The Research into the Influence of Liability on Commercial Bank Competition

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Abstract. Assessing the assets and liabilities of commercial banks is critical to their individual competition and overall development. Although the asset and liability management methods and strategies of different commercial banks have been comparatively analysed and systematically improved to a large extent, there is a lack of statistical research on how exactly balance sheet ratios affect the competition of different commercial banks. Therefore, this paper collects data on gearing, competition, and other control variables for 3,687 banks from the WIND and CSMAR databases for the period 2012 to 2021. The paper constructs a fixed effects regression model and demonstrates that the model is robust; the endogeneity of the model is tested using two-stage least squares. The conclusions suggest that bank gearing has a negative impact on bank competition, especially for regional banks and banks with high gearing.

Keywords: Fixed Effect Model, Asset-Liability, Bank Competition

1 Introduction

The banking sector is a cornerstone of economic activity, and understanding its dynamics is critical to promoting financial stability and growth. Among the many factors affecting the competitiveness of commercial banks, Debt-to-Asset Ratio (DAR) stands out as a key indicator. DAR represents the ratio of banks' liabilities to their total assets, and is a fundamental measure of financial health and risk management in the banking sector [2]. Despite its significance, empirical studies on how DAR affects the competition of commercial banks are still limited.

Nevertheless, prior empirical studies provide some insights into the relationship between DAR and bank competition. For example, Su et al. (2021) study bank competition in China, emphasising the importance of understanding the impact of financial indicators such as DAR on market dynamics [10]. Similarly, Husna and Satria (2019) examined the impact of various financial ratios, including DAR, on firm value, pointing out the relevance of DAR in assessing financial performance [5]. In conclusion, commercial banks are constantly adjusting their asset and liability structures in pursuit of market share and profitability, but the exact impact of these adjustments on competition has not been accurately assessed.

Therefore, this research aims to build on these findings to comprehensively analyse the relationship between DAR and competition in commercial banks. By examining how changes in DAR affect the level of competition, this study aims to provide actionable insights for regulators, policy makers and bank practitioners. Understanding these dynamics can help

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relevant investment banks or institutions to make informed decisions that can improve market efficiency, financial stability and innovation in the banking sector [4].

The paper consists of four main sections: Introduction, Background and Literature Review, Data and Measurement, Empirical Results and Conclusion. Together, these sections provide the theoretical underpinnings, outline the research methodology and empirical results, and summarise the key insights and implications, thereby deepening the understanding of banks' competitive dynamics.

2 Background And Literature Review

Over time, commercial banks have become progressively more independent of bank assets and bank liabilities. Part of this is driven by the intensive use of risk-mitigating instruments such as interest rate swaps and adjustable-rate loans among banks in order to compete, which may ultimately change the inputs and outputs of the financial system and banking markets. The study of commercial banks' Debt to Asset Ratio is therefore crucial for the regulatory control and financial innovation of firms, as well as for the macroeconomy as a whole. While there is a theoretical link between commercial banks' Debt to Asset Ratio and competition, there is limited research on the actual impact of Debt to Asset Ratio on commercial banks' competition and its underlying mechanisms [9]. Therefore, this study focuses on the impact of commercial bank Debt to Asset Ratio on competition in order to draw economically significant conclusions.

Debt-to-asset ratio can be measured in a number of ways.Su, Qin, Abbas Rizvi & Umar (2021) showed that in determining the amount of assets and liabilities, the best measure to be used in a given situation should be selected based on the criteria of useful financial information (relevance, reliability, comparability, neutrality, timeliness, understandability, optimal disclosure, and readability) for measuring the face value of cash, discounted value of future cash flows, and future cash flows [10].According to Kochergin & Yangirova (2019), typical correlation is a suitable tool for analysing commercial banks' balance sheet ratios because it can usually be converted not only to multiple types of liabilities with different characteristics (e.g., demand deposits, household checking and savings accounts, long-term certificates of deposit, and certificates of deposits), but it can also be converted into multiple asset classes with different characteristics (e.g., short-term loans, long-term loans, investment securities) [6]. Surprisingly, typical correlation analyses are rarely used to describe asset-liability relationships [8]. In addition to this, Dong, Yin, Liu, Hu, Li & Liu (2020) proposed a modified SCA model [3] to investigate the regression of assets and liabilities on operating profit in Ethiopian commercial banks. The model assumes that return on earning assets is positive and varies with assets and cost of liabilities ratio is negative and varies with liabilities. While the cost of liabilities ratio is negative and varies with liabilities. In recent years, business competition in terms of assets and liabilities, changing interest rates and exchange rates have put pressure on banks and ALM has evolved into a systematic and dynamic process that involves planning, organising, co-ordinating and controlling the bank's assets and liabilities. In this study, total liabilities/total assets of the bank is used to measure the balance sheet ratio of the bank.

To evaluate the competitiveness of commercial banks, it is usually considered that the new deposits of banks account for one tenth of the total deposits to measure the degree of competition. In addition, researchers also try to combine other methods with CAMELS evaluation system to analyze bank competitiveness more comprehensively. Husna & Satria (2019) suggest that based on the annual data from 2004 to 2014, 20 depository banks in Turkey were analyzed and a CAMELS rating system containing 21 different indicators was established [5]. On this basis, multiple nominal Logistic regression analysis is established. Another possible approach is to quantify a firm's market power in a more formal way. This can be done by applying the Lerner index (which defines the difference between marginal cost and marginal revenue) [7]. And the H statistic created by Panzar and Rosse (1987), which is used to measure the responsiveness of total bank revenues to changes in input prices. An H statistic less than 0 indicates monopoly or collusive oligopoly, less than 1 indicates monopolistic competition, and 1 indicates perfect competition. Banking competition can also be measured by regulatory indicators of market barriers and restrictions [9]. In recent years, innovative approaches have been used to describe competition in a more direct and accurate way.

3 Data And Measurement

Based on the above literature review and theoretical analyses, this paper uses competition as an explanatory variable and Debt to Asset Ratio, Return on Assets, Non-performing Loan Ratio, Capital Adequacy Ratio, Total Assets, Interest Expenses and Due to Banks as explanatory variables. Table 1 shows all the variables.

Table 1 Table of variables.

Variable	Type	Symbol	Description
Competition	Explained Variable	COM	New Deposits / Total Deposits
Debt to Asset Ratio	Explanatory Variable	DAR	Total Liabilities / Total Assets
Return on Assets	Control Variables	ROA	Net Income / Total Assets
Non-performing Loan Ratio		NLR	Non-performing Loans / Total Assets
Capital Adequacy Ratio		CAR	Eligible Capital / Risk-weighted Assets
Total Assets		TA	Natural logarithm of Total Assets
Interest Expenses		IE	Natural logarithm of Interest Expenses
Due to Banks		DB	Natural logarithm of due to banks and other institutions

As per the objective of the study, an attempt has been made to select exhaustive and precise data covering 3687 banks for the period 2012 to 2021. The data is obtained from Wind database and CSMAR database and some of the lack of data is complemented by the annual financial statements of the banks. Since the structure of the data is panel data, a panel model is used to analyse relationship between COM and DAR. And since there may be relationship between individual effect or time effect and DAR, this paper use the panel model with fixed effect regression model to further analyze the relationship between COM and DAR.

Based on the global regression model, this paper examines both the individual and year effects of the sample bank. Therefore, this paper utilizes the fixed effect regression model. The model is presented as follows:

$$COM_{it} = \beta_0 + \beta_1 DAR_{it} + \sum v_j Controls_{ijt} + m_i + \lambda_t + u_{it} \quad (1)$$

Where β_0 represents intercept, β_1 represents the Debt to Asset Ratio (DAR), Controls are the Control Variables, including Return on Assets (ROA), Non-performing Loan Ratio (NLR), Capital Adequacy Ratio (CAR), Total Assets (TA), Interest Expenses (IE), and Due to Banks (DB); m_i represents individual effect, λ_t represents time effect, and μ_{it} represents random interference.

4 Empirical Results

In this paper, Stata is used as an analytical tool for the analysis of the statistical description of the variables. By processing the statistics, descriptive statistics for the indicators of 3687 commercial banks from 2012 to 2021 were obtained. Table 2 presents the specific results of the descriptive statistics.

Table 2 Statistical description of variables.

Statistical Magnitude	Number Observed	Mean Value	Standard Deviation	Minimum Value	Maximum Value
COM	3687	0.6667	1.0259	0.2777	3.7006
DAR	3687	92.2526	2.1690	60.6374	101.3128
ROA	3687	0.9281	0.4852	-1.7554	7.2213
NLR	3687	2.1401	1.9084	0	33.98
CAR	3687	13.6927	2.0157	10.73	18.56
TA	3687	24.6938	1.7039	21.1233	31.1912
IE	3687	20.7738	1.7871	16.7552	26.8792
DB	3687	19.4260	4.5615	-1.6094	28.6178

As shown in Table 2, for the period 2012-2021, the mean value of Competitiveness of 3687 banks is 0.6667, the maximum value, the minimum value is 3.7006, 0.2777 and the standard deviation is 1.0259. The mean value of Debt to Asset Ratio is 92.2526, the maximum value is 101.3128, the minimum value is 60.6374 and the standard deviation is 2.1690. The return on assets is 0.9281, the maximum value and the minimum value is 7.2213 and -1.7554 respectively. The mean value of return on assets is 0.9281, the maximum value and minimum value are 7.2213 and -1.7554 respectively. The maximum value of return on assets is 7.2213, the minimum value is -1.7554, the mean value is 0.9281 and the standard deviation is 0.4852. The maximum value of non-performing loan ratio is 33.98, the minimum value is 0, the mean value is 2.1401 and the standard deviation is 1.9084. The maximum value of Capital Adequacy Ratio is 33.98, the minimum value is 0, the mean value is 2.1401, and the standard deviation is 1.9084. The maximum value of Total Assets is 31.1912, the minimum value is 21.1233, the mean value is 24.6938, and the standard deviation is 1.7039. The maximum value of Interest Expense is 26.8792, the minimum value is 16.7552, and the standard deviation is

1.78752. The maximum value of interest expense is 26.8792, minimum value is 16.7552, mean value is 20.7738 and standard deviation is 1.7871. The maximum value of payable to bank is 28.6178, minimum value is -1.6094, mean value is 19.4260 and standard deviation is 4.5615.

4.1 Basic Regression Model

In this paper, we conduct empirical regression on the basis of constructing the regression model. The detailed procedures for regression and empirical model testing will be as follows: we use the Hausman test to determine whether the panel data should be modelled as an individual fixed-effects model or an individual random-effects model [8]. The preliminary hypothesis of the study is that the random effects model should be a suitable empirical model if the interception term of the individual effects is independent of the explained variables. If the probability value is less than 0.05, the individual fixed effects model ought to be used [11].

Table 3 shows various regression with different control variables and the probabilities for Hausman test of all the models are all less than 0.05, which indicating that the model of fixed effect should be established. The regressions in table 3 show that the regression coefficients of competition on profitability in various models are robust and model 7 should be used as a proper model to analyze the influence of competition on profitability because it covers more control variables.

Table 3 Regression Results.

COM	Model 1	Model 2	Model 3
DAR	-0.0251*** (0.0030)	-0.0184*** (0.0030)	-0.0264*** (0.0038)
ROA	0.0467*** (0.0131)	0.03918*** (0.01380)	0.037362*** (0.0142)
NLR	0.0119*** (0.0028)	0.0148*** (0.00282)	0.0123*** (0.0029)
CAR	-0.0186*** (0.0031)	-0.0170*** (0.00315)	-0.0181*** (0.0032)
TA	0.5713*** (0.0248)	0.5731*** (0.0242)	0.6199*** (0.0367)
IE	-0.0123 (0.0207)	-0.0438** (0.0213)	-0.0225 (0.0223)
DB	-0.0155*** (0.0020)	-0.0151*** (0.0020)	-0.0151*** (0.0021)
C	-10.3767*** (0.4176)	-10.4212*** (0.3803)	-11.2151*** (0.6467)
Adj.R^2	0.8139	0.8166	0.8135
F-statistic	463.70	5780.75	191.12
Prob (F-stat)	0.0000	0.0000	0.0000
N	3687	3687	3687
Bank control	Y	N	Y
Year control	N	Y	Y

Note: Standard errors in parentheses, *, ** and *** indicate significance at the 10%, 5% and 1% levels respectively.

First, return on assets, non-performing loan ratio and total assets have a positive impact on competition, indicating that reducing the operational risk of commercial banks and increasing new deposits are conducive to improving the competitiveness of commercial banks.

Second, asset-liability ratio, capital adequacy ratio, bank loan and interest expense have a negative impact on bank competition. This not only shows that reducing debt is conducive to improving the competitiveness of commercial banks, but also shows that excessive burdens hinder the ability of banks to create wealth.

Third, because banks and other financial institutions have no significant impact on banking competition.

The Hausman test shows that the chi2 statistic is 91.50 with a corresponding probability of 0.0000, which means that model 3 should be used as the baseline model.

4.2 Heterogeneity analysis

Heterogeneity refers to whether the explanatory effects of the explanatory variables on the explained variables in a subsample change significantly [4] and whether the explanatory effects of the explanatory variables on the explained variables show a pattern different from that of the full sample [2]. Generally, in heterogeneity analysis, in order to investigate whether there is a significant difference in the effect of the explanatory variables on the explained variables in different sub-samples [1], the samples can be classified according to their characteristics.

Firstly, the heterogeneity analysis is based on the type of bank. The banks in the sample are classified into large commercial banks, rural commercial banks and regional commercial banks, and individual fixed effects regressions are conducted. The specific results are shown in Table 4.

Then, heterogeneity is analysed according to the gearing ratio. Banks are divided into two groups, one with gearing ratio higher than 92.4 and the other with gearing ratio lower than 92.4. Individual fixed effects regressions are performed. The results are shown in Table 5.

Table 4 Heterogeneity Regression on bank types.

COM	Model 4 (Large commercial banks)	Model 5 (Rural commercial banks)	Model 6 (Regional commercial banks)
DAR	-0.0843** (0.0412)	-0.0089*** (0.0034)	-0.0141** (0.0056)
ROA	-0.1287 (0.1909)	0.0089 (0.0107)	0.1271*** (0.0323)
NLR	0.0475*** (0.0159)	0.0017 (0.0019)	-0.0042 (0.0119)
CAR	-0.0812*** (0.0296)	-0.0092*** (0.0024)	-0.0109 (0.0073)
TA	2.4480***	0.2044***	0.6318***

	(0.3136)	(0.0325)	(0.0687)
IE	-0.5876** (0.2526)	-0.0065 (0.0195)	-0.1194*** (0.0407)
DB	-0.1988*** (0.0665)	-0.0066*** (0.0013)	-0.0228*** (0.0067)
C	-37.7568*** (5.7258)	-3.6277*** (0.5679)	-10.9286*** (1.2515)
Adj.R^2	0.2288	0.5603	0.7758
F-statistic	11.77	71.39	119.02
Prob (F-stat)	0.0000	0.0000	0.0000
N	197	2383	1107
Bank control	Y	Y	Y
Year control	Y	Y	Y

Table 5 Heterogeneity Regression on Debt to Assert Ratio.

COM	Mode 7 (Banks with high DAR)	Model 8 (Banks with low DAR)
DAR	-0.0535*** (0.0097)	-0.0176*** (0.0035)
ROA	-0.0275 (0.0276)	0.0495 (0.0152)
NLR	0.0126*** (0.0039)	0.0080*** (0.0057)
CAR	-0.0179** (0.0062)	-0.0147* (0.0033)
TA	0.9149*** (0.0668)	0.4387 (0.0787)
IE	-0.1362*** (0.0417)	0.0169 (0.0428)
DB	-0.0219*** (0.0035)	-0.0076 (0.0243)
C	-13.2491*** (1.3129)	-8.7389 (0.7818)
Adj.R^2	0.8248	0.8087
F-statistic	111.47	79.54
Prob (F-stat)	0.0000	0.0000
N	2008	1679
Bank control	Y	Y
Year control	Y	Y

As can be seen from the regression results in Table 4, there are certain differences in the impact of DAR on COM of commercial bank considering their type and DAR. Competition

has a significant impact on the profitability of regional commercial banks and banks whose DAR is lower than 92.4, but for Large joint-stock banks, rural commercial banks and banks whose DAR is higher than 92.4, the effect of competition on profitability is not significant. This indicates that more competition could not be a sign of greater profitability for large banks and financially risky banks, in contrary to smaller banks and robust banks.

4.3 Robustness analysis

Model robustness means that the influence of the model's core explanatory variables on explanatory variables tends to be relatively stable on the basis of not significantly changing with environmental fluctuations [11]. There are many ways to test the robustness of a model, such as increasing or decreasing the sample size to see if the core explanatory variable has a significant effect on the explanatory variable. If there is no significant change in the coefficient or effect of the core explanatory variable on the explained variable, the model can be considered robust. Another approach is to select variables that are similar to the core explanatory variable for regression, and then see if the core explanatory variable has a significant effect on the explained variable. If there is no significant change in the coefficient or effect of the core explanatory variable on the explanatory variable, the model can be considered robust. In this paper, we choose to reduce the sample size and replace the core explanatory variable debt-to-asset ratio with a simple lag to perform regression and assess whether the model is robust.

In order to reduce the chronological sample size, the sampling period for 3687 banks is reduced from 9 years from 2012 to 2021 to 8 years from 2013 to 2021. In another regression, the core explanatory variable ‘competition’ is replaced by its simple lag, holding other factors constant. Using both methods yields robust regression results, as shown in Table 6.

Table 6 Robustness Regression.

	Benchmark Model (Model 3)	Robustness Analysis 1 (Sample reduced)	Robustness Analysis 2 (COM lagged)
DAR	-0.0264*** (0.0038)	-0.0306*** (0.0032)	-0.0432*** (0.0043)
DAR(-1)	---	---	0.0712*** (0.0213)
ROA	0.037362*** (0.0142)	0.0154 (0.0139)	0.0643*** (0.0193)
NLR	0.0123*** (0.0029)	0.0096*** (0.0025)	0.0207*** (0.0047)
CAR	-0.0181*** (0.0032)	-0.0125*** (0.0029)	-0.0189*** (0.0049)
TA	0.6199*** (0.0367)	0.5999*** (0.0354)	0.5485*** (0.0469)
IE	-0.0225 (0.0223)	0.0191` (0.0213)	0.0547* (0.0297)
DB	-0.0151*** (0.0021)	-0.0120*** (0.0018)	-0.0136*** (0.0028)

C	-11.2151*** (0.6467)	-11.2738*** (0.6353)	-9.7005*** (0.8101)
Adj.R^2	0.8135	0.8115	0.8084
F-statistic	191.12	173.98	149.63
Prob (F-stat)	0.0000	0.0000	0.0000
N	3687	3349	2966
Bank control	Y	Y	Y
Year control	Y	Y	Y

4.4 Endogeneity analysis

After careful analysis of the model regression results, we noticed that DAR, the core explanatory variable, has a certain explanatory power to the changes of COM in commercial banks. However, this does not completely rule out the possibility of an underlying endoplasmic causality between the two. For the sake of rigor, we used a two-stage least-squares regression method to assess the degree of endogeneity. In the first stage, we built the instrumental variables based on the first-order hysteresis of DAR and other control variables. In the second stage, we use this newly constructed asset-liability ratio instrumental variable to carry out regression analysis of commercial bank COM.

In the whole regression process, the first order lag of DAR is used as an instrumental variable. The final regression results show that the influence coefficient of DAR treated with instrumental variables on COM of commercial banks is -0.0227, which is similar to the influence coefficient of DAR before endogeneity treatment on COM of commercial banks. This comparison shows that the influence of DAR on COM of commercial banks does not change significantly after considering the endogenous influence. Based on the above results, we can infer that the endogeneity of the model in this study is not severe.

5 Conclusions

Overall, DAR of commercial banks has a negative effect on competition among commercial banks. And we find through heterogeneity analysis that large banks have a greater negative effect on competition among commercial banks, while regional and rural commercial banks have a relatively smaller effect. This suggests that large banks need to pay more attention to regulation in terms of DAR, but the regulation about DAR among regional and rural commercial banks still needs to be further strengthened. In addition, low DAR has a greater impact on commercial banks. This suggests that the more robust a commercial bank is from a liability perspective, the relatively smaller the impact of the bank's gearing ratio on its competitiveness will be. Therefore, commercial banks need to operate soundly to further weaken the negative effect of DAR.

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