International Journal of
Finance
(IJF)

Assessing Macroeconomic Determinants of Banks' Efficiency in the West African Monetary Zone

CARI Journals

International Journal of Finance

ISSN 2520-0852 (Online)

Vol. 8, Issue No. 4, pp 96 - 116, 2023 www.carijournals.org

Assessing Macroeconomic Determinants of Banks' Efficiency in the West African Monetary Zone

[1*]Awosusi Charles Temitope (Phd),[2]Ayemidotun Damola

[1*]Department of Banking and Finance, Adekunle Ajasin University, Akungba-Akoko Ondo State, Nigeria

[2]Department of Business Administration and Management, Rufus Giwa Polytechnic Owo, Ondo State, Nigeria

https://orcid.org/0009-0006-0346-8487

Accepted: 14th Aug2023 Received in Revised Form: 27th Aug 2023 Published: 8th Sep 2023

Abstract

Purpose: This study assesses how six selected macroeconomic variables, namely, size of the banking system, liquid liability of the system, interest rate, inflation, gross domestic product and exchange rate affect banking system efficiency in the West African Monetary Zone countries group. Spanning a twenty-nine-year period (1992 – 2020).

Methodology: the study used fixed and random effect models of panel least squares to analyze the relationship between these macroeconomic variables and bank efficiency of the countries as a group. Further, the study analyzed the country-by-country net effect of the selected macroeconomic variables on bank efficiency.

Findings: We find that when examined as a group, only the positive effect of exchange rate on bank efficiency is significant. We also find reveal that the macroeconomic variables have negative effect on bank efficiency in Gambia, Ghana and Sierra Leone while they positively affected bank efficiency in Guinea, Liberia and Nigeria. Finally, we find that interest rate and inflation have causal relationship with bank efficiency in the countries as a group.

Unique Contribution to Theory, Practice and Policy (Recommendations: We advocate that bankers in the WAMZ critically appraise their size, liquidity and interest rates vis-à-vis their efficiency goal. We also recommend that the governments of Gambia, Ghana and Sierra Leone formulate bank friendly policies especially with respect to interest rates and inflation variables that have causal relationship with bank

Key Words*; Macroeconomic Variables, Bank's Efficiency, West Africa Monetary Zone (WAMZ)*

1.0 Introduction

The intermediation process of financial institutions links the lenders of fund to its borrowers. This process addresses two major objectives: availability of fund and minimization of cost of funds. Banks as the main operators in the intermediation process execute assets and brokerage transformation purposes. In particular, banks facilitate liquidity and credit to meet the finance gap in households and firms. Through the provision of credits, critical sectors that are pivotal to economic growth are financed (Adalessossi & Erdogan 2019). According to Kohlscheen *et al.* (2018), banks in developing and emerging economies have, in the last twenty years, witnessed significant transformations that have considerably reshaped the industry and made it more relevant in the economic development process more than ever before. In performing its all-important roles, banks must also ensure profitability and efficiency to remain stable. Its assets, liquidity and liability management and capital adequacy strategies must be well articulated to achieve its goals (Myktybekovich, 2013).

An efficient banking system is an engine of economic growth, a facilitator of equality and a promoter of income redistribution. Matthews (2010) opined that an efficient banking system is a sign of an efficient intermediation process and a well-articulated monetary policy. Blankson, Anarfo, Amewu and Doabil (2022) stated an efficient banking system builds confidence and trust in the people and facilitates a sound financial system that can effectively compete with peers in other economies. On the contrary, Berger and Humphrey (1997) posited that an inefficient banking system is characterized non-performing loans, impairment/insolvency and weakness. This would result in greater occurrence of bank failure which can also cause distortions in other economic sectors.

Msomi (2022) asserted that the global financial crisis of 2008–2009 added impetus to the interest of researchers and policy makers in the determinants of banks' efficiency and bank crisis. As pointed out by Ozili (2018), African banks have experienced frequent crisis which has caused considerable fragility such that the banking system has received tremendous attention. Beck and Cull (2013) stated that although banks in Africa develop models that could predict instability, many of them do not include the actual determinants of (in)stability in their risk models.

According to Nyantakyi and Sy (2015), financial intermediaries need effective cost control and effective use of resources if they aim to achieve operational efficiency, especially in a highly competitive market like banking. Granted that technological innovations are driving new products in banking, the extent to which it facilitates efficiency is debatable. Generally, also, there is no consensus in literature on the specific factors that propel efficiency in banks especially in West Africa. Nyantakyi and Sy (2015) however suggested that banks' superfluous operating cost in the WAMZ could result in gross inefficiency which may also be attributable to external factors beyond the control of the banks.

The West Africa Monetary Zone (WAMZ) is a group of six countries, namely, Gambia, Ghana, Guinea, Liberia, Nigeria and Sierra Leone whose aim is to promote setting the conditions and standards for sub-regional fiscal and monetary policy harmonization. The WAMZ primarily focused price stability, sustainable fiscalism, exchange rate stability and minimization of deficit budgeting by member-States' governments (Harvey & Cushing, 2015). Expectedly, the banking system in the WAMZ constitutes the main driver of financial system and economic growth. However, Adalessossi and Erdogan (2019) observed that the banking system in West Africa generally is weak when compared with other sub-regions in the emerging and developing economies. Characteristic of under-developed countries, the authors asserted that excessive risk, high cost of operations, poor liquidity and often eroded capital base hinder efficiency in many banking systems in the WAMZ.

Ample literature exists on the determinants of banks efficiency (Bolt, Haan, Hoeberichts, Oordt and Swank, 2012; Alessandri & Nelson, 2015; Borio,Gambacorta & Hofmann, 2015) . "The influence of monetary policy on bank profitability," BIS Working Papers 514, Bank for International Settlements. 2015) but, to the best of our knowledge, most of the empirical works done on the subject have concentrated on developed economies and North Africa (particularly Egypt – Alber (2015); Farag & Lang (2015); Hassan & Jreisat (2015) and Shokr & AlGasaymeh, (2016)). A study that concentrates on a regional economic and financial block like the West Africa Monetary Zone will provide more insight into the determinants of bank efficiency in the zone. Hence, this study investigated the determinants of bank efficiency in the 6 countries that make up the West African Monetary Zone. Recognizing the heterogeneity of country-specific characteristics, the study also carried out a country specific-effect of and causality between selected determining variables and bank efficiency.

2.0 Literature Review

2.1 Theoretical and Conceptual Review

Intermediation Theory

We premised this research on financial intermediation theory due to the absence of an all-inclusive theory on banks input and output and because it is considered to be the best fit for assessing financial institutions optimum efficiency . Berger and Humphrey (1997) had argued that the financial intermediation theory outperforms other theories on bank performance because it incorporates interest expenses which is the major component of costs to banks. The position of the theory is that the minimization of costs (interest and non-interest expenses and other costs) is a necessity for profit maximization and efficiency. It explains the intermediary link between funds' supply and demand (Barry, Lepetita and Tarazia (2010). Hence its choice as our theoretical underpinning on banking activities

Banking System Efficiency in the West African Monetary Zone

Blankson et al (2022) classified the Ghanaian banking sub-sector as mainly a universal banking system because the assets of this category of banks represented more than 90% of the assets of the whole banking system. In order to achieve especially after the global economic downturn some level of efficiency in the banking system, the government and monetary authorities in the country have, over the years, carried out various reforms to spur competitiveness, resilience and efficiency. Blankson et al (2022) observed that although there were banking crises in Ghana, some considerable improvements in financial system stability and soundness were recorded particularly in areas of liquidity, solvency and profitability. Tremendous growth in assets, deposits and loans and advances were recorded. The Ghanaian banking system has been adjudged to be the main engine of economic growth in the country during the study period.

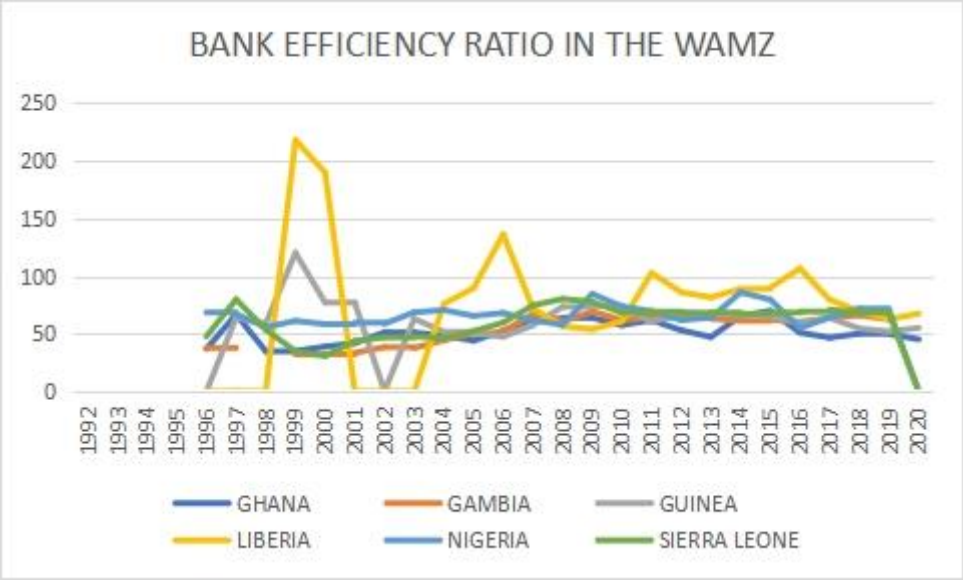

Figure 1: Banking System Efficiency Ratios in the WAMZ

Source: Author's (2023)

As at 2020, the International Monetary Fund (IMF) reported that the financial system of Guinea was mainly informal and weak, largely cash based and representing about 22% of the Guinean GDP. The country's banking system, as of 2017, was lowly patronized as only about 8% of the population owned a bank account. Though poor, the IMF (2020) stated that there was a growth from about 5.5% recorded in 2014. Mobile banking has become a factor in the banking system of Guinea as about 14% of the population was using mobile wallet and other payment channels.

As of December 2018, there were 16 commercial banks in Guinea and constituted about 95% of the country's financial market with insurance and other non-bank financial institutions taking the remaining 5%. (IMF, 2020).

Another content of the IMF (2020) reports is that most financial system indicators in Guinea were negative and vulnerable with extremely high-risk exposures and illiquidity. Although there are strict regulations of the Guinean banks, the high level of dollarization of the country's banking system exposed it to liquidity risk tied with exchange rate volatility. According to the IMF. The "Central Bank of the Republic of Guinea (BCRG)" stated that out of the 12 financial system soundness metrics, only one of them (return on equity) was positive, depicting the non-efficiency of the Guinean banking system.

Measures of Banks Efficiency

How efficiency or performance should be measured is captured by Debreu (1951) and Koopmans (1951) who proposed that efficiency should be measured by ascertaining the gap between expected output and actual output for a given amount of input. However, measuring bank efficiency has been broadly differentiated into structural and non-structural measures by Hughes and Master (2008). While the structural approach or technical efficiency relies on cost minimization and or optimization, the non-structural approach centers around performance comparison through the use of ratios among banks. This latter approach also reflects performance strategies vis-à-vis other factors that may affect business. The structural measure also considers the intermediation function of banks which includes risk diversification, production and information management.

But Wozniewska (2008) identified three classifications of efficiency measurement: traditional, parametric and non-parametric measures. The traditional methods used mainly ratios to ascertain whether a bank is efficient when compared to other banks or the industry. These methods rely primarily on financial reports of banks for the estimation of the needed ratios (Tuskan & Stojanovic, 2016). The parametric approaches involve some functional programming of production and expenditure to arrive at a pre-determined scale and performance goal. According to Berger and Humphrey (1997), the parametric approaches include the "distribution-free approach" (DFA), the "tick frontier approach" (TFA) and the "stochastic frontier approach" (SFA). A detailed explanation of these approaches can be found in the authors' work. thirdly, the non-parametric approach as explained by Charnes, Cooper and Rhodes (1978), ties performance to decision making units and constructs efficiency measures based on these units' scores. However, Charnes, et al (1978) argued that the "data envelopment approach" (DEA) should be used in assessing bank efficiency because, according to the authors, it "provides a new way of obtaining the empirical estimate of relations such as the production functions or efficient production possibility surface which are considered to be the cornerstone of modern economics". Berger & Humphrey (1997) recommended that the DEA should be used in place of the conventional traditional measures of bank efficiency.

Determinants of Bank Efficiency

Adalessossi and Erdogan (2019) listed the factors that determine bank efficiency as including internal and external factors. This classification is also supported by Mercia, M. C., Evren, O., & Hassan, T. (2002), Goddard, J., Molyneux, P., & Wilson, H. O. S. (2004, and Panayiotis P. Athanasoglou & Sophocles N. Brissimis & Matthaios D. Delis, (2005). The internal factors are the bank-level factors while the external factors are the industry-specific factors which are beyond the control of individual banks. According to Adalessossi and Erdogan (2019), bank specific factors include elements of efficiency that can be pinned down to ratios in respect of liquidity, capital, profits and assets utilization. The external, determinants include macroeconomic indicators (GDP, inflation, exchange rate, money supply, government expenditure etc), bank concentration ratio, competition among others

2.2 Empirical Literature

Eferakeya and Erhijakpor (2020) used the DEA technique to investigate what determined operational efficiency of Nigerian banks from 2002 to 2019. The study examined the effect of overhead cost ratio, non-performing loan ratio (NPLR), bank size, inflation and intermediation ratio on the operating efficiency ratio (OER) of the banks. It was discovered that the Nigerian banking system recorded both efficient and otherwise performance during the study period. In specific terms, intermediation ratio and bank size exerted significant positive effect on operating efficiency but overhead cost ratio, inflation and NPLR exerted negative effect on it.

Adalessossi and Erdogan (2019) assessed the factors that determine banks efficiency of 86 banks selected from eight West African countries between 2006 and 2016. Using dynamic and static panel models, the authors found that bank-specific variables significantly affected banks performance similar to the effect of macroeconomic variables except the liquid assets/total deposit ratios and non-performing asset ratio which were not statistically significant.

Kohlscheen et al (2018) used the General Moments Methods (GMM) to evaluate the key drivers of bank efficiency of 534 banks domiciled in 19 emerging economies. The authors analyzed the effect of interest rates, GDP, credit growth and risk premia on the efficiency of the banks and found that increasing interest rate on long-term facilities improved efficiency, credit growth increased cost of funds and reduced efficiency and the effect of GDP on bank efficiency was insignificant. Risk premia was also found to reduce efficiency of the banks.

Novickyte and Droždz (2018) studied the factors that determined bank efficiency in Lithuania between 2012 and 2016 using a “non-parametric frontier input-oriented” DEA approach. The authors analyzed the banks’ data based on two returns to scale types: variable and constant. Based on the variable returns to scale, local banks were found to be more efficient while the constant return to scale-based analysis showed that banks with larger size used more suitable business models compared to smaller-sized banks in Lithuanian.

In Malaysia, Hamid et al (2017) assessed the efficiency of 21 banks in Malaysia from 2005-2014 using the DEA method. The study was done from two perspectives: technical efficiency with and without undesirable outputs. Findings revealed that banks without undesirable outputs perform better than those with it in terms of technical efficiency. Also, it was found that domestic banks outperformed foreign banks in Malaysia. However, the authors did not include non-performing loan ratio which is an important component of undesirable outputs.

Hassan and Jreisat (2016) examined the determinants of the efficiency of 14 Egyptian banks between 1997 and 2013 using a DEA approach. The study further carried out a comparative analysis of the effect based on whether they are large, medium, small, foreign or domestic in ownership. The study revealed that the medium-sized banks were the most efficient followed by foreign-owned banks. Shokr and AlGasaymeh (2018) assessed how monetary policy variables influence banking system efficiency in Egypt from 1996 to 2014 using the GMM technique. Findings from the study showed that reduction in inflation and rising GDP helped banks to perform more efficiently than otherwise.

Khalad et al (2015) used the DEA and Tobit regression to examine the determinants of banks technical efficiency of specialized and private banks in Libya between 2004 and 2010. Findings from the study suggested that specialized banks were more technically. Efficient than private banks. A positive relationship was discovered between capital adequacy ratio, size, return on assets, government owned banks and banks' efficiency in Libya.

A study by Adusei (2016) to examine the credit risk – technical efficiency relationship with Binary Logit regression showed that a significant negative relationship exists between them.

Alber (2015) examined the effects of bank size, ownership structure and age of ten Egyptian banks on their efficiency from 1984 to 2013 using a DEA approach. The study found that the three variables have different efficiency scores but privately owned older and small banks were more efficient than publicly owned younger and bigger banks. Still in Egypt, Farrag and Lang (2015) investigated the country's bank efficiency between 2000 and 2006, a period characterized by key regulatory and structural changes in the country. Analyzing a dataset of 34 banks, the authors found that technological change did not significantly benefit Egyptian banks, rather, the banks experienced a "negative dynamics of the cost frontier." However, effects of size, merger and growth on the banks' efficiency was significantly positive.

Tzeremes (2015), while studying the determinants of efficiency among Indian banks between 2004 and 2012 with a "conditional directional distance function" found that foreign banks performed more efficiently than domestic banks. Further findings revealed that Indian government-owned banks could not achieve operational efficiency when the industrial sector was going through some degree of restrictions.

Msomi (2022) assessed the link between some macro-economic and bank-level variables and non-performing loans in 47 commercial banks across six African countries (Nigeria, Guinea, Burkina Faso, Benin Republic, Gambia and Nigeria) between 2008 and 2019. Results of the fixed effect model showed that liquidity ratio, inflation and capital adequacy ratio affect non-performing loans respectively and inflation rate significantly affect non-performing loans in the countries.

Blankson *et al* (2022), and Yildrium and Fatty (2021) reported a mixed effects of bank specific variables on bank efficiency in Ghana and Gambia respectively while Banyen and Biekpe (2020), Maude and Ahmad (2021) and Palazzo (2019) reported a positive significant relationship. Shamshur and Weill (2019) found that bank efficiency did not significantly affect small and medium scale enterprises.

3.0 Methodology

3.1 Research Design

We adopt ex-post research design for this work. The reason for this is predicated on the fact that our data were sourced from secondary sources such as the CBN Statistical Bulletin and World Bank Financial indicators for countries. The whole commercial banking sector of the selected WAMZ countries was captured as our study population. Our motivation for this is the ease of accessing needed data on the banking sector as a whole than for the individual commercial banks in the selected countries in the zone. In the same vain, the sample size is also made up of the commercial banking sector of the selected countries from 1992 to 2020. The study applied judgmental sampling because within this period government at regular intervals have intervened in the commercial banking sub-sector by way of reforms aimed strategically to reposition it for better service delivery and efficiency. The choice of our variables for estimation is pinned to the relevant theories and existing empirical works, given the identified research gap.

3.2 Analytical Techniques

We employ panel least regression to examine the effect of pooled data of selected macroeconomic variables (country-based logarithm of assets of the banking system, interest rate, gross domestic product at current prices, inflation, liquid liability of the financial system and exchange rate) on banking system efficiency in six WAMZ countries: from 1992 to 2020, Gambia, Ghana, Guinea, Liberia, Nigeria and Sierra Leone. Indicators such as non-performing loan and capital adequacy ratios are excluded from this study for want of requisite data for them in most of the countries. The panel regression model used in this study is expressed as:

$$BEF_{it} = \alpha_{it} + \beta_1 SIZE_{it} + \beta_2 LQL_{it} + \beta 3 INTRit + + \beta_4 INFL_{it} + \beta_5 GDP_{it} + \beta_6 EXCR_{it} + \varepsilon_{it} \ldots\ldots (i)$$

Due to different units of measurement and the need to put all the variables on the same pedestal, equation (i) is expressed in logarithm form as:

$ln\text{BEF}it = \alpha it + \beta_1 ln\text{SIZE}_{it} + \beta_2 ln\text{LQL}_{it} + \beta_3 ln\text{INTRit} + + \beta_4 ln\text{INFL}_{it} + \beta_5 ln\text{GDP}_{it} + \beta_6 ln\text{EXCR}_{it} + \varepsilon_{it}$ ….. (i)

where:

BEF = Banking system efficiency ratios of individual countries

SIZE = Total assets of the banking system (in millions of domestic currencies)

LQL = Liquidity liabilities of the banking system (in millions of domestic currencies)

INTR = Interest rate (%)

INFL = Inflation rate (%)

GDP = Gross domestic product at current prices denominated in United States dollar

EXCR = Exchange rate

ln = Natural logarithm

α = Regression intercept

β_1 …… β_6 = Regression coefficients

ε = Stochastic error term

i = Individual country identifier

t = Time identifier (years)

Recognizing the possibility of biasness and spuriousness in ordinary least square regression estimates, we estimate the fixed and random effect models as well as Hausman test of model suitability to ascertain the more appropriate model on which inferences regarding the effects of selected variables on banks' efficiency in the countries are drawn.

In addition, this study analyzed the cross -section effects of the regression model in order to ascertain the individual country effect of the variables on bank efficiency in terms of slopes. Finally, for robustness, the study also examined whether there exists causal relationship between the variables and bank efficiency in the WAMZ.

4.0 Results and Discussion

This section analyzes the pooled data of WAMZ countries with respect to the research objectives. We used annual data of the selected variables (bank efficiency ratio – BEF; logarithm of banking system total assets – SIZE; liquid liabilities of the banking system – LQL; interest rate – INTR; inflation rate – INFL; gross domestic product – GDP and official exchange rates – EXCR for the six WMAZ countries between 1992 and 2020. First, we examined the statistical demographics and

correlations of the variables before proceeding to estimate the effect of macroeconomic variables on bank efficiency in the countries.

Descriptive Statistics

Table 1 contains the descriptive statistics, showing the statistical properties of the study variables that are directly relevant to the discussion here..

Table 1: Statistical Properties

	BEF	SIZE	LQL	INTR	INFL	GDP	EXCR
Mean	64.7567	121.5191	16910.8	20.6915	10.5204	7.87E+1	1169.780
Skewness	0.67169	0.255619	0.92409	0.63618	0.89954	1.84250	2.096100
Kurtosis	3.44776	2.517324	3.25051	2.89564	22.3807	2.89577	7.021195
Jarque-Bera	27.3019	113.1664	68.7286	5.63651	1509.34	59.3908	116.6999
Probability	0.56020	0.072289	0.24895	0.05971	0.00120	0.08634	0.000000

Source: Author's Computation (2023)

Table 1 shows that BEF, SIZE, LQL, INTR, INFL, GDP and EXCR have means of 64.75671, 121.5191, 16910.87, 20.69150, 10.52048, 7,870,000,000 and 1169.78 as means respectively. All these variables are skewed positively to the right of their means with coefficients of skewness of 0.671692, 0.255619, 0.924091, 0.636189, 0.899542, 1.842505 and 2.096100 respectively. All the variables (except INFL and EXCR are normally distributed given their kurtosis which hover around 3. INFL and EXCR are leptokurtic (22.38070 and 7.021195 respectively). The Jarque-Bera statistics and their accompanying probabilities also confirm that BEF, SIZE, LQL, INTR and GDP are normally distributed given the probabilities above 0.05 level of significance. Again, INFL and EXCR exhibit probability values that show lack of normal distribution (probability = 0.001208 and 0.0000 respectively).

Table 2 gives the Pearson's correlation coefficients of banking system efficiency (dependent variable) with the explanatory variables (SIZE, LQL, INTR, INFL, GDP and EXCR

Table 2: Correlation Coefficients

VARIABLE	BEF	SIZE	LQL	INTR	INFL	GDP	EXCR
BEF	1.000000						
SIZE	0.477890	1.000000					
LQL	0.117590	-0.199990	1.000000				
INTR	-0.549134	-0.520123	-0.334220	1.000000			
INFL	-0.170409	-0.170694	-0.047070	0.277145	1.000000		
GDP	0.122529	-0.201030	0.987094	-0.338008	-0.028810	1.0000	
EXCR	0.023498	-0.231859	-0.248379	-0.090304	0.042604	-0.2508	1.00000

Source: Author's Computation (2023)

From Table 4.2 SIZE moves in the same direction with BEF as shown by a relatively high positive coefficient of correlation of 0.477890 (48%). LQL has a low positive correlation of 0.117590 (or 12%) direct co-movement with BEF. But INTR has a relatively high inverse (negative) correlation coefficient with BEF (-0.549154 or -55%). INFL has a relatively low inverse (negative) correlation with BEF (-0.170409) with BEF. GDP and EXCR have a positive but relatively low and extremely low correlation with BEF (0.122529 or 12% and 0.023498 or 0.2%) respectively.

Analysis of Objective 1: Effect of Macroeconomic Variables on Bank Efficiency in WAMZ

The first objective of this study is an assessment of the macroeconomic determinants of bank efficiency in six West Africa Monetary Zone countries for the period 1992 to 2020. The study null hypothesis tested is that no significant relationship exists between macroeconomic variables and bank efficiency in the WAMZ during the years under study. Subsequent discussions in this section address the research objective.

Pooled/Panel Least Squares Regression Results

Table 3 presents the estimates of pooled least squares regression on the relationship between macroeconomic variables and bank efficiency.

Table 3: Extract of Pooled OLS Regression Models Result

Dependent Variable = BEF

Variables	Coefficients	Std. Error	t-Statistic	Prob.(t-stat)	R^2	R^{-2}	Prob(F-stat)
SIZE	0.024751	0.009760	2.535881	0.0133			
LQL	-7.03E-05	0.000305	0.230281	0.8185			
INTR	-0.966726	0.499944	-1.933667	0.0569			
INFL	-0.036803	0.122984	-0.299252	0.7656			
GDP	2.97E11	6.76E11	0.439512	0.6615			
EXCR	0.001017	0.01028	0.989048	0.3258			
C	79.79914	12.67544	6.295572	0.000			
					0.36	0.31	0.00

Source: Author's Computation(2023)

Table 4 shows that reveals that SIZE, GDP and EXCR have positive effect on BEF, while LQL, INTR and INFL have negative effect. However, only the positive effect of SIZE on BEF is significant given its probability (*p* value of 0.0133 lesser than the 0.05 level of significance). Therefore, a unit increase in the size of the banking system (assets) leads to a significant 0.024751 increase in bank efficiency. The coefficient of determination (R-Squared) of 0.362996 implies that about 36% of the variations in BEF is explained by the explanatory variables while the remaining 64% is explained by variables outside the research model. The probability of calculated F-Statistics (0.000004<0.05) implies that the study model is reliable and statistically significant in its entirety.

Fixed and Random Effects Tests

Ordinary panel least squares (OPLS) regression suffers the general shortcoming of OLS which assumes homogeneity in the characteristics of entities in the panel. This implies that all the cross-sections in the panel data exhibit the same intercept and slope, which may not necessarily be true. Hence, this study further tests for the validity of the whether the cross-sections have the same characteristics (random effect) or heterogenous characteristics (fixed effect) over the time of the study.

Table 4 Extracts of Fixed and Random Effects Model Tests

Fixed Effects Model Random Effects Model

Dependent Variable = BEF					Dependent Variable = BEF				
Variabl	Coefficient	Std. Error	t-Statistic	Prob.	Variable	Coefficient	Std. Error	t-Statistic	Prob.
SIZE	0.006574	0.015480	0.424666	0.6723	SIZE	0.024751	0.009798	2.526264	0.0136
LQL	-6.85E-05	0.000295	-0.232349	0.8169	LQL	-7.03E-05	0.000306	-0.229408	0.8192
INTR	0.716488	0.759901	0.942870	0.3489	INTR	-0.966726	0.501847	-1.926334	0.0578
INFL	-0.152994	0.129813	-1.178572	0.2424	INFL	-0.036803	0.123452	-0.298118	0.7664
GDP	3.82E-11	6.61E-11	0.576889	0.5658	GDP	2.97E-11	6.79E-11	0.437845	0.6627
EXCR	0.003849	0.001717	2.241836	0.0281	EXCR	0.001017	0.001032	0.985298	0.3276
C	44.39477	17.60839	2.521229	0.0139	C	79.79914	12.72369	6.271698	0.0000
R-Squared			0.437125		*R-Squared*			0.362996	
Adjusted R-Squared			0.358947		*Adjusted R-Squared*			0.312706	
F-Statistic			5.591462		*F-Statistic*			7.218076	
Prob(F-statistic)			0.000004		*Prob(F-statistic)*			0.000004	

Source: Author's Computation (2023)

From Table 5, in the fixed effect model, while SIZE, INTR, GDP and EXCR all have positive effect on bank efficiency (BEF) given their coefficients (0.006574, 0.716488, 0.00000000382 and 0.003849 respectively), LQL and INFL have negative effect (-0.000685 and -0.152994 respectively. However, only the effect of EXCR on BEF is significant ($p = 0.0281<0.05$), other are not. About 0.437125 (or 44%) of the variations in BEF is explained by the macroeconomic variables.

In the random effect test, SIZE, GDP and EXCR have positive effect on BEF. Only the effect of SIZE on BEF is significant ($p = 0.0136<0.05$). on the other hand, LQL, INTR and INFL all have negative but statistically insignificant effect. About 0.362996 (36%) of the variations in BEF is

explained by the explanatory variables while the remaining 64% is explained by other variables outside the model. Both fixed and random effect models are statistically reliable given their F-Statistics and corresponding probabilities. To determine which of these models is used for inference, the Hausman test is employed.

Hausman Test

The Hausman Test is carried out to determine which of fixed or random model estimates should be used for inference. The test ascertains whether the null hypothesis (which posits that the random effect model is more appropriate) or the alternative hypothesis (which prefers fixed effect model) should be accepted/rejected. Decision in Hausman Test is based on the asymptotic Chi-square statistics and its corresponding probability. A *p* value <0.005 implies a rejection of the hull hypothesis (random effect) and acceptance of the alternative hypothesis (fixed effect) and vice-versa. Table 6 contains the extract from the Hausman test results.

Table 6: Extract from the Hausman Test Results

Test Summary	Chi-square statistic	Chi-square d.f.	Prob.
Cross-section random	10.221977	6	0.0156

Source: Author's Computation with E-Views (2023)

From Table 6, the asymptotic Chi-square statistic is 10.221977 with a *p* value of 0.0156 (which is lesser than the 0.05 significance level. This implies that the null hypothesis which prefers random effect model cannot be accepted, hence our inference is drawn on the fixed effect model estimates.

Table 4.5 shows that based on fixed effect model, SIZE exerts an insignificant positive effect on BEF. A unit increase in SIZE brought an insignificant increase of 0.006574 on BEF given its *p* value of 0.6723 (>0.05). LQL exerts a negative but insignificant effect on BEF. A unit increase in LQL reduced BEF by an insignificant 0.000685 in BEF ($p = 0.08169$). INTR has an insignificant positive effect on BEF such that a unit rise in INTR increased BEF by 0.716488 ($p = 0.3489>0.05$). INFL impaired BEF though insignificantly. A unit rise in inflation reduced BEF by 0.152994 ($p = 0.2424>0.05$). GDP positively affects BEF, though insignificantly. A unit increase in GDP brought about an insignificant 0.000000000382 in BEF ($p = 0.5658>0.05$). Finally, EXCR has a positive and significant effect on BEF. A unit rise in EXCR increased BEF significantly by 0.003849 ($p = 0.0139$).

The R-Squared (0.437125) implies that macroeconomic variables explain about 44% of the changes in BEF during the period. Other variables outside the model explain the remaining 56% of the variations. The F-Statistic (5.591462) and its probability (0.000004) imply that the fixed effect model is statistically significant and reliable. The result of EXCR affecting BEF significantly

means that at least one out of the six macroeconomic variables significantly affects bank efficiency in the WAMZ countries. This also implies that the null hypothesis on no significant effect between these variables cannot be accepted.

Cross-Country Effects of Macroeconomic Variables on Bank Efficiency in WAMZ

The fixed effect model is premised on the heterogeneity or cross-sectional effects of independent on dependent variables. It assumes that the countries in our study possess different characteristics that make them to have different effect. The cross-country net effects of macroeconomic variables on bank efficiency are as shown in Table 7.

Table 7: Cross-Country Fixed Effects of Macroeconomic Variables on Bank Efficiency

WAMZ COUNTRY	Cross-Country Fixed Effect
GAMBIA	-11.57773
GHANA	-5.658160
GUINEA	6.600671
LIBERIA	25.44842
NIGERIA	3.982077
S. LEONE	-10.74864

Source: Author's Computation (2023).

The six WAMZ countries have different fixed effects as depicted on Table 7. This means that whereas macroeconomic variables impair bank efficiency in Gambia, Ghana and Sierra Leone, the variables spur bank efficiency in Guinea, Liberia and Nigeria. The magnitudes of these effects are also different. Cross-country fixed effects facilitate a better understanding of the net effect of macroeconomic variables in the WAMZ on a country-by country basis such that the estimates of combined results do not mislead. The null hypothesis of homogeneity of the characteristics of the WAMZ countries with respect to the effect of macroeconomic variables on bank efficiency cannot be accepted.

Determination of Causality between Macroeconomic Variables and Bank Efficiency in WAMZ.

We tested for the presence (or otherwise) of causal relationship between each of the selected macroeconomic variables on bank efficiency. The result of Granger causality test is presented in Table 4.9

Table 8. Extract from Results of Causality Test

Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.	Causality
SIZE does not Granger Cause BEF	110	1.77795	0.1740	None
BEF does not Granger Cause SIZE		1.94302	0.1484	
LQL does not Granger Cause BEF	111	0.97460	0.3807	None
BEF does not Granger Cause LQL		0.01295	0.9871	
INTR does not Granger Cause BEF	72	1.85133	0.1650	Uni-directional from BEF to INTR
BEF does not Granger Cause INTR		4.04057	0.0220	
INFL does not Granger Cause BEF	114	0.20565	0.8144	Uni-directional from BEF to INFL
BEF does not Granger Cause INFL		5.73870	0.0043	
GDP does not Granger Cause BEF	114	0.88638	0.4151	None
BEF does not Granger Cause GDP		0.04181	0.9591	
EXCR does not Granger Cause BEF	114	0.26279	0.7694	None
BEF does not Granger Cause EXCR		0.48062	0.6197	

Source: Author's Computation (2023)

Granger causality test follows the F- distribution where the critical value of F is compared with its calculated value or simply compare the *p* value of F-Statistic with the selected level of significance (0.05). if the former is lesser than the latter, then the hypothesis of non-causality cannot be accepted and vice versa. From Table 8, while SIZE and BEF, and LQL and BEF, GDP and BEF and EXCR and BEF all have no causal relationship, INTR and INFL have uni-directional causality with BEF that flows from BEF in both cases. This connotes that previous changes in BEF causes present greater in INTR and INFL than what previous changes in INTR and INFL cause in themselves presently. This is dictated by the *p* values of BEF to INTR and BEF to INFL which are 0.0220

(0.05) and 0.0043 (<0.05) respectively. Again, the null hypothesis of no causality cannot be accepted.

4.2 Summary of Findings

In examining the first objective of this study, it was found that, when examined as a group, the panel least squares fixed effect model results show that the size of the banking system, gross domestic product and exchange rate have positive effect on banking system efficiency in the West African Monetary Zone countries. On the other hand, liquid liabilities of the banking system (M3) and inflation negatively affect banking system efficiency. However, of all these variables, only the positive effect of exchange rate is significant. Although exchange rate increase is theoretically expected to affect performance negatively, the banking sector may gain from exchange rate increase because earning from foreign exchange forms a major source of revenue for banks. A rising exchange rate provides an avenue for banks to sell foreign exchange at higher prices, thereby increasing the gross earnings of the banking system. The significant effect agrees with Msomi (2022), Kohlscheen et al (2018). It however contradicts findings by Shamshur and Well (2019) and Adalessossi and Erdoğan (2019).

The second objective is an examination of country-specific net effect of macroeconomic variables on bank efficiency in the West African Monetary Zone countries. Results of cross-section analysis to ascertain the net effect of the selected macroeconomic variables on each of the WAMZ countries reveal that the selected macroeconomic variables have negatively affected bank efficiency in Gambia, Ghana and Sierra Leone while the variables positively affected bank efficiency in Guinea, Liberia and Nigeria. Regardless of the magnitudes of these negative or positive effect, the results imply that these countries face different economic conditions that affect them. If we go by the significant effect of exchange rate, we may conclude that whereas it negatively affected bank efficiency in some countries, its net effect is positive. This result refutes the finding of Bishnu Prasad Bhattarai (2018) which showed no evidence of impact of macroeconomic variables on bank performance but consistent with the work of Aburime (2008) which proved a positive result.

Thirdly, the study discovered that interest rate and inflation have causal relationship with bank efficiency. This corroborate the outcome of Sufian and Chong (2008) but in disagreed with that of Akani, Nwanna and Mbachu (2016) which showed contrary result. First, interest on loans is a major source of earnings for banks. All things being equal, a rising interest rate means more revenue for the banks, more profits and greater efficiency. In the same vein, inflation has causality with bank efficiency. This expected as inflation affects every aspect of the economy, including bank operations. Inflation naturally takes its toll on interest rates, banks operating cost, customers cash holding and deposits decision and banks' investments. However, with these results, it is difficult for this study to identify which of these variables significantly caused the changes in bank

efficiency in each of the countries examined. Country specific studies are advocated to determine variable by variable effect on bank efficiency in each of the countries.

5.0 Conclusion and Recommendations

5.1 Conclusion

We assessed how six macroeconomic variables (banking sector size, liquid liability of the banking system, interest rate, inflation, gross domestic product and exchange rate) affected bank efficiency in the six-member West African Monetary Zone countries as a group (Gambia, Ghana, Guinea, Liberia, Nigeria and Sierra-Leone). We find that, based on fixed effect panel least squares regression results, only exchange rate has a significant (positive) effect on bank efficiency in the WAMZ. The effect of other are not significant. We also find that the net effect of the variables on bank efficiency in the selected countries is negative in three (Gambia, Ghana and Sierra Leone) and positive in three (Guinea, Liberia and Nigeria) WMAZ countries respectively. Finally, we find that interest rates and inflation have significant causal relationship with bank efficiency in the stated countries.

Arising from the outcomes of this study, we conclude that macroeconomic variables significantly affect bank efficiency in the WAMZ countries at least, in term of exchange rate; and that the impacts of macroeconomic variables on the operational efficiencies of banking sector across the selected WAMZ countries are non-homogeneous in term of volume and direction of impacts. Thus, the conclusion of this work would be instructive to setting banking policies towards increasing efficiency in each country of the zone accordingly.

5.2 Recommendations

We observe that banks in the WAMZ have not benefited significantly from their own size, liquidity liabilities and interest rates on which they have some level of control. This should arouse the interest of bankers in the WAMZ to critically appraise their size, liquidity and interest rates vis-à-vis their efficiency goal. Hence, the creation of research and development department within the banks, saddled with the task of monitoring, analyzing and forecasting the behavior of the major macroeconomic indicators to foster operational efficiency in the sector would be a viable strategy by the banks' decision makers. Moreover, the network growth policy of the bank should be directed toward optimality so that any growth achieved in the bank size would directly translate into efficiency of their financial sector.

Finally, we strongly suggest that the monetary authorities of these countries should formulate bank friendly policies (especially with respect to interest rates and inflation variables that have causal relationship with bank efficiency). They should also factor the behavioral differences of the macroeconomic environments of their respective countries into their policy initiatives toward efficiency

References

Aburime, Toni. (2008). Determinants of Bank Profitability: Macroeconomic Evidence from Nigeria. SSRN Electronic Journal. 10.2139/ssrn.1231064.

Adalessossi, K. & Erdoğan, E. O (2019). Analysis of factors influencing bank profitability: evidence from the West African Economic and Monetary Union banking sector, Journal of Accounting, Finance and Auditing Studies 5(1), 122-154

Akani, H. W., Nwanna, I., & Mbachu, A. (2016). Effects of selected macroeconomic variables on commercial banks performance in Nigeria.IIARD International Journal of Banking and Finance, 2(3)

Alber, N. (2015). Determinants of banking efficiency: Evidence from Egypt. International Business Research 8 (8). Retrieved from: https://ssrn.com/abstract=2705643

Albertazzi, U & Gambacorta, L. (2009). Bank profitability and the business cycle, Journal of Financial Stability, 5, 393-409.

Alessandri, P & Nelson, B. D. (2015). Simple banking: profitability and the yield curve, Journal of Money, Credit and Banking, 47(1), 143-175.

Banyen, K., & Biekpe, N., (2020). Financial integration, competition and bank efficiency: Evidence from Africa's sub-regional markets. Economic Change and Restructuring. 53 (4), 495–518.

Barry, T. A., Lepetita, L., & Tarazia, A. (2010). Ownership structure and bank efficiency in Six Asian Countries. Philippine Management Review (Special Issue), 18, 19-35.

Berger, A. & Humphrey, D. (1997). Efficiency of financial institutions: International survey and directions for future research. European Journal of Operational Research 98, 175-212.

Bishnu P. B. (2018). Impact of Bank Specific and Macroeconomic Variables on Performance of Nepalese Commercial Banks. Global Review of Accounting and Finance Vol. 9. No. 1. Issue. Pp. 35 – 53

Blankson N, Anarfo EB, Amewu G, Doabil L.(2022). Examining the determinants of bank efficiency in transition: Empirical evidence from Ghana, Heliyon 8, 1-11,

Bolt W., Haan L., Hoeberichts M., Oordt M, and Swank J (2012). Bank profitability during recessions, Journal of Banking and Finance, 36(9), 2552—2564.

Charnes, A., C. W. & Rhodes, E. (1978). Measuring the efficiency of decision-making units. European Journal of Operational Research, 2, 429–444.

Debreu, G. (1951). The coefficient of resource utilization, Econometrica: Journal of the Econometric Society, 273-292.

Eferakeya I. & Erhijakpor, A. E. O. (2020). Determinants of operating efficiency of Nigeria's banking sector, Palarch's Journal of Archaeology Of Egypt/Egyptology 17(7), 13151-13166.

Ehigiamusoe, K. U., & Lean, H. H. (2020). The role of deficit and debt in financing growth in West Africa, Journal of Policy Modeling, 42(1), 216-234,

Farrag, N. & Lang, G. (2015). Is Bigger Better for Egyptian Banks? An Efficiency Analysis of the Egyptian Banks during a Period of Reform 2000–2006. Review of Middle East Economics and Finance, De Gruyter 11(3) 225-248.

Goddard J; Molyneux P and Wilson J, (2004). The profitability of european banks: a cross-sectional and dynamic panel analysis, Manchester School, 72, (3), 363-381

Hamid, N, Ramli, N & Hussin S (2017). Efficiency measurement of the banking sector in the presence of non-performing loan, AIP Conference Proceedings 1795, 020001-020008;

Harvey, S. K. & Cushing, J. M. (2015). Is West African Monetary Zone (WAMZ) a common currency area? Review of Development Finance, 5(1); 53-63.

Hassan, M. & Jreisat, A. (2016). Does bank efficiency matter? A case of Egypt, International Journal of Economics and Financial Issues, 6(2), 473–478.

International Monetary Fund. (2020). Guinea financial sector stability review, IMF Country Report No. 20/42.

Kaitibi, D & Koroma, B (2017). Impact of efficient credit management on profitability of commercial banks in Sierra Leone. Open Journal of Business and Management, 6, 139-150

Khalad A , Mazila M, & Badrul K (2015). Measuring bank efficiency and its determinants in developing countries using data envelopment analysis: the case of Libya 2004-2010, International Journal of Business and Management; Vol. 10, (9), 1-18

Kohlscheen, E ; A. Murcia and J. Contreras (2018). Determinants of bank profitability in emerging markets, Bank for International Settlement (BIS) Working Papers No 686.

Koopmans, T. C. (1951). Analysis of production as an efficient combination of activities. activity analysis of production and allocation. In Koopman T. C (ed) Activity analysis of production and allocation , Cowles Commission for Research in Economics, Monograph No. 13, 33-97, Willey.

Matthews, K. (2010). Banking efficiency in emerging market economies State Bank of Pakistan Zahid Husain Memorial Lecture Series - No. 17, 1-34

Maude, F.A. & Ahmad, B.D. (2021). Financial soundness indicators and efficiency of listed deposit money banks in Nigeria. Gasau Journal of Account and Finance 2 (2), 1–17.

Marcia C, Evren O & Hassan.T (2002). (2002). Bank performance around the introduction of subsidiary banks in the US. Journal of Banking and Finance, 17, 389–40.

Mester, L. & Hughes, J. (2008). Efficiency in banking: theory, practice, and evidence, Oxford Handbook of Banking.

Msomi, T. S. (2022). Factors affecting non-performing loans in commercial banks of selected West African countries. Banks and Bank Systems, 17(1), 1-12. doi:10.21511/bbs.17(1).2022.01.

Myktybekovich, S. T. (2013). Factors affecting the profitability of banking system in Kyrgyzstan. Master thesis in Banking and Finance. Eastern Mediterranean University, Gazimağusa, North Cyprus, January 2013.

Novickyte L., & Droždz, J. (2018). Measuring the efficiency in the Lithuanian banking sector: The DEA application. International Journal of Financial Studies, 3(1), 23-41.

Nyantakyi, B. E. & Sy, M. (2015). The banking system in Africa: Main facts and challenges, Africa Economic Brief, 6(5), 1-16.

Ozili, P. K. (2018). Banking stability determinants in Africa. Munich Personal RePEc Archive, MPRA Paper No. 101825.

Palazzo, I. J. (2019). Determinants of bank efficiency: evidence from the Latin American banking industry, Applied Economic Analysis, 27(81), 184-206, DOI 10.1108/AEA-09-2019-0027

Shamshur, A. & Weill, L. (2019). Does bank efficiency influence the cost of credit? Retrieved from: https://www.sciencedirect.com/science/article/pii/S0378426619300998.

Sharma R., Kumar R., Kumar I. & Sharma, U. (2015). Sharma et al-European Journal of Organic Chemistry (2) [15].

Shokr, M. A., & Al-Gasaymeh, A. (2018). Bank lending channel and banking sector efficiency: panel data of Egypt. International Journal of Emerging Markets, 13(5), 1291–1310.

Sufian, F., & Chong, R. R. (2008). Determinants of bank profitability in a developing economy: empirical evidence from the philippines.Asian Academy of Management Journal of Accounting & Finance, 4(2)

Tuškan, B., & Stojanović, A. (2016). Measurement of cost efficiency in the European Banking Industry. Croatian Operational Research Review, 7(1), 47–66.

Tzeremes, N. G. (2015). Efficiency dynamics in Indian banking: A conditional directional distance approach. European Journal of Operational Research,240(3), 807-818.

Wozniewska, G. (2008). Methods of measuring the efficiency of commercial banks: An example of Polish Banks. Ekonomika, 1258-1264.

Yildirim, S. & Fatty, B. M. (2021). An empirical analysis of bank efficiency in Gambia, International Journal of Banking, Finance, Insurance and Technology.1(1):01-15.