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The Effect of Bank Size, Net Interest Margin, and Capital Adequacy Ratio on Commercial Banks' Return on Assets: Empirical Evidence from Tanzania

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Abstract

While the current body of literature offers valuable insights into the factors influencing bank financial performance, there is a significant paucity of empirical research focusing on least developed nations. This paper presents new evidence of the effect of bank size, capital adequacy ratio (CAR), and net interest margin (NIM) on banks' return on assets (financial performance) from the perspective of Tanzania – a least-developed country. We employed the Random Effect, and the Generalized Least Squares (GLS) regression models utilizing a panel dataset spanning the period 2000 to 2022 of ten (10) Tanzanian commercial banks to examine the specific effect of the foregoing variables on commercial banks' financial performance. The estimation results show that capital adequacy ratio (CAR) and bank size have positive significant effects on the financial performance of commercial banks in Tanzania. Whereas we found inconsistent results for the effect of NIM; while the random effect model shows a marginally significant positive effect on ROA, the GLS regression shows a significant negative effect, indicating that the effect of NIM could be either positive or negative depending on the context. Therefore, policymakers should prioritize measures aimed at promoting healthy levels of capital adequacy and encouraging the growth of larger banks while ensuring adequate oversight to mitigate potential risks associated with market dominance. Additionally, regulatory frameworks should be designed to foster competition and efficiency in the banking sector, facilitating a conducive environment for banks of all sizes to thrive and thus contribute to economic growth.

Keywords: Bank size, return on Assets, net interest margin, capital adequacy ratio, Tanzania

Introduction

In the purview of global finance, commercial banks serve as pivotal institutions driving economic growth and stability, particularly in emerging markets. Understanding the factors that affect or to some extent determine the performance of commercial banks is crucial for policymakers, investors, and stakeholders. A robust and secure banking system is considered essential for sustainable economic development. Thus the financial stability of a bank holds paramount importance, not solely for its depositors but also its shareholders, employees, and the economy as a whole.

While existing literature provides valuable insights into the determinants of bank financial performance, there remains a notable gap concerning empirical evidence from underdeveloped countries. Most studies in this domain have focused on developed economies, with limited attention given to the unique characteristics and challenges faced by banks in emerging markets. This dearth in literature is what this paper intends to fill. More particularly, the motivation behind this research stems from the imperative need to comprehensively understand the factors that underpin the financial performance of Tanzanian commercial banks with a particular emphasis on the effect of bank size, capital adequacy ratio (CAR), and net interest margin (NIM) on the return on assets (ROA) of ten (10) Tanzanian commercial banks. We do this by utilizing data garnered from 10 commercial banks in Tanzania. The inclusion of net interest margin alongside traditional determinants such as bank size and capital adequacy ratio offers a comprehensive analysis that accounts for the multifaceted nature of banks' financial performance. We delineate and implement a sequential econometric methodology that firstly determines whether the variables of interest are stationary, secondly identifies the optimal model via the Hausman test, thirdly run a full sample regression of the random effect model and generalized least square regression to examine the impact of the variables of interest, and that finally ran diagnostics test to see if any of the assumptions are violated. We found that both capital adequacy ratio and bank size exhibit a positive significant effect on banks‘ return on assets, whereas the result of the effect of NIM was context-dependent.

The Tanzanian banking sector has witnessed notable change in recent years, characterized by increased competition, regulatory reforms, and shifts in market dynamics. Commercial banks in Tanzania have undergone significant regulatory and technological changes in the last decade. The entry of major international banks into the retail banking industry, along with regulatory requirements, financial and technological advancements, and the challenges of recent financial crises has resulted in increased competition and costs for Tanzanian banks. These reforms have had a vital effect on the financial performance of commercial banks in the sector.

As Tanzania continues its trajectory towards economic development and financial inclusion, findings from this research will inform regulatory authorities in formulating policies aimed at enhancing the resilience and stability of commercial banks, ultimately fostering a more robust financial system in Tanzania. By understanding the drivers of financial performance, banks can optimize their strategies to mitigate risks, enhance operational efficiency, and maximize shareholder value. The subsequent sections of this paper are organized as follows: First, we present a succinct overview of the banking sector of Tanzania. Second, we delve into the existing literature related to the topic. Third, we present the description of the data and variables. Fourth, we explain the econometric model and methodology employed. Lastly, we discuss the findings and present our conclusion.

Tanzania Banking Sector

The banking industry in Tanzania plays a pivotal role within the nation's financial sector, assuming a fundamental role in fostering economic expansion, facilitating capital investment, and fostering financial inclusivity. Supervision and regulation of this sector are entrusted to the Bank of Tanzania (BoT), serving as the nation's central banking authority. The BoT assumes responsibility for crafting and executing monetary policies, overseeing financial entities, and safeguarding the stability and integrity of the banking system. As reported by BoT, the sector comprises various types of financial institutions, including commercial banks, community banks, development finance institutions, and microfinance institutions. Commercial banks hold a predominant position within the sector, providing a wide range of banking services catering to individuals, enterprises, and governmental bodies. While domestic banks dominate the market in terms of branch network and customer base, foreign-owned banks play a significant role, particularly in international banking and corporate finance (BoT, 2022). The vast majority of these banks provide a comprehensive range of financial services, including deposit-taking, lending, trade finance, foreign exchange, treasury services, and electronic banking. While others also offer specialized services such as wealth management, investment banking, and Islamic banking. The banking sector accounts for 70 percent of the assets of the financial sector and remains well-capitalized, profitable, and with sufficient liquidity levels (BoT, 2022). The sector continued to grow in terms of deposits and assets, supported by regulatory and supervisory measures, and a favorable macroeconomic environment. The number of institutions under the Bank's purview increased to 64, of which 44 were banks, while the remaining 20 were non-bank financial institutions (BoT, 2022).

		Ownership structure		Stock exchange listing	
Type of bank	Number	Domestic	Foreign	Listed	Not listed
Commercial banks	34	11	23	6	28
Microfinance banks	3	0	3	0	3
Community banks	5	5	0	0	5
Development finance banks	2	2	0	0	2
Total	44	18	26	6	38

Figure 1. Licensed Banks in Tanzania; Source: Bank of Tanzania

Literature Review

The exploration of factors influencing the financial performance of banks has garnered considerable attention within the realm of finance. Existing scholarly literature provides valuable insights into the impact of diverse variables, encompassing bank size, capital adequacy ratio (CAR), net interest margin (NIM), and non-performing loans (NPLs), on the return on assets (ROA). Khrawish (2011) conducted a study on the determinants of commercial bank profitability in Jordan. His paper encompassed an examination of numerous bank-specific metrics, including overhead costs ratio, short-term customer funding, equity, loans, loan loss provision, and other revenue-to-total assets ratio, alongside macroeconomic indicators such as GDP growth rate, inflation rate, financial sector depth, and institutional quality. The findings suggested that the profitability of foreign banks is significantly influenced by a combination of bank-specific factors, macroeconomic conditions, and additional metrics pertinent to multinational banks.

Similarly, Tan et al. (2017) undertook an analysis of the determinants of bank financial performance in China. Their study delved into the relationship between inflation and bank profitability while controlling for various bank- and industry-specific variables. The results indicated a positive correlation between bank financial performance, cost efficiency, banking sector growth, stock market development, and inflation in China.

Conversely, factors contributing to diminished bank profitability were identified as non-traditional production volume and elevated taxation levels.

Bank Size and ROA:

Bank size is one of the vital determinants of a bank’s financial performance. A study by Alexiou and Sofoklis (2009) examining commercial banks in Europe found mixed results regarding the relationship between Bank Size and ROA. While larger banks exhibited economies of scale leading to higher profitability, some large banks experienced diseconomies of scale due to organizational complexities and inefficiencies. They concluded that the effect of Bank Size on ROA may vary across different banking contexts. Similarly, Khediri and Khedhiri (2009) investigated the determinants of bank profitability across 22 countries and found that Bank size had a positive impact on its financial performance, indicating economies of scale and scope in larger banks. Based on these findings, hypothesis one examining the effect of bank size and bank’s ROA is formulated as follows:

H1: There exists a statistically significant positive correlation between the size of banks and the financial performance of Tanzanian commercial banks.

Capital Adequacy Ratio and ROA:

Capital adequacy ratio (CAR) is another significant indicator of a bank's financial soundness and ability to absorb potential losses. According to Bikker and Metzemakers (2005), a higher CAR reflects a bank’s capacity to withstand adverse shocks and maintain stability, which can positively impact its ROA. Research by Berger and DeYoung (1997) suggested that an increase in CAR positively impacts the profitability of commercial banks. Elsas and Krahnen (1998) also conducted a study on German banks and found that a higher CAR positively affects ROA. As such, we formulated the second hypothesis concerning the impact of capital adequacy ratio on banks’ ROA as follows:

H2: There is a positive statistically significant relationship between capital adequacy ratio and the financial performance of Tanzanian commercial banks.

Net Interest Margin and ROA:

A study by Saona (2011) found that higher Net Interest Margin was positively associated with ROA in a sample of commercial banks in the United States. Another research by Ho and Saunders (1981) suggests that a wider NIM is associated with improved profitability, supporting the positive relationship between NIM and ROA. On the other hand, Demirgüç-Kunt and

Huizinga (1999) found that the relationship between NIM and ROA could be nonlinear and context-dependent. They noted that in some cases, an increase in NIM may lead to higher ROA, while in others, it may not have a significant effect or could even be detrimental to banks' profitability. Therefore, the third hypothesis regarding the effect of NIM on ROA is as follows:

H3: There exists a positive statistically significant relationship between net interest margin and Tanzanian commercial banks' financial performance.

Data

The dataset utilized in this study encompasses 10 Tanzania Commercial banks from the period 2000-2022. The dataset includes both cross-sectional and time series information, allowing for the examination of individual variability and dynamic adjustments over time. Data were sourced from published resources, such as the audited financial reports and annual reports of the selected commercial banks. The descriptive statistics of the variables are presented in Table 3. The highest and lowest levels for return on asset for the sampled commercial banks are achieved at 10.87 percent and −15.1 percent, respectively. This indicates that there is a wide range between the maximum and minimum values of ROA. The skewness for ROA is -2.193, which also indicates that ROA is long left-tailed with a kurtosis of 27.16. This is a positive leptokurtic kurtosis as 27.16 is greater than 3, which further implies that there were more observations with higher values above the average of the sample. The mean value of net interest margin, capital adequacy ratio, and bank size are 6.216, 16.12, and 10.931, respectively.

Table 1. Sampled Banks

No.	*Banks*	*Code*
1.	Cooperative and Rural Development Bank	CRDB
2.	National Bank of Commerce	NBC
3.	Bank of Africa	BOA
4.	Absa Bank	ABSA
5.	Dar es salaam Commercial Bank	DASU
6.	Ecobank Transnational Inc	ECO
7.	Azania Bank Ltd	AZAN
8.	Akiba Commercial Bank	AKCO
9.	Access Bank	AC
10.	Standard Chartered Bank	SCB

Table 2. Variables Description

Symbols	Variables	Proxy	Expected results
REGRESSAND			
ROA	Return on assets	Net Profit /Average Total Assets	
REGRESSORS			
NIM	Net Interest Margin	Net Interest Income/Total Assets	Positive
CAR	Capital Adequacy Ratio	Capital / Risk Weighted Assets	Positive
BNII	Bank Non-Interest Income	Other income/Total Asset	Positive
NPL	Non-Performing Loans	Non-Performing Loans/Gross Loans	Negative
LDR	Loan Deposit Ratio	Loans/ Customer deposits	Positive

Table 3. Descriptive Statistics

Variables	Obs	Mean	Std Dev	Min	Max	Skew	Kurt
ROA	180	2.409	2.153	-15.1	10.87	-2.193	27.169
CAR	120	16.121	4.252	1.75	26.97	.044	3.877
NIM	180	6.216	3.276	1.253	16.807	.548	2.554
LDR	143	7.130	4.034	.45	22.83	1.457	5.596
NPL	75	9.888	5.817	2.84	37.25	1.655	7.93
BNII	180	38.253	10.688	14.41	64.11	.014	2.657
Bank Size	215	10.931	4.579	3.040	25.110	2.023	9.781
INF	190	8.054	6.213	-.7	32.9	1.268	4.796

Source: Authors' computations

Econometric Model and Methodology

Measurement Model

To test the effect of capital adequacy ratio, net interest margin, and bank size on banks' financial performance - measured by return on asset – from an empirical standpoint, we employed the following multivariate model:

$$ROA_{it} = a_0 + \beta_1 CAR_{it} + B_2 NIM_{it} + B_3 BankSize_{it} + B_4 NPL_{it} + B_5 LDR_{it} + B_6 BNII_{it} + B_7 INF_{it} + \varepsilon_{it} \quad (1)$$

Where:

α_0 = the intercept term
ROA_{it} = Return on Assets for bank *i* in year *t*
NIM_{it}= Net Interest Margin for bank *i* in year *t*
LDR_{it} = Loan Deposit Ratio for bank *i* in year *t*
CAR_{it} = Capital Adequacy Ratio for bank *i* in year *t*
$BNII_{it}$= Bank Non-Interest Income to total Asset for bank *i* in year *t*
NPL_{it} = Non-Performing Loans for bank *i* in year *t*
$Bank\ Size_{it}$ = Bank Size for bank *i* in year *t*
INF_{it}= Inflation for bank *i* in year *t*
B1- B7 = coefficients of the regressors
ε_{it}= the normal error terms

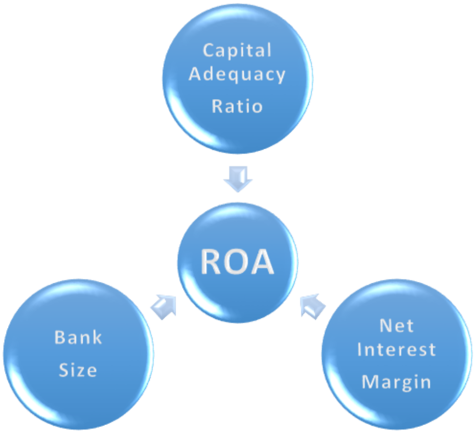

Figure 2. Schematic Diagram of the variables of interest

Methodology

The study's methodology is broken down into five steps. Firstly, to ascertain the robustness of our findings, we employed a panel unit-root test to examine the stationarity of the variables across time and individual banks. This ensures the reliability of the subsequent analysis by confirming the suitability of employing panel data techniques. Secondly, the Hausman specification test was employed to ascertain the suitability of either the random effect model or the fixed effect model for the analysis. This evaluates whether the individual-specific effects are correlated with the explanatory variables, thus guiding the selection of the appropriate model. Thirdly, after determining the appropriate model specification, a full sample random effect estimation was conducted which accounts for both time-invariant heterogeneity across commercial banks and time-varying factors influencing ROA. Fourthly, given the potential presence of endogeneity issues in our model, we address this concern by employing the generalized least squares (GLS) regression technique to mitigate bias arising from endogeneity. After the model estimation, we run several diagnostic tests to assess the validity of the regression assumptions. Specifically, we ran the heteroskedasticity, autocorrelation, and Ramsey RESET tests to detect potential violations of the underlying assumptions of the random effect and the GLS regression, such as non-constant variance, serial correlation in the error terms, and misspecification of functional form. Addressing these issues is crucial to ensuring the reliability and robustness of our findings.

Empirical Findings & Discussions

Correlation Matrix

Table 4 presents the correlation matrix of the regressand and regressors. It can be seen that ROA has positive correlations with CAR (0.464), NIM (0.362), and bank size (0.312), indicating that higher values of CAR, NIM, and bank size tend to be associated with higher ROA, i.e., an increase in the indicative paired explanatory variables will increase banks' return on assets. Moreover, ROA is negatively correlated with NPL, BNII, and INF, which also indicates that an increase in any of the three variables will cause a decrease in ROA.

Table 4. Correlation Matrix

	ROA	CAR	NIM	LDR	NPL	BNII	Bank Size	INF
ROA	1.000							
CAR	0.464	1.000						
NIM	0.362	0.183	1.000					
LDR	0.293	-0.035	0.478	1.000				
NPL	-0.479	-0.310	-0.031	0.231	1.000			
BNII	-0.072	-0.046	-0.260	-0.307	-0.015	1.000		
Bank Size	0.312	0.291	0.261	0.140	-0.181	0.251	1.000	
INF	-0.018	-0.161	0.313	0.274	0.143	0.034	-0.095	1.000

Source: Authors' computations

Unit Root Test

To avoid spurious regression and to ensure the robustness of our findings, we employed the Dickey-Fuller unit root test to determine whether the panel is stationary or exhibits a unit root. The test was conducted at one lag based on the assumption that the panel is non-stationary and has a unit root.

The test statistic for the Dickey-Fuller test is defined as:

$$\Delta y_t = \rho y_{t-1} + \alpha + \beta t + \epsilon_t \qquad (2)$$

Where Δy_t is the differenced time series variable at time t; $y_{t-1}$is the lagged value of the time series variable at time t-1; ρ is the coefficient of the lagged variable, which is the parameter being tested for stationarity; α and β are parameters representing the intercept and trend, respectively; *t* is the time trend; ϵ_t is the error term.

Table 6 presents the result of the unit root test. The test result indicates that BankSize, NIM, LDR, NPL, and INF are statistically significant and stationary at I (0). Return on assets (ROA), capital adequacy ratio (CAR), and bank net interest income (BNII) are non-stationary at the original level but became stationary after first differencing. For ROA, CAR, BNII, and Bank Size, the value of the chi-square statistic presented in parentheses indicates the presence of heteroskedasticity in the data.

Table 6. Unit Root Test

Variables	Chi^2 statistics	P-value	Level	1st difference
ROA	28.9663 (89.9056)	0.0884 (0.0000)***	Non-stationary	Stationary
CAR	25.6002 (103.1040)	0.1093 (0.0000) ***	Non-stationary	Stationary
NIM	42.7064	0.0022 ***	Stationary	-
LDR	34.1512	0.0121**	Stationary	-
NPL	28.6103	0.0118 **	Stationary	-
BNII	24.3296 (95.8396)	0.2283 (0.0000) ***	Non-stationary	Stationary
BankSize	40.4502 (110.1746)	0.0044***	Stationary	-
INF	45.8292	0.0009 ***	Stationary	-

*Note: ***, **, * represent 1%, 5%, 10 significance levels respectively.*
Source: Authors' computations

Random Effect Model

The random effect model assumed individual-specific effects to be random variables with mean zero and constant variance. The model allows for the inclusion of entity-specific random effects, capturing unobserved heterogeneity among entities. The random effect model is represented as:

$$y_{it} = \alpha + \lambda_i + \beta_1 x_{1it} + \beta_2 x_{2it} + \ldots + \beta_k x_{kit} + \epsilon_{it} \qquad (3)$$

Where: α is the intercept.; X_{it} is a vector of explanatory variables.; λ_i represents the individual-specific random effect for entity i; $x_{1it}, x_{2it}, \ldots, x_{kit}$ are the explanatory variables for entity i at time; $\beta_1, \beta_2, \ldots, \beta_k$ are vectors of coefficients; ε_{it} is the error term

Fixed Effects Model

The entity-specific fixed effects are included in the fixed-effect regression equation to capture time-invariant heterogeneity among entities. The model estimates separate intercepts for each entity, allowing for the control of unobserved individual-specific effects. Mathematically, the fixed effect model can be represented as:

$$y_{it} = \alpha_i + \beta_1 x_{1it} + \beta_2 x_{2it} + \ldots + \beta_k x_{kit} + u_{it} \qquad (4)$$

Where y_{it} is the dependent variable for entity i at time t. α_i represents the entity-specific fixed effect. x_{1it}, $x_{2it}, \ldots, x_{kit}$ are the explanatory variables for entity i at time t. $\beta_1, \beta_2, \ldots, \beta_k$ are the coefficients associated with the explanatory variables. u_{it} is the error term.

Table 7. Random and Fixed Effect Regression

Variables	Random Effect		Fixed Effect	
dROA	Coef	P-value	Coef	P-value
dCAR	0.146	0.041 **	0.177	0.012 **
NIM	0.115	0.069*	-0.354	0.219
LDR	0.010	0.960	0.114	0.479
NPL	-0.204	0.188	-0.258	0.000 ***
dBNII	0.045	0.622	0.044	0.556
BankSize	0.202	0.002***	0.051	0.050
INF	0.022	0. 866	-0.054	0.992
Constant	2.842	0.002	6.972	0.001

*Note: ***, **, * represents 1%, 5%, 10% significance level respectively.*
Source: Authors' computations

Hausman Specification Test

To determine which model is appropriate for the study, we employed the Hausman specification test based on the regression estimates in Table 7. The test results are shown in Table 8. The test statistic adheres to a Chi-square distribution, with the degrees of freedom corresponding to the number of coefficients being estimated (Hausman, 1978). Judging from the p-value, it is observed that the test statistic does not achieve statistical significance at the 5% level. Therefore, the null hypothesis, positing the consistency of the random effect, cannot be refuted, implying a preference for the random effects model. Hence the random effect model is chosen for this study.

Table 8. Hausman (1978) Specification Test

Test Statistics	
Chi-square test value.	**0.49**
P-value	**0.9995**

Source: Authors' computations

Random Effect Model Full Sample Estimation

Table 9 reports the result of the full sample random effect model estimation. The result indicates that capital adequacy ratio (CAR) exhibits a positive effect on banks' return on assets (ROA), and this effect is statistically significant at the 5% level. This suggests that maintaining adequate capital levels is significant for banks in Tanzania to ensure the safety of depositors' funds and reduce the risk of bankruptcy while generating higher profits. These findings are consistent with prior studies by Elsas & Krahnen (1998), Bikker & Metzemakers (2005), and Berger & DeYoung (1997), all of whom showed a positive statistically significant association between capital adequacy ratio and bank financial performance.

The coefficient estimate for NIM is positive (0.115), and statistically robust at the 10% level (p-value=0.069). This suggests that an increase in net interest margin tends to be associated with a positive change in return on Assets. An increase of 1% in NIM corresponds to a 0.115% increase in ROA. A higher net interest margin indicates greater profitability for banks, however, it may also result in riskier lending practices and potential loan loss provisions. This finding aligns with Saona (2011) and Ho and Saunders (1981), who found a positive significant relationship between NIM and ROA. In the context of Tanzania, this result is also in line with the findings of Demirgüç-Kunt and Huizinga (1999).

Bank Size has a positive and statistically significant coefficient estimate (0.202, p-value=0.002). This indicates that larger Commercial banks tend to perform better than smaller ones, as they may benefit from economies of scale, enhanced market power, and greater diversification, which in return, contribute to an increase in financial performance. This finding corroborates prior research by Khediri & Khedhiri (2009) who examined the determinants of bank profitability across 22 countries and found that the size of a bank has a positive significant effect on its profitability. However, this result conflicts with the findings of Alexiou & Sofoklis (2009) who also investigated the relationship between bank size and ROA of commercial banks in Europe and found that while larger banks exhibited economies of scale leading to higher profitability, some large banks experienced diseconomies of scale as a result of their organizational complexities and inefficiencies.

Table 9 shows that non-performing loans (NPL) is negative and not statistically significant (p-value=0.188). This is consistent with the fact that potential investors want to invest in businesses that have strong financial records. As such, a higher level of non-performing loans recorded by a bank reduces its attractiveness to prospective investors. Other variables such as Loan-to-Deposit Ratio (LDR), Inflation (INF), and Bank Net Interest Income (dBNII) do not exhibit statistically significant effects on the return on assets of Tanzania commercial banks, as indicated by their non-significant coefficient estimates. The constant term is not statistically significant (p-value=0.762), suggesting that it does not contribute significantly to explaining the variation in ROA.

Table 9. Random Effect Full Sample Panel Regression

dROA	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NIM	0.115	0.350	2.72	0.069	1.093	0.435	*
NPL	-0.204	0.153	-1.32	0.188	-0.502	0.099	
LDR	0.010	0.204	0.05	0.960	-0.389	0.410	
dCAR	0.146	1.193	4.76	0.041	3.232	0.525	**
INF	0.022	0.165	0.12	0.703	-0.904	0.343	
dBNII	0.045	0.233	-0.28	0.622	0.921	0.391	
BankSize	0.202	0.223	6.24	0.002	1.385	0.490	***
Constant	3.180	3.895	1.30	0.762	5.814	6.454	
Mean dependent var		2.232	SD dependent var			2.781	
Overall r-squared		0.210	Number of obs			82.000	
Chi-square		8.491	Prob > chi2			0.091	
R-squared within		0.229	R-squared between			0.060	

**** p<0.01, ** p<0.05, * p<0.1*
Source: Authors' computations

Endogeneity Issue

The random effect model assumed that the error terms have constant variance and are uncorrelated. If these assumptions are violated, i.e., if heteroscedasticity and autocorrelation are present, this can potentially result in spurious and biased parameter estimates. To avoid this, we employed the generalized least squares (GLS) regression to account for the correlated errors and unequal variances. The GLS approach allows for the specification of a variance-covariance matrix for the errors, which account for the heteroscedasticity and autocorrelation present in the data.

The GLS estimator is given by:

$$Y = X\beta + \varepsilon \qquad (5)$$

$$\hat{\beta}_{GLS} = (X'V^{-1}X)^{-1}X'V^{-1}y \qquad (6)$$

Here, *V* represents the variance-covariance matrix of the errors, ε, and V^{-1} denotes the inverse of the variance-covariance matrix.

The GLS regression estimates are presented in Table 10. In both regressions, the coefficient estimates for the variables are similar in magnitude. In Table 9 (random effects regression), the coefficient estimate for dCAR is 0.146 with a p-value of 0.048, suggesting a positive statistically significant relationship with return on assets at the 5% level of significance. Similarly, in Table 10 (GLS regression), the coefficient estimate for dCAR remains 0.146, with a p-value of 0.056, statistically significant at the 5% level. The consistency in the significant coefficient estimate across both regressions suggests a robust and significant positive relationship between CAR and ROA. This implies that an increase in capital adequacy ratio tends to result in an increase in ROA for Tanzanian commercial banks.

In the random effects regression, bank size has a coefficient estimate of 0.202 with a p-value of 0.002, which indicates a positive and statistically significant relationship with ROA at the 1% level. Similarly, in Table 10 (GLS regression), Bank Size has a coefficient estimate of 0.053 with a p-value of 0.014, suggesting a positive and statistically significant relationship with ROA at the 1% level of significance. It can be seen that the significance level of the bank size effect on banks' return on assets does not differ between the two regressions which implies that the interpretation of the results remains largely consistent between the two regressions, thus larger commercial banks are likely to have higher returns on assets.

The coefficient for NIM in Table 9 is positive (0.115), and statistically significant at the 10% level (p-value=0.069). In the GLS regression, NIM is negative (-0.251) and statistically significant at the 5% significance level (p-value=0.046). While the random effects regression suggests a positive but insignificant relationship with ROA, the GLS regression indicates a significant negative relationship. This disparity is in line with the research of Demirgüç-Kunt and Huizinga (1999), who discovered that the relationship between NIM and ROA depends on the context and could potentially be either positive or negative. This negative coefficient can be attributed to factors such as the interest rate environment, loan quality, and the dynamics of the market. For instance, in an environment of declining interest rates, banks may experience compression in their net interest margins. As interest rates decrease, the spread between the interest earned on assets (loans and investments) and the interest paid on liabilities (deposits and borrowings) may narrow, leading to a lower NIM.

This compression, however, may not necessarily correspond to a proportional increase in the return on assets due to other factors such as increased competition, credit risk, or operating expenses. Similarly, a recessionary environment may lead to higher credit losses and reduced loan demand, affecting banks' profitability. Thus NIM may, in certain circumstances, result in a greater ROA; yet, in other circumstances, it could not have much of an impact or exhibit a negative impact on banks' financial performance.

Table 10: Generalized Least Squares (GLS) Regression

dROA	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NIM	-0.251	0.358	5.72	0.046	1.327	0.445	**
NPL	-0.202	0.153	-1.32	0.188	-0.502	0.099	
LDR	0.568	0.338	1.68	0.092	0.094	1.230	*
dCAR	0.146	0.193	4.76	0.054	1.232	0.525	**
INF	0.020	0.165	0.12	0.905	0.304	0.343	
dBNII	-0.065	0.233	-0.28	0.779	-0.521	0.391	
BankSize	0.053	0.223	6.24	0.014	1.385	0.490	***
Constant	-1.180	3.895	-0.30	0.762	-8.814	6.454	
Mean dependent var		4.032	SD dependent var			4.281	
Overall r-squared		0.210	Number of obs			82.000	
Chi-square		8.491	Prob > chi2			0.291	
R-squared within		0.229	R-squared between			0.060	

**** p<0.01, ** p<0.05, * p<0.1*
Source: Author's computations

Heteroskedasticity Test

The parameter estimates of the GLS regression do not differ substantially from the estimation in the random effect model, thus the null hypothesis of the presence of homoskedasticity cannot be rejected (p-value = 0.291 > 0.05). Hence, the error variances and the regressors are serially correlated. In correction of this, we employed the Breusch-Pagan heteroskedasticity test to make independent the explanatory variables and the error variances. The test statistic is distributed $n\chi 2$ with k degrees of freedom equal to the number of regressors in the model. The test results are presented in Table 11. With p-value = 0.0005 < 0.05, the null hypothesis of the presence of homoskedasticity is rejected. Thus, it is ascertained that the error variances and explanatory variables in the panel are serially uncorrelated and independent.

Table 11. Heteroskedasticity Test

dROA	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NIM	-0.027	0.075	-0.36	0.719	0.175	0.121	
NPL	-0.014	0.057	-0.24	0.808	-0.126	0.098	
LDR	0.120	0.113	1.06	0.288	0.101	0.342	
dCAR	0.054	0.095	0.57	0.568	0.032	0.241	**
INF	-0.041	0.049	-0.83	0.407	-0.136	0.055	
dBNII	-0.023	0.021	-1.06	0.291	-0.065	0.019	
BankSize	0.085	0.088	0.96	0.034	0.087	0.257	**
Constant	-1.066	1.204	-0.89	0.376	-3.426	1.294	
Mean dependent var		-0.032	SD dependent var			4.281	
Number of obs		82.000	Chi-square			26.098	
Prob > chi2		0.0005					

*Note: ***, **, * represents 1%, 5%, 10% significance level respectively.*
Source: Authors' computations

Table 12: Autocorrelation Test

dROA	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
NIM	-0.191	0.169	-1.13	0.058	-0.521	0.140	*
NPL	0.064	0.079	0.81	0.419	-0.091	0.218	
LDR	0.435	0.177	2.46	0.014	0.088	0.782	**
dCAR	0.389	0.112	3.48	0.000	0.170	0.609	***
INF	-0.047	0.089	-0.53	0.597	-0.221	0.127	
dBNII	0.122	0.176	0.69	0.491	-0.224	0.467	
BankSize	0.110	0.108	1.02	0.006	1.101	0.322	**
Constant	-2.667	1.860	-1.43	0.152	-6.312	0.978	
Mean dependent var		4.032	SD dependent var			4.281	
Overall r-squared		0.123	Number of obs			82.000	
Chi-square		27.745	Prob > chi2			0.001	
R-squared within		0.130	R-squared between			0.572	

*Note: ***, **, * represents 1%, 5%, 10% significance level respectively.*
Source: Authors' computations.

Autocorrelation Test

Table 12 presents the result of the test of the presence of serial correlation within the residuals of the dataset. The chi-square statistic for the autocorrelation test is 27.745, with a p-value of 0.001. This result signifies that the null hypothesis positing the absence of autocorrelation, is rejected at the 1% conventional significance level. The presence of autocorrelation suggests that the error terms in the regression model are correlated with each other, which violates the classical linear regression assumption of no autocorrelation. This autocorrelation is largely ascribed to the fact that the rules and regulations are similar for commercial banks in Tanzania.

Ramsey RESET Test

We employed the Ramsey RESET test to address potential omitted variable biases in the model. The results are presented in Table 13. The null hypothesis that the model is correctly specified and all relevant nonlinearities and interactions are captured cannot be rejected, as evidenced by a p-value of 0.0632, which is greater than the conventional significance level of 0.05. This indicates that there is no evidence of specification error in the model, i.e., the functional form of the model appears to be correctly specified, and there are no significant omitted nonlinearities or interactions among the variables included in the model.

Table 13. The Ramsey RESET Test

Test statistics	
F (3, 71)	1.93
P-value	0.0632
No of observations	82

Source: Authors' computations

Table 14. Summary of Diagnostic Test

Test	Test statistics	P-value
A: Endogeneity	8.491	0.291
B: Heteroskedasticity	25.616	0.0005 ***
C: Autocorrelation	112.439	0.001 ***
D: Ramsey RESET	1.93	0.0632 *

A: GLS is used to test for endogeneity in the regressors and error terms in the panel
B: Breusch-Pagan test is to correct endogeneity in the residuals of the model.
C: FGLS is used to test for residual autocorrelation.
D: Ramsey Reset is used to test for omitted variables

Conclusion

The effect of the determinants of bank financial performance has been the subject of extensive research in the field of finance in recent decades. A number of studies have explored the relationship between these determinants and their impact on the financial performance of commercial banks in the context of advanced countries. Through empirical investigation into Tanzania's – a least developed country – banking sector, this study sought to examine the effect of bank size, capital adequacy ratio (CAR), and net interest margin (NIM) on commercial banks' return on assets (ROA). Using a panel data set of 10 Tanzanian commercial banks, we employed the random effect model and generalized least squares regression–result presented in Tables 9 and 10–to examine the effect of the explanatory variables on the regressand.

Effect of Explanatory Variables

Bank Size: The random effect and GLS regressions consistently reveal a statistically significant positive relationship between bank size and return on assets. This result underscores the importance of size and scale in driving profitability within the banking industry. It further indicates that larger banks are better positioned to leverage their resources, capabilities, and market presence to generate higher returns on assets compared to smaller banks. This finding supports the first hypothesis *H1* of the study which posits that there is a positive significant relationship between the size of a bank and its ROA.

Capital Adequacy Ratio (CAR): The results from the random effect and the GLS regressions demonstrate a positive significant relationship between capital adequacy and return on assets, albeit at different levels of significance. This result substantiates the second hypothesis *H2* which asserted that there exists a positive significant relationship between CAR and ROA. This result aligns with the fact that capital adequacy ratios serve to mitigate the risk of bank insolvency, thereby ensuring the integrity and quality of the soundness and reliability of a country's financial sector. Consequently, a bank with a high capital adequacy ratio is generally perceived as secure and competent in fulfilling its financial commitments. Hence, the higher the bank's capital adequacy level, the more secure depositors' funds are. Further, the result shows that improvements in capital adequacy positively impact banks' profitability, as they are better equipped to absorb losses and manage risks.

Net Interest Margin (NIM): The random effect and GLS regressions show an inconsistent result of the effect of net interest margin on return on assets. While the random effect identifies a marginally significant positive relationship between NIM and banks' return on assets, the GLS regression shows a significant negative relationship. This inconsistency supports the findings of Demirgüç-Kunt and Huizinga (1999) who saw that the relationship between NIM is context-dependent; i.e., the relationship could be either positive or negative considering the context. In some cases, an increase in NIM may lead to higher ROA, while in others, it may not have a significant effect or could even be detrimental to profitability.

Implications & Policy Recommendations:

The findings underscore the importance of bank size and capital adequacy in driving commercial banks' financial performance in Tanzania. Policymakers and banking regulators should recognize the role of these factors in fostering a stable and resilient banking sector. While net interest margin remains a crucial determinant of banks' profitability, its precise impact warrants further exploration. Policymakers should prioritize measures aimed at promoting healthy levels of capital adequacy and encouraging the growth of larger banks while ensuring adequate oversight to mitigate potential risks associated with market dominance. Regulatory frameworks should be designed to foster competition and efficiency in the banking sector, facilitating a conducive environment for banks of all sizes to thrive and contribute to economic growth.

Limitations and Future Research:

The study is constrained by the limited scope of data which may not fully capture the dynamics of the entire commercial banking sector of Tanzania. Future research could benefit from a broader sample size encompassing a more comprehensive representation of banks in Tanzania. Additionally, the study's focus on traditional financial metrics may overlook other factors influencing banks' profitability, such as technological innovation, customer segmentation strategies, and regulatory changes. Future studies could explore these aspects to provide a more holistic understanding of the determinants of banks' profitability.

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