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Exchange Rate Volatility and Bank Performance in Tanzania

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Exchange Rate Volatility and Bank Performance in Tanzania

By Ronald Ochen and Pascal Muhangi

Abstract

The banking sector is a crucial indicator of a country's economic health and stability. However, macroeconomic shocks often trigger spillover effects that influence the performance and resilience of banks. This study examines the impact of exchange rate volatility on the performance of Tanzania's banking sector. Using high-frequency macroeconomic and financial data from January 2008 to December 2024, sourced from the Bank of Tanzania, the World Bank Development Indicators, and the International Monetary Fund, we evaluate bank performance through three key indicators: Return on Assets (ROA), Return on Equity (ROE), and Net Interest Margins (NIM). The focus is on nominal exchange rates as the primary explanatory variable across three model configurations. To achieve our aims, we employed the two-step system, Generalised Method of Moments (GMM), and the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) models. The results are threefold. First, the GARCH model confirms significant volatility in nominal exchange rates during the study period. Second, both short-term and long-term effects of exchange rate volatility on bank performance were identified. Specifically, both in the short and long run, fluctuations in the nominal exchange rate exert a negative and significant effect on ROA and NIM, but a negative and statistically insignificant impact on ROE. Lastly, the Russia-Ukraine war had varied effects on Tanzania's banking sector. It negatively but insignificantly affected ROA, while positively and significantly influencing ROE and NIM. In conclusion, exchange rate volatility poses a considerable risk to the performance of banks in Tanzania. It is therefore essential to strike a balance between financial stability, competitiveness, and sustainable economic growth, particularly given ongoing macroeconomic pressures and vulnerabilities to external shocks such as geopolitical conflicts. A coordinated approach incorporating prudent monetary policy, effective regulation, and sound risk management is vital to safeguarding the stability and performance of the banking sector in a volatile global economic environment.

Keywords: Exchange Rate Volatility, Bank Performance, GARCH & Two-Step System GMM Models, Tanzania.

1.0 Introduction

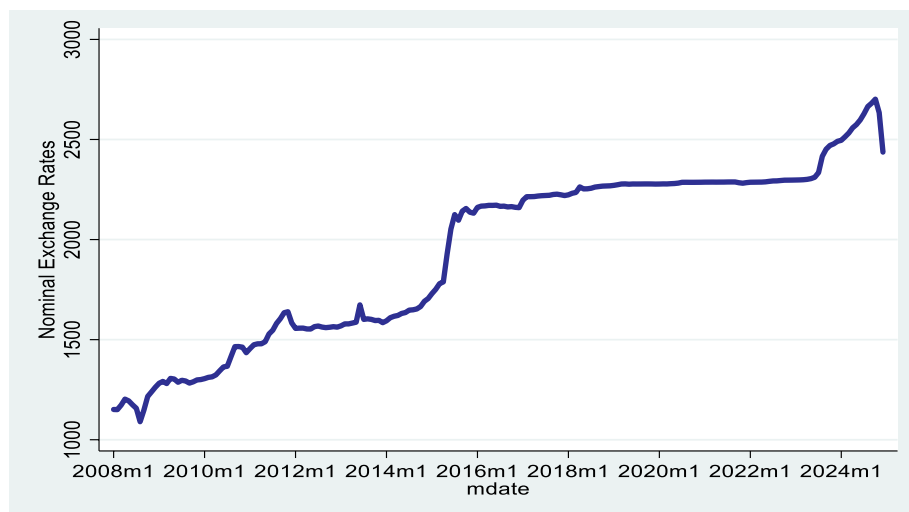
Exchange rates are vital to a nation's international trade, balance of payments, and overall economic well-being (Lagat & Nyandema, 2016). However, fluctuations in exchange rates distort corporate performance through cash flows and profits (Abbas El Hussein & Osman, 2019). Like many countries, Tanzania has faced the repercussions of global events such as the Russia-Ukraine conflict, along with the post-pandemic surge in aggregate demand coupled with supply shortages, leading to unprecedented inflationary pressures (Ochen, 2024). These factors have caused macroeconomic shocks impacting the country's economy. Specifically, this study examines the effect of exchange rate shocks on banks' performance.

Why is it important to examine the impact of exchange rate volatility on the performance of the banking sector in Tanzania? Fluctuations in exchange rates can adversely affect the profitability and liquidity of banks, particularly the foreign assets. This can undermine their stability and performance, ultimately affecting their ability to mobilise deposits and capital to extend credit. The banking sector in Tanzania might have experienced exchange rate volatility, as visually illustrated in **Figure 1**. Empirically, commercial banks play a crucial role in the allocation of economic resources (Ongore & Kusa, 2013). The level of risk resulting from unforeseen changes in the exchange rates and the greater likelihood of incurring losses has an important impact on bank performance (Njagi & Nzai, 2022). Exchange rate volatility also increases the vulnerability of banks to hazards which impact their profitability by affecting the risk of transactions, conversions, credit, interest rates, and inflation (Simon *et al.*, 2022).

Despite a number of empirical studies—such as those conducted by Taiwo & Adesola (2013), Lambe (2015), Kemisola *et al.* (2016), Offiong *et al.* (2016), Abbass Elhussein & Osman (2019), Moyo & Tursoy (2020), Keshtgar *et al.* (2020), Lu *et al.* (2021), Jackson *et al.* (2021), Simon *et al.* (2022), Isik & Yuncu (2022), Gumbo *et al.* (2022), Akinsola *et al.* (2022), and Yemi & Nakawooya (2024)—that have investigated various aspects of this topic, significant gaps persist that need to be addressed. These studies, while contributing valuable insights into the subject, often lack comprehensive analysis or fail to consider certain variables that could affect the outcomes. Further research is essential to fill these gaps and enhance our understanding of the underlying issues and their implications.

Chapter 01

Figure 1: Graphical exposition of Nominal Exchange Rates in Tanzania (2008 – 2024)



A within-country review in Nigeria indicates that the effects of exchange rate shocks on banks' performance, whether significant or insignificant, tend to be more negatively skewed. For example, Kemisola *et al.* (2016) found that exchange rate fluctuations had an insignificant but negative effect on return on assets in Nigeria. Akinsola *et al.* (2022) discovered that the exchange rate had a statistically significant negative impact on the banks' profitability in Nigeria. Taiwo & Adesola (2013) noted that fluctuating exchange rates may influence lenders' ability to manage loans, resulting in a high level of bad loans. Yemi & Nakawooya (2024) found a significant and negative effect of foreign exchange rates on banks' profits in Nigeria. Offiong *et al.* (2016) observed that exchange rate movements detract from the profitability of commercial banks in Nigeria. However, Lambe (2015)

found a strong and positive relationship between profits after tax and exchange rates, inflation, interest rates, and total assets in Nigeria. In this regard, we argue that Lambe (2015) examined different parameters of bank performance, which could explain the positive effect noted in the study.

Elsewhere, Abbass Elhussein & Osman (2019) found that foreign exchange rate fluctuations have a weak negative effect on the financial performance of Sudanese commercial banks. Isik & Yuncu (2022) found a statistically significant negative impact of deposit dollarization on return on assets and return on equity in Turkish commercial banks. In contrast, Lu *et al.* (2021) discovered a positive correlation between bank performance and the exchange rate during the Brexit period. Keshtgar *et al.* (2020) reported

that in Iran, exchange rate volatility has a negative and statistically significant effect on banks' capital return ratios. Moyo & Tursoy (2020) identified a weak relationship between the exchange rate and return on equity in South African commercial banks. Gombo *et al.* (2022) found a significant and negative relationship between exchange rates and bank profitability (as measured by returns on assets) in Zimbabwean banks. Additionally, Jackson *et al.* (2021) revealed that the nominal exchange rate had a negative and significant effect on returns on equity, while it had a positive and significant effect on returns on assets for commercial banks in Sierra Leone.

Some studies conducted in the East African region on the same show inconclusive findings. Njagi & Nzai (2022) found that exchange rate volatility poses a risk to the profitability of commercial banks in the East African Community. Lagat & Nyandema (2016) found a strong positive relationship between foreign exchange rates and the financial performance of commercial banks listed on the Nairobi Stock Exchange. While Njagi & Nzai (2022) focus on the East African Community, including Tanzania, it remains unclear how volatile exchange rates specifically influence the banking sector in Tanzania. Moreover, the study does not utilise bank-level data to examine the effects of exchange rate volatility on bank performance. This, therefore, provides the impetus to conduct this study, contributing to the existing body of knowledge concerning Tanzania. Furthermore, their study uses low-frequency data, which is unsuitable for capturing volatility in exchange rates, unlike high-frequency data.

That said, our study adds to the existing body of work in four ways. First, we investigate the impact of the Russia/Ukraine war on the performance of banks in Tanzania. To this end, Liadze *et al.* (2023) and Thi Thu

Vu *et al.* (2023) revealed that the Russian invasion of Ukraine caused a significant decline in banks' overall performance and stability. Therefore, we anticipate that the banking sector in Tanzania experienced similar shocks, considering the global interconnectedness of financial systems and the presence of foreign capital and equity in these domestic banks. Second, we introduce an additional key metric for bank performance, Net Interest Margin, which all the reviewed studies overlooked. Third, we take a comprehensive approach to examining the performance of the banking sector, analysing both commercial banks and microfinance institutions, whereas most studies focus solely on commercial banks.

1.1 Research Objectives

The study's central objective is to investigate the effects of exchange rate volatility on the performance of the banking sector in Tanzania. We break down this objective into four subobjectives.

- i. To determine whether exchange rate volatility exists in Tanzania.
- ii. To examine the effects of exchange rate volatility on bank performance in Tanzania.
- iii. To determine whether there exists a short or long-run relationship between exchange rate volatility and bank performance in Tanzania.
- iv. To determine whether the Russian/Ukraine war had an impact on the banking sector in Tanzania.

1.2. Research Questions

The central puzzle of the study is does exchange rate volatility affect bank performance in Tanzania? As such, we shall then further investigate the following questions:



- i. Does exchange rate volatility exist in Tanzania?
- ii. Does exchange rate volatility affect bank performance in Tanzania?
- iii. Is there a short-run or long-run relationship between exchange rate volatility and bank performance in Tanzania?
- iv. How has the Russia/Ukraine war impacted the banking sector in Tanzania?

The rest of this paper is organised as follows: Section 2 presents the theoretical frameworks related to the study. Section 3 describes the research methodology, including the design, data collection methods, and analytical techniques used. In Section 4, the results are shown and discussed in detail, exploring their implications in relation to existing research. Finally, the conclusion summarises the main findings.

2.0 Theoretical Framework

2.1 Profit Maximization Theory

The profit maximisation theory, as used in Machlup (1967), argues that the primary goal of a firm is to maximise profit by efficiently managing costs and revenues. In the banking sector, this includes ensuring good interest margins, keeping operational costs and risk management, and making strategic responses to external market conditions, including the foreign exchange markets. This theory explains why increased exchange rate volatility negatively affects bank performance, as banks seek to avoid risks that reduce earnings or adopt measures to maintain or restore macroeconomic stability in response to shocks like exchange rate volatility.

2.2 Monetary Theory

Developed by Friedman (1968), monetary theory emphasises the role of monetary variables like money supply, interest rates and exchange rates in influencing macroeconomic outcomes, including financial sector performance. Volatility in the nominal exchange rates often reflects monetary conditions like inflationary pressures and external shocks like the Russia-Ukraine war. Exchange rate volatility, as conceived under the monetary theory, disrupts financial intermediation through price instability and speculative tendencies. These affect credit allocation, interest rate spreads and bank profitability and stability (Funso & Lawal, 2020; Njagi & Nzai, 2022).

Chapter 02

In developing economies like Tanzania, where capital markets are less developed, banks are particularly sensitive to such monetary shocks. Moreover, during periods of heightened geopolitical uncertainty, such as the Russia-Ukraine conflict, international capital flows and investor confidence are influenced by central banks' responses, including exchange rate management and inflation targeting (Thi Thu Vu *et al.*, 2023). These responses transmit into the banking sector via shifts in credit demand, funding costs, and asset valuations.

3.0 Methodology

To address the research questions, the study utilized a Panel Generalized Methods of Moments (GMM) model to analyze the dynamic interactions between exchange rate volatility and bank performance. Given that our study is an N>T, for instance, N=21 banks and T=17 years, the panel GMM approach allows us to bypass the common requirement that the number of entities (N) exceeds the number of periods (T) (Roodman, 2009). Specifically, we estimated a two-step system GMM model to examine the impact of exchange rate volatility on the performance of banks. To do this, we follow Roodman (2009) to estimate the panel GMM shown in the equation.

$$y_{it} = \alpha y_{i,t-1} + X_{it}' \beta + \varepsilon_{it} \dots\dots\dots (1)$$

$$\varepsilon_{it} = \mu_i + v_{it}$$

$$E(\mu_{it}) = E(v_{it}) + E(\mu_{it} v_{it}) = 0$$

From equation 1, the disturbance term has both orthogonal components, the fixed effects, μ_i and the idiosyncratic shocks v_{it} .

Why use the two-step system panel GMM model? Importantly, we discovered the presence of fixed effects in the model, hence endogeneity in the variables. The presence of Fixed Effects in the models implies correlation of the endogenous variables with the error term (see **Table A2** in the appendix. This is confirmed by the Hausman (1978) specification test (ibid). Roodman (2009) provides four main justifications for this approach. First, the two-step GMM estimator, which employs a weighting matrix derived from the residuals of the first step, generally has a smaller asymptotic variance compared to the one-step estimator. This means it offers more precise estimates. Second, the two-step GMM is more robust to heteroskedasticity (non-constant variance of the errors) and serial correlation in the residuals. Third, the one-step GMM estimator can produce biased standard errors, especially when heteroskedasticity is present. The two-step GMM addresses this issue by using a more accurate weighting matrix in the second step, correcting this bias. L

Chapter 03

Furthermore, we also ran the Panel GMM Two Stage Least Squares model to check for and address the endogeneity issues expected in the endogenous variables. To measure bank performance, we used commonly recognised metrics of profitability, including Returns on Assets, Returns on Equity, and Net Interest Margins. Consequently, we estimate three dynamic autoregressive empirical models as illustrated below.

Model 1:

$$ROA = \beta_0 + \beta_1 NER_{it} + \beta_1 NER_{it-1} + \beta_2 CPI_{it} + \beta_3 LR_{it} + \beta_4 GE_{it} + \beta_5 BS_{it} + \beta_6 DEP_{it} + \beta_7 BC_{it} + \beta_8 Dum-(Russia/Ukraine) war_t + \varepsilon_{it} \dots\dots\dots (2)$$

Model 2:

$$ROE = \beta_0 + \beta_1 NER_{it} + \beta_1 NER_{it-1} + \beta_2 CPI_{it} + \beta_3 LR_{it} + \beta_4 GE_{it} + \beta_5 BS_{it} + \beta_6 DEP_{it} + \beta_7 BC_{it} + \beta_8 Dum-(Russia/Ukraine) war_{it} + \varepsilon_{it} \dots\dots\dots (3)$$

Model 3:

$$NIM = \beta_0 + \beta_1 NER_{it} + \beta_1 NER_{it-1} + \beta_2 CPI_{it} + \beta_3 LR_{it} + \beta_4 GE_{it} + \beta_5 BS_{it} + \beta_6 DEP_{it} + \beta_7 BC_{it} + \beta_8 Dum-(Russia/Ukraine) war_{it} + \varepsilon_{it} \dots\dots\dots (4)$$

Where *ROA* denotes Return on Assets, *NER* denotes Nominal exchange Rates, *RGDP* denotes Real Gross Domestic Product, *LR* denotes Lending interest rates, *BS* denotes Bank Size, and *BC* denotes Bank Capital. *Dum-Russia/Ukraine war* denotes a dummy for the Russian/Ukrainian war, and μ denotes the error term. Then β_0 denotes the constant, and $\beta_1, \dots, \beta_9$ denote the coefficients for the independent variables. ε_{it} is the disturbance term with orthogonal components and idiosyncratic shocks.

Also, to determine the long-run coefficients of the panel *GMM* model, we run the quotient of the significant short-run coefficients against the coefficient of the lagged dependent variables. The mathematical expression of the long-run effects of the study is shown below.

$$\beta_k \div [1 - \phi]$$

Separately, the study also assessed the effects of the Russia/Ukraine war on the performance of the banking sector—a dummy variable will be created, with 1 representing the war period from February 2022 when Russia invaded Ukraine, and 0 indicating no war.

3.2 Estimating the GARCH Model for Volatility

To evaluate volatility in the primary dependent variable, nominal exchange rates, we used the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. GARCH models have been effectively employed in modelling changing variability or the variance volatility in time series for financial investment measurement (Dritsaki, 2017).

According to Dritsaki (2017), volatility denoted as σ_t^2 in the basic Autoregressive Conditional Heteroskedasticity model (ARCH) [q] is defined as:

$$\sigma_t^2 = \omega + \sum_{i=1}^q \alpha_i \varepsilon_{t-1}^2$$

Where σ_t^2 is the conditional variance, $\omega > 0$ and $\alpha_i \geq 0$ for σ_t^2 are positive. Furthermore, from the above equation, the generalised form of the GARCH model (p, q) developed by Bollerslev (1986) is formulated as shown below:

$$R_t = \mu + \varepsilon_t \text{ (mean equation)}$$

$$\sigma_t^2 = \omega + \sum_{j=1}^q \beta_j \varepsilon_{t-1}^2 + \sum_{j=1}^p \beta_j \sigma_{t-j}^2 \text{ (variance equation)}$$

Where R_t are the returns of the nominal exchange rates at time t , μ is the mean value of the returns, ε_t is the error term at time t , which is assumed to be normally distributed with zero mean and conditional variance σ_t^2 , p is the order of the GARCH and q is the order of the ARCH process, and μ, ω, α_i and β_j are parameters for estimation.

Before estimating the ARCH and GARCH models, we first estimated the ARIMA model, and to do this, we first undertook a preliminary check. First, to establish stationarity in the nominal exchange rates, we used the VAR lag length criteria for optimal lags to include in the Augmented Dickey-Fuller (ADF) test for stationarity. The results of the VAR lag length criteria, asterisked by the Likelihood Ratio, Final Prediction Error, Akaike Information Criterion, Hannan-Quinn Information Criterion, and Schwarz Information Criterion, indicated that we use 2 lags to include in the ADF test.

Table 1: VAR lag length Criteria

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-1493.020	180293	14.940	14.947	14.957			
1	-942.216	1101.600	1	0.000	738.250	9.442	9.456	9.475
2	-926.486	31.459*	1	0.000	637.14*	9.29486*	9.31489*	9.34434*
3	-926.295	0.383	1	0.536	642.313	9.303	9.330	9.369
4	-926.292	0.005	1	0.944	648.756	9.313	9.346	9.395

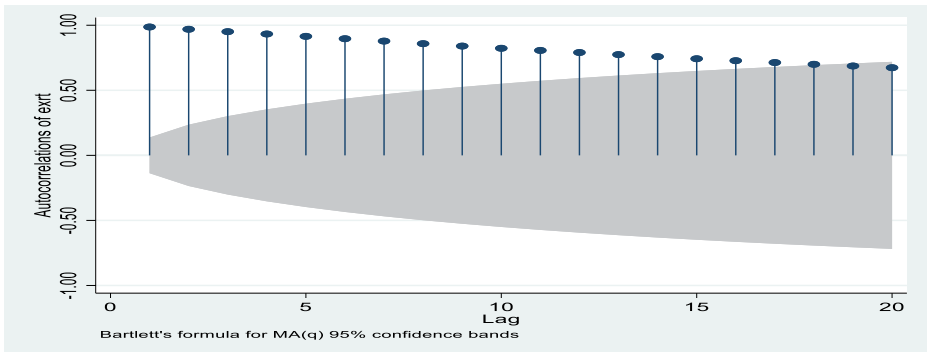
Source: Author's calculation

The results of the Augmented Dickey-Fuller test show the presence of unit roots in the nominal exchange rates. We thus fail to reject the null hypothesis that there are no unit roots in nominal exchange rates in otherwards, nominal exchange rates are non-stationary.

Table 2: Augmented Dickey-Fuller Test results

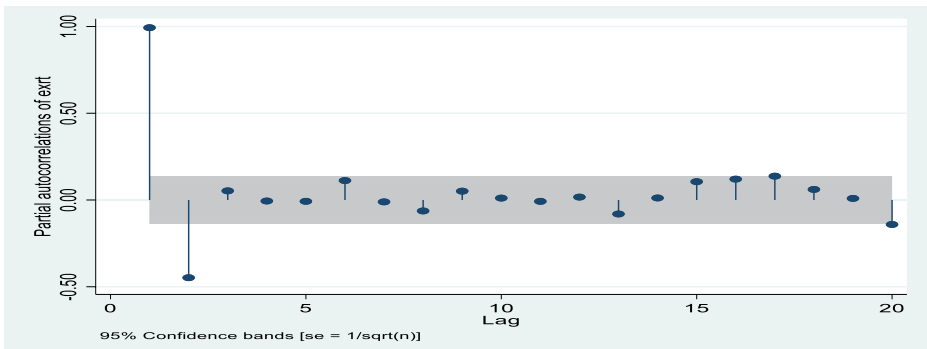
Augmented Dickey-Fuller test for unit root				Number of obs = 201
----- Interpolated Dickey-Fuller -----				
	Test statistic	1% Critical value	5% Critical value	10% Critical value
Z(t)	-1.573	-3.476	-2.883	-2.573
MacKinnon approximate			p-value for Z(t) = 0.4969	

After confirming the non-stationarity of the nominal exchange rate, we then conducted the ARIMA model by first examining the Autocorrelation (AC) with Autoregressive (AR) lags in the nominal exchange rates with 20 lags and a 95% confidence interval. **Figure 2** shows that the AR model has significant lags until the 17th lag, when they start decaying into insignificance. We also ran the Partial-Autocorrelation (PAC) model with Moving Averages (MA) showed the 1 significant positive lag while the rest were insignificant (see **Figure 3**).

Figure 2: Autoregressive Model results

Source: Author's construction

To further reaffirm our results, we conducted the common correlogram test for the nominal exchange rates, and the results indicated that at all 20 lags, the Q statistic of both the AC and PAC is free of autocorrelation. We then estimate the Autoregressive Conditional Heteroskedasticity (ARCH) model of nominal exchange rates, integrating both the AR and MA with one lag each. We established that significant AR and MA disturbances. After this, we predicted the residuals of the model and the variance of the ARCH model. This was done to establish the smoothness of the nominal exchange rate and the volatility (see **Figure 4**).

Figure 3: Partial-Autoregressive results

Source: Author's construction

Table 3: Autoregressive Conditional Heteroskedasticity model with ARMA disturbances

Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig	
Nominal Exchange Rates	1152.226	155.299	7.42	0.000	847.846	1456.605	***
AR	1.004	0.003	331.64	0.000	0.998	1.01	***
MA	0.404	0.031	13.12	0.000	0.343	0.464	***
Constant	637.519	23.622	26.99	0.000	591.222	683.817	***
Mean dependent var		1935.998		SD dependent var		433.218	
Number of observations		204		Chi-square		114436.740	
Prob > chi2		0.000		Akaike crit. (AIC)		1904.276	

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's computation. Note: Values rounded off to three decimal places.

We then estimated the ARCH model [AR (1) MA (1/1) ARCH (1/1) GARCH (1/1)] with ARMA and the ARCH with an extension of a GARCH model, both with one lag, but the coefficients of the AR and ARCH were more unrealistic, although significant (see Table 4). However, introducing more lags — four in the ARCH [AR (1) MA (1/1) ARCH (1/4) GARCH (1/1)] — improved the coefficients (<1), and they remained significant (see Table 5). This confirmed that Tanzania experienced volatility in the monthly nominal exchange rates during the period of study (2008–2024), which is observed in Charts 5 and 6. In other words, we reject that the variance of the error terms of the ARCH model was not homoscedastic but heteroscedastic, implying that high volatility was experienced. Simply put, over the study period, the variation of nominal exchange rates was not constant around the mean but non-constant. This could relate to two episodes during this time: the 2008 global financial crisis caused by subprime mortgages in the US and the recent post-pandemic period induced by COVID-19. Not to forget the recent Russia/Ukraine war.

Table 4: ARCH family regression - ARMA disturbances

Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig	
Nominal Exchange Rates	1167.466	13.55	86.16	0.000	1140.909	1194.023	***
AR	1.00	0.000	39608.39	0.000	1.000	1.000	***
MA	-0.31	0.031	-9.97	0.000	-0.371	-0.249	***
ARCH	5.218	0.446	11.71	0.000	4.345	6.091	***
GARCH	0.046	0.021	2.15	0.032	0.004	0.088	**
Constant	0.061	0.062	0.99	0.321	-0.06	0.182	

Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig	
Mean dependent var		1935.998		SD dependent var		433.218	
Number of Observations		204		Chi-square		1674660896.276	
Prob > chi2		0.000		Akaike crit. (AIC)		1638.325	

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's computation. Note: Values rounded off to three decimal places.

Table 5: ARCH family regression - ARMA disturbances

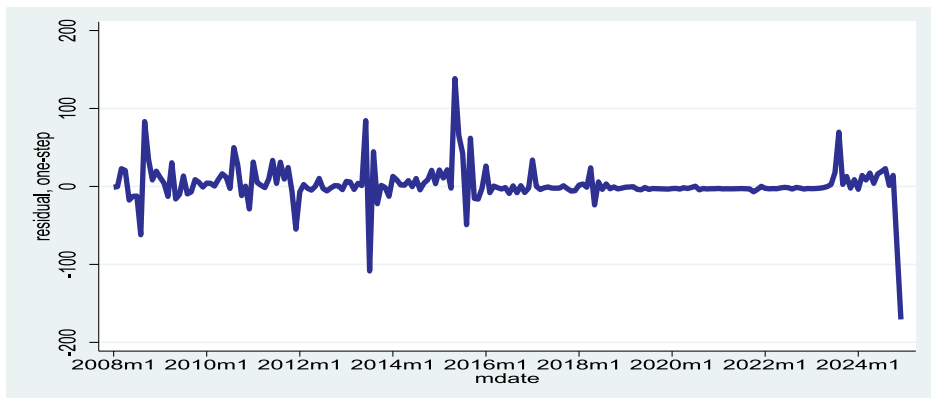
Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig	
Nominal Exchange Rates	2311.923	4.593	503.40	0.000	2302.921	2320.924	**
AR	0.098	0.001	823.32	0.000	0.973	0.978	**
MA	0.454	0.029	15.60	0.000	0.397	0.512	**
ARCH	0.988	0.421	2.35	0.019	0.162	1.813	**
GARCH	-0.493	0.189	-2.61	0.009	-0.863	-0.123	**
Constant	0.189	0.350	0.54	0.589	-0.497	0.876	

Mean dependent var	1935.998	SD dependent var	433.218
Number of Observations	204	Chi-square	1674660896.276
Prob > chi2	0.0000	Akaike crit. (AIC)	1638.325

*** p<0.01, ** p<0.05, * p<0.1

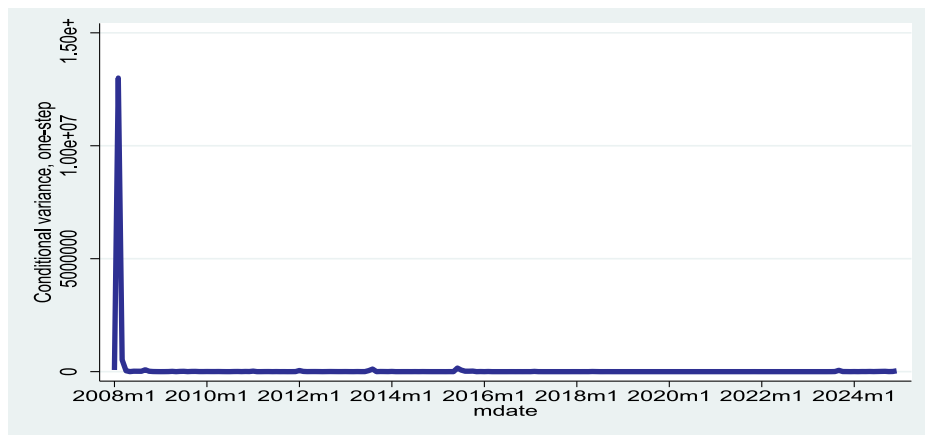
Source: Author's computation. Note: Values rounded off to three decimal places.

Chart 4: Graphical exposition of the residuals of the ARMA model.



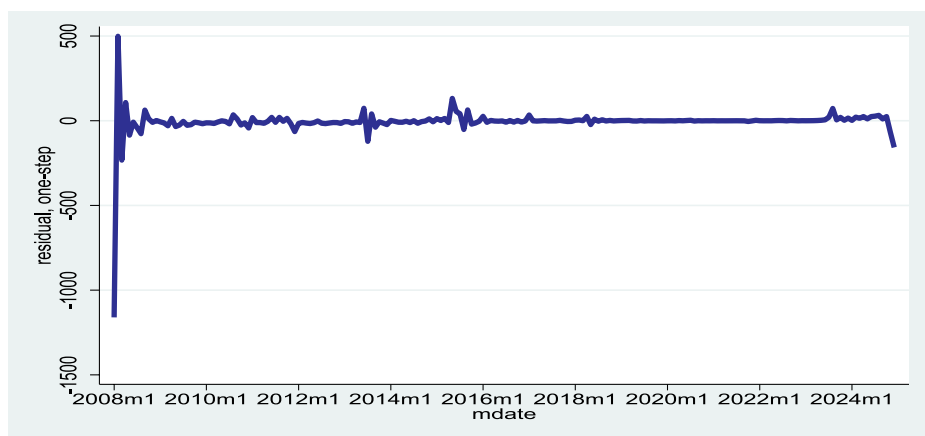
Source: Author's construction

Figure 5: Graphical exposition of the residuals of the ARCH model.



Source: Author's construction

Figure 6: Graphical exposition of the residuals after inclusion of the GARCH model.



Source: Author's construction

3.3 Data and Sources

We collected annual data from 2008 to 2024 from various reliable sources, including the Bank of Tanzania (BOT), Audited Financial Statements/Reports of individual banks, the International Monetary Fund (IMF), and the World Bank Development Indicators (WDI) [see Table 6 for details]. The annual data was then converted into high-frequency monthly data (2008M1 – 2024M12) using linear interpolation because exchange rates tend to fluctuate more significantly; thus, high-frequency data better captures volatility. Meanwhile, the annual data remains more smoothed out due to time lags and potential monetary policy interventions during the year. Notably, Tanzania has 34 commercial banks and 3 microfinance banks, but due to data scarcity, we managed to collect data from the annual audited financial statements of 19 commercial banks and 2 microfinance banks in Tanzania (see **Table A1** in the appendix).

Furthermore, the primary study variables—nominal exchange rates, Returns on Assets, and Returns on Equity—as well as the macroeconomic and bank-specific control variables. The macroeconomic control variables include Real Gross Domestic Product (GDP), Consumer Price Index (CPI), and lending interest rates. The bank-specific control variables consist of bank size (Total Assets), bank efficiency metrics such as deposits and the Loan-to-Deposit ratio—which measures the bank's ability to convert excess capital into lending—and bank capital (Equity/Total Assets). For standardisation purposes, we converted the variables, including Total Assets, Deposits, Nominal Exchange Rates, Real GDP, and Consumer Price Index, into natural logs. Additionally, among the variables is a dummy variable capturing the duration of the Russian-Ukrainian war.

Table 6: Summary of variables analysed in the study

Variables	Acronym	Empirical Literature	Measurement	Sources
Nominal Exchange Rates	NER	Jackson <i>et al.</i> (2021).	Natural log	Bank of Tanzania
Return on Assets	ROA	Jackson, <i>et al.</i> (2021); Lu <i>et al.</i> (2021); Abbas Elhoussein and Osman (2019); Kemisola <i>et al.</i> (2016)	Percentages	Bank's Financial Reports
Returns on Equity	ROE	Jackson, <i>et al.</i> (2021); Lu <i>et al.</i> (2021); Abbas Elhoussein & Osman (2019); Kemisola <i>et al.</i> (2016)	Percentages	Bank's Financial Reports
Net Interest Margins	NIM	None	Percentages	Bank's Financial Reports
Real GDP	RGDP	Lu <i>et al.</i> (2021); Taiwo & Adesola (2013)	Natural log	World Development Indicators

Variables	Acronym	Empirical Literature	Measurement	Sources
Consumer Price Index	CPI	Njagi & Nzai, (2022); Lu <i>et al</i> , (2021).	Natural log	World Development Indicators
Lending Rates	LR	Lagat & Nyandema, (2016)	Percentages	Bank of Tanzania
Government Expenditure % of GDP	GE	Lu <i>et al</i> . (2021); Taiwo & Adesola (2013)	Percentages	International Monetary Fund
Bank Size (Total Assets)	BS	Isik & Yuncu (2022).	Natural log	Bank's Financial Reports
Deposits	DEP	Isik & Yuncu (2022).	Natural log	Bank's Financial Reports
Bank Capital	BC	Isik & Yuncu (2022).	Percentages	Bank's Financial Reports
Dummy __ Russia/ Ukraine war	Dum- Russia/ Ukraine war	Liadze <i>et al</i> . (2023); Thi Thu Vu <i>et al</i> . (2023)	1 & 0	Authors

Source: Authors' compilation.

3.3.1. Summary Statistics Analysis

In **Table 7**, the descriptive statistics highlight the financial performance of banks in Tanzania, revealing insights into the banking sector's health and economic stability. The average Return on Assets (1.55%) and Return on Equity (8.89%) indicate moderate profitability, but high standard deviations suggest significant performance disparities. This variance may stem from differences in management efficiency, risk exposure, or regulatory environments. The Net Interest Margin of 10.5% is notably high, potentially indicating strong pricing power or inefficiencies and limited competition. Capital adequacy appears solid, with a mean capital ratio of 20.67%, suggesting resilience to economic shocks. However, an extremely high maximum value (92.74%) may indicate some banks are holding excess capital, which can limit credit

growth. On the macroeconomic front, the nominal exchange rate shows minimal fluctuation, likely pointing to a managed currency regime that offers short-term stability but restricts monetary policy flexibility. High lending rates (around 16%) reflect inflationary expectations and could hinder borrowing, affecting investment and consumption. The Consumer Price Index indicates that inflation remains high but stable, with an average of 5.04%. Government spending is consistent, demonstrating a controlled fiscal approach, though there is limited ability to respond to economic disruptions. The incorporation of a war dummy variable associated with the Russia/ Ukraine conflict for approximately 18% of the dataset allows for the examination of its effects on banking performance and lending practices, which may lead to an increase in non-performing loans and a decline in investor confidence.

Table 7: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Returns on Assets	1944	1.547	4.746	-16.17	31.899
Returns on Equity	1944	8.894	18.71	-77.3	65.165
Net Interest Margin	1944	10.495	11.73	0	83.463
Nominal Exchange Rates	4284	7.566	0.23	7.155	7.869
Bank Capital	1944	20.668	17.764	0.011	92.742
Government Expenditure	4032	18.193	1.067	16.35	19.805
Lending Rates	4284	16.007	0.866	14.545	17.775
Dummy __ Russian/Ukraine War	4284	0.176	0.381	0	1
Consumer Price Index	4284	5.036	0.296	4.43	5.412
Total Assets	1944	16.658	3	10.297	21.618
Deposits	1932	16.146	3.109	7.26	21.265

Source: Author's construction

3.3.2. Pairwise Correlation Matrix

The analysis of pairwise correlations indicates meaningful links between banking performance metrics and macroeconomic factors, highlighting the impact of external conditions—especially inflation, exchange rates, and geopolitical tensions—on the financial industry. Bank profitability, assessed through Return on Assets (ROA) and Return on Equity (ROE), generally shows a positive correlation with macroeconomic factors, though it tends to decrease as inflation and lending rates rise. This suggests that economic strain, particularly from inflation, diminishes profitability. Additionally, the weak negative correlation with nominal exchange rates implies that a weakening currency (reflected by higher Log of Nominal Exchange Rates, LNER) is somewhat connected to lower ROA, likely due to

the negative effects of exchange rate fluctuations on profits. Net Interest Margins (NIM) typically expand during times of inflation, currency decline, and conflicts, indicating that banks may pass increased costs to their borrowers. However, this could also signify elevated credit risk or a decrease in loan quality. The relationship among inflation (as indicated by the Consumer Price Index, CPI), currency depreciation, and climbing lending rates emphasizes the economy's susceptibility to inflation and its potential vulnerability to external disturbances, such as geopolitical conflicts, notably the Russia-Ukraine situation. Bank Capital (BC) displays a slight negative relation to profitability, suggesting that while substantial capital reserves can provide stability, they might lower returns if not utilized efficiently, especially during periods of crisis. Lending rates (LR) usually increase in reaction to

inflation and currency depreciation but tend to drop with rising government expenditure, implying a possible counter-cyclical fiscal policy effect. Lastly, Bank Size, represented by the log of Total Assets (LTA) and Deposits (LDEP), shows a strong internal correlation; however, larger banks appear to operate with narrower interest margins, potentially due to heightened competition or regulatory constraints.

Table 8: Pairwise Correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) roa	1.000										
(2) roe	0.700*	1.000									
(3) nim	-0.097*	-0.097*	1.000								
(4) lner	-0.118*	-0.038	0.170*	1.000							
(5) bc	0.063*	-0.146*	0.065*	-0.021	1.000						
(6) ge	0.024	-0.018	0.063*	-0.522*	-0.005	1.000					
(7) lr	-0.099*	-0.099*	0.019	0.657*	0.053*	-0.751*	1.000				
(8) dum_war	-0.005	0.020	0.199*	0.498*	-0.096*	0.306*	-0.108*	1.000			
(9) lcpi	-0.177*	-0.103*	0.204*	0.966*	-0.035	-0.418*	0.654*	0.536*	1.000		
(10) lta	0.009	0.112*	-0.135*	-0.085*	-0.146*	0.063*	-0.010	-0.030	-0.046*	1.000	
(11) ldep	0.044	0.141*	-0.169*	-0.123*	-0.312*	0.070*	-0.033	-0.032	-0.084*	0.981*	1.000

***: $p < 0.01$, **: $p < 0.05$, *: $p < 0.1$

Source: Author's construction.

3.3.3. Panel Stationarity Tests

We conducted a stationarity test with one lag on the variables using the Fisher-type tests developed by Choi (2001). This test was chosen due to its robust approach to examining panel data for unit roots, with the null hypothesis positing that all panels contain a unit root. Also, it combines the p-values from individual unit root tests applied to each panel to determine the overall stationarity of the panel data. The objective of the stationarity test was to determine the presence of unit roots in our selected variables, which is crucial for ensuring the validity of subsequent analyses. As

presented in **Table 9**, none of the variables showed significance at the initial levels, indicating that we could not reject the null hypothesis in its original form. However, upon applying first differencing to the variables, all of them became statistically significant. This result leads us to reject the null hypothesis of unit roots and conclude that all panels are stationary after first differencing. This finding implies that all the variables are integrated of order one, denoted as $I(1)$, which implies that the variables become stationary after first differencing. Consequently, we proceed with further analyses of the stationary variables.

Table 9: Unit root test results using Fisher-type test

Variables	Levels		First Difference		Order of Integration
	chi2 (42)	P > chi2	chi2 (42)	P > chi2	
Returns On Assets	35.746	0.741	761.417	0.000	1
Returns On Equity	32.058	0.867	761.839	0.000	1
Net Interest Margin	34.342	0.794	34.342	0.000	1
Nominal Exchange Rates	17.603	0.100	1721.207	0.000	1
Bank Capital	41.327	0.500	778.336	0.000	1
Deposits	28.928	0.938	807.226	0.000	1
Total Assets	23.801	0.989	817.624	0.000	1
Government Expenditure	19.063	0.100	1532.135	0.000	1
Consumer Price Index	51.751	0.144	1853.293	0.000	1
Lending Rates	27.129	0.963	1605.865	0.000	1

Source: Author's computation. **Note:** Values rounded off to three decimal places.

4.0 Results Presentation and Discussion

Table 10 presents the estimated results from a dynamic panel model that examines the effects of nominal exchange rates and other macroeconomic indicators on Return on Assets (ROA). The coefficient for the lagged dependent variable (ROA) is 0.813 and is statistically significant at the 1% level ($p < 0.01$). This indicates a strong persistence in bank profitability; in other words, previous profitability significantly influences current performance, underscoring the path-dependent nature of outcomes in the banking sector.

The nominal exchange rate shows a statistically significant negative coefficient of -0.011 ($p < 0.01$), suggesting that a depreciation of the Tanzanian shilling negatively affects the profitability of commercial banks. This finding highlights that exchange rate volatility poses a critical risk to the stability of the banking sector, likely due to increased foreign currency liabilities, rising import costs, and associated credit risks. This result aligns with the findings of several scholars, including Abbass Elhussein & Osman (2019), Gombo *et al.* (2022), Isik & Yuncu (2022), Njagi & Nzai (2022), and Akinsola *et al.* (2022). However, it contradicts the work of Kemisola *et al.* (2016), who found the effect on ROA to be insignificant, as well as Lu *et al.* (2021), who reported a positive and significant effect. Similarly, Lagat & Nyandema (2016) and Jackson *et al.* (2021) also identified a positive and statistically significant effect.

Inflation, as measured by the Consumer Price Index (CPI), has a positive and statistically significant effect on ROA, with a coefficient of 0.123 ($p < 0.01$). This result implies that in inflationary periods, banks may benefit from increased interest margins as loan rates adjust more quickly than deposit rates. It also suggests that banks in Tanzania have some pricing power to pass on inflation-related costs to borrowers. The lending rate coefficient is -1.581 and significant at the 5% level ($p < 0.05$). This negative relationship indicates that higher lending rates are associated with lower bank profitability. A plausible explanation is that elevated lending rates discourage borrowing or increase the likelihood of default, thereby reducing interest income and impairing asset quality. Government expenditure is negatively associated with ROA, with a coefficient of -1.834 ($p < 0.01$). This suggests that increased fiscal spending may exert crowding-out effects on private sector credit or generate macroeconomic imbalances that reduce the banking sector's ability to operate efficiently. Deposits show a

Chapter 04

positive but weakly significant effect on ROA, with a coefficient of 3.305 ($p < 0.1$). This result underscores the importance of deposit mobilization in supporting bank profitability. A larger deposit base can reduce reliance on costly external funding and enable more stable lending operations. Neither total assets nor bank capital was found to have a statistically significant effect on ROA in this model. These results suggest that, within the Tanzanian context, mere increases in size or capital buffers do not automatically translate to higher

profitability without efficient asset utilization and risk management strategies. The Russia-Ukraine war dummy variable has a negative coefficient (-0.282) but is statistically insignificant ($p = 0.513$). This implies that while the geopolitical shock may have exerted downward pressure on profitability, the effect was not strong enough to generate a statistically observable impact on ROA during the study period. This finding confirms those of Liadze *et al.* (2023) and Thi Thu Vu *et al.* (2023).

Table 10: Two-step System GMM model for Returns on Assets

Returns on Assets	Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig
L. Return on Assets	0.813	0.019	43.32	0.000	0.774	0.853	***
Nominal Exchange Rate	-0.011	0.003	-3.29	0.004	-0.018	-0.004	***
Consumer Price Index	0.123	0.034	3.58	0.002	0.051	0.0194	***
Lending Rates	-1.581	0.641	-2.47	0.023	-2.918	-0.244	**
Government Expenditure	-1.834	0.497	-3.69	0.001	-2.87	-0.799	***
Deposits	3.305	1.631	2.03	0.056	-.096	6.706	*
Bank Size (Total Assets)	-2.807	1.666	-1.68	0.108	-6.283	0.669	
Bank Capital	0.045	0.065	0.69	0.498	-0.09	0.179	
Russia/Ukraine War	-0.282	0.424	-0.67	0.513	-1.168	0.603	
Constant	52.993	18.596	2.85	0.01	14.203	91.783	***
Mean dependent var	1.281		SD dependent var		4.197		
Number of Observations	1791		F-test		4254.802		

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ AR (1): 0.000; AR (2): 0.101; Sargan Test: 0.000; Hansen Test: 0.959

Source: Author's construction. **Note:** Values rounded off to three decimal places. Robustness tests are evidenced by AR (1), (2), Sargan & Hansen Tests, shown in the plane below.

Table 11 presents the results of estimating the model that examines the factors influencing Return on Equity (ROE). The coefficient for the lagged dependent variable (ROE) is 0.936, which is highly significant at the 1% level ($p < 0.01$). This indicates a strong persistence of equity returns within the banking sector, where the performance from the previous period significantly impacts current outcomes. This inertia suggests a degree of structural rigidity or institutional memory in the financial system, likely reflecting the compounding nature of retained earnings and capital adequacy practices.

Notably, the coefficient for the nominal exchange rate is -0.013 , with a p -value of 0.114, meaning it is statistically insignificant at conventional levels. Although the negative direction of this effect suggests that currency depreciation could adversely impact equity returns, the lack of statistical significance indicates that exchange rate fluctuations do not consistently influence ROE in the short run. This finding contrasts with the stronger impact seen on Return on Assets (ROA), as discussed in Table 10, and may highlight differing sensitivities across various profitability measures. Moreover, our results contradict those of Moyo & Tursoy (2020) and Jackson *et al.* (2021), who identified a negative and statistically significant relationship between nominal exchange rates and returns on equity.

The effect of inflation on ROE is positive (0.124) but statistically insignificant ($p = 0.184$). This implies that inflationary pressures may not systematically enhance or erode returns to shareholders in Tanzanian banks. It is possible that any inflation-induced gains in interest

income are offset by increased operating or credit costs. The lending rate has a statistically significant and negative impact on ROE, with a coefficient of -3.941 ($p < 0.05$). This finding aligns with the results for ROA, suggesting that higher borrowing costs may reduce loan uptake or increase the risk of default, thus negatively affecting shareholder returns. Government expenditure is negatively associated with ROE (coefficient = -3.950) and statistically significant at the 1% level. This implies that increased public sector spending could be crowding out private sector investment or contributing to macroeconomic imbalances, thereby constraining bank profitability and returns to equity holders. Deposits show a negative but weakly significant effect on ROE (coefficient = -7.305 , $p < 0.1$). This contrasts with their positive effect on ROA, suggesting that while deposits may support operational profitability, they do not necessarily translate into higher returns for shareholders, particularly if capital or risk management is inefficient. Total assets are positively associated with ROE (coefficient = 7.124 , $p = 0.078$), significant at the 10% level. This implies that asset expansion, possibly through lending or investments, may contribute to shareholder value. However, the marginal significance calls for caution in interpreting this as a robust driver. Bank capital has a negative and marginally significant effect on ROE (coefficient = -0.260 , $p = 0.05$). While counterintuitive, this result may reflect the "capital dilution effect," where holding excess capital beyond regulatory requirements can lower the return on equity due to reduced leverage. Interestingly, the Russia-Ukraine war dummy has a positive and weakly significant impact on ROE (coefficient = 2.329 , $p = 0.088$). This suggests that

Tanzanian banks may have indirectly benefited from war-induced global financial dynamics (e.g., commodity prices, shifts in capital flows) that favoured their equity performance during the conflict period. This finding contradicts those of Liadze *et al.* (2023) and Thi Thu Vu *et al.* (2023).

Table 11: Two-step System GMM model for Returns on Equity

Returns on Equity	Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig
L. Returns on Equity	0.936	0.013	71.51	0.000	0.911	0.962	***
Nominal Exchange Rate	-0.013	0.008	-1.58	0.114	-0.03	0.003	
Consumer Price Index	0.124	0.093	1.33	0.184	-0.059	0.307	
Lending Rates	-3.941	1.715	-2.30	0.022	-7.302	-0.581	**
Government Expenditure	-3.95	1.513	-2.61	0.009	-6.915	-0.985	***
Deposits	-7.305	4.071	-1.79	0.073	-15.285	0.675	*
Bank Size (Total Assets)	7.124	4.043	1.76	0.078	-0.8	15.048	*
Bank Capital	-0.26	0.133	-1.96	0.005	-0.52	0	**
Russia/Ukraine War	2.329	1.366	1.70	0.088	-0.349	5.007	*
Constant	146.706	55.519	2.64	0.008	37.891	255.521	***
Mean dependent var	8.299		SD dependent var		18.773		
Number of Observations	1791		Chi-square		97802.493		

*** p<.01, ** p<.05, * p<.1

AR (1): 0.009

AR (2): 0.101

Sargan Test: 0.000

Hansen Test: 0.947

Source: Author's construction. **Note:** Values rounded off to three decimal places. Robustness tests are evidenced by AR (1), (2), Sargan & Hansen Tests, shown in the plane below.

Table 12 summarises the regression results estimating the impact of macroeconomic factors and external shocks on Net Interest Margin (NIM). The coefficient on the lagged dependent variable is 0.280 and statistically significant at the 1% level ($p < 0.01$), suggesting moderate persistence in net interest margins over time. This indicates

that the current NIM is partially influenced by past performance, consistent with the view that structural and institutional characteristics play a role in interest margin determination. The nominal exchange rate has a negative and statistically significant impact on NIM, with a coefficient of -0.011 ($p < 0.05$). This result implies that currency depreciation erodes interest margins, possibly through higher funding costs or losses on foreign currency-denominated liabilities. The finding reinforces earlier evidence from the ROA model that exchange rate instability poses a threat to bank profitability in Tanzania.

Inflation exerts a positive influence on NIM (coefficient = 0.102), significant at the 10% level. This indicates that banks may benefit slightly from inflationary conditions by widening the spread between lending and deposit rates. However, the marginal significance suggests that the effect is modest and possibly contingent on how quickly banks can adjust their pricing. Lending rates are positively associated with NIM, with a coefficient of 1.382 , significant at the 10% level ($p = 0.054$). This suggests that an increase in lending rates allows banks to enhance their interest margins, provided that credit demand and repayment capacity are not severely compromised. This stands in contrast to the negative impact lending rates had on ROA and ROE, indicating that while higher rates improve spreads, they may simultaneously increase

credit risk and reduce profitability. Government expenditure has a positive but statistically insignificant relationship with NIM (coefficient = 0.665 , $p = 0.418$). This suggests that fiscal activity does not directly influence interest margins in the banking sector, potentially due to weak transmission mechanisms or offsetting effects from public sector borrowing. Neither deposits nor total assets have statistically significant effects on NIM in this model. Although deposits are essential for funding, their effect on the interest margin appears neutral, possibly due to competitive pressures or regulated pricing structures. Similarly, the scale of operations (total assets) does not appear to drive interest income relative to interest expenses. The coefficient on bank capital is statistically insignificant (0.030 , $p = 0.794$), indicating that capital adequacy does not have a direct relationship with interest margin performance. This is consistent with findings in the ROA and ROE models, where capital also lacked strong explanatory power. The Russia-Ukraine war dummy variable has a statistically significant and positive effect on NIM (coefficient = 3.182 , $p < 0.01$). This indicates that Tanzanian banks experienced a notable increase in interest margins during the conflict period. This could be due to global commodity price movements or liquidity tightening that allowed banks to adjust pricing in their favour. This finding contradicts those of Liadze *et al.* (2023) and Thi Thu Vu *et al.* (2023).

Table 12: Two-step System GMM model for Net Interest Margin

Net Interest Margin	Coef.	St. Err.	t-value	p-value	[95% Conf	Interval]	Sig
L. Net Interest Margin	0.28	0.03	9.35	0.000	0.221	0.338	***
Nominal Exchange Rate	-0.011	0.005	-2.23	0.026	-0.021	-0.001	**
Consumer Price Index	0.102	0.057	1.78	0.075	-0.01	0.214	*
Lending Rates	1.382	0.717	1.93	0.054	-0.024	2.787	*

Net Interest Margin	Coef.	St. Err.	t-value	p-value	[95% Conf Interval]	Sig
Government Expenditure	0.665	0.822	0.81	0.418	-0.946 2.276	
Deposits	2.243	3.547	0.63	0.527	-4.71 9.196	
Bank Size (Total Assets)	-1.625	3.575	-0.45	0.649	-8.632 5.382	
Bank Capital	0.03	0.115	0.26	0.794	-0.195 0.255	
Russia/Ukraine War	3.182	1.124	2.83	0.005	00.979 5.385	***
Constant	-31.842	29.179	-1.09	0.275	-89.032 25.347	

Mean dependent var	10.281	SD dependent var	10.924
Number of Observations	1791	Chi-square	3595.002

*** $p < .01$, ** $p < .05$, * $p < .1$

AR (1): 0.095

AR (2): 0.101

Sargan Test: 0.000

Hansen Test: 0.948

Source: Author's construction. Note: Values rounded off to three decimal places. Robustness tests are evidenced by AR (1), (2), Sargan & Hansen Tests, shown in the plane below.

Furthermore, in **Table 13**, the long-term estimation results reveal that nominal exchange rates have a statistically significant negative effect on both Return on Assets (ROA) and Nominal Interest Margin (NIM). Specifically, a one-unit increase in the nominal exchange rate is associated with a 0.058 decrease in ROA ($p < 0.05$), indicating that currency depreciation adversely impacts the asset efficiency of financial institutions. Similarly, the Nominal Interest Margin decreases by 0.016 units following a one-unit rise in the exchange rate ($p < 0.05$), suggesting that

exchange rate volatility can diminish bank profitability by narrowing interest spreads. Conversely, although the coefficient for Returns on Equity (ROE) is negative (-0.207), it is not statistically significant at conventional levels ($p = 0.140$). This implies that the long-term effect of nominal exchange rates on equity returns remains uncertain within the sample period and model framework. Overall, the findings highlight the vulnerability of bank performance—particularly asset returns and interest margins—to fluctuations in exchange rates.

Table 13: Long Run Coefficients of the Two-Step System Panel GMM Models

Return on Assets	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Nominal Exchange Rates	-0.058	0.020	-2.830	0.005**	-0.097	-0.018
Returns on Equity	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Nominal Exchange Rates	-0.207	0.140	-1.470	0.140	-0.482	0.068
Nominal Interest Margin	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
Nominal Exchange Rates	-0.016	0.007	-2.240	0.025**	-0.030	-0.002

*** p<.01, ** p<.05, * p<.1

Notes: Coefficients are asterisked and reported in the first row, and p-values in the second row are shown in parentheses. Values rounded off to three decimal points.

Source: Author's construction..

3.2 Diagnostic Checks

In **Table 10**, the validity of the GMM estimation is supported by diagnostic tests. The Arellano-Bond test for first-order autocorrelation (AR(1)) is significant, as expected, while the second-order autocorrelation test (AR(2)) is insignificant ($p = 0.101$), confirming the absence of serial correlation in the residuals. The Sargan test is significant, but the Hansen test ($p = 0.959$) confirms the validity of the instruments used, suggesting that the model is well-specified.

Table 11 shows that the model passes standard specification tests. The Arellano-Bond test for first-order autocorrelation is significant (AR(1) $p = 0.009$), while the second-order test is not (AR(2) $p =$

0.101), confirming the absence of higher-order serial correlation. The Hansen test ($p = 0.947$) suggests that the instruments used in the GMM estimation are valid and not overidentified, strengthening the credibility of the results.

In **Table 12**, the model diagnostics support the reliability of the estimation. The AR (1) test is significant at the 10% level ($p = 0.095$), while the AR(2) test is not ($p = 0.101$), suggesting no second-order serial correlation. The Hansen test ($p = 0.948$) confirms the validity of the instruments used in the GMM estimation, indicating that the model is correctly specified.

Furthermore, since we suspected and confirmed the presence of endogeneity in the variables, we implemented the two-stage least squares (2SLS) model to address the issues of biased and inconsistent estimates (see **Table 14**). The robustness checks yielded the LM statistic for under-identification and the Hansen J statistic for over-identification, both indicating that the model is sound, with no issues of under-identification or over-identification. This provides evidence that the endogeneity problem has been successfully resolved.

Table 14: Instrumental Variable Two-Stage Least Squares Model

Dependent Variables	Estimation Method: 2SLS					
	Returns On Assets		Returns On Equity		Net Interest Margin	
Variables:						
Deposits	0.357	(0.212)	3.854**	(0.000)	-3.410**	(0.000)
Total Assets	-0.296	(0.287)	-3.089**	(0.000)	3.151**	(0.000)
Nominal Exchange Rates	0.007**	(0.000)	0.038**	(0.000)	-0.008**	(0.001)
Consumer Price Index	-15.361**	(0.000)	-69.224**	(0.000)	12.965**	(0.000)
Lending Rates	0.621**	(0.037)	0.512	(0.641)	1.188**	(0.067)
Government Expenditure	0.064	(0.79)	0.239	(0.819)	-0.314	(0.391)
Russia/Ukraine War	1.532**	(0.008)	4.312	(0.108)	5.524**	(0.000)
Constant	52.149**	(0.000)	259.518**	(0.000)	-49.701**	(0.000)
Kleibergen-Paap rk LM statistic	76.841**	(0.000)	76.841**	(0.000)	76.841**	(0.000)
Hansen J Test	0.313	(0.86)	1.521	(0.468)	1.005	(0.605)
F- Statistics	9.49**	(0.000)	23.14**	(0.000)	15.20**	(0.000)
Number of Instruments	2		2		2	
Number of Banks	21		21		21	
Observations	1768		1768		1768	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Notes: Coefficients are asterisked and reported in the first row, and p-values in the second row are shown in parentheses. Values rounded off to three decimal points.

Source: Author's construction.

5.0 Conclusion and Policy Implications

This study set out to examine the effects of exchange rate volatility on the performance of the banking sector in Tanzania, using high-frequency macroeconomic and financial data from 2008 to 2024. By applying GARCH and two-step system GMM models, the study confirmed that nominal exchange rates in Tanzania have exhibited significant volatility over time. The empirical results reveal that exchange rate volatility has a negative and significant effect on banks' Return on Assets (ROA) and Net Interest Margins (NIM), indicating that fluctuations in the exchange rate undermine the profitability and financial intermediation capacity of banks. While the impact on Return on Equity (ROE) was also negative, it was statistically insignificant. Additionally, the Russia-Ukraine conflict had differential impacts on bank performance, highlighting the sensitivity of the Tanzanian banking sector to external geopolitical shocks. These findings have several important implications for policymakers and financial sector regulators:

Strengthen Exchange Rate Management: Given the adverse impact of exchange rate volatility on bank performance, the Bank of Tanzania should adopt measures to reduce excessive currency fluctuations. This can include building adequate foreign exchange reserves, improving transparency in monetary policy, and promoting greater exchange rate predictability. Importantly, the central bank of Tanzania could adopt a sterilised foreign market intervention by buying or selling domestic/foreign assets in order to increase or reduce its monetary supply to the level that existed prior to the intervention period.

Enhance Risk Management in Banks: Banks should be encouraged to adopt robust foreign exchange risk management practices, including the use of hedging instruments and diversification of currency exposures in their asset and liability portfolios.

Promote Financial Sector Resilience: Regulators should strengthen macroprudential

Chapter 05

frameworks to ensure that banks can absorb shocks from both domestic and international sources. Regular stress testing and stronger capital adequacy requirements can help cushion the impact of volatility.

Monitor External Shocks Closely: The differential effects of the Russia-Ukraine conflict underscore the need for closer monitoring of global events and their transmission channels into the domestic financial system. Early warning systems and scenario analysis should be incorporated into central bank policy planning.

Foster Economic Diversification: Reducing the economy's dependence on volatile external sectors

(e.g., commodity exports) can help stabilise exchange rates over the long term, thereby supporting banking sector stability.

In conclusion, exchange rate volatility presents a significant risk to the performance of banks in Tanzania. It is crucial to find a balance between financial stability, competitiveness, and sustainable economic growth, especially in light of ongoing macroeconomic pressures and vulnerabilities to external shocks, such as geopolitical conflicts. A coordinated approach that includes prudent monetary policy, effective regulation, and sound risk management is essential to protect the stability and performance of the banking sector in a volatile global economic environment.

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Notes :

To elaborate on the data conversion procedure, we used E-Views software to convert annual data into monthly data. First, we gathered and uploaded the annual data into E-Views. Next, we created a new workfile specifically for the monthly data. When prompted to select the frequency of the data, we chose the option to convert it from annual to monthly. We then copied and pasted the data into the new workfile, applying linear interpolation for the frequency conversion. This method assumes a linear trend between the annual data points. Once the conversion was complete, we exported the data back into Excel and conducted our analysis using Stata 16.

Appendix

Table 1A: List of Financial Institutions used in the analysis

Commercial Banks	Microfinance Banks
Akiba Commercial Plc	FINCA Microfinance Bank
Amana Bank Limited	Vision Fund Microfinance Bank
Azania Bank Plc	
Bank of Africa Tanzania Limited	
Bank of Baroda Tanzania Limited	
Bank of Baroda Tanzania Limited	
China Dasheng Bank	
CRBD Bank	
DCB Commercial Bank	
Diamond Trust Bank Tanzania	
ECO Bank Tanzania	
Habib African Bank	
I&M Bank Tanzania	
International Commercial Bank	
Mkombozi Commercial Bank	
Mwalimu Commercial Bank	
National Bank of Commerce	
NCBA Bank Tanzania	
NMB Bank	

Source: Author's Compilation.

Table A2: Testing for Fixed Effects in the models

Variables	Fixed Effects	Random Effects	Hausman
Nominal Exchange Rate	14.779***	13.502***	13.502***
Consumer Price Index	-18.304***	-12.556***	-12.556***
Government Expenditure	0.507**	0.278	0.278
Deposits	0.278	-2.769***	-2.769***
Bank Capital	-0.045*	-0.085***	-0.085***
Lending Rate	0.537**	0.323	0.323
Total Assets	5.078***	3.272***	3.272***
Cons	-80.857***	-55.803***	-55.803***
N	1812	1812	1812
r ²	0.091		

*** p<0.01, ** p<0.05, * p<0.1

Source: Author's construction. Values rounded off to three decimal points.

Notes



Notes

Dotted lines for note-taking.



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