*\*). This indicates that an increase in asset turnover can significantly improve the operational performance of banks, reflecting the importance of asset utilization efficiency to the profitability of banks.

### 5.3 The Impact of Non-Performing Loan Ratio (BL) on Operational Performance

The coefficients of non-performing loan ratio (BL) in the three models are all negative and highly significant (Model (1): -0.1149\*\*\*;

Model (2): -0.1099\*\*\*; Model (3): -0.0623\*\*\*). This indicates that an increase in the non-performing loan ratio will significantly reduce the operational performance of banks, reflecting the importance of asset quality to the profitability of banks.

According to the data analysis in Table 4, financial disintermediation of commercial banks has a positive impact on operational performance. This result provides strong empirical support for Research Hypothesis H1 and confirms the correctness of Research Hypothesis H1.

## 6. Heterogeneity Analysis

Heterogeneity refers to the different manifestations of research objects in specific attributes, which may lead to different responses or results to the same problem. Heterogeneity analysis is an empirical research method whose core lies in exploring the changes in research results under different groups or conditions. This analysis method is committed to revealing the implementation effects of specific intervention measures or policies in different environments, in-depth analyzing the differences between individuals, and demonstrating the complex characteristics and details of research objects. With the help of heterogeneity analysis, researchers can identify and describe the differences between different samples, and then evaluate how these differences specifically affect the research results. Among the numerous indicators of commercial banks, total asset turnover and non-performing loan ratio show a significant correlation with operational performance. In view of this, this paper will focus on conducting in-depth analysis and research on the impact of banks' total asset turnover and non-performing loan ratio on the operational performance of commercial banks, and strive to reveal the

internal connections and mechanism of action among them.

In the research on the operational performance of commercial banks, asset turnover (ZZ) is an important indicator to measure the efficiency of banks' asset utilization. A high asset turnover usually indicates that a bank can efficiently use

**Table 5. Heterogeneity Analysis Based on Asset Turnover**

ROA	Low Asset Turnover	High Asset Turnover
	Model (4)	Model (5)
TM	0.0061***(0.0017)	-0.0006(0.0013)
PJ	-0.1808***(0.0405)	-0.119(0.0308)
ZF	-0.0010(0.0058)	-0.0020***(0.0044)
ZZ	16.083***(3.2654)	17.4153***(1.4309)
ZC	-0.0076(0.0028)	0.0034***(0.0009)
CG	0.0004(0.0015)	-0.0036***(0.0018)
BL	-0.0893***(0.1336)	-0.1021***(0.0070)
EPS	0.4449***(0.0620)	0.2162***(0.0300)
FS	0.0115(0.0133)	0.0025(0.0092)
M2	-0.2690***(0.055)	-1.1751***(0.0490)
C	11.1231***(1.7328)	8.2176***(1.5973)
Adj.R <sup>2</sup>	0.2194	0.4039
F-statistic	26.48	64.37
Prob(F-stat)	0.0000	0.0000
N	2415	2422
Individual Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes

According to the regression results in Table 5, Model (4) and Model (5) conduct regression analysis on banks with low asset turnover and high asset turnover respectively. The results show that financial disintermediation (TM) has a significant positive impact on the operational performance (ROA) of banks with low asset turnover (coefficient is 0.0061), while its impact on banks with high asset turnover is insignificant (coefficient is -0.0006). This result indicates that financial disintermediation has a more significant promoting effect on banks with low asset utilization efficiency. This may be because these banks face greater pressure in traditional businesses, and the business diversification and efficiency improvement brought by financial disintermediation have a more obvious effect on improving their operational performance. Asset turnover is an important measure of the efficiency of asset utilization of commercial banks. A low asset turnover indicates that a bank fails to fully and

its assets to generate income, while a low asset turnover may reflect low asset utilization efficiency. Therefore, this paper selects asset turnover as the classification standard for heterogeneity analysis to explore the differential impact of financial disintermediation (TM) on banks with different asset utilization efficiencies. effectively use its assets within a specific period and cannot achieve the optimal allocation and use of assets. This situation will lead to a reduction in the overall operational efficiency of the bank, a decline in profitability, and ultimately have an adverse impact on operational performance. In contrast, commercial banks with high asset turnover have relatively high asset utilization efficiency and can complete the optimal allocation and use of assets in a short period of time. Therefore, even if they encounter the problem of slow growth in traditional businesses caused by financial disintermediation, these banks can quickly adjust their business structure and actively explore new profit growth points with their efficient asset management capabilities, thereby effectively alleviating the negative impact of financial disintermediation on operational performance.

In conclusion, through the heterogeneity analysis based on asset turnover, this paper finds that financial disintermediation has a significant positive impact on the operational performance of banks with low asset turnover, while its impact on banks with high asset turnover is insignificant. This result indicates that financial disintermediation has a more significant promoting effect on banks with low asset utilization efficiency. In addition, total asset turnover, non-performing loan ratio, and broad money supply all have a significant impact on the operational performance of both types of banks, but the degree of impact varies.

### 7. Robustness Analysis and Endogeneity Analysis

The robustness of a model means that the impact trend of key explanatory variables on the explained variable in the model remains relatively stable and is not prone to significant changes due to minor modifications. There are various methods to verify the robustness of a model. One common method is to change the sample size and observe whether the impact of the core explanatory variable on the explained variable remains significant. If the coefficient of

the core explanatory variable does not change significantly after adjusting the sample size, or its impact degree remains relatively stable, it can be initially judged that the model has good robustness. Another verification method is to select variables with similar properties to the core explanatory variable for regression analysis and check whether the significant impact of these variables (similar to the core explanatory variable) on the explained variable remains consistent. If the coefficient of the core explanatory variable and its impact degree hardly change after replacing the variable, this also indicates that the model is robust.

Following the above analysis logic, this paper adopts the following two strategies to verify the robustness of the model, with specific implementation steps as follows:

### 7.1 Robustness Test Based on Adjustment of Sample Observations

Considering that changes in the sample scope may affect the model results, this paper conducts a robustness test on the model of the impact of financial disintermediation on the operational performance of commercial banks by changing the sample observations. In view of

the impact of the COVID-19 pandemic on the operational performance of banks, this paper adjusts the sample observation period from 2010-2023 to 2010-2019. By comparing the regression results of the adjusted sample with those of the benchmark model, it focuses on analyzing the coefficient change of financial disintermediation (TM) on the operational performance (ROA) of commercial banks. If the coefficient changes slightly, it indicates that the model remains robust when the sample scope changes.

### 7.2 Robustness Test Based on the First-Order Lag Term of the Core Explanatory Variable

This method involves incorporating the first-order lag term of the core explanatory variable into the regression analysis as a means of robustness test, which is also an effective way to test the robustness of the model. Through this method, the stability of the model in different time dimensions can be further verified. After the regression operation, the robustness analysis results of the impact of financial disintermediation on the operational performance of commercial banks are presented in Model 8 and Model 9 of Table 6.

**Table 6. Robustness Test Table**

ROA	Benchmark Model (Model 2)	Robustness Test (Model 8)	Robustness Test (Model 9)
TM	0.0024**(-0.001)	0.0061*** (0.0013)	0.0027*** (0.0010)
PJ	-0.1133***(-0.0232)	-0.1209*** (0.0326)	-0.0955*** (0.0241)
ZF	-0.0014(-0.0032)	-0.0068(0.0041)	-0.0084** (0.0033)
ZZ	17.9722***(-1.1056)	17.6915*** (1.4182)	18.0368*** (1.1337)
ZC	0.0043***(-0.0008)	0.0043*** (0.0009)	-0.0004 (0.0009)
CG	-0.0005(-0.0011)	-0.0003(0.0016)	-0.0003(0.0010)
BL	-0.1099***(-0.0061)	-0.1030*** (0.0081)	-0.1120*** (0.0062)
EPS	0.2910***(-0.0071)	0.2611*** (0.0383)	0.2929*** (0.0272)
FS	0.0201**(-0.0072)	0.0356*** (0.0098)	0.0197*** (0.0073)
M2	-0.1881***(-0.0315)	-0.1847*** (0.0459)	-0.2883*** (0.0344)
C	7.5794***(-0.9905)	7.5942*** (1.3981)	11.3875*** (0.0287)
Adj.R <sup>2</sup>	0.4085	0.3216	0.4360
F-statistic	140.38	82.12	148.86
Prob(F-stat)	0	0.0000	0.0000
N	4850	3493	4421
Individual Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Industry Fixed Effects	No	No	No

Note: Standard errors are shown in parentheses. Significance levels are marked with asterisks: \* indicates significance at the 10% level, \*\* indicates significance at the 5% level, and \*\*\* indicates significance at the 1% level. To ensure the reliability of the research conclusions, this paper conducts robustness tests on the model of the

impact of financial disintermediation (TM) on the operational performance (ROA) of commercial banks through two methods: one is the robustness test based on the adjustment of sample observations, and the other is the robustness test based on the first-order lag term of the core explanatory variable. The test results

are shown in Table 6, where Model 8 and Model 9 reflect the regression results under the two test methods respectively.

### 7.3 Robustness Test Based on Adjustment of Sample Observations

Considering the significant impact of the COVID-19 pandemic on the operational performance of banks, this paper first adjusts the sample observation period from 2010-2023 to 2010-2019 to eliminate the interference of the pandemic on the research results. By comparing the regression results of the adjusted sample (Model 8) with those of the benchmark model (Model 2), it focuses on analyzing the coefficient change of financial disintermediation (TM) on the operational performance (ROA) of commercial banks. The regression results show that the coefficient of financial disintermediation significantly increases from 0.0024 in the benchmark model to 0.0061\*\*\*, and the significance level is improved. This indicates that after eliminating the interference of the pandemic, the positive impact of financial disintermediation on ROA is more significant. This result may be related to the more obvious role of financial disintermediation in promoting the business transformation of banks before the pandemic. In addition, the coefficient directions and significance levels of other control variables such as PJ, ZZ, and BL remain stable in Model 8, which further supports the robustness of the model. The adjusted  $R^2$  value is 0.3216, slightly lower than 0.4085 of the benchmark model, which may be due to information loss caused by the reduction of the sample scope, but the explanatory power of the overall model is still strong. By comparing these three impact coefficients, it can be found that the impact of financial disintermediation on the operational performance of commercial banks does not change significantly. At the same time, the t-test results of these three coefficients are all significant, with no large data deviation and no positive-negative alternation of regression coefficients. This slight change in coefficients indicates that the basic regression Model 2 has robustness, and it is feasible to explore the relationship between the two variables.

### 7.4 Robustness Test Based on the First-Order Lag Term of the Core Explanatory Variable

To further verify the robustness of the model, this paper also incorporates the first-order lag

term of financial disintermediation into the regression analysis (Model 9). This method can test the stability of the model in different time dimensions and also help alleviate the possible endogeneity problem. The regression results show that the coefficient of financial disintermediation is 0.0027\*\*\*, which is basically consistent with the result of the benchmark model (0.0024\*\*), and the significance level is improved. This indicates that the positive impact of financial disintermediation on ROA remains stable in different time dimensions. In addition, the coefficient directions and significance levels of other control variables such as PJ, ZZ, and BL also remain stable in Model 9, which further proves the robustness of the model. The adjusted  $R^2$  value is 0.4360, higher than 0.4085 of the benchmark model, indicating that the explanatory power of the model is improved after introducing the first-order lag term of financial disintermediation.

Through the above two robustness test methods, this paper verifies the stability of the impact of financial disintermediation on the operational performance of commercial banks. Whether adjusting the sample observations or introducing the first-order lag term of the core explanatory variable, the research results show that the positive impact of financial disintermediation on ROA remains significant under different conditions. This indicates that financial disintermediation has a positive impact on the operational performance of commercial banks by promoting the diversification of banking business, optimizing asset allocation, and improving operational efficiency. In addition, the coefficient directions and significance levels of control variables such as PJ (average salary), ZZ (total asset turnover), and BL (non-performing loan ratio) remain stable in different models, which further supports the robustness of the model. The positive impact of financial disintermediation on the operational performance of commercial banks remains significant in different sample scopes and time dimensions, indicating that the research conclusions of this paper have high reliability.

Endogeneity analysis is a key concept in social science fields such as economics and sociology. It mainly explores the correlation between explanatory variables and error terms (also known as residual terms or disturbance terms) in the model. It mainly judges the explanatory

degree of the core explanatory variable (financial disintermediation) and other control variables on the operational performance of commercial banks based on the model regression results and the economic connections between variables. Conversely, the operational performance of commercial banks will also have an impact on financial disintermediation and other control variables. In some cases, the explained variable (dependent variable) may affect the explanatory variables (independent variables), that is, there is a two-way causal relationship. This will lead to a correlation between the explanatory variables and the error term. Therefore, in theory, the operational performance of commercial banks and the proportion of financial disintermediation affect each other, which may lead to endogeneity problems. The core explanatory variable in the above regression analysis has relatively comprehensively reflected the influencing

factors of the operational performance of commercial banks. Therefore, selecting the first-order lag term of the core explanatory variable (financial disintermediation) as an instrumental variable may weaken the correlation between the instrumental variable and the explained variable. Following this idea, this paper constructs a two-stage regression analysis method to solve the endogeneity problem, and its regression results are shown in Table 7.

First Stage: Construct a new instrumental variable using the first-order lag term of financial disintermediation together with other control variables.

$$TM_{it} = \beta_0 + \beta_1 TM_{it-1} + \sum v_j controls_{jit} + m_i + \lambda_t + \mu_{it} \quad (2)$$

Second Stage: Conduct regression using the newly constructed instrumental variable (TM) as the core explanatory variable.

$$ROA_{it} = \beta_0 + \beta_1 TM_{it} + \sum v_j controls_{jit} + m_i + \lambda_t + \mu_{it} \quad (3)$$

**Table 7. Endogeneity Test Table**

	Benchmark Model	Two-Stage Least Squares	Two-Stage Least Squares	System GMM Method
	(Model 2)	First Stage (Model 10)	Second Stage (Model 11)	(Model 12)
		TM	ROA	ROA
TM(-1)	---	0.6937***(0.0098)	---	---
L.ROA	---	---	---	0.1855***(0.0133)
TM	0.0024*(-0.001)	---	0.0039***(0.0014)	0.0055***(0.0010)
PJ	-0.1133***(-0.0232)	2.3468***(0.2392)	-0.1046***(0.0249)	-0.0202***(0.0276)
ZF	-0.0014(-0.0032)	-0.2516***(-0.0330)	-0.0074**(-0.0033)	-0.0074**(-0.0038)
ZZ	17.9722***(-1.1056)	46576***(-11.2288)	17.8600***(-1.1509)	24.0423***(-1.2553)
ZC	0.0043***(-0.0008)	-0.1279***(-0.0093)	0.00007(0.0009)	24.0423***(-1.2553)
CG	-0.0005(-0.0011)	-0.0087(0.0104)	-0.0003(0.0010)	-0.0002(0.0007)
BL	-0.1099***(-0.0061)	0.2262***(-0.0609)	-0.1129***(-0.0062)	-0.0833***(-0.0106)
EPS	0.2910***(-0.0071)	-0.7102***(-0.2693)	0.2956***(-0.0273)	0.4594***(-0.0685)
FS	0.0201**(-0.0072)	-0.2701***(-0.0719)	0.0207***(-0.0073)	-0.0179***(-0.0049)
M2	-0.1881***(-0.0315)	1.2431***(-0.3403)	-0.2931***(-0.0347)	-0.2149***(-0.0036)
C	7.5794***(-0.9905)	-24.9307**(-10.8657)	11.4840***(-0.0288)	8.0177***(-1.0101)
Adj.R <sup>2</sup>	0.4085	0.7079	0.4345	---
F-statistic	140.38	466.50	97	---
Prob(F-stat)	0	0.0000	0.0000	---
N	4850	4421	4421	4008
Individual Fixed Effects	Yes	Yes	Yes	
Year Fixed Effects	Yes	Yes	Yes	

In this study, financial disintermediation (TM), as the core explanatory variable, may have a two-way causal relationship with the explained variable, i.e., the operational performance of commercial banks (ROA). That is, while financial disintermediation affects bank operational performance, changes in bank operational performance may in turn influence the degree of financial disintermediation. This two-way causal relationship will lead to a correlation between the explanatory variables and the error term, thereby triggering

endogeneity issues and affecting the consistency and effectiveness of model estimation. Therefore, this paper adopts the Two-Stage Least Squares (2SLS) method and the System Generalized Method of Moments (System GMM) to test and correct the endogeneity problem.

To address the endogeneity issue, this paper employs the Two-Stage Least Squares (2SLS) method for regression analysis. In the first stage, the first-order lag term of financial disintermediation (TM (-1)) is used as an

instrumental variable, and a new instrumental variable is constructed together with other control variables. The selection of instrumental variables needs to satisfy two conditions: first, a high correlation with the endogenous explanatory variable (financial disintermediation); second, no correlation with the error term. The regression results show that the coefficient of the first-order lag term of financial disintermediation is 0.6937\*\*\*, which is significantly positive. This indicates a strong correlation between the instrumental variable and financial disintermediation, meeting the correlation condition of instrumental variables. In addition, the adjusted R<sup>2</sup> value of the first-stage regression is 0.7079, and the F-statistic is 466.50, which further proves the validity of the instrumental variable.

In the second-stage regression, the newly constructed instrumental variable (TM) is used as the core explanatory variable to re-estimate the impact of financial disintermediation on the operational performance of commercial banks. The regression results show that the coefficient of financial disintermediation is 0.0039, which is significantly positive, and it is consistent with the trend of the result (0.0024) of the benchmark model (Model 2). This indicates that the positive impact of financial disintermediation on ROA remains significant after controlling for the endogeneity problem. Furthermore, the coefficient directions and significance levels of other control variables such as PJ, ZZ, and BL remain stable across different models, which further supports the robustness of the model.

To further verify the reliability of the research conclusions, this paper also uses the System Generalized Method of Moments (System GMM) as a supplementary test for endogeneity. By introducing the lag term of the explained variable as an instrumental variable, the System GMM method can effectively control the dynamic endogeneity problem in the model. The regression results show that the coefficient of financial disintermediation is 0.0055\*\*\*, which is significantly positive, and the coefficient of the first-order lag of ROA (L.ROA) is 0.1855\*\*\*, indicating that the operational performance of commercial banks has persistence. This result is basically consistent with that of the 2SLS method, further verifying the positive impact of financial disintermediation on bank operational performance.

Through the endogeneity tests using the Two-Stage Least Squares method and the System Generalized Method of Moments, this paper verifies that the positive impact of financial disintermediation on the operational performance of commercial banks remains significant after controlling for the endogeneity problem. The validity of the instrumental variables and the robustness of the model results indicate that the research conclusions of this paper have high reliability.

## 8. Findings

According to the above analysis, the findings can be found that financial disintermediation has a positive impact on operational performance. And the impact is robust.

In conclusion, the academic community has accumulated many research results on the impact of financial disintermediation on the operational performance of commercial banks, but the research conclusions have not reached a unified view. Therefore, this paper aims to analyze the specific impact of financial disintermediation on the operational performance of commercial banks and determine the degree of this impact through empirical analysis.

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