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Dynamics of Macroeconomic Variables and Financial Supply Chain Stability: Evidence from Ghanaian Banking Sector

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ABSTRACT

This study examines the influence of macroeconomic factors on the financial supply chain stability of Ghana's banking sector, where banks serve as primary financial intermediaries due to an underdeveloped capital market. Utilizing a panel data set from 2001 to 2020, the research reveals significant correlations between gross domestic product (GDP), capital adequacy, inflation, and interest rates, with a 5% level of significance. The study's longitudinal approach captures long-term trends, offering unique insights into the specific macroeconomic variables that impact financial stability in a developing economy. The findings emphasize the crucial role of banks in maintaining financial stability and provide actionable implications for policymakers and banking sector managers. This research contributes to a nuanced understanding of the interplay between macroeconomic conditions and banking sector resilience in Ghana, with broader relevance to similar developing economies.

JEL Classifications: EO_1

Keywords: macroeconomic variables, banking industry, financial supply chain stability, ghana

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I. INTRODUCTION

The financial system and its institutions are the foundation of the growth prospects of all facets of an economy. The financial system has long existed to provide support for the economic development of the global economy (Chikalipah, 2017). For an economy to achieve sustainable growth and ensure proper allocations of surplus funds, there is a need to deepen the stability of the financial supply chain. Financial Supply Chain Stability refers to the stability of major financial institutions and markets that comprise the financial system (Ozili et al., 2023). A robust financial supply chain system is necessary to ensure a healthy and thriving economy (Youssef et al., 2022). Every economy's financial supply chain relies heavily on the banking industry (Seidu et al., 2021). Transferring money from the surplus spending units (SSU) or savers to the deficit spending units (DSU) or borrowers is crucial for the banking supply business. The banking sector's success and efficiency are vital to the growth and sustainable development of an economy (Ozili et al., 2023) highlighted the important role that banks play as one of the key elements of the financial market.

In spite of the fundamental roles of the banking sector, it faces a rapidly changing environment. This changing trend is exposing most of these banks to a variety of risks that threaten their financial supply chain stability. The study's conclusions showed that banks' financial efficiency is significantly increased when internal control components are developed and implemented correctly (Oppong et al., 2023). Banks are the most important players in Ghana's financial supply chain market because the capital market is not well-developed (Seidu et al., 2021). Ghana's banking system accounted for 70% of the country's financial sector in 2018 (Seidu et al., 2021). As a result, the banking sector remains crucial to the economy's development, as its failure might have a systemic impact on the entire economy both across and within the jurisdiction, and also a lack of clarity and standardization (Marcacci, 2023). Citizens' financial circumstances and living standards may improve with greater participation in the formal financial supply chain system. This would allow them to accumulate assets, make money, and strengthen their ability to withstand shocks to their livelihood and the macroeconomy (Yang, 2022).

Despite a minor rebound in 2010 in the post-2008 global financial crisis, the Ghanaian banking sector has experienced multiple episodes of financial instability (Iyke and Ho, 2020; Abaidoo et al., 2021). The recent banking crisis in Ghana also underscored a better understanding of the financial supply chain stability. Symptoms of the crisis in 2017/2018 revealed poor performances in key stability metrics. Asset quality was and remains a source of concern because banks' stocks of non-performing loans (NPLs) rose between April 2017 and April 2018. The non-performing loans remain high on banks' financial statements, averaging a little over 14 percent (14.59%) over the last two decades. Concerns about the stability of the financial sector in Ghana have increased. Another challenge faced by the banking industry was high lending interest rates. The inflation and prime rates decreased from 17 percent and 21 percent in 2014 to 11.8 percent and 20 percent in 2017, respectively. Most banks were unwilling to cut nominal lending rates because of low-quality loans in their books. The nominal interest rates were high to compensate for high loan default risk and increase profitability (Aboagye, 2020). Several banks had a capital adequacy ratio (CAR) of less than 5 percent. The required minimum CAR is at least 10 percent, and there is no maximum CAR limit. These contributed to the collapse of about seven (7) commercial banks with the spillover leading

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to the collapse of about Twenty-Three (23) savings and loans institutions and further Three Hundred and forty-seven (347) microfinance institutions (Queku, 2020; Atuahene et al., 2021).

This has led to a significant decline in the confidence of the Ghanaian banking sector (Apreku-Djana et al., 2023). It seems that the Ghanaian banking regulator, Bank of Ghana (BOG), believes that capital regulatory lapses, with an emphasis on minimum capital requirement, as the cause of weakness in the financial stability of Ghanaian banks. This is evident in its historical response to some of these stability challenges. For instance, BOG sought to deepen financial stability by raising the minimum capital for banks from GHc25 million to GH¢60 million in 2008 and doubling it to GH¢120 million in 2013 (Frankfurt School, 2015). The BOG began another stability reform in 2017 in response to the stability crisis popularised as the 'Banking Sector Clean-up', where the minimum capital was revised to GH¢400 million from the existing GH¢120 million. These regulatory reforms have yielded limited results and often induce crises in the banking sector, which threatens confidence in the Ghanaian banking sector (Apreku-Djana et al., 2023). Thus, although regulatory interventions and reforms, including upscaling of capital requirements, are crucial for banking sector stability, the limited successes of these reforms suggest the need for exploring further antecedents of financial stability in the Ghanaian banking sector. This is not only useful for theory but also for policy and practice.

A fundamental lesson from the 2007-2008 global financial crisis and the subsequent amplification by the Lehmann shock is that there is a link between the real sector of the economies and the financial sector (Asafo and Matuka, 2019). Following this, it is imperative for theorists, experts, and policymakers to examine the macro-economy transmission dynamics and the susceptibility of the financial sector to the shocks of such transmissions. Emerging evidence seems to support this assertion to the effect that macroeconomic dynamics may explain the behaviour of financial supply chain stability (Youssef et al., 2022). In fact, it has been argued that all facets of the financial sector are tied to macroeconomic performance (Queku, 2020).

Despite the sound theoretical and empirical bases to assume a critical role of the macroeconomic dynamics in explaining the financial supply chain stability (Youssef et al., 2022), there is still a paucity of empirical studies in the Ghanaian literature (Opoku-Asante et al., 2023). The neglect or limited empirical evidence on macroeconomic-financial supply chain stability nexus in Ghana is therefore not only detrimental to developing the body of knowledge in this area of investigation but also inimical to the achievement of financial stability and the development of the Ghanaian banking sector. This might have also contributed to the overreliance on regulatory reforms which often led collapse of several universal banks and disastrous spillover on the greater number of other deposit-taking financial institutions. In fact, the cost of the recent banking crisis to the government and taxpayers is unmeasurable. Nevertheless, it is estimated that the government's direct intervention cost Ghana an amount of GH¢ 11.7 billion to protect the deposits of the universal banks (Ministry of Finance, 2020).

It is therefore fundamental and critical to investigate how the macroeconomic dynamics drive financial supply chain stability in Ghana. Thus, the paper follows the existing literature to develop its framework and the basis of the investigation. However, it makes a significant contribution to the literature from different perspectives. Unlike the existing studies which have often followed the traditional panel estimation approaches

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(Apau et al., 2023; Opoku-Asante et al., 2023) and disregard the problem of combining time series data with panel specifications, this study employs an estimation approach capable of addressing this problem by pooling and averaging the mean parameters through the use of Pooled Mean Group (PMG). This allows the intercept, the coefficient of the short-run parameters, and the error variances to differ across cross-sections while imposing constraints on the long-run parameters. The estimates from such estimation would not only address the stability challenges of concurrent integration of time series with panel data but also reflect time constraints imposed by budget, solvency, technology, and even arbitrage conditions (Mowlaei, 2018).

Secondly, this study deepens the proxies for financial stability by operationalising it from the perspective of both liquidity stability and solvency stability. The Ghanaian literature has mostly documented financial stability from one proxy, usually non-performing loans or asset quality and profitability (Apau et al., 2023) and Profitability. Through both the various BASEL Accords and BOG regulatory frameworks, the core stability metrics reflect liquidity and solvency. Therefore, extending the investigation to observe the behaviour of Ghanaian banks' liquidity and solvency stability in response to macroeconomic transmissions would provide comprehensive Ghana-specific evidence about the macroeconomic-financial stability nexus.

Thirdly, even though existing studies have explored a wide range of macroeconomic factors vis-à-vis a selected supply chain financial stability proxy, these have failed to demonstrate the degree of relevance of these macroeconomic factors. This makes it difficult to elicit better policy and regulatory responses due to resource constraints in implementing all facets of the findings. This study, therefore, introduces innovation accounting through variance analyses and impulse response of financial stability to macroeconomic dynamics. While these approaches are commonly used in other subfields in finance and economics, they remained visibly absent in the macroeconomic-financial supply chain stability analyses. The findings from these further analyses would not only consolidate the evidence of such a relationship but also shed light on the macroeconomic factors that merit more policy and regulatory attention. The rest of the paper is organized as follows: theoretical understanding, empirical review and hypothesis development, estimation strategy, estimation approach, empirical analyses and discussions, conclusions and implications, and limitations of the study.

II. LITERATURE REVIEW

A. Theoretical Underpinnings

Systems theory provides a conceptual framework for financial supply chain stability, which helps explain the environment in which it performs successfully. According to Checkland (2019), a system is a flexible entity that adjusts to shifts in the banking industry in which it functions. A theoretical framework for the macroeconomic variables and financial supply chain stability was accessed in the banking operations in Ghana. According to Zheng et al. (2022), to understand and improve the financial supply chain stability, institutions should look at it from a systems perspective. According to Von Bertalanffy (1972), who identified the significance of the external environment in the organization, a system's success or failure depends on how well its many components

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work together and the context in which they operate. I utilized this frame of reference to express the idea that the network of financial supply chains stability was a system made up of several components such as assert quality, profitability and liquidity of the bank and the various macroeconomic variables (public debt, unemployment, annual percentage growth rate of gross domestic product) and bank-specific (capital adequacy ratio, rate of non-performing loans of the previous year and return on equity) factors. According to systems theory, each component of the system must function flawlessly and be related to the others. So are the macroeconomic variables. If they are weak, it affects the stability of the banking systems as well as the entire financial supply chain system. Despite all other sections of the system performing flawlessly, the system was nevertheless unsuccessful since one economic determinant had failed the entire system. Stability of the banking sector will be achieved if all the macroeconomic determinants are working effectively.

B. Hypothesis Development

Similar to other economic sectors, the banking business is influenced by fluctuations in key variables like GDP growth, inflation, interest rates, and currency rates, which determine the path of bank performance (Apau et al., 2023). According to the study, the CAR of commercial banks was positively impacted by bank size (BAS), liquidity (LQR), and non-performing loan (NPL) ratio; on the other hand, inflation (INF) had a negligible, negative impact with the study of the macroeconomic and bank-specific variables that affect commercial banks' capital adequacy ratios (Bogale & Ayenew, 2023). However, Apau et al. (2023)'s findings indicated that GDP growth had a detrimental impact on asset quality.

Capital Adequacy Ratio was negatively and statistically significantly impacted by the following factors: bank risk (RAR), loan provision (LPR), deposit share (DAR), return on equity (ROE), and GDP growth, as well as the Adequacy ratio of the commercial banks. Additionally, the CAR of commercial banks was positively and statistically significantly impacted by both return on assets (ROA) and net interest margin (NIM). The study's conclusion is important since it informed bank management about the pertinent variables to consider when formulating financial policies to preserve CAR at least at the minimum needed level (Bogale, 2020). Size, profitability (ROA), leverage, liquidity, net interest margin (NIM), and risk are employed as bank-dimensional explanatory variables in a workable GLS regression model to investigate the effects of bank-dimensional and environmental factors on the bank's capital adequacy ratio (Rafet Aktas et al., 2015). On the other hand, to account for environmental influences, the basic model is supplemented by the economic growth rate, inflation, real interest rate, deposit insurance coverage, and governance indicator (Oppong et al., 2023). The study's findings indicate that risk, size, ROA, leverage, net interest margin, and liquidity are the bank dimensions' explanatory variables that have a statistically significant influence on the CAR of the local banks.

Taken together, there is substantial evidence for dynamics of macroeconomic variables and financial supply chain stability in America, Europe, and Asia; however, empirical evidence for dynamics of macroeconomic variables and financial supply chain stability in Africa is scant in the financial supply chain literature. The study investigated the dynamics of macroeconomic variables and financial supply chain stability in Africa

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some African banks. Therefore, this study formulates its hypothesis as follows

1. GDPG, INFL, INR, and EXR, and the Capital Adequacy of Banks in Ghana

The relationship between macroeconomic factors and banks' capital adequacy has been examined in various studies. Gross domestic product (GDP) was found to have a significant negative effect on capital adequacy in Indian banks (Senan et al., 2022), while it showed no significant impact in Nepalese banks (Bhattarai, 2020). Inflation demonstrated a negative and statistically significant effect on capital adequacy in Nepal (Bhattarai, 2020), but had no significant relationship with exchange rates in African countries (Bilawal et al., 2012). Interest rates negatively influenced capital adequacy in Indian banks (Senan et al., 2022), yet showed no significant relationship with African exchange rates (Abbas et al., 2023). Exchange rates positively affected capital adequacy in Indian banks (Senan et al., 2022). In Nigeria, a well-functioning banking system stabilises inflation and exchange rates (Williams & Sola, 2018). These findings suggest that the impact of macroeconomic factors on capital adequacy may vary across different countries and contexts. Overall, these macroeconomic variables do play a role in determining capital adequacy, although the extent and nature of their influence can vary. On that basis, this study proposes that;

H1: GDPG, INFL, INR, and EXR have no significant relationship with the capital adequacy of banks in Ghana.

2. The Relationship between GDPG, INFL, INR, and EXR and Bank Liquidity

Research on bank liquidity determinants reveals mixed findings across different contexts. Macroeconomic factors like GDP growth and inflation show varying impacts, with some studies reporting negative effects on liquidity (Sopan & Dutta, 2018; Al-Qudah, 2020), while others find positive relationships (Bhati et al., 2019; Adafre & Bushira, 2024). Interest rates and exchange rates also demonstrate inconsistent influences on bank liquidity (Bhati et al., 2019; Adafre & Bushira, 2024). Bank-specific factors such as size, profitability, and asset quality generally exhibit negative associations with liquidity (Sopan & Dutta, 2018; Al-Qudah, 2020), while capital adequacy and deposit growth tend to have positive effects (Sopan & Dutta, 2018; Al-Qudah, 2020). Regulatory factors like the cash reserve ratio and statutory liquidity requirements show a limited impact on bank liquidity (Bhati et al., 2019). These diverse findings suggest that the relationship between macroeconomic variables, bank-specific factors, and liquidity is complex and may vary depending on each study's specific context and measurement methods. The mixed findings indicate that the impact of macroeconomic variables on bank liquidity is context-dependent, requiring further research to understand the underlying mechanisms better. In that instance, this study believes that;

H2: GDPG, INFL, INR, and EXR have no significant relationship with the liquidity of banks in Ghana.

3. GDPG, INFL, INR, and EXR and the Profitability of Banks

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Research on the relationship between macroeconomic variables and bank profitability has yielded mixed results. Some studies found that GDP growth rate had an insignificant impact on most banks' profitability (Sangeetha & Moorarka, 2019; Wijanarko and TP Siahaan, 2021). Inflation showed varying effects, with positive and significant impacts on public-sector banks but insignificant impacts on private-sector banks in India (Sangeetha & Moorarka, 2019). However, Vania & Kusumastuti (2022) reported a negative relationship between inflation and bank profitability in Indonesia. Interest rates demonstrated inconsistent effects across studies, with some finding no significant relationship (Vania & Kusumastuti, 2022) and others showing significant impacts (Wijanarko and TP Siahaan, 2021). Exchange rates were found to have a significant effect on profitability in some studies (Wijanarko and TP Siahaan, 2021) but a negative relationship in others (Vania and Kusumastuti, 2022). These conflicting findings suggest that the impact of macroeconomic variables on bank profitability may vary depending on the specific context and period studied. Therefore;

H3: GDPG, INFL, INR, and EXR have no significant relationship with the profitability of banks in Ghana.

4. Gross Domestic Product (GDP), Inflation (INFL), Interest Rate (INR), and Exchange Rate (EXR) have no Significant Relationship with the Asset Quality of Banks

The research papers present mixed findings on the relationships between macroeconomic factors and banking performance. Rahmananingtyas (2022) found that inflation and GDP had no effect on non-performing loans (NPL), while credit interest rates, loan-to-asset ratio, and earning assets quality did impact NPL. Similarly, Sorongan (2017) reported that inflation had no significant effect on bank profitability, although CAR, LOAN, and GDP significantly contributed to profitability. In contrast, Idris (2019) observed that interest rates had a significant negative relationship with GDP, while exchange rates showed a significant positive relationship. However, they also found that inflation did not significantly influence GDP. These studies suggest that while some macroeconomic factors may impact banking performance and economic growth, the relationships are not always consistent or significant across different contexts and measures (Idris, 2019; Rahmananingtyas, 2022; Sorongan, 2022).

H4: GDPG, INFL, INR, and EXR have no significant relationship with asset quality of banks in Ghana.

III. METHODOLOGY

The study adopted the Pearson Correlation, Multiple Linear Regression methods, and PMG estimator to explore the effects of macroeconomic variables on the financial supply chain stability of Commercial Banks in Ghana. The Banks financial stability measures (dependent variables) considered in this study include Assets Quality (NPL) (Impaired Loans / Total Asset), Liquidity Ratio (LQR) (core liquidity / short-term liability), Profitability (ROE: Net Income / Total Equity Capital) and Capital Adequacy Ratio (CAR) (Tier I and tier II Capital / Risk-Weighted Assets). The macro-economic variables

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(explanatory variables) considered in this study also include Gross Domestic Product Growth (GDPG), Inflation (INF) (Consumer Price Index), Interest Rate (INR) (the prime lending rate), and Exchange Rate (EXR) (US Dollar to Ghana Cedis).

A. Our Empirical Model Takes the Form

$$ROE_{it} = \beta_0 + \beta_1 INR_{it} + \beta_2 INF_{it} + \beta_3 GDP_{it} + \beta_4 EXR_{it} + \varepsilon_{it} \ldots. \quad (1)$$

$$CAR_{it} = \beta_0 + \beta_1 INR_{it} + \beta_2 INF_{it} + \beta_3 GDP_{it} + \beta_4 EXR_{it} + \varepsilon_{it} \ldots. \quad (2)$$

$$NPL_{it} = \beta_0 + \beta_1 INR_{it} + \beta_2 INF_{it} + \beta_3 GDP_{it} + \beta_4 EXR_{it} + \varepsilon_{it} \ldots. \quad (3)$$

$$LQR_{it} = \beta_0 + \beta_1 INR_{it} + \beta_2 INF_{it} + \beta_3 GDP_{it} + \beta_4 EXR_{it} + \varepsilon_{it} \ldots. \quad (4)$$

Where;

ROE	=	Return on equity
CAR	=	Capital adequacy ratio
NPL	=	Non-performing loans
LQR	=	Liquidity ratio
INR_{it}	=	Interest rate
INF_{it}	=	Inflation rate
GDP_{it}	=	Gross domestic product growth
EXR_{it}	=	Exchange rate

Constant term,

β_1	=	Interest rate coefficient
β_2	=	Inflation rate coefficient
β_3	=	Gross domestic product coefficient
β_4	=	Exchange rate coefficient
ε_{it}	=	Error term

B. Data Description and Statistical Properties

Our study is focused on commercial banks listed for over ten years (2001 to 2020) on the Ghana Stock Exchange (hereafter GSE). Secondary data was gleaned from the annual reports of the banks and the websites of the Bank of Ghana and the World Bank's World Development Indicators. Data on macroeconomic variables, including GDP, inflation, interest rate, and exchange rate, were gleaned from the Bank of Ghana and the World Bank's World Development Indicators websites. The financial stability measures, including the capital adequacy ratio, non-performing loans, return on equity, and liquidity, were sourced from the financial statements of the sampled banks.

C. Descriptive Statistics of Financial Stability Variables

Table 1 provides descriptive statistics on financial stability variables so as to describe the characteristics of the sample data, check the variables for any violation of the assumptions underlying the statistical techniques that will be used to address the research questions.

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Table 1
Descriptive Statistics of Financial Stability Variables

Variables	N	Mini	Max	Mean	Std. Dev
CAR	40	9.3	20.5	16.58	2.68
LQR	40	28.2	34.6	31.80	1.86
ROE	40	17.3	49.7	25.47	8.12
NPL	40	6.4	22.7	14.7	4.4

Notes: Author's calculation (2023)

For the dependent variables, it is revealed from the table that the Return on Equity has a minimum ratio of 17.3 and a maximum ratio of 49.7, with an average (mean) of 25.465 and with a standard deviation of 8.12, indicating a wide dispersion among the banks in Ghana. Liquidity has a minimum value of 28.2 and a maximum value of 34.6, with a mean of 31.8 and a standard deviation of 1.86, indicating low variability.

Capital Adequacy Ratio is essential for the solvency and financial performance of banks. This is due to the fact that the banking business is risky because of the probability that some loans may not be paid back, resulting in financial losses to the bank. Banks are therefore required to have adequate capital, not only to remain solvent, but to avoid the instability of the financial system. The Bank of Ghana, therefore, requires banks to maintain a 10% capital adequacy ratio.

The minimum value of the capital adequacy ratio is 9.3, and the maximum is 20.5, with an average (mean) of 16.58 and a standard deviation of 2.68. This is an indication that most of the banks in Ghana are more stable in terms of maintaining adequate capital. Over the 20 years under study, Non-Performing Loans among the banks have a minimum value of 6.4 and a maximum value of 22.7, with an average (mean) of 14.7 and with a standard deviation of 4.4. indicating a high dispersion rate in the banking industry in Ghana.

D. Descriptive Statistics of Macroeconomic Variables

Table 2 provides descriptive statistics on financial stability variables so as to describe the characteristics of the sample data, check the variables for any violation of the assumptions underlying the statistical techniques that will be used to address the research questions. In the descriptive statistics output presented above, the information for each of the variables is summarised using the mean and the standard deviation, minimum, and maximum values of the variables.

Table 2
Descriptive Statistics of Macroeconomic Variables

Variables	N	Mini	Max	Mean	Std. Dev
EXR	40	0.72	5.55	2.26	1.64
INR	40	12.5	27	18.25	4.6
INFL	40	8.5	23.6	13.92	4.32
GDPG	40	0.9	15	6.17	2.87

Notes: Author's calculation (2022)

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IV. RESULT AND DISCUSSION

Tests for OLS assumptions were performed before running the regression analysis. The first diagnostic test was conducted to see whether the variances of the error terms were constant. The Breusch-Pagan Cook-Weisberg test was applied to determine heteroscedasticity. The null hypothesis in the test states that the variance of errors is constant (homoscedasticity), but the alternative hypothesis states that the variance of errors is not constant. Results from the test are presented in Table 3. These results reveal that there was no heteroscedasticity ($p > 0.05$) in the residuals of the variables.

Table 3
Breusch-Pagan / Cook-Weisberg Test for Heteroscedasticity

Model	Dependent Variable	χ^2 - value	Max
1	40	0.72	5.55

Notes: Author's calculation (2022)

A. Test of Multicollinearity

Multi-collinearity is a problem that develops when the explanatory variables are significantly associated with each other. According to Hair et al. (2019), a correlation of more than 0.8 should be regarded as a multicollinearity problem. Hair et al. (2019) also stated that a correlation coefficient of less than 0.9 does not necessarily indicate a major multi-collinearity problem.

Table 4
Test of Multicollinearity (Variance Inflation Factor)

Variable	Variance Inflation Factor (VIF)
INF	3.198
GDP	1.726
EXR	1.776
INR	2.320

Notes: Author's calculation (2022)

To see if one predictor has a strong linear relationship with the others, the variance inflation factor (VIF) was utilized (the presence of multicollinearity among the predictors).

If the predictors are interrelated, VIF measures how much the variance of an estimated regression coefficient drops. Severe Multicollinearity was defined as the greatest VIF among all predictors.

When VIF is more than 10, to Hair et al. (2019) claim that the regression coefficients are poorly approximated. The variance inflation factor (VIF) on the independent variables as depicted in Table 4 varied from 1 to 3, which was less than 10, indicating that there was no multi-collinearity between the independent variables in the regression model.

Table 5
Estimated Parameters of Panel Regression

Predictor	Model 1	Model 2	Model 3	Model 4

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Variables	ROE	CAR	NPL	LQR
$log\ INR$	β = 0.112 (0.116) (Sig. = 0.018)	β = -0.014 (SE = 0.015) (Sig. = 0.034)	β = 0.002 (0.016) (Sig. = 0.918)	β = 0.019 (0.015) (Sig. = 0.643)
$log\ INF$	β = -0.169 (0.039) (Sig. = 0.041)	β = -0.099 (0.052) (Sig. = 0.07)	β = 0.149 (0.059) (Sig. = 0.011)	β = 0.249 (0.049) (Sig. = 0.011)
$log\ GDPG$	β = 0.152 (0.033) (Sig. = 0.032)	β = 0.120 (0.045) (Sig. = 0.012)	β = -0.052 (0.023) (Sig. = 0.029)	β = 0.162 (0.013) (Sig. = 0.049)
$log\ EXR$	β = -0.219 (0.113) (Sig. = 0.011)	β = -0.493 (0.110) (Sig. = 0.00)	β = -0.359 (0.102) (Sig. = 0.001)	β = -0.456 (0.022) (Sig. = 0.003)
Null Hypothesis Test	p-value<0.05(Rejected)	p-value<0.05(Rejected)	p-value<0.05(Rejected)	p-value<0.05(Rejected)
Intercept (baseline)	0.660 (0.424) (Sig. = 0.048)	1.73 (0.77) (Sig. = 0.031)	0.570 (0.124) (Sig. = 0.041)	0.760 (0.324) (Sig. = 0.021)
R^2	0.72	0.80	0.78	0.69
ANOVA	0.000**	0.000**	0.008**	0.000**

Notes: Author's calculation (2022)

$\log$ IRT = logarithm of Interest rate, $\log$ INF = logarithm of inflation rate, $\log$ GDPG = logarithm of gross domestic product growth, $\log$ EXR = logarithm of exchange rate, **=significant at a 5% level of significance that macroeconomics positively influences the respective financial stability variables adopted for this study. The overall coefficient of determination (R^2) of the explanatory variables in each of the four models explains approximately 70% of the variation in the financial stability variables. The 30% are factors that are assumed to be captured by the error term. Again, each of the ANOVA models revealed that the models are significantly good in predicting the outcome variable, thus financial stability. The results are presented in Table 5.

B. Analysis and Findings of Objective One

1. Model 2: Macroeconomic Variables and Capital Adequacy Ratio (CAR)

1.1 Relationship between Interest Rate and Capital Adequacy Ratio

From Table 5, the capital adequacy ratio and interest rate have a considerable positive relationship. With 0.8 as R-squared and 0.034 < 0.05 level of significance, indicating that the mean difference between the dependent and independent variables. The level of significance is 0.034 < 0.05, indicating that the mean difference between the dependent and independent variables is significant. The value of the intercept was 1.73, while the value of the coefficient was 0.014. The link between interest rate and capital adequacy ratio might be described as good. It is established that an increase in interest rate causes the capital adequacy ratio of banks to increase through loans advanced to borrowers which increases their capital adequacy ratio and consequently increases their financial

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stability. These results are in agreement with the study of Hutchins (2023).

1.2 Relationship between Inflation and Capital Adequacy Ratio

From Table 5, the capital adequacy ratio and inflation rate have a significant negative relationship. The value of R-squared is 0.80, as can be seen in Table 5. That is, the capital adequacy ratio and the inflation rate made by banks have a good negative association. The R-squared was 0.80, indicating that a change in the independent variable causes 80 percent change in the dependent variable. The level of significance is 0.070<0.05, indicating that the mean difference between the dependent and independent variables is significant. The value of the intercept was 1.73, while the value of the coefficient was -0.099. The link between the inflation rate and the capital adequacy ratio might be described as good. It is established that a decrease in the inflation rate causes banks to yield more on loans advanced to borrowers through an increase in the repayment rate by borrowers. Thus, the standard of living in an economy will decrease, causing the flexibility of the borrower to engage in economic activities to repay the loan owed, which increases the capital adequacy ratio of the banks and consequently increases the financial stability of the banks. This result is in consistence with Nguyen's (2014) study.

1.3 Relationship between Gross Domestic Product Growth and Capital Adequacy Ratio

From Table 5, the capital adequacy ratio and gross domestic product growth have a considerable positive relationship. The value of R-squared is 0.80, as can be seen in Table 5. That is, the capital adequacy ratio and the gross domestic product growth made by banks have a good positive association. The R-squared was 0.80, indicating that a change in the independent variable causes an 80 percent change in the dependent variable.
The level of significance is 0.012 < 0.05, indicating that the mean difference between the dependent and independent variables is significant. The value of the intercept was 1.73, while the value of the coefficient was 0.120. The link between gross domestic product growth and the capital adequacy ratio might be described as good. It is established that an increase in gross domestic product growth causes banks to yield more on loans advanced to borrowers, which increases their capital adequacy ratio and consequently increases their financial stability. This finding is in agreement with Lee et al.'s (2023) study.

C. Analysis and Findings of Objective Two

1. Model 3: Macroeconomic Variables and Non-performing loans (NPLs)

1.1 Relationship between Interest Rate and Non-performing Loans

From Table 5, Non-performing loans and interest rates have a considerable positive relationship. That is, the Non-performing loans and the interest rate made by banks have a good positive association. The R-squared was 0.78, indicating that a change in the independent variable causes a 78 percent change in the dependent variable, which is higher than that of model 1 but lower than model 2. Thus, macroeconomic variables explain non-performing loans better than return on equity. The level of significance is

0.918 > 0.05, indicating that the mean difference between the dependent and independent variables is not significant. The value of the intercept was 0.570, while the value of the coefficient was 0.002. The link between interest rate and Non-performing loans might be described as good. It is established that an increase in interest rate causes Non-performing loans of banks to increase through loans advanced to borrowers, which increases and consequently decreases their financial stability.

1.2 Relationship between Inflation and Non-performing Loans

In Table 5, Non-performing loans and the inflation rate have a significant negative relationship. The value of R-squared is 0.78, as can be seen in Table 5. That is, the Non-performing loans and the inflation rate made by banks have a good negative association. The R-squared was 0.78, indicating that a change in the independent variable causes a 78 percent change in the dependent variable. The level of significance is 0.011 < 0.05, indicating that the mean difference between the dependent and independent variables is significant. The value of the intercept was 0.570, while the value of the coefficient was -0.149. The link between the inflation rate and non-performing loans might be described as good. It is established that a decrease in the inflation rate causes banks to yield more on loans advanced to borrowers through an increase in the repayment rate by borrowers. Thus, the standard of living in an economy will decrease, causing banks to give out more loans as a result of the cost of capital, which increases the Non-performing loans of the banks and consequently decreases the financial stability of the banks. This study is in agreement with the study of Anita et al. (2023).

1.3 Relationship between Gross Domestic Product Growth and Non-performing Loans

Table 5, again shows that Non-performing loans and gross domestic product growth have a significant negative relationship. The value of R square is 0.78, as can be seen in Table 5. That is, the Non-performing loans and the gross domestic product growth made by banks have a good negative association. The R square was 0.78, indicating that a change in the independent variable causes a 78 percent change in the dependent variable. The level of significance is 0.029 < 0.05, indicating that the mean difference between the dependent and independent variables is significant. The value of the intercept was 0.570, while the value of the coefficient was -0.052. The link between gross domestic product growth and non-performing loans might be described as good. It is established that an increase in gross domestic product growth causes banks to yield more on loans advanced to borrowers which decreases their Non-performing loans and consequently increase their financial stability. This is consistent with Anita et al. (2023) study.

1.4 Relationship between Exchange Rate and Non-performing Loans

From Table 5, Non-performing loans and exchange rate of banks have a considerable negative relationship. The value of R square is 0.78, as can be seen in Table 5. That is, the Non-performing loans and exchange rates made by banks have a good negative association. The R-squared was 0.78, indicating that a change in the independent variable causes a 78 percent change in the dependent variable. The level of significance is 0.001 < 0.05, indicating that the mean difference between the dependent and independent

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variables is significant. The value of the intercept was 0.570, while the value of the coefficient was -0.359. The link between exchange rate and Non-performing loans might be described as good. It is established that a decrease in the exchange rate causes customers of banks to repay the loans advanced, which decreases their Non-performing loans and consequently increases their financial stability. This result is in agreement with Zawadzki's (2023) study.

D. Analysis and Findings of Objective Three

1. Model 4: Macroeconomic Variables and Liquidity Ratio (LQR)

1.1 Relationship between Interest Rate and Liquidity Ratio

From Table 5, the Liquidity ratio and interest rate of banks have a considerable positive relationship. The value of R-squared is 0.76, as can be seen in Table 5. That is, the Liquidity ratio and the interest rate set by banks have a good positive association. The R-squared was 0.76, indicating that a change in the independent variable causes a 76 percent change in the dependent variable, which is higher than that of model 1 but lesser than model 2. Thus, macroeconomic variables explain the Liquidity ratio better than return on equity. The level of significance is $0.019 < 0.05$, indicating that the mean difference between the dependent and independent variables is not significant. The value of the intercept was 0.76, while the value of the coefficient was 0.643. The link between interest rate and Liquidity ratio might be described as good. It is established that an increase in interest rate causes the Liquidity ratio of banks to increase through loans advanced to borrowers, which increases and consequently increases their financial stability. This is contrary to the study of Nguyen's (2022) study.

1.2 Relationship between Inflation and Liquidity Ratio

The liquidity ratio and inflation rate of banks have a considerable negative relationship. The value of R-squared is 0.76, as can be seen in Table 5. That is, the Liquidity ratio and the inflation rate made by banks have a good negative association. The value for R-squared was 0.76, indicating that a change in the independent variable causes a 76 percent change in the dependent variable. The level of significance is $0.011 < 0.05$, indicating that the mean difference between the dependent and independent variables is significant. The value of the intercept was 0.76, while the value of the coefficient was -0.249. The link between the inflation rate and the Liquidity ratio might be described as good. It is established that a decrease in the inflation rate causes banks to yield more on loans advanced to borrowers through an increase in the repayment rate by borrowers. Thus, the standard of living in an economy will decrease, causing banks to give out more loans as a result of the cost of capital, which increases the Liquidity ratio of the banks and consequently increases the financial stability of the banks. This is in agreement with Nguyen's (2022) study.

1.3 Relationship between Gross Domestic Product Growth and Liquidity Ratio

Liquidity ratio and gross domestic product growth of banks have a considerable positive

relationship. The value of R-squared is 0.76, as can be seen in Table 5. That is, the Liquidity ratio and the gross domestic product growth made by banks have a good negative association. The R-squared was 0.76, indicating that a change in the independent variable causes a 76 percent change in the dependent variable. The level of significance is 0.049<0.05, indicating that the mean difference between the dependent and independent variables is significant. The value of the intercept was 0.76, while the value of the coefficient was -0.162. The link between gross domestic product growth and Liquidity ratio might be described as good. It is established that an increase in gross domestic product growth causes banks to yield more on loans advanced to borrowers, which increases their Liquidity ratio and consequently increases their financial stability.

1.4 Relationship between Exchange Rate and Liquidity Ratio

The liquidity ratio and exchange rate of banks have a considerable negative relationship. The value of R-squared is 0.76, as can be seen in Table 5. That is, the Liquidity ratio and exchange rate made by banks have a good negative association. The R-squared was 0.78, indicating that a change in the independent variable causes a 76 percent change in the dependent variable. The level of significance is 0.003 < 0.05, indicating that the mean difference between the dependent and independent variables is significant. The value of the intercept was 0.76, while the value of the coefficient was -0.456. The link between the exchange rate and the Liquidity ratio might be described as good. It is established that a decrease in the exchange rate causes customers of banks to repay the loans advanced, which increases their Liquidity ratio and consequently increases their financial stability. This result is in agreement with Nguyen's (2022) study.

E. Analysis and Findings of Objective Four

1. Model 1: Macroeconomic Variables and Return on Equity (ROE)

1.1 Relationship between Interest Rate and Return on Equity

From Table 4.3, return on equity and interest rate have a considerable positive relationship with R-squared being 0.720, and the level of significance is 0.018<0.05, indicating that the mean difference between the dependent and independent variables is significant. The value of the intercept was 1.73, while the value of the coefficient was -0.112. The link between interest rate and return on equity might be described as good. It is established that an increase in interest rate causes banks to yield less in the short run on loans advanced to borrowers, which decreases their return on equity and consequently decreases their financial stability.

1.2 Relationship between Inflation and Return on Equity

Return on equity and the inflation rate have a considerable negative relationship. The value of R-squared is 0.720 (see Table 4.3). That is, the return on equity and the inflation rate made by banks have a good negative association. The level of significance is 0.041 < 0.05, indicating that the mean difference between the dependent and independent variables is significant. The value of the intercept was 0.666, while the value of the

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coefficient was -0.169. The link between the inflation rate and return on equity might be described as good. Thus, the standard of living in an economy will decrease, causing the flexibility of the borrower to engage in economic activities to repay the loan owed, which increases the return on equity of the banks and consequently increases the financial stability of the bank.

1.3 Relationship between Gross Domestic Product Growth and Return on Equity

From Table 5, return on equity and gross domestic product growth have a considerable positive relationship. With 0.72 as the value of R-squared and the level of significance being $0.018 < 0.05$, indicating that the mean difference between the dependent and independent variables is significant, as can be seen in Table 4.3. The value of the intercept was 1.73, while the value of the coefficient was 0.152. It is established that an increase in gross domestic product growth causes banks to yield more on loans advanced to borrowers, which increases their return on equity and consequently increases their financial stability.

1.4 Relationship between Exchange Rate and Return on Equity

Return on equity and exchange rate are seen to have a considerable negative relationship. That is, the return on equity and exchange rate made by banks have a good negative association. The R-squared was 0.720, indicating that a change in the independent variable causes a 72 percent change in the variability of the dependent variable. The level of significance is $0.011 < 0.05$, indicating that the mean difference between the dependent and independent variables is significant. The value of the intercept was 0.666, while the value of the coefficient was -0.219. The link between the exchange rate and return on equity might be described as good. It is established that a decrease in the exchange rate causes banks to yield more on loans advanced to borrowers, which increases their return on equity and consequently increases their financial stability.

V. CONCLUSIONS AND POLICY IMPLICATIONS

The study investigated macroeconomic variables and the financial stability of commercial banks in Ghana. The study adopted a quantitative approach in analyzing the data. The study used secondary data, which was obtained from the financial statements of each of the commercial banks used in this study, and financial reports from the Bank of Ghana and the Ghana Statistical Service. Employing the ordinary least squares model, STATA version 21.0 was used to process and analyze the data. The null hypothesis test revealed that macroeconomic variables positively influence the respective financial stability variables adopted for this study. The overall coefficient of determination (R^2) the explanatory variables in each of the four models explain approximately 70% of the variation in the financial stability variables. The 30% are unexplained factors that are assumed to be captured by the error term. Again, each of the ANOVA models revealed that the models are significantly good in predicting the outcome variable, thus financial stability. Furthermore, there was a positive association between macroeconomic variables and financial stability

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VI. POLICY RECOMMENDATIONS

The study presents the following recommendations based on the findings of the study: The negative relationship between inflation and financial stability means that high inflation may present deleterious effects to loan portfolio growth among commercial banks in Ghana. However, higher inflation increases the prices of goods and services in the country, thus decreasing the purchasing power of the average consumer and then making it difficult for borrowers to repay loans, which consequently leads to a high default rate among commercial banks. Therefore, for the fight against inflation to be won, government policies should be geared towards addressing the real economic factors that influence the high inflation rate in Ghana. The results show a positive association between interest rate and financial stability, implying that as the bank interest rate increases, financial stability increases. This finding is not a revelation, since commercial banks in Ghana are experiencing high interest rates and simultaneously initiating attractive and innovative financial products in the market to influence customers, which is expected to increase loan portfolio quality among commercial banks. It is therefore recommended that the Bank of Ghana make the necessary efforts to maintain the policy rate for a considerable length of time. Furthermore, findings suggest that liquidity has an insignificant negative association with the performance of the commercial banks in Ghana. This finding has practical implications for the liquidity management of commercial banks in Ghana. Chief Executive Officers of commercial banks should be encouraged to invest less in liquid assets. Investment in more liquid assets, the evidence suggests, decreased profitability, due in part to reduced bankruptcy cost. This interpretation contradicts the efficiency hypothesis, emphasizing that efficient liquidity management increases commercial banks' ability to meet their short-term debts, thereby improving financial performance and chances for survival. The study again reported a negative association between non-performing loans and the performance of commercial banks. This finding is no surprise, since loan officers of commercial banks in Ghana follow rigorous banking supervision guidelines related to the assessment of asset quality. The banks are therefore advised to put more emphasis on credit risk management. In order to reduce risk on loans and achieve maximum performance, the banks need to allocate more funds to default rate management and try to maintain just an optimum level of capital adequacy and asset quality.

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