Macroeconomic Variables and Quoted Commercial Banks' Capital Adequacy Ratio in Nigeria

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Abstract

This study examined the effect of macroeconomic variables on quoted commercial banks capital adequacy ratios. Cross sectional data were sourced from financial statement of the commercial banks and central Bank of Nigeria statistical bulletin from 2015 to 2024. Capital adequacy ratio was modeled as the function of interest rate, real gross domestic product, inflation rate and exchange rate. The study employed the employed that panel data ordinary least square methods. R-square, Adjusted R-square, Regression coefficient, Durbin Watson, T-statistic and F-values were used to determine the effect of macroeconomic variables on the capital adequacy of the quoted commercial banks. Findings revealed that 72.1 percent of the total variations in the capital adequacy ratio of the 14 quoted commercial banks are accounted for, by the four macroeconomic variables as formulated in the model. Inflation rate has positive effect on capital adequacy of the quoted commercial banks and added 0.53 percent, interest have positive but no significant effect on capital adequacy of the quoted commercial banks and added 0.3 percent, exchange rate have positive and significant effect and added 0.59 percent to capital adequacy while gross domestic product have negative and no significant affect, reduce bank capital adequacy by 0.005 percent over the periods of the study. From the findings, the study concludes that macroeconomic variables determine commercial banks capital adequacy in Nigeria. We recommend that Government should ensure that macroeconomic policies such as interest rate through money supply are properly managed in a manner that it will enhance commercial bank capital adequacy ratios. There is need for efficient management of exchange, inflation and interest rates in such a way to stimulate the financial market that cushion the volatility of macroeconomic variables to enhance commercial banks capital adequacy. That foreign exchange rate could be maintained at a low rate if there is a consistent growth in commercial bank capital adequacy. Domestic monetary and macroeconomic policies should be formulated to control hyperinflation in the economy to encourage savings, investment as this can enhance commercial banks policies and increase commercial banks capital adequacy. The macroeconomic environment and policies should be revisited, existing policies that threaten investment and the financial market should be abolished and new policies that will enhance economy growth should be formulated for effective management of commercial banks for increase capital adequacy and Macroeconomic policies

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should be directed towards increasing the operational efficiency of Nigeria banking industry for increase in commercial capital adequacy against monetary and macroeconomic shocks *Keywords: Macroeconomic Variables, Commercial Banks, Capital Adequacy Ratio, Nigeria*

INTRODUCTION

Banks play a key role in preserving and mobilizing funds for both private and public sector of the economy as well as providing funds for small and medium scale businesses. Banks greatly contribute to the socioeconomic development of a nation by supporting the financial system of the economy. Banks globally provide about 20-25% of the global economy (Ross, 2021). The global market size for commercial banks is USD 3 trillion and industry employment of 7.7 million employees (IbisWorld, 2022; Karim, Akhtar, Tashfeen, Rabbani, Abdul Rahman, & AlAbbas, 2022). Capital adequacy ratio is an important issue that has drawn the attention of researchers and academics. According to Al-Sabbagh (2004), capital adequacy is an indicator of risk exposure of banks (that is how banks are exposed to risks). Risk in the banking industry is classified into various types including credit risk, market risk, interest rate risk and exchange rate risk that are considered in the CAR calculation. According to Abdul-Karim (1996), regulatory authorities use capital adequacy ratio to evaluate the soundness of banks and other depository institutions because, to them, capital serves as a cushion to absorb losses. The adoption of the Basel Framework aids commercial banks in upholding extra capital reserves to absorb losses. Consequently, this surplus capital offers various advantages to long-term financial stability. The bank Capital Adequacy Ratio (CAR), maintained in accordance with the minimum regulatory standards, serves as a metric to evaluate the desired capital level. The Basel Accords established guidelines for determining the CAR to mitigate banking risks. It is crucial to analyze how global commercial banks handle capital and the interplay between capital management and risk dynamics (Ogunode, Awoniyi, & Ajibade, 2022; Le, Nguyen, Le, & Cao, 2022; Lucky, 2018).

Macroeconomic variables form a huge portion of the external determinants of commercial banks soundness in most studies carried out. The most common macroeconomic factors that have been identified among others are gross domestic product growth, inflation, interest rate, exchange rate (Haron, 2004). An economic slowdown is likely to have a negative effect on bank resilience because typically low interest rates in a recession contribute to the erosion of banks' interest margins. Income from operating activities falls in the environment of macroeconomic instability (Abiad, Bluedorn, Guajardo and Topalova, 2012; Gharaibeh, 2023; Obeid, 2023). In sum, it can be expected that bank risk is correlated negatively with the business cycle, rising at times when economic activity slows. This implies that banks must be capital adequacy ratio to withstand macroeconomic instability (Nguyen, Tran, Le, & Simioni, 2021; Naoaj, 2023; Mehrotra, Vyas, & Naik, 2023; Lucky & Phil-Olumba, 2020). Commercial bank capital adequacy ratio has become a staple of financial regulation. Banking system capital adequacy ratio is about more than the ability of individual banks to withstand shocks. It is about the system's tendency to generate shocks in the first place, and its ability to adapt and evolve in response to them.

The different phases of business cycle have direct effect on the activities and business of commercial banks. It is imperative that bank managers are aware of these factors in order to reduce procyclical effect of macroeconomic variables on commercial banks capital adequacy ratios. Macroeconomic variables are beyond the control of an organization, therefore, the need for banking institution to predict the heterogeneous effect of these macroeconomic variables to withstand unforeseen event within the operating environment required a critical investigation. Markman and Venzin (2014) believed that the bank resilience with better effect should be composed of protective resources with high value, rare, difficult to imitate and irreplaceable, to ensure the long-term role of capital adequacy ratios and thus realize a virtuous cycle of bank operation. The studies on commercial banks capital adequacy ratios pays more attention to overall, forward-looking and strategic management ability of the risks of the bank, as well as the long-term profitability of the bank and the balanced development process with future risks (Abobakr, 2018; Adnan & Rahat, 2020; Chowdhury, Mustafa, Islam, Hasan, Zayed, & Raisa, 2021; Rahman, Amin & Al Mamun, 2021;). Compared with the traditional banking theory, bank resilience has its unique focus. Studies on effect of macroeconomic variables such as exchange rate, inflation and gross domestic product show that economic variables have implication on loan portfolio quality of banks. Nanteza (2015) found a strong relationship between exchange rate and nonperforming loans. Inflation rate have a significant effect on the build-up of non-performing loans as shown by studies (Endut, Syuhaha, Ismail & Mahmood, 2013 and Kjosevski, Petkovski & Naumovska, 2019, Klein, 2013, Fajar & Umanto, 2017; Lucky, & Tamunoiduabia, 2022). From the above, this study examined the effect of macroeconomic variables and commercial banks capital adequacy of quoted commercial banks in Nigeria.

LITERATURE REVIEW

Macroeconomic Variables

Macroeconomics is the study of behavior of whole economy not individuals units. There are some macroeconomic variables that have impact banking activities which exist in a specific economy. Macroeconomic variables are wide economic indicators used to judge the performance of the economy at specific point of time. These are external factors that affect the operation of firms either positively or negatively. The control of macroeconomic variables is beyond bank management.

Interest Rate

Nominal interest rate refers to the interest rate before taking inflation into account. Nominal can also refer to the advertised or stated interest rate on a loan, without taking into account any fees or compounding of interest. Finally, the monetary policy rate, the interest rate set by the Central Bank of Nigeria referred to as a nominal rate. Nominal interest rates exist in contrast to real interest rates and effective interest rates. Real interest rates tend to be important to investors and lenders, while effective rates are significant for borrowers as well as investors and lenders. To avoid purchasing power erosion through inflation, investors consider the real interest rate, rather than the nominal rate. One way to estimate the real rate of return in the Nigeria is to observe the interest rates on Treasury inflation protected securities (TIPS). The difference between the yield on a treasury

bonds and the yield on TIPS of the same maturity provides an estimate of inflation expectations in the economy. For example, if the nominal interest rate offered on a three-year deposit is 4% and the inflation rate over this period is 3%, the investor's real rate of return is 1%. On the other hand, if the nominal interest rate is 2% in an environment of 3% annual inflation, the investor's purchasing power erodes by 1% per year.

Inflation Rate

The effects of inflation on the economy are diverse and can be both positive and negative. The negative effects are however most pronounced and comprise a decrease in the real value of money as well as other monetary variables over time. As a result, uncertainty over future inflation rates may discourage investment and savings, and if inflation levels rise quickly, there may be shortages of goods as consumers begin to hoard out of anxiety that prices may increase in the future. Inflation is one of the most important macroeconomic indicators to analyze the economic conditions of the economy. Few studies have addressed the linkage between the stock market and inflation Fama (1990) suggests that macroeconomic variables have projecting power for the stock exchange performance, although he did not consent to the anticipating authority of stock performance for the economy. Agawam (1981) Soenen and Hennigar (1988) measured the relationship between inflation rates and stock prices. A common expectation is that the stock prices and inflation should be positively related. This is done with the mind that, common stocks should be a hedge against inflation because stocks represent the ownership of the real assets. In line with Demberg and McDougall (nd), refer to inflation as a continuous price increase as calculated by an index such as the Consumer Price Index (CPI) as cited in (Jhingan, 2002). In an inflationary economy, it is difficult for the national currency to function as a means of exchange and a store of value without having an adverse effect on the distribution of income, production and employment (CBN, 2016). Inflation is characterized by a fall in the currency value of the country and an increase in the exchange rate of the country with the currencies of another state. Inflation as an indicator of price stability affects the solvency of loan. For long periods of high inflation, the real value of the payments of borrowers begins to decrease, which helps them to pay duties. This is associated with improved quality of the loan portfolio. The Consumer Price Index (CPI) methodology is used to calculate inflation rates in Nigeria as it is readily available and currently available on a monthly, quarterly and annual basis (CBN, 2016).

Gross Domestic Product

Gross domestic product is the overall measure of the performance of an economy and there is a close and meaningful relationship between GDP and stock market return. There studies that have investigated the effects of GDP on stock returns empirically include Fama (1990) and Schwert (1990). Fama (1990) argued that the standard valuation model posits three sources of variation in stock returns: i) Shocks to expected cash flow, ii) predictable return variation due to variation through time in the discount rate that price expected cash flows; and iii) Shocks to discount rates.

The real GDP is the sum of the value added in the economy during a given period or the sum of incomes in the economy during a given period adjusted for the effect of increasing prices

(Daferighe & Aje, 2009). Nominal GDP is the determination of GDP without taking into account other factors or variables such as inflation. Nominal GDP increases overtime for two reasons (Daferighe & Aje, 2009). The first is that the production of most goods increases overtime. The second is that the naira price of most goods increases overtime. For instance, in a study by Ugbede, Otache and Umar (2012) on the impact of commercial banks credit on Nigeria's GDP they discovered that Commercial banks credit has a high positive impact on the nation's GDP meaning the higher the volume of Commercial banks credit made available, the higher the corresponding GDP. Gross domestic production (GDP) can be defined as the measurement of the total market value of the goods or services produced by the economy of a particular country as well as total income earned by the people living at that country. High rise of GDP implies that economy is performing well coupled with the increase of income of the people. Borrowers with the rising trend of income indicate that they would be able to pay off the loan. Annual growth of GDP indicates that banks can implicitly be assured that lending function of banks would work effectively.

Exchange Rates

Jhingan, (2002) defined exchange rate as the domestic price of foreign currency which can be determined either administratively or by the market forces of demand and supply of currencies through imports and exports respectively in the foreign exchange market. The importance of this definition is that it focuses on the concept of price as a nature of exchange rate. The basis for exchange rate determination has been on the premise of purchasing power parity (PPP) concept as enunciated by Cassel (1918). Purchasing power parity (PPP) concept defines exchange rate as the amount of the currency of one country, which endows the holder with the same amount of purchasing power. Expressed differently, purchasing power parity theory states that the same collection of goods purchased with different currencies should have same cost as measured in any of the currencies (Cooper & Fraser, 1990). Exchange rates are defined as the price of one country's currency in relation to another. They may be expressed as the average rate for a period of time or as the rate at the end of the period. This indicator is measured in terms of national currency per US dollar.

Exchange rate moves are likely to have a different effect on banks with different kinds of exposure. The magnitude of exchange rate moves can be a risk source of its own. Excessive exchange rate volatility impairs economic and financial stability in a country and was found to have played a significant role in inducing banking crises in many countries (Lindgren et al. 1996). Given the fairly "crude" measure of exchange rate fluctuations used in subsequent empirical analysis (annual percentage change of the exchange rate), it is the meaning of these kinds of moves that our econometric model may help reveal. A sufficiently strong depreciation of a currency can be expected to induce disintermediation and increase bank risk as depositors withdraw their money and seek to invest it in "hard" currency assets. Exchange rate plays an increasingly significant role on companies' performance in Nigeria as it directly affects domestic selling price level, profitability, allocation of resources and investment decision in the companies (Kituku, 2014). These as seen in the exchange rate against one USD to get to as high as N390 making it difficult for the companies to operate at the minimum cost and price level desired. The fluctuation or

volatility in the exchange rate has attracted public attention especially from importers who have argued that the strengthening naira is eroding their competitiveness.

Capital Adequacy

Capital Adequacy Ratio is a measure of the amount of bank's capital expressed as a percentage of its risk weighted credit exposure. Capital adequacy ratio is calculated dividing capital fund by risk weighted assets. As per the NRB guideline, commercial banks in Nepal must maintain the capital adequacy ratio above 10 percent. Capital adequacy increases the strength of the bank which improves the solvency of the bank and capacity to absorb the loan loss and protect bank from bankruptcy. Alshatti (2015) has asserted that capital adequacy ratio don't affect the profitability of Jordanian commercial Banks. However, Poudel (2012) found significant negative association between capital adequacy ratio and bank performance in Nepalese context. Likely, Djan, Stephen, Bawuah, Halidu and Kuutol (2015) also found that capital adequacy ratio have an inverse impact on banks' performance. Bhattarai (2017) has found that capital adequacy ratio was significant and negative effect on bank profitability. In this scenario, a negative relationship is expected between capital adequacy ratio and bank profitability. Capital adequacy ratio (CAR) is the ratio that is set by the regulatory authority in the banking sector, and this ratio can used to test the health of the banking system. Hence, capital adequacy ratio for banking organizations is an important issue that has received a considerable attention in finance literature. According to Al-Sabbagh (2004), capital adequacy is defined as a measure of bank's risk exposure. Banks risk is classified into credit risk, market risk, interest rate risk and exchange rate risk that are included in the calculation of capital adequacy ratio. Therefore regulatory authorities used capital adequacy ratio as an important measure of safety and soundness for banks and depository institutions because they view capital as a buffer or cushion for absorbing losses.

Financial Accelerator Theory

Financial accelerator theory was propounded by Bernanke and Gertler (1989). Financial accelerator theory explains how relatively small economic shocks such as inflation and exchange rate instability can have large and persistent effects on aggregate economic activity due to financial market imperfections. Financial accelerator theory shows the mechanism of economic shocks amplification and propagation in an economy. The theory considers the interplay between economic agents' net worth and the external finance premium that arises due to asymmetric information between lenders and borrowers. This theory opines that banks' loan portfolio is likely to grow substantially resulting in improved financial performance during periods of economic expansion and this assertion holds true with the studies of (Fajar & Umanto,2017; Gremi ,2013; Polat ,2018) However, during recession banks will find it more difficult to lend resulting in a contraction in the loan portfolio. Also loan growth over an economic expansionary period may have adverse effect on banks financial performance in a recession period as the borrowers find it difficult to service their loans.

Capital Buffer Theory

The theoretical framework adopted for this study is capital buffer theory. It predicts that banks hold safety cushions above the regulatory capital requirement. Stolz (2007) define capital buffer as the capital that banks hold in excess of the regulatory minimum capital requirement. It is due to the fact that the banks may not be able to adjust capital and risk instantaneously due to adjustment costs or illiquid markets. Furthermore, under asymmetric information, raising equity capital could be interpreted as a negative signal with regard to a bank's value (Myers & Majluf 1984), rendering it unable or reluctant to react to negative capital shocks instantaneously. However, to breach regulations trigger costly supervisory actions that can possibly lead to a bank's closure. Consequently, banks have an incentive to hold more capital than required (a capital buffer) as an insurance against violation of the regulatory minimum capital requirement (Milne & Whalley 2001).

Empirical Review

Yusuf, Chijioke, Daniel, Johnson and Iriabije (2024) examined the moderating role of capital adequacy on the relationship between macroeconomic variables on loan portfolio quality among listed deposit money banks in Nigeria. The study period covered the period of 10 years from 2014-2023 using secondary data (Annual audited reports) of listed banks in Nigeria. The study used census sample of 12 banks listed in Nigeria. The study used descriptive research design to determine the effect of the independent variables to the dependent variable as well as the moderating effect. The independent variable of exchange rate, inflation and gross domestic product were regressed on loan portfolio quality. The data analysis includes descriptive and inferential statistical analysis by employing regression analysis. Panel regression analysis was adopted to estimate the regression equation. Findings from the study revealed that the exchange rate, Gross domestic product and capital adequacy has significant positive and significant effect on loan portfolio quality, conversely inflation rate has positive but no significant relationship with loan portfolio quality among listed Banks in Nigeria. Furthermore, capital adequacy has moderating effect on the relation between exchange rate and loan portfolio quality, capital adequacy has moderating effect on the relationship between inflation rate and loan portfolio quality. On the other hand, capital adequacy has positive but no moderating effect on the relationship between gross domestic product and loan portfolio quality among listed Banks in Nigeria. The study recommends amongst other things to Central Bank of Nigeria on fiscal and monetary policies which could aim at controlling hyper-inflation and growing a robust economy that will support the intermediation functions of deposit money banks without jeopardizing the loan portfolio quality of banks.

Orlu, Maton-Awaji and Amadi (2024) investigated the effects of macroeconomic variables and quoted commercial banks resilience in Nigeria. The study adopted ex-post facto research design. Stratified and random sampling methods were used to select 13 out of the 22 quoted existing commercial banks. Secondary data were obtained from the Central Bank of Nigeria publications and financial statement of the quoted commercial banks. Commercial bank resilience (variation in capital adequacy ratio) modeled as the function of interest rate, real gross domestic products, exchange rate, inflation rate and money supply. A critical analysis of the financial statements of

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the commercial banks over a period of 10 years (2011-2020) was conducted. Diagnostic tests were conducted using Hausman specification test. Fixed effects estimator was employed and regression analysis to test the formulated hypotheses. The study found that 51.6 percent variations in commercial banks resilience can be attributed to the influence of economic variables while the remaining 48.9 percent variations in the dependent variable were caused by other factors not included in this model. The p-value of the F-statistic found that simultaneous combinations of the proxies of the macroeconomic indicators significantly influence commercial banks resilience since it is less than the 0.05 significant level adopted for this study. the study conclude that the variables have positive but no significant effect on commercial banks resilience within the periods covered in the study.it therefore recommend that . Government should ensure that financial market is properly managed in a manner that it will enhance commercial bank resilience. Government should direct its financial market regulators to ensure proper policies that will enhance effective transmission of macroeconomic policies that impact positive and significantly to commercial banks resilience and the need for efficient management of exchange, inflation and interest rates in such a way to stimulate the financial market that cushion the volatility of macroeconomic variables to enhance commercial banks resilience.

Ikue, Denwi, Sodipo and Enegesi (2022) examined bank-specific performance indicators and macroeconomic factors affecting the short-term financing obligation of Nigerian banks from 2010 to 2019. The data for the study are sourced annually from the financial statements of the selected Deposit Money Banks and the Central Bank of Nigeria Statistical Bulletin. The panel unit root and co-integration tests are employed to ascertain the sustainability of the bank-specific performance indicators. The models for the industry were cast in a host of panel frameworks such that we estimated the static and dynamic panel models. The study observed that the capital adequacy ratio, which is the short-term financing obligation of Nigerian banks was elastic to bank profitability positively. In addition, interbank call rate, bank size, and oil price positively influence the capital adequacy ratio over time, whereas loan-to-deposit ratio, inflation and exchange rate exacerbate the capital adequacy ratio. Consequently, we canvass that Nigerian banks should reduce dividend payouts and increase retained profits as a buffer against exposed risks. El-Ansary, El-Masry, and Yousry (2019) employed a comparative approach utilizing the Generalized Method of Moments (GMM) on panel data to identify the elements influencing the CAR in both Islamic and conventional banks. This study reveals a noteworthy correlation between the CAR and these banks. Additionally, long-term effects are observed, with bank size, operational efficiency, and GDP growth rate influencing CAR. For Islamic banks, this study demonstrates a significant link between CAR and deposits-to-assets ratio. By contrast, conventional banks exhibit connections between CAR and factors such as profitability, credit risk, and portfolio risk.

Dagher, Dell'ariccia, Laeven, Ratnovski and Tong (2020) demonstrated that maintaining a bank capital level ranging from 15% to 23% of risk-weighted assets would have been sufficient to absorb losses during most historical banking crises in advanced economies. Additional increases in capital beyond this range would have yielded minimal benefits for preventing further crises. Appropriate capital requirements could be set below this range because banks usually hold capital exceeding regulatory thresholds and other instruments that could be bailed contribute to a bank's

capacity to absorb losses. Obeid (2023) revealed that credit risk, bank size, and GDP growth rate have a favorable impact on CAR within the Arab banking sector. Conversely, the study shows that bank profitability has a detrimental influence on the CAR. The author emphasizes the critical role of CAR as a significant indicator of absorbing losses and enhancing the banking system's overall stability.

Naoaj (2023) investigated factors influencing the capital adequacy of commercial banks in Bangladesh. This reveals that capital adequacy is significantly affected by leverage, liquidity risk, real GDP, net profit, and inflation. On the other hand, it explores the determinants of CAR in both the short and long term. Alpera and Anbarb (2011) examined the bank-specific and macroeconomic determinants of the banks' profitability in Turkey over the time period from 2002 to 2010. The bank profitability is measured by return on assets (ROA) and return on equity (ROE) as a function of bank-specific and macroeconomic determinants. Using a balanced panel data set, the results show that asset size and non-interest income have a positive and significant effect on bank profitability. However, size of credit portfolio and loans under follow-up have a negative and significant impact on bank profitability. With regard to macroeconomic variables, only the real interest rate affects the performance of banks positively. These results suggest that banks can improve their profitability through increasing bank size and noninterest income, decreasing credit/asset ratio. In addition, higher real interest rate can lead to higher bank profitability.

Risqi (2017) examined the impact of bank specific determinants and macroeconomic indicators on profitability in Islamic Bank Period 2012-2015 using the multiple linear regression method. The study found that Financing Growth has a positive and significant influence on Return on Assets in Islamic Banks. The inflation rate was found to have a positive but insignificant influence on Return on Assets in Islamic Banks, while Exchange rate had a negative and significant influence on Return on Assets in Islamic banks. Sumandi (2017) examined an early warning system for the robustness of Islamic banking in Indonesia using the non-parametric with signaling approach. The results of the study showed that Islamic banks had poor resilience during the period 2004–2005 but that they also registered a stable performance during the 2008 financial crisis. The poor resilience of Islamic banks in 2004 was due to their vulnerability. The results also indicated that 3 leading indicators out of 5 indicators could be used to measure the vulnerability of Islamic banks. These were Interest rate, Inflation and the financing to deposits ratio (FDR). The selection criteria were based on the noise to signal ratio (NSR), the proportion of crises correctly called, the proportion of false alarms to total alarms, the proportion of crises with an alarm issued and the proportion of probability of crisis given no alarm.

Bilal, Saeed, Gull and Akram (2013) have identified the influence of bank specific and macroeconomic factors on profitability of commercial banks in Pakistan over the period of Bhattarai 38 2007 to 2011. Return on assets and return on equity are used as dependent variable. Deposit to assets, bank size, capital ratio, net interest margin and nonperforming loans to total advances are utilized as bank specific measures. Inflation, real gross domestic product and industry production growth rate are macroeconomic factors. By employing descriptive statistics, correlation and regression analysis researcher conclude that bank size, net interest margin, and industry

production growth rate has positive and significant impact on the ROA and ROE. Nonperforming loans to total advances and inflation have negative significant impact on Return on assets while real gross domestic product has positive impact on ROA. Capital ratio has positive significant impact on ROE. Simiyu and Ngile (2015) based on vital contribution of the commercial banks to economic progression Kenya, this study endeavors to investigate the effect of macroeconomic variables on financial profitability of listed commercial banks in the Nairobi Securities Exchange (NSE) for years 2001 to 2012. Panel data analysis using Fixed Effects model was applied on the data to examine the effects of three major macroeconomic variables which included: Gross Domestic Product (GDP), Exchange rates, and interest rates on profitability of the listed commercial banks. The study findings indicated that real GDP growth rate had positive but insignificant effect to profitability of commercial banks as measured through Return on Assets (ROA). Further, real interest rates had a significant negative influence on profitability of listed commercial banks in Kenya. While the exchange rate had a positive significant effect on the profitability of listed commercial banks on Nairobi Securities Exchange.

Literature Gap

The empirical literatures presented in this study are mainly foreign studies. Similar studies in Nigeria focused on macroeconomic variables and profitability of commercial banks. This study focused on how macroeconomic variables affect commercial banks capital adequacy ratio in Nigeria.

METHODOLOGY

This study examined the effect of macroeconomic variables and capital adequacy of quoted commercial banks over a period of 10 years. Ex-post facto research design will be employed in obtaining, analyzing and interpreting the relevant data for hypotheses testing. The rationale for the variety is that ex-post facto research design allows the researcher the opportunity to observe one or more variables over a period of time (Uzoagulu, 1998). Specifically, cross sectional panel data will be adopted in data analysis. The target population for this study includes 14 quoted commercial banks in Nigeria within the time scope of this study. The study used secondary data that was extracted from the Annual Reports and Statements of Accounts of the quoted commercial banks. The data from the Annual Report are assume to be reliable, because according to section 11, chapter one of the Companies and Allied Matters Act 1990, companies are required to keep accounts and to produce accounts that give true and fair view of the company.

Data Analysis Method

The method of data analysis to be used in this study will be the panel data multiple linear regressions using Ordinary Least Square (OLS) method. This approach, which is a quantitative technique, includes tables and the test of the hypotheses formulated by using ordinary least square regression analysis at 5% level of significance. To arrive at a result that was not lead to spurious regressions. Other tests that were carried out on the model include test of Durbin Watson Test and test of model specification so as to achieve the objectives of our study as well as answer the research question and hypotheses. Moreover, in order to undertake a statistical evaluation of our analytical model, so as to determine the reliability of the results obtained the coefficient of

correlation (r) of the regression, the coefficient of determination (r^2), the student T-test and F-test was employed.

To obtain the observed values on the expectation of the effect of, cash flow analysis, human capital investment on the profitability of commercial banks, panel data survey over a ten-year period was employed. Panel data structure allows us to take into account the unobservable and constant heterogeneity, that is, the specific features of each quoted firm. The researcher employed pooled Ordinary Least Square (OLS), Fixed Effects and Random Effects regression models to test the various hypotheses. Pooled OLS regression technique is popular in financial studies owing to its ease of application and precision in prediction (Alma, 2011). In addition, OLS method has been employed in a wide range of economic relationships with fairly satisfactory results (Koutsoyiannis, 1977). Citing the work of Gaur and Gaur (2006), Ujunwa (2012) stressed that fixed effects and random effects models aided to observe variations among cross-sectional units simultaneously with variations within individual units over time. It assumes that variables are strictly time disparity or time invariant. This undermines an exploration of the effect of slow changing within individual firms' factors. Hence, the rationale for adopting Fixed Effects and Random Effects models estimator as additional test is to enable the researcher control time contrast and time invariant variables, and thereby control for the effect of the unobserved heterogeneity in the dataset. Ujunwa (2012) opined that coefficient of estimations are reliable when regression parameters do not change over time and do not differ between various cross-sectional units. Therefore, when the regression estimation differ widely between the two models (Fixed and Random Effects models), the adoption of Hausman test were essential. Panel data over the period from 2009-2019 is used as the work of Majumdar and Chhibber (1999), Zeitun and Tian (2007), and Onaolapo and Kajola (2010), commercial banks profitability measure was regressed on each of the variants of human capital investment and other control variables holding other factors that may affect deposit money banks profitability not included in the equation constant. These analytical techniques were enable the researcher attain justifiable and robust results.

Model Specification

From review of literature, commercial bank capital adequacy can be affected by several generic factors. So, it is necessary to investigate the effect, Basel III and bank management practices of commercial banks in Nigeria. Following the study objective, regression models were formulated to capture the effect of independent variables on the dependent variables.

$$Y = \beta_0 + \beta_{1Xit} + \mu$$

Where Y=Dependent Variable β_{1Xit} =Independent variable β_0 =Regression Intercept μ =Error Term

Disaggregating Equation 1 to form the multiple regression models, we have

Linear Regression Models

The linear regression model is formulated as follows:

Incentives

$$CAR = \psi_0 + \psi_1 IFR + \psi_2 INTR + \psi_3 RGDP + \psi_3 EXR + \varepsilon$$

(2)

Where

CAR = Capital adequacy ratio measured as tier one capital to risk capital weight

IFR = Inflation rate

INTR = Interest rate measured by real interest rate

RGDP = Real Gross Domestic Product as growth rate

EXR = Exchange rate

 β_0 = regression intercept

 β 1 - β 3 = coefficient of independent variables to the dependent variables

 $\mu = \text{error term}$

A-priori Expectation of the Result

The explanatory variables are expected to have positive and direct effects on the dependent variables. That is a unit increase in any of the variables is expected to increase commercial banks capital adequacy or reduce commercial; banks' capital adequacy. This can be express mathematically as a_1 , a_2 , a_3 , a_4 , > 0 or a_1 , a_2 , a_3 , a_4 , < 0.

Empirical Specification of Model

In order to actualize the objectives of this study, the regression model was formulated. This comprises the Pooled Ordinary Least Square (OLS) model, Panel Fixed Effects Model and Random Effects Model. This was necessary to identify the regression model with the highest explanatory power. First, the data was subjected to Pooled ordinary least square regression. In the pooled regression, the data pertaining to the commercial banks were pooled together and the regression model was run, ignoring the cross-section and time series nature of the data. Another weakness of pooled regression is that it does not distinguish between the various commercial banks included in the regression and neglects the heterogeneity that may exist among them.

According to Basso (2012) it is fair to assume that the fixed effects model is more important because it considers exogenous effects on a model. The Panel fixed effects model also eliminates unobserved time-invariant company effects and makes it possible for all potential error reasons to be included in the model. The Fixed Effect Model allows for heterogeneity among the companies by allowing each to have its own intercept value. Although, each company has its own intercept value, this intercept does not vary with time. Therefore, the intercept is time invariant. Also, in the fixed effects model, the independent variables do not have random nature. Allison (2009) noted that with fixed effects model, the effects of time invariant characteristics are controlled for whether such characteristics are measured or not.

Fixed effects model helps to control for omitted variable bias by having the individual companies serve as their own controls. Fixed effects model use only within-individual differences, irrespective of the differences between individual companies. In Random Effects Model, the companies have a common mean value for the intercept. The difference between fixed effects model and random effects model according to Clark and Linzer (2012) is that fixed effects model produces unbiased estimates of the coefficients, but the coefficients can be subject to high variability based on the sample. Although, random effects model rarely produces biased estimates of the coefficients that are closer (on the average) to the true value in

any sample. This implies that fixed effects model may produce estimates that are highly sampledependent. Another difference between fixed effects model and random effects model is that fixed effects model requires the estimation of a parameter for each coefficient on the unit dummy variable and reduces the model's explanatory power and increases standard errors of the coefficient estimates. Conversely, the random effects model estimates only the mean and standard deviation of the distribution of unit effects and not a set of dummy variables.

In the view of Clark and Linzer (2012), the incorporation of the theoretical assumptions into the choice of a model can be tedious. Thus, the Hausman specification test is used to testing whether the Fixed Effects model is more appropriate than the Random Effects model. This is done by detecting violation of the assumption that the predictor variables are orthogonal to the unit effects. In this study, Hausman specification test was computed for each model. According to Torres-Reyna (2007) based on the Hausman specification test, where the P-value is less than 5 percent, the Fixed-Effects model is appropriate and where the P-value is more than 5 percent, the Random-Effects model is appropriate. Although, Clark and Linzer (2012) argued that the absence of a significant difference in the Hausman test does not follow that the random effects estimation of the coefficients is unbiased and is more appropriate than the fixed effects estimation of the coefficients. Furthermore, a random effects biased estimator can be preferable to a fixed effects unbiased estimator in a circumstance that the random effects biased estimator provides enough reduction of the variance. Thus, the Hausman specification test may be inconclusive in choosing the most appropriate model between fixed effects and random effects model. Under this circumstance, Clark and Linzer (2012) advocate for simulation analysis to determine the conditions that a fixed effects or random effects model provides unbiased coefficient estimates.

Variable	Coefficient	Std Error	t-Statistic	Proh					
Pooled Regression Model									
D(IFR)	-0.380378	0 457737	-0.830997	0.4085					
D(INTR)	-0.023166	0.032359	-0.715929	0.4762					
D(RGDP)	0.037287	0.081079	0.459883	0.6469					
D(EXR)	-0.222968	0.117926	-1.890742	0.0424					
С	12.45990	7.837248	1.589830	0.1159					
ECM(-1)	-0.839869	0.105575	-7.955210	0.0000					
R-squared	0.455974	Mean dependent var		-0.619524					
Adjusted R-squared	0.421101	S.D. dependent var		10.43771					
S.E. of regression	7.941571	Akaike info criterion		7.050849					
Sum squared resid	4919.347	Schwarz criterion		7.224478					
Log likelihood	-290.1356	Hannan-Quinn criter.		7.120646					
F-statistic	13.07512	Durbin-Watson stat		2.061147					
Prob(F-statistic)	0.000000								
Fixed Regression Model									
D(IFR)	0.533997	0.489166	4.091647	0.0008					
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D(INTR)	0.030013	0.041759	0.718701	0.4748
D(RGDP)	-0.005897	0.154356	-0.038206	0.9696
D(EXR)	0.598235	0.138454	4.431783	0.0007
C	15.14018	8.615792	1.757259	0.0833
ECM(-1)	-1.003673	0.112690	-8.906477	0.0000
	Effects Sp	pecification		
Cross-section fixed (dumr	ny variables)			
R-squared	0.550237	Mean dependent var		-0.619524
Adjusted R-squared	0.458981	S.D. dependent var		10.43771
S.E. of regression	7.677349	Akaike info criterion	7.074858	
Sum squared resid	4066.977	Schwarz criterion		7.508933
Log likelihood	-282.1441	Hannan-Quinn criter	7.249353	
F-statistic	6.029585	Durbin-Watson stat	2.021867	
Prob(F-statistic)	0.000000			
	Rando	m Regression Model		
D(IFR)	-0.380378	0.442508	-3.859597	0.0026
D(INTR)	0.023166	0.031282	0.740568	0.4612
D(RGDP)	0.037287	0.078381	0.475711	0.6356
D(EXR)	-0.222968	0.114003	-1.955813	0.0541
С	12.45990	7.576497	1.644546	0.1041
ECM(-1)	-0.839869	0.102062	-8.228994	0.0000
	Effects Sp	pecification		
			S.D.	Rho
Cross-section random	0.000000	0.0000		
Idiosyncratic random			7.677349	1.0000
	Weighted	d Statistics		
R-squared	0.755974	Mean dependent var		-0.619524
Adjusted R-squared	0.721101	S.D. dependent var	10.43771	
S.E. of regression	7.941571	Sum squared resid	4919.347	
F-statistic	13.07512	Durbin-Watson stat		2.061147
Prob(F-statistic)	0.000000			
	Unweight	ed Statistics		
R-squared	0.455974	Mean dependent var		-0.619524
Sum squared resid	4919.347	Durbin-Watson stat	2.061147	
Correlated Random Effect	ts - Hausman T	est		
	Chi	-Sq.		
Test Summary	Stat	istic Chi-Sq. d.f. P	rob.	
Cross-section random	12.807	591 5 0.0	0253	
Source: E-Views output				
Analysis of Results				

Our study used the likelihood ratio test to choose between the Pooled effect model and the fixed effects model as how in table 1 above. The fixed effects model is better than pooled effect that the results of the likelihood ratio test were significant (p-value< 0.0000 for the three models. This result means that we reject the Pooled effect model and choose the fixed effects model for this study. To make a choice between the fixed effects model and the random effects model, we utilized the Hausman test as shown in the table above. The hypotheses of the test are as follows: The fixed effects model is more appropriate than the random effects model. As the result found that the results of this test were significant (p-value = 0.0253). Hence, we reject the null hypothesis and conclude that the fixed effects model is the most appropriate of the models.

F-Test: The F-calculated value is 19.62061 from the fixed regression results while the P-value of F-statistic are 0.034491 at 5% level of significance, considering the P-value, the chosen level of significance $\alpha = 0.05$ [5%] is less than the P-value of F-statistic. It is concluded that the regression model is statistically significant. This means that the joint influence of the explanatory variables on the dependent variable is statistically significant.

Coefficient of Multiple Determinations (\mathbb{R}^2): The computed coefficient of multiple determinations of 0.721101 from the fixed effect shows that 72.1 percent of the total variations in the capital adequacy ratio of the 14 quoted commercial banks are accounted for, by the explanatory variables while the remainder is attributed to variable that is influenced by other factors not included in the regression model.

Durbin Watson statistics (DW): The computed DW is 2.021030 from the fixed results; show that at 5% level of significance with two explanatory variables and 140 observations. The value of computed DW is greater than the lower limit. Therefore, there is no evidence of positive first order serial correlation.

Regression Coefficient and T-Statistics: The regression intercept proved that if other variables are held constant, bank capital adequacy will be 15.1 percent over the periods of the study. However, the study found that inflation rate has positive effect on capital adequacy of the quoted commercial banks and added 0.53 percent, interest have positive but no significant effect on capital adequacy of the quoted commercial banks and added 0.3 percent, exchange rate have positive and significant effect and added 0.59 percent to capital adequacy while gross domestic product have negative and no significant affect, reduce bank capital adequacy by 0.005 percent over the periods of the study. The positive effect of the variables confirm the findings of Yusuf, Chijioke, Daniel, Johnson and Iriabije (2024) that the exchange rate, Gross domestic product and capital adequacy has significant positive and significant effect on loan portfolio quality, conversely inflation rate has positive but no significant relationship with loan portfolio quality among listed Banks in Nigeria, the findings of Orlu, Maton-Awaji and Amadi (2024) that simultaneous combinations of the proxies of the macroeconomic indicators significantly influence commercial banks resilience since it is less than the 0.05 significant level adopted for this study, in line with the findings of Ikue, Denwi, Sodipo and Enegesi (2022) that the capital adequacy ratio, which is the short-term financing obligation of Nigerian banks was elastic to bank profitability positively. In addition, interbank call rate, bank size, and oil price positively influence the capital adequacy ratio over time, whereas loan-to-deposit ratio, inflation and exchange rate exacerbate the capital adequacy ratio. Consequently, we canvass that Nigerian banks should reduce dividend payouts and increase retained profits as a buffer against exposed risks and the findings of Obeid (2023)

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that credit risk, bank size, and GDP growth rate have a favorable impact on CAR within the Arab banking sector. Conversely, the study shows that bank profitability has a detrimental influence on the CAR.

	CAR	IFR	INTR	RGDP	EXR
Mean	41.26369	25.96000	3.893333	31.81667	26.38667
Median	42.31500	25.29000	3.150000	30.84500	26.18000
Maximum	51.84000	30.72000	8.390000	38.99000	28.81000
Minimum	25.86000	20.59000	2.570000	26.06000	24.57000
Std. Dev.	7.585882	3.582366	2.037228	4.711599	1.344498
Skewness	-0.481527	0.032100	1.732328	0.339231	0.543820
Kurtosis	2.144799	1.726505	4.102803	1.644362	2.427376
Jarque-Bera	5.805944	5.690687	46.27008	8.043223	5.288006
Probability	0.054860	0.058114	0.000000	0.017924	0.071076
Sum	3466.150	2180.640	327.0400	2672.600	2216.480
Sum Sq. Dev.	4776.285	1065.168	344.4747	1842.531	150.0371
Observations	140	140	140	140	140

Table 2 Descriptive Statistics

Source: E-Views output

Table 2 reports summary statistics for the variables used in the study. A critical examination of the descriptive statistics for the dependent and explanatory variables reveals several issues. The capital adequacy ratio for the sample as a whole is 41.2 percent while the inflation rate is higher than capital adequacy ratio at 4.3 percent. Interest rate shows that Nigerian commercial banks have a high capital adequacy sensitive to interest rate. The very high ratio of capital adequacy ratio of 42 % recorded may reflect the impact of a relatively the oligopolistic nature of Nigeria banking commercial banks. Some of the commercial banks strictly comply with specifications of the Basle III capital on capital base regulation.

Conclusion

This study examined the effect of selected macroeconomic variables and capital adequacy ratio of quoted commercial banks in Nigeria. The study used cross sectional data of 14 quoted commercial banks from 2015-2024. The study found that that 72.1 percent of the total variations in the capital adequacy ratio of the 14 quoted commercial banks are accounted for, by the four macroeconomic variables as formulated in the model. Inflation rate has positive effect on capital adequacy of the quoted commercial banks and added 0.53 percent, interest have positive but no significant effect on capital adequacy of the quoted commercial banks and added 0.3 percent, exchange rate have positive and significant effect and added 0.59 percent to capital adequacy while gross domestic product have negative and no significant affect, reduce bank capital adequacy by 0.005 percent over the periods of the study. From the findings, the study concludes that macroeconomic variables determine commercial banks capital adequacy in Nigeria.

Recommendations

In the light of the researcher's findings, the following recommendations are presented:

- i. Government should ensure that macroeconomic policies such as interest rate through money supply are properly managed in a manner that it will enhance commercial bank capital adequacy ratios.
- ii. There is need for efficient management of exchange, inflation and interest rates in such a way to stimulate the financial market that cushion the volatility of macroeconomic variables to enhance commercial banks capital adequacy.
- iii. That foreign exchange rate could be maintained at a low rate if there is a consistent growth in commercial bank capital adequacy. Domestic monetary and macroeconomic policies should be formulated to control hyperinflation in the economy to encourage savings, investment as this can enhance commercial banks policies and increase commercial banks capital adequacy.
- iv. The macroeconomic environment and policies should be revisited, existing policies that threaten investment and the financial market should be abolished and new policies that will enhance economy growth should be formulated for effective management of commercial banks for increase capital adequacy.
- v. Macroeconomic policies should be directed towards increasing the operational efficiency of Nigeria banking industry for increase in commercial capital adequacy against monetary and macroeconomic shocks.

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