Sustainable Development in Nigeria: The Impact of Monetary Policy, Exchange Rates, and Trade Balance

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Abstract

This study examines the interrelationships among monetary policy, exchange rates, and trade balance in Nigeria, with a focus on their implications for sustainable development. Using time series data from the Central Bank of Nigeria (CBN) Statistical Bulletin (2023), the National Bureau of Statistics (2023), and the Ministry of Finance, Budget, and National Planning (2023) for the period 1981 to 2023, the study employs correlation analysis, Augmented Dickey-Fuller unit root tests, Johansen cointegration tests, and the Vector Error Correction modeling technique. The findings reveal a long-term cointegration among trade balance, money supply, and exchange rates. It was observed that unexpected monetary shocks have a negative impact on the trade balance, while exchange rate fluctuations exert a non-transitory effect on trade. Specifically, exchange rates were found to positively and significantly influence trade balance in the long run, while their short-term effects are positive but statistically insignificant. Additionally, money supply negatively impacts the trade balance over the long term but shows no significant short-term effect. Interest rates demonstrated a positive long-run influence on trade, whereas credit to the private sector negatively affected trade balance over time. The study concludes that sustainable development in Nigeria requires a comprehensive approach to monetary policy, effective exchange rate management, and diversification of the export base. The government should focus on promoting domestic production to mitigate the negative effects of expansionary monetary policies on trade and foster a more stable, diversified economy conducive to sustainable development.

Key words: Monetary policy, Exchange rate, Trade balance, Sustainable development and Economic diversification

Introduction

Sustainable development, defined by the United Nations as development that meets present needs without compromising the ability of future generations to meet theirs (United Nations, 2020), has become a central focus for policymakers in developing countries. Nigeria, Africa's largest economy, grapples with multiple challenges in achieving sustainable development, including managing the impacts of its monetary policy, exchange rates, and trade balance on economic growth. The complexities of these macroeconomic factors highlight the importance of formulating policies that promote not only economic expansion but also environmental and social sustainability.

Monetary policy plays a critical role in shaping the Nigerian economy. As a tool used by the Central Bank of Nigeria (CBN) to control inflation, manage liquidity, and stabilize the financial system, monetary policy has significant implications for long-term sustainable development (Olayinka & Ogunlana, 2021). The CBN's adjustments to interest rates, money supply, and other financial levers directly affect the cost of borrowing, investment levels, and ultimately, economic growth. However, Nigeria's heavy reliance on oil exports makes its economy vulnerable to external shocks, which in turn impact the effectiveness of monetary policies (Eze, 2021).

Exchange rates also have a profound effect on sustainable development, particularly in countries like Nigeria that rely heavily on imports and exports. The Nigerian naira has faced significant devaluation over the past decade, leading to inflationary pressures and a decline in purchasing power (Adeola & Iyoboyi, 2022). Exchange rate volatility can exacerbate poverty and inequality, thereby threatening the country's long-term development goals. A stable and competitive exchange rate can stimulate exports, improve trade balance, and promote sustainable economic growth (Ezenwakwelu et al., 2021).

Trade balance, the difference between a country's imports and exports, is another critical factor influencing sustainable development in Nigeria. A positive trade balance, typically resulting from an increase in exports, can enhance economic resilience, reduce dependency on foreign goods, and create more opportunities for domestic industries (Eboh et al., 2020). Nigeria's current trade dynamics, however, are characterized by a heavy reliance on crude oil exports and the importation of manufactured goods, which creates vulnerabilities to global price fluctuations and limits diversification efforts (Ogunleye, 2022). Balancing trade by promoting exports in non-oil sectors

and enhancing local manufacturing capacity is essential for achieving sustainable development. The interplay between monetary policy, exchange rates, and trade balance in Nigeria underscores the importance of well-coordinated macroeconomic strategies for sustainable development. This study explores how these factors influence Nigeria's sustainable development trajectory and highlights the need for policies that integrate economic, social, and environmental considerations.

Background of the Study

Sustainable development has become a central paradigm for addressing the wide-ranging social, economic, and environmental challenges facing developing countries. The concept, formalized by the Brundtland Commission in 1987, is based on the principle of achieving economic growth that does not deplete resources or harm future generations' capacity to meet their own needs (Brundtland Commission, 1987). In Nigeria, this pursuit has taken on increasing importance as the nation grapples with issues such as widespread poverty, unemployment, environmental degradation, and a largely unstable economy. These challenges are closely tied to the country's monetary policies, exchange rate fluctuations, and trade imbalances, making these macroeconomic factors critical in shaping Nigeria's sustainable development trajectory.

Nigeria's Economic Context

Nigeria, Africa's largest economy with a GDP of $440 billion as of 2021 (World Bank, 2021), is primarily driven by its oil sector. However, the country's overwhelming reliance on crude oil, which accounts for over 90% of its export revenues, presents significant challenges for sustainable economic growth. This dependence has left Nigeria highly exposed to fluctuations in global oil prices, which have repeatedly destabilized its economy (Ogunleye, 2022). Additionally, the country's other key sectors, such as agriculture, manufacturing, and services, remain underdeveloped, limiting diversification and creating a precarious economic environment. This vulnerability is exacerbated by Nigeria's large and growing population, now exceeding 200 million people, necessitating significant investments in infrastructure, healthcare, and education to support its development goals (Eboh et al., 2020). Within this challenging context, the role of macroeconomic variables like monetary policy, exchange rates, and trade balance cannot be overstated. Effective management of these factors is critical to fostering a stable, resilient economy capable of sustainable long-term growth.

The Role of Monetary Policy in Sustainable Development

Monetary policy, typically managed by a country's central bank, involves controlling the money supply and interest rates to maintain economic stability, control inflation, and promote growth (Adebayo, 2020). In Nigeria, the Central Bank of Nigeria (CBN) manages these responsibilities, utilizing a range of tools such as interest rate adjustments, open market operations, and reserve requirements to influence economic activity. Over the years, the CBN has employed these instruments to address inflationary pressures, manage liquidity, and stabilize the financial system.

Despite these efforts, monetary policy in Nigeria has faced several obstacles, particularly due to high inflation, fluctuating oil prices, and structural weaknesses in the financial sector. Inflation, a long-standing issue in Nigeria, significantly undermines economic stability and disproportionately affects low-income households by eroding their purchasing power (Adeola & Iyoboyi, 2022). High inflation also contributes to increased interest rates, which can hinder investment and stunt economic growth. The challenge for Nigerian policymakers lies in finding the balance between controlling inflation and fostering economic growth, a critical requirement for long-term sustainable development.

Monetary policy's impact on sustainable development is profound, as it influences not only short-term economic performance but also long-term economic stability and resilience. Nigeria's heavy reliance on oil revenues further complicates the situation, as global oil price volatility limits the central bank's ability to manage the domestic economy effectively (Eze, 2021).

Exchange Rates and Economic Volatility

The exchange rate, which determines the value of a nation's currency relative to others, plays a pivotal role in a country's economic performance, particularly in terms of its trade competitiveness (Ezenwakwelu et al., 2021). Nigeria's exchange rate regime has seen various phases, ranging from fixed to floating systems, with the country now operating under a managed float system. In this arrangement, the CBN periodically intervenes in the foreign exchange market to stabilize the value of the naira.

Over the past few years, the naira has experienced substantial depreciation, driven by declining foreign reserves, a strong dependence on imports, and falling oil revenues. The depreciation has led to increased inflation and reduced purchasing power for Nigerian consumers, exacerbating poverty and widening economic inequality (Adeola & Iyoboyi, 2022). Furthermore, exchange rate volatility has deterred foreign investment and created uncertainty for domestic industries, especially those reliant on imported goods and raw materials. For Nigeria to foster sustainable development, a stable exchange rate is essential. Stable exchange rates contribute to price stability, increase investor confidence, and support the growth of the non-oil export sector. However, achieving this requires strong foreign exchange management, reduced dependency on imports, and a diversified export base (Eboh et al., 2020).

The Significance of Trade Balance for Economic Diversification

A nation's trade balance—defined as the difference between its exports and imports—is a key indicator of its economic health. A favorable trade balance, where exports exceed imports, reflects a strong economy, while a negative balance can indicate an overreliance on foreign goods and services (Obadeyi, 2020). In Nigeria's case, the trade balance has been heavily influenced by its oil sector, with crude oil exports contributing the majority of the country's foreign earnings. This reliance on a single commodity exposes Nigeria to significant economic risks, as fluctuations in global oil prices have profound effects on the country's trade balance.

The Nigerian government has recognized the need to diversify the economy and improve the trade balance by promoting non-oil exports, particularly in agriculture and manufacturing. However, the diversification process has been slow, hampered by infrastructural deficits, inadequate policy implementation, and weak support for local industries (Ogunleye, 2022). A more balanced trade profile is essential for sustainable development, as it would reduce vulnerability to external shocks, foster economic resilience, and create more inclusive growth opportunities.

The trade balance is closely linked to both exchange rate stability and monetary policy. A competitive exchange rate can boost exports by making Nigerian goods more attractive in international markets, while effective monetary policy can create a favorable environment for investment in productive sectors (Ezenwakwelu et al., 2021). For Nigeria, achieving a sustainable

trade balance is crucial for reducing its dependence on oil exports and fostering growth in other sectors. Nigeria's journey toward sustainable development is marked by complex interactions between monetary policy, exchange rate management, and trade balance. These macroeconomic factors not only influence the country's short-term economic performance but also determine its long-term sustainability. Effective management of monetary policy, stabilization of exchange rates, and diversification of the trade balance are critical steps toward achieving Nigeria's development goals. This study aims to analyze these interactions and provide insights into how Nigeria can effectively leverage its macroeconomic tools to promote sustainable development.

Statement of the Research Problem

Sustainable development is a critical priority for developing nations like Nigeria, where economic, social, and environmental challenges are deeply interconnected. Despite being Africa's largest economy, Nigeria remains heavily reliant on crude oil exports, making the country vulnerable to external shocks, particularly fluctuations in global oil prices. This dependence on a single commodity has led to a fragile economic structure, characterized by high inflation, unemployment, and recurring trade imbalances. These economic vulnerabilities are further compounded by ineffective monetary policies and volatile exchange rates, which have serious implications for Nigeria's capacity to achieve sustainable development.

Monetary policy, directed by the Central Bank of Nigeria (CBN), plays a pivotal role in regulating inflation, managing money supply, and influencing interest rates—all of which affect economic stability. However, Nigeria's monetary policy has struggled to find a balance between curbing inflation and promoting economic growth, particularly in the face of external shocks and persistent inflationary pressures. Likewise, exchange rate instability poses significant challenges for Nigeria's trade balance. The continued depreciation of the naira has weakened purchasing power, driven up inflation, and discouraged foreign investment. Exchange rate fluctuations also undermine the competitiveness of Nigerian exports, worsening the trade imbalance.

Nigeria's trade balance, which reflects the difference between its exports and imports, remains negative due to its over-reliance on crude oil exports and the heavy importation of goods. This trade deficit limits Nigeria's potential for achieving inclusive and sustainable growth. Thus, the

central research question becomes how Nigeria can optimize its monetary policy and exchange rate management to improve the trade balance and advance sustainable development.

Nigeria has paid more to foreign countries than received. For example, in 1981, the trade balance was in deficit of N1.82 billion. It was in deficit of N2.3 trillion in 2015 and worsened to N7.91 trillion deficit in 2020. Thus, the attendant result affects the economy, leading to gross depletion of Nigeria's foreign reserves and depreciation of the exchange rate. It has also attracted reduction in the country's productive capacities and persistent inflationary pressures.

However, monetary policy could be seen to have implications for the balance of the trade position of a country. Monetary policy is aimed at controlling money supply to counteract all undesirable trends in the economy which may include unemployment, inflation, fluctuations in exchange rate or disequilibrium in the balance of trade (Gbosi, 2002). Consequently, empirical findings have shown that money supply (being one of the monetary policy instruments) and exchange rates are among the most important factors that determine fluctuations in external balance (Aniekan, 2013; Ajayi, 2014; Udude, 2015).

From the angle of exchange rate, available statistics from the Central Bank of Nigeria (2021) revealed a continuously depreciation of the official exchange rate from the early 1980s till date. The data show that exchange rate of the naira to the US dollar was quite low and stable from 1980s until in the 1990s when it began to increase. The naira appreciated against the US dollar from N0.71 in 1970 to N0.55 in 1980, but it continued to depreciate in the 1980s even though it became relatively stable in the mid-1990s then continued to depreciate. It moved from N8.04 in 1990 to N102.11 in 2000 and N150.30 in 2010 and then N358.81 in 2020 (CBN, 2021). During the period, 2015 to 2021, the trade balance fluctuated sharply. Trade balance was in deficit of N2.3 trillion in

2015. Although, it appreciated to 5.36 trillion in 2018, it worsened to N7.91 trillion deficit in 2020. The deficit abated to N3.19 in 2021 (CBN, 2021).

Although prior research has explored the individual impacts of monetary policy, exchange rates, and trade balance in Nigeria, there is a notable gap in understanding how these variables interact and their combined effect on sustainable development. Existing studies often overlook the long-term implications of misaligned monetary and exchange rate policies on Nigeria's trade performance and economic sustainability.

This study aims to fill this gap by examining the interconnections between monetary policy, exchange rates, and trade balance, and their collective impact on sustainable development in Nigeria. By doing so, it seeks to provide insights into how macroeconomic tools can be better coordinated to stabilize the economy, diversify exports, and support long-term sustainable growth. Without such coordination, Nigeria's path toward sustainable development will remain hindered by economic volatility and suboptimal growth outcomes.

Research Questions

Stemming from the research problems, the following research questions were identified for which this study sees to provide answers to:

i. How does money supply affect trade balance in Nigeria?
ii. To what extent does exchange rate influence trade balance in Nigeria?
iii. How does interest rate influence trade balance in Nigeria?
iv. What is the relationship between credit to core private sector and trade balance in Nigeria?
v. How does exchange rate depreciation improve or deteriorate the impact of money supply on trade balance?
vi. How does exchange rate depreciation improve or deteriorate the impact of interest rate on trade balance?

Objectives of the Study

The main objective of this study is to investigate the relationship between monetary policy variables and trade balance in Nigeria as well as the role of exchange rate. Consequently, the specific objectives are to:

i. examine the effect of money supply on trade balance in Nigeria.
ii. analyse the effect of exchange rate on trade balance in Nigeria.
iii. investigate the influence of interest rate on trade balance in Nigeria.
iv. determine the impact of credit to core private sector on trade balance in Nigeria.
v. examine the joint effect of money supply and exchange rate depreciation on trade balance; and
vi. examine the joint effect of interest rate and exchange rate depreciation on trade balance.

Hypotheses of the Study

Hypotheses guiding this study are stated in their null forms as follows:

i. There is no significant relationship between money supply and trade balance in Nigeria.
ii. The level of exchange rate does not significantly affect trade balance in Nigeria.
iii. There exists no significant relationship between interest rate and trade balance in Nigeria.
iv. Credit to core private sector has no significant impact on trade balance in Nigeria.
v. There exists no significant joint impact of exchange rate depreciation and money supply on the trade balance.
vi. The interaction between exchange rate and interest rate does not have a significant impact on trade balance.

Significance of the Study

The significance of this study lies in its potential to contribute to the understanding of the complex relationships between monetary policy, exchange rates, trade balance, and sustainable development in Nigeria. With Nigeria facing persistent economic challenges—including high inflation, currency depreciation, and a chronic trade deficit—this study offers valuable insights into how these macroeconomic factors influence the country's long-term development trajectory. It addresses a critical gap in the literature by examining how the interaction of monetary policy and exchange rate management impacts trade balance and, ultimately, sustainable development.

First, this study contributes to the academic discourse by providing a comprehensive analysis of the interrelationship between monetary policy, exchange rates, and trade balance in Nigeria, an area that has been insufficiently explored. Previous studies have typically examined these variables in isolation, overlooking how they work together to shape economic outcomes. By adopting an integrated approach, this research offers a more holistic understanding of the macroeconomic dynamics that influence Nigeria's ability to achieve sustainable development. The findings can also add to global discussions on how developing economies, particularly resource-dependent ones like Nigeria, can better manage their macroeconomic policies to foster sustainable growth.

Secondly, this study has practical implications for policymakers in Nigeria. The findings can inform more effective policy formulation by highlighting the importance of coordinating monetary policy and exchange rate management to stabilize the economy and improve trade balance. For instance, understanding the long-term effects of monetary policy on trade and exchange rates can help the Central Bank of Nigeria (CBN) and other economic stakeholders design strategies that not only control inflation but also promote export diversification and reduce dependence on oil revenues. Additionally, the study's insights on how exchange rate volatility affects trade can guide policymakers in implementing more stable and competitive exchange rate regimes that enhance Nigeria's export competitiveness in the global market.

Third, this research has relevance for the private sector, particularly businesses involved in export and import activities. By shedding light on the effects of monetary policy and exchange rates on trade, the study can help businesses anticipate changes in the economic environment and adjust their strategies accordingly. This is particularly important for sectors looking to expand into non-

oil exports, as these industries will benefit from stable economic policies and a competitive exchange rate environment.

Finally, the study has broader implications for Nigeria's sustainable development goals. Achieving economic sustainability requires addressing structural weaknesses in the economy, including over-reliance on oil exports and currency instability. This study's findings can contribute to a deeper understanding of how macroeconomic policies can be leveraged to create a more diversified, resilient economy that promotes inclusive and sustainable development.

Conceptual Literature Review

Monetary Policy

Monetary policy is the policy adopted by the monetary authority of a nation to control either the interest rate payable for very short-term borrowing (borrowing by banks from each other to meet their short-term needs) or the money supply, often as an attempt to reduce inflation or the interest rate, to ensure price stability and general trust of the value and stability of the nation's currency (*Jahan, 2014; Eduardo & Federico, 2010).* Monetary policy is a modification of the supply of money, i.e., "printing" more money, or decreasing the money supply by changing interest rates or removing excess reserves. This contrasts with fiscal policy, which relies on taxation, government spending, and government borrowing as methods for a government to manage business cycle phenomena such as recessions (*Friedman, 2001*). Further purposes of a monetary policy are usually to contribute to the stability of gross domestic product, to achieve and maintain low unemployment, and to maintain predictable exchange rates with other currencies. In developed countries, monetary policy is generally formed separately from fiscal policy.

Exchange Rate

Generally, exchange rate is the price of one currency in terms of another currency. It can also be defined as the price of one country's currency relative to other countries' currencies. Thus, an exchange rate has two components. The domestic and foreign currency and can be quoted either directly or indirectly. In a direct quotation, the price of a unit of domestic currency is expressed in terms of the foreign currency. Exchange rates are usually quoted in values against the US dollar. However, they can also be quoted against another nation's currency, which are known as a cross currency or cross rate.

Trade Balance

Trade balance also known as the balance of trade (BOT) compares the value of a country's exports with its imports. It refers to the difference between the monetary value of a country's imports and exports over a given time period. A positive trade balance indicates a trade surplus while a negative trade balance indicates a trade deficit. Trade balance is usually used as a statistical tool by economists to measure the relative strength of a country's economy relative to another as well as the flow of trade between countries. By measurement, it is given as the difference between the total value of a country's exports of goods and its total value of imports of goods (Chamberlin & Yueh, 2006; Mishkin, 2004). If a country's total value of exports is less than its total value of imports, we referred it as trade deficit. Trade deficit is also regarded by many countries as unfavorable trade balance. A country with large trade deficit is essentially borrowing money to finance foreign goods and services. Conversely, if a country's total value of exports exceeds its total value of imports is called trade surplus. Trade surplus is usually regarded as favorable trade balance and such country essentially lends money to deficit countries.

Literature Review

Odungweru, and Ewubare, (2020) investigated the effect of monetary policies on foreign trade in Nigeria. They made use of time series data from 1980-2017. They employed regression analysis. The results revealed exchange rate exerts a significant positive effect on trade in the long run while minimum rediscount rate exerts a significant negative effect on trade in the long run. It was concluded that the monetary policy channels through which foreign trade in Nigeria can be influenced are money supply, minimum rediscount rate and exchange rate.

In Indian, Tafajul and Biswajit (2020) examined the role of monetary policy and trade openness to raise income for the monetary-targeting regime and the multiple-indicator approach regime of monetary policy. The impact of the key instruments of monetary policy, namely, money supply, interest rate and exchange rate, with trade openness on income, were assessed. Besides, how interest rate responded to monetary instruments, income and trade openness was studied. The empirical findings revealed a significant positive impact of the broad money supply, both in the short run and the long run, along with a negative long-run impact of the real interest rate and a positive impact of the real effective exchange rate in the variations of income. On the other hand, trade openness contributed to a rise in income in the short run, while its impact on the long run is negative. The interest rate has also responded to policy instruments, income and openness which indicate that the monetary policy is effective over the two monetary regimes.

Also, in Sierra Leone, Tarawalie and Kpana (2022) examined monetary policy, exchange rate fluctuations and trade balance. The study utilized the Autoregressive Distributed Lag Modeling technique. The results from the unit root test revealed a combination of I(0) and I(1) series, while the bound test result confirmed that there is cointegration, which validates the existence of a long-run relationship. The long run results revealed that, money supply, real effective exchange rate and

real GDP are the main determinants of trade balance in Sierra Leone. The findings indicate that money supply and real effective exchange rate have negative impact on trade balance, whilst a positive relationship exists between real GDP and trade balance. Furthermore, results from the beta coefficients confirm that real GDP has the greatest effect on trade balance in the long run, followed by real effective exchange rate, whilst money supply has the least effect. Also, the short run ARDL error correction model results revealed that real GDP, government expenditure and foreign direct investment are the main determinants of trade balance in Sierra Leone. A major policy recommendation is to maintain exchange rate stability consistent with its equilibrium path and ensure that money supply growth is in tandem with domestic demand for non-tradeable goods and services.

In Nigeria, Ashamu (2020) investigated monetary policy on foreign trade during period 1981 to 2017 adopting the Error Correction Model (ECM) in the study. The study revealed that there is a significant relationship, implying that there is a long-run causality between monetary policy and foreign trade in Nigeria. Also, Sakanko and Akims (2021) analysed monetary policy and Nigeria's trade balance from 1980 to 2018. The study utilized the Autoregressive Distributed Lag Modeling (ARDL) technique. The findings reveal that monetary policy tools of real interest and effective exchange rate have a long-run co-integration relationship and significant adverse effects on Nigeria's trade balance both in the short-run and long-run.

Similarly, Osinusi, Lawal and Bisiriyu (2022) evaluated trade balance, exchange rate and money supply in Nigeria. The ARDL cointegration of the least square was adopted. The result showed a long-term relationship among trade balance, exchange rate, broad money supply, interest rate, inflation rate, and economic growth in Nigeria. The study thus concludes that the oil trade balance is the fundamental driver of Nigeria's economic growth and appropriately, it was suggested that to

ensure economic growth in Nigeria and other African countries; the government should strategize on policies to develop trade in the non-oil sector; also the monetary authorities should design frameworks towards making money supply growth enhancer, and stabilization of the exchange rate for domestic countries to gain more from trade by intensifying the flux of credit to the real and exporting sector towards setting the economies on the track of expansion.

Also, Nwagu, Orji, Jude, Ogbuabor, Anthony-Orji, and Nwufo (2022) analyzed the impact of fiscal and monetary policy instruments on the trade balance in Nigeria. They used the cointegration method and ordinary least square estimation to examine the impact of fiscal and monetary policy on Nigeria's trade balance from 1981 to 2018. The co-integration test confirms the existence of a long-run relationship between monetary policy as measured by broad money supply and fiscal policy as measured by government spending, taxation, and trade balance. The empirical findings revealed that the selected monetary and fiscal policy variables did not improve Nigeria's trade balance during the study period.

Abdullahil Emrah, and Harun (2021) examined the impact of currency misalignment on the trade balance of emerging market economies (EMEs) from 1980 through 2016. It firstly measures the equilibrium real effective exchange rate (RER) and corresponding misalignment series of 21 EMEs separately adopting a single equation approach and then includes them in the trade regression together with undervaluation and overvaluation to estimate the dynamic relationship between the trade balance and real exchange rate misalignment employing the system generalized method of moment estimation approach. The study suggests that, being a composite series of undervaluation and overvaluation, higher real exchange rate misalignment helps recover trade imbalances. It also identifies that undervaluation improves trade balance, while overvaluation cuts it down. The study identifies that the misalignment series of RER for most of the EMEs are substantially dominated

by overvaluation episodes, and hence the opposing impact of undervaluation and currency misalignment on the trade balance of EMEs is not surprising. From the policy perspective, competitiveness achieved through currency movements helps emerging market economies not only to improve trade balance but also to withstand vulnerability that arises from huge external borrowings creating a strong external payment position.

Keho (2021) investigated the determinants of the trade balance in the West African Economic and Monetary Union (WAEMU) over the period 1975-2017. The study employed the Mean Group (MG), Dynamic OLS (DOLS) and Fully Modified OLS (FMOLS) models. The results reveal that the trade balance is negatively related to domestic and foreign income and positively related to real effective exchange rate depreciation in the long run. However, the results do not confirm evidence of the J-curve.

Similarly, using linear and non-linear ARDL approaches, Hunegnaw (2020) examined the effect of the real exchange rate on the three sectors' trade balances in East Africa. The linear ARDL results showed that real exchange rate depreciation improved the manufacturing and mining trade balances but worsened the agricultural trade balance in the long run. However, nonlinear ARDL results showed an absence of the asymmetric effect of real exchange rate on trade balances, except the manufacturing sector. The implication is that heterogeneity effects can be obscured by the weak effect of real exchange rate on the aggregate trade balance. Therefore, the results suggest that sectoral investigation is crucial in analyzing the effects of real exchange rate on trade dynamics.

Mesagan, Alimi and Vo (2022) analysed the impact of exchange rate asymmetries on trade and output growth in 8 of the largest African countries between 1970 and 2019 using the non-linear autoregressive distributed lag (NARDL) framework. The empirical result confirmed a long-run relationship between exchange rate, trade and output growth. Also, currency appreciation and depreciation enhanced short-run trade and output in South Africa while reducing both in Angola.

Regarding Egypt and Morocco, currency appreciation improves short-run trade and growth, but in the long run, depreciation lowers both. This is similar in Kenya and Nigeria, except for the weak negative effect of currency depreciation on trade. In general, for most African nations, both appreciation and depreciation primarily exerted negative impacts on the long-run trade balance, while depreciation had mainly short-run positive effects.

Research Gap

While existing literature provides valuable insights into the relationships among monetary policy, exchange rates, and trade balance, several gaps remain. First, many studies have examined these variables in isolation, failing to explore their combined and dynamic effects on sustainable development. The complex interdependencies between monetary policy, exchange rate management, and trade performance are not fully understood, particularly in the context of a resource-dependent economy like Nigeria. There is a need for a more integrated analysis that considers how these macroeconomic factors interact to influence trade balance and long-term economic sustainability.

Second, much of the existing research focuses on short-term impacts without adequately addressing the long-term implications of misaligned monetary policies and exchange rate instability on Nigeria's trade balance and sustainable development. Understanding these long-term dynamics is crucial for formulating policies that promote stability, economic diversification, and resilience. Finally, the literature largely overlooks the role of sustainable development in shaping economic policy decisions. While trade balance, monetary policy, and exchange rate stability are important for economic growth, their impact on sustainable development—defined as the integration of economic, social, and environmental goals—remains underexplored. This study aims to fill these gaps by examining the interrelationships among monetary policy, exchange rates, and trade balance and their collective impact on Nigeria's sustainable development trajectory.

Methodology

To address the question of how monetary policy variables influence trade balance in Nigeria, the monetary theory of balance of trade was adopted. The Polak's (1957) macroeconomic model reflecting the monetary approach to the balance of trade (BOT) was developed in the International Monetary Fund (IMF) as a framework for handling adjustment in countries requiring IMF support for funding. Its objective was to integrate monetary, income and balance of trade analysis so that the causes of BOT disequilibrium and the policies that will correct it will be appraised together (Polak, 1957).

Based on the theoretical framework explained in the preceding section, this study augmented the model with monetary policy and fiscal policy variables al a the works of Okeke and Godfrey (2019); Aamir, Aneel and Muhammad (2019); Duru, Eze, Saleh, Yusuf, and Uzoma, K. (2022). Hence, the empirical model of this study is stated in its functional form as:

$$BOT = f(MS, EXR, INTR, CCP, GEXPMS, * EXR, INTR * EXR,) \quad (3.18)$$

Where:

BOT = Trade balance

MS = Money supply

EXR = Exchange rate

$INTR$ = Real interest rate

CCP = Credit to core private sector

$GEXP$ = Government expenditure

A restatement of equation (3.18) in econometric form yields the specification:

$$BOT_t = \alpha_0 + \alpha_1 LNMS_t + \alpha_2 LNEXR_t + \alpha_3 LNINTR_t + \alpha_4 LNCCP_t + \alpha_5 LNGEXP + \alpha_6 MS * EXR_t + \alpha_7 NTR * EXR_t + \mu_t \quad (3.19)$$

Where: μ_t stands for the error term, $\alpha_0, \alpha_1, \ldots, \alpha_5$ are parameters, and t subcript implies time quarterly. It is expected that $\alpha_1, \alpha_2, \alpha_4, \alpha_7 > 0; \alpha_3 < 0., \alpha_{45}, and\ \alpha_6 = +/-$

In light of the foregoing, the VEC model of this study, in compact form, is specified as follows:

$$\Delta Y_t = \alpha_j + \beta_{ij} \sum_{i=1}^{n} \Delta Y_{t-i} + \rho_j ECM_{t-1} + \varepsilon_j \quad (3.20)$$

Where,

Y_t = Vector of the endogenous variables

Y_{t-i} = Vector of the lagged endogenous variables

ECM_{t-1} = Error correction term

Δ = Difference operator

α_j= Vector of j intercept terms

β_{ij} = Matrix of $i \times j$ coefficients

ε_j = Vector of j stochastic terms

Therefore, the specification of the over-parameterized VEC model for this study using money supply, exchange rate and balance of trade is given in matrix notation as follows:

$$\begin{bmatrix} \Delta BOT_t \\ \Delta MS_t \\ \Delta EXR_t \end{bmatrix} = \begin{bmatrix} \alpha_1 \\ \alpha_2 \\ \alpha_3 \end{bmatrix} + \sum_{i=1}^{n} \begin{bmatrix} \beta_{11} & \cdots & \beta_{1j} \\ \vdots & \ddots & \vdots \\ \beta_{31} & \dots & \beta_{3j} \end{bmatrix} \begin{bmatrix} \Delta BOT_t \\ \Delta MS_t \\ \Delta EXR_t \end{bmatrix} + \begin{bmatrix} \rho_1 \\ \rho_2 \\ \rho_3 \end{bmatrix} ECM_{t-1} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \end{bmatrix} \quad (3.21)$$

The specific Vector Error Correction Model (VECM) equations are thus specified as;

$$\Delta BOT_t = \beta_{1t} + \sum_{j=i}^{k} \sigma_{ij} \Delta BOT_{t-1} - \sum_{j=i}^{k} \pi_{ij} \Delta MS_{t-j} + \sum_{j=i}^{k} \alpha_{ij} \Delta EXR_{t-j} + \sum_{j=i}^{k} \lambda_{ij} \Delta INTR_{t-j} + \Omega_t CCP_t + \Pi_t GEXP_t + \delta_t MS^* EXR_t + \gamma_t INTR^* EXR_t + \rho_1 ECM_{t-1} + \mu_{1t} \quad (3.22)$$

$$\Delta MS_t = \beta_{2t} + \sum_{j=i}^{k} \sigma_{ij} \Delta BOT_{t-1} - \sum_{j=i}^{k} \pi_{ij} \Delta MS_{t-j} + \sum_{j=i}^{k} \alpha_{2j} \Delta EXR_{t-j} + \sum_{j=i}^{k} \lambda_{2j} \Delta INTR_{t-j} + \Omega_t CCP_t + \Pi_t GEXP_t + \delta_t MS^* EXR_t + \gamma_t INTR^* EXR_t + \rho_2 ECM_{t-1} + \mu_{2t} \quad (3.23)$$

$$\Delta EXR_t = \beta_{3t} + \sum_{j=i}^{k} \sigma_{ij} \Delta BOT_{t-1} - \sum_{j=i}^{k} \pi_{ij} \Delta MS_{t-j} + \sum_{j=i}^{k} \alpha_{3j} \Delta EXR_{t-j} + \sum_{j=i}^{k} \lambda_{3j} \Delta INTR_{t-j} + \Omega_t CCP_t + \Pi_t GEXP_t + \delta_t MS^* EXR_t + \gamma_t INTR^* EXR_t + \rho_3 ECM_{t-1} + \mu_{3t} \quad (3.24)$$

Where: μ = stochastic or error term.

J = 1, 2, ….,n.

K= total number of lags

β_{ij} = autonomous term

σ_{ij} = coefficient of Trade balance

π_{ij} = coefficient of money supply

α_{ij} = coefficient of exchange rate

λ_{ij} = coefficient of interest rate

Ω_{ij} = coefficient of commercial banks' credit to private sector

Π_{ij} = coefficient of government expenditure

δ_t = coefficient of the interaction of money supply and exchange rate

γ_t = coefficient of the interaction of interest rate and exchange rate

A-priori expectations

The variables to be used in this study are described in some details in Table 3.1.

Table 3.1: Definitions of the Variables

S/N	Type	Symbol	Description	Measurement
1.	Dependent	BOT	Trade balance on goods and services equals exports of goods and services minus imports of goods and services.	It is measured in billion naira.
2.	Independent	MS	Broad money is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the	It is captured in billion naira.

S/N	Type	Symbol	Description	Measurement
			central government; bank and traveller's checks; and other securities such as certificates of deposit and commercial paper.	
3.	Independent	EXR	Official exchange rate is the rate at which local currency units exchange for another currency. It is either determined by national authorities or the exchange market.	It is calculated as local currency units (LCU) relative to the U.S. dollar.
4.	Independent	INTR	Real interest rate is the lending interest rate adjusted for inflation as measured by the GDP deflator.	Percentage (%)
5	Independent	CCP	Credit to core private sector consists of all credit facilities allocated to the private sector for production purposes.	It is measured in billion naira
6	Independent	MS*EXR	An interaction of money supply and exchange rate	Money supply values multiplied by exchange rate
7	Independent	INRT*EXR	An interaction of interest rate and exchange rate	Interest rate multiplied by exchange rate
6.	CONTROL	GEXP	Government expenditure includes all government current expenditures for purchases of goods and services (including compensation of employees).	It is computed in billion naira.

Source: Author's compilation, 2023

Sources of Data

The data used for the study are secondary quarterly data covering the period, 1981 to 2023. The data are sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin, 2023; various issues of CBN Annual Reports; the National Bureau of Statistics, 2021; and Ministry of Finance, Budget and National Planning, 2023.

Methods of Estimation

This study employed the Vector error correction (VEC) model this analysis succeeds the preliminary tests such as the descriptive statistics, correlation analysis, unit root test and co-integration test. All of these have been discussed below**.**

Descriptive Statistics

Table 4.1: Descriptive Statistics

	BOT	MS	EXR	INTR	CCP	GEXP
Mean	1069119.	7391.247	108.1966	17.23927	4454.207	2494.303
Maximum	6255359.	43817.57	414.9384	30.57031	23931.80	13198.35
Minimum	-8448825.	12.85000	0.585313	6.210938	7.940000	9.306250
Std. Dev.	2654447.	10587.64	109.1022	4.632829	6090.552	3165.387
Skewness	-0.641424	1.478604	0.980356	0.317133	1.242995	1.420253
Kurtosis	5.085838	4.323665	3.201823	3.590611	3.405197	4.286915
Jarque-Bera	40.97555	71.73064	26.54834	5.132609	43.35293	66.45158
Probability	0.000000	0.000000	0.000002	0.076819	0.000000	0.000000

Source: Author's computation using EViews 10.0

In Table 4.1, balance of trade (BOT) has a mean of ₦106.91 billion over the period 1981 to 2023. It indicates an average balance of trade surplus within the period of review. The maximum surplus and highest deficit values of balance of trade are ₦6,255.59 billion and ₦8,448.83 billion respectively. Its skewness value is -0.64 indicating that the distribution of balance of trade is slightly skewed to the left about its mean. Its Kurtosis (5.09) shows that the distribution is leptokurtic. The Jarque-Bera value of 40.98 with probability value less than 0.01 suggests that balance of trade is not normally distributed about its mean at the 5 percent level of significance.

Money supply (MS) has a mean of ₦7.39 trillion. The maximum and minimum values of money supply for the period are ₦43.82 trillion and ₦12.85 billion respectively. Its skewness value is 1.48 and it indicates that the distribution of money supply is skewed to the right slightly. Its Kurtosis (4.32) indicates that the distribution is leptokurtic. The Jarque-Bera value of 71.73, with probability value less than 0.01 suggests that money supply is not normally distributed.

Exchange rate (EXR) has a mean of ₦108.20 to US$1. The maximum and minimum values of exchange rate for the period are ₦414.93 and ₦0.59 to US$1 respectively. The value of skewness for exchange rate is 0.98. This means that the distribution of exchange rate is slightly positively skewed. Its kurtosis value of 3.20 which is higher than 3 indicates that the distribution of exchange rate is slightly peaked. The Jarque-Bera value of 26.55 with probability of less than 0.01 indicates that exchange rate is not normally distributed.

The average value of interest rate (INTR) within the period under review is 17.24%. The highest and lowest values of interest rate within the period are 30.57% and 6.21% respectively. The skewness value (0.32) shows that interest rate is positively skewed. Its Kurtosis (3.59) indicates that the distribution is lepokurtic. The Jarque-Bera value of 5.13 with a probability value of 0.08 suggests that interest rate is normally distributed at the 5% level of significance.

For credit to core private sector (CCP), the mean value for the period under review is ₦4.45 trillion. The highest and lowest values of funds allocated to the core private sector for the period are ₦2.39 trillion and ₦7.94 billion respectively. The skewness value for credit to core private sector (1.24) shows that its distribution is positively skewed. Its Kurtosis (3.41) indicates that the distribution is leptokurtic. The Jarque-Bera statistic (43.35) indicates that the variable is not normally distributed at the 5% level of significance.

Government expenditure (GEXP) has an average value of ₦2.49 trillion with a standard deviation ₦3.17 trillion. The maximum and minimum government expenditure levels for the period are ₦13.20 trillion and ₦9.31 billion respectively. Its skewness value is 1.42 and it indicates that the distribution of government expenditure is skewed to the right. Its Kurtosis (4.29) indicates that the distribution is leptokurtic. The Jarque-Bera value of 66.44, with probability value less than 0.01 suggests that the variable is not normally distributed at the 5% level.

Pair-wise Correlation

The correlation matrix for all the variables in the study is reported in Table 4.2.

Table 4.2: Pair-wise Correlation Matrix

Correlation / **Probability**	**BOT**	**MS**	**EXR**	**INTR**	**CCP**	**GEXP**
BOT	1.000					

MS	-0.1234	1.000				
	(0.1151)	-----				
EXR	-0.0166	0.9357	1.000			
	(0.8332)	(0.0000)	-----			
INTR	0.1211	-0.2420	-0.1216	1.000		
	(0.1225)	(0.0018)	(0.1208)	-----		
CCP	-0.0785	0.9883	0.9348	-0.2250	1.000	
	(0.3179)	(0.0000)	(0.0000)	(0.0038)	-----	
GEXP	-0.0643	0.9885	0.9560	-0.2253	0.9740	1.000
	(0.4135)	(0.0000)	(0.0000)	(0.0037)	(0.0000)	-----

Note: p-values are in parentheses.

Source: Author's computation using E-views 10.0

From Table 4.2, the correlation statistic between balance of trade (BOT) and money supply (MS) is weak and negative ($r = -0.12, p = 0.11$) but insignificant at the 5% level. This suggests that the correlation between balance of trade and money supply is inverse though insignificant. Similarly, the correlation coefficient balance of trade (BOT) and exchange rate (EXR) is also weak and negative though insignificant at the 5% level ($r = -0.02, p = 0.83$). The coefficient indicates that balance of trade has a negative insignificant relationship with exchange rate. On the other hand, the correlation statistic between balance of trade (BOT) and interest rate (INTR) ($r = 0.67, p < 0.01$); gross fixed capital formation (% of GDP) (GFCF) ($r = 0.123\, p = 0.12$) is positive but insignificant at the 5% level. This shows there is a positive insignificant relationship between balance of trade and interest rate. Again, the correlation coefficient between balance of

trade (BOT) and credit to core private sector (CCP) is negative ($r = -0.08, p = 0.32$) but insignificant at the 5% level. This suggests that the correlation between balance of trade and credit to core private sector is inverse though insignificant. Similarly, the correlation coefficient balance of trade (BOT) and government expenditure (GEXP) is negative though insignificant at the 5% level ($r = -0.06,\ p = 0.41$). A cursory look at the correlation coefficients among the explanatory variables indicated that some of the variables are highly correlated (CCP and MS, $MS\ and\ GEXP, as\ well\ as\ CCP\ and$ DEXP). This is a pointer to the possibility of multicollinaerity in the model. To correct this problem the explanatory variables were converted to their natural log form and if there is any indication of multicollinearity in the regression result we can resort to dropping the less important highly correlated variables from the model. But, this was not the case as it was realized that even when we dropped those variables the R-Squared and t-ratios were relatively stable when compared to what it was with all the variables.

Unit Root Tests

In this section, the summary of the unit root results using the Augmented Dickey-Fuller tests at levels and first differences are presented and analysed.

Table 4.3: Augmented Dickey-Fuller Unit Root Tests at Levels

Null Hypothesis: Variable has a unit root			
Variable	**t-Statistic**	**Probability**	**Remarks**
BOT	-1.397	0.582	Non-stationary
MS	9.640	1.000	Non-stationary
EXR	1.718	0.998	Non-stationary
INTR	-2.470	0.125	Non-stationary
CCP	5.572	1.000	Non-stationary
GEXP	1.866	0.998	Non-stationary

Source: Results Extract from EViews 10.0

From Table 4.3, the results based on Augmented Dickey-Fuller test showed that balance of trade (BOT), money supply (MS), exchange rate (EXR), interest rate (INTR), credit to core private (CCP), and government (GEXP) are non-stationary at levels. This is because the t-statistics are not significant at the 5% level of statistical significance. Therefore, the null hypothesis that the variable

has a unit root process cannot be rejected. Consequently, the variables were tested at their first differences. The results are reported in Table 4.4.

Table 4.4: Augmented Dickey-Fuller Unit Root Tests at Differences

Null Hypothesis: Variable has a unit root			
Variable	**t-Statistic**	**Probability**	**Remarks**
D(BOT)	-4.385	0.001	Stationary
D(MS)	-3.464	0.001	Stationary
D(EXR)	-3.148	0.026	Stationary
D(INTR)	-2.935	0.031	Stationary
D(CCP)	-4.989	< 0.01	Stationary
D(GEXP)	-10.262	< 0.01	Stationary

Source: Results Extract from EViews 10.0

As depicted in Table 4.4, the results based on Augmented Dickey-Fuller test showed that balance of trade (BOT), money supply (MS), exchange rate (EXR), interest rate (INTR), credit to core private (CCP), and government (GEXP) are all first difference stationary. This is because the t-statistics are significant at the 5% level. Thus, the null hypothesis of a unit root process in the variables cannot be accepted at their first differences.

Co-integration Tests

This section presents the analysis of the cointegration test using the Johansen cointegration technique.

Table 4.5: Johansen Co-integration Test

Series: BOT MS EXR INTR CCP GEXP

Hypothesized No. of CE(s)	*Trace Statistic*	*0.05 Critical Value*	*Prob.*	*Max-Eigen Statistic*	*0.05 Critical Value*	*Prob.*
None	195.2699	95.75366	0.0000*	87.51195	40.07757	0.0000*
At most 1	107.7579	69.81889	0.0000*	50.13967	33.87687	0.0003*
At most 2	57.61828	47.85613	0.0047*	40.03477	27.58434	0.0008*
At most 3	17.58351	29.79707	0.5969	9.841007	21.13162	0.7594
At most 4	7.742506	15.49471	0.4933	7.313249	14.26460	0.4528
At most 5	0.429256	3.841466	0.5124	0.429256	3.841466	0.5124
Trace test indicates 3 cointegrating eqn(s) at the 0.01 level				Max-eigen test indicates 3 cointegrating eqn(s) at the 0.01 level		

Source: Results Extract from EViews 10.0

As revealed in tables 4.5 the cointegration test based on the trace test indicates that there are three co-integrating equations at the 1 percent level. Similarly, the maximum Eigen value test indicates three co-integrating equations at the 1 percent level. These results show that a long run relationship exists among balance of trade (BOT), money supply (MS) and exchange rate (EXR) in the model.

VAR Lag Order Selection Criteria Tests

Table 4.6: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-5139.443	NA	1.11e+24	63.88128	63.93870	63.90459
1	-4098.108	2030.926	3.00e+18	51.05724	51.28691	51.15050
2	-3981.684	222.7247	7.89e+17	49.72278	50.12470*	49.88598*
3	-3971.533	19.04137*	7.78e+17*	49.70848*	50.28265	49.94162

Source: Results Extract from EViews 10.0

Note: * indicates lag order selected by the criterion, LR: sequential modified LR test statistic (each test at 5% level), FPE: Final prediction error, AIC: Akaike information criterion, SC: Schwarz information criterion, HQ: Hannan-Quinn information criterion

From Table 4.6, the lag order selection criteria indicate that the optimum lag order for the endogenous variables in the VEC model is 3 judging by the AIC selection criterion. Thus, in

estimating the VEC model, the highest lag order introduced in the first differences of the endogenous variables is not greater than 3.

Analysis of Vector Error Correction Model Results

The results of the estimated Vector Error Correction (VEC) model are reported in Table 4.7 below.

Table 4.7: Estimated VEC Model

Co-integrating Equation	**CointEq1**		
BOT(-1)	1.000000		
LNMS(-1)	-4916828. (1791093) [-2.74515]		
LNEXR(-1)	3412065. (906127.) [3.76555]		
C	20438632		
Error Correction:	**D(BOT)**	**D(LNMS)**	**D(LNEXR)**
CointEq1	-0.102128	8.38E-09	-1.59E-08
	(0.02119)	(2.9E-09)	(5.1E-09)

	[-4.81850]	[2.86839]	[-3.10154]
D(BOT(-1))	0.711819	5.53E-09	-3.94E-09
	(0.07628)	(1.1E-08)	(1.8E-08)
	[9.33209]	[0.52563]	[-0.21382]
D(BOT(-2))	0.326278	-1.83E-08	1.90E-08
	(0.08989)	(1.2E-08)	(2.2E-08)
	[3.62971]	[-1.47327]	[0.87369]
D(LNMS(-1))	414533.3	-0.100795	-0.072089
	(577369.)	(0.07958)	(0.13957)
	[0.71797]	[-1.26652]	[-0.51651]
D(LNMS(-2))	229399.9	-0.050279	0.074829
	(576560.)	(0.07947)	(0.13937)
	[0.39788]	[-0.63266]	[0.53690]
D(LNEXR(-1))	40400.61	0.011279	0.341151
	(330984.)	(0.04562)	(0.08001)
	[0.12206]	[0.24722]	[4.26387]

D(LNEXR(-2))	240488.1	-0.059252	0.079748
	(335107.)	(0.04619)	(0.08101)
	[0.71765]	[-1.28276]	[0.98447]
C	169622.9	-0.001838	0.096376
	(444843.)	(0.06132)	(0.10753)
	[0.38131]	[-0.02998]	[0.89624]
LNINTR	300319.7	-0.018617	0.043935
	(178372.)	(0.02459)	(0.04312)
	[1.68367]	[-0.75721]	[1.01894]
LNCCP	-369024.3	-0.004255	-0.073057
	(137559.)	(0.01896)	(0.03325)
	[-2.68266]	[-0.22440]	[-2.19704]
LNGEXP	229727.5	0.023716	0.044529
	(131716.)	(0.01816)	(0.03184)
	[1.74412]	[1.30628]	[1.39851]
MS_EXR	-0.019904	7.07E-09	-1.07E-08
	(0.02347)	(3.2E-09)	(5.7E-09)

	[-0.84807]	[2.18516]	[-1.89171]
INTR_EXR	-38.80082	-1.24E-05	7.02E-06
	(62.6337)	(8.6E-06)	(1.5E-05)
	[-0.61949]	[-1.44046]	[0.46378]
R-squared	0.684	0.126	0.248
Adj. R-squared		0.457	0.513
0.674			
F-statistic	26.70	1.785	4.079
D-W -statistic	**2.04**	1.92	1.97

Source Author's compilation (2023) extracted from Eviews 10.0 output.

Notes: () represents standard error; [] denotes t-statistics.

Based on the co-integration result, the granger causality result, and the AIC lag selection criteria a Vector Error Correction Model (VECM) with optimum lag minus one was conducted to capture both the short run relationship and the long run dynamics of the explanatory variables on the endogenous variables and the result is presented in Table 4.7.

The long-run VECM results revealed that the natural log values (which captured the elasticity) of money supply (LNMS) and exchange rate (LNEXR), are highly significant in driving trade balance in Nigeria for the period under study. The long-run LNMS showed an inverse relationship with BOT, precisely, the result indicated that a 1% rise in FDI will result to a fall trade balance by (-4916828 naira). MS was also found to be statistically significant by 1% level of significance as shown on the OLS version of the VECM result and the t-statistics value of -2.74. Exchange rate (LNEXR) was found to have a positive and significant relationship with trade balance (BOT) in the long-run. This implies that in the long-run all things being equal, a 1% rise in the exchange

rate (level of depreciation) will result to an improvement in the trade balance by 3412064.0 units. Both MS and EXR can have strong significant impact on the BOT in the long-run.

The short-run vector error correction model results of the BOT, LNMS, and LNEXR, models are presented respectively. However, the BOT model is of interest on the VECM to extract the relationship and effects of MS, EXR, INTR, CCP, GEXP, MS_EXR, and INTR_EXR on BOT See Table 4.7 for the entire VECM result.

It was observed that the D(BOT) model has a good-fit as the coefficient of determination is 68%, indicating that the variations in the dependent variable was accounted for by the explanatory variables put together. The overall F-statistics and the corresponding probability values of 26.70 and 0.000 are indication that the overall model passed the test of significance at the 5 per cent level. This implies that that the hypothesis of a significant linear relationship between the dependent and independent variables cannot be rejected. Also, the Durbin-Watson statistics which was obtained through the re-estimation of the VECM result with the least squares approach showed a value of 2.04 which is approximately 2, thereby indicating an absence of stochastic dependence in the model and no serial correlation problem.

Further, the error correction component which is depicted as (CointEq1) with a coefficient of

-0.102128 possessed the expected negative coefficient and is significant at 1 per cent level of significance judging by the t-statistics 0f -9.86 and a probability value of 0.0000. Thus, we are confident of the inter-temporal stability of the model and hence short-run fluctuations will converge at the long-run estimates at an expected speed of about 10% annually. This means that about 10 per cent of the deviation from long run equilibrium relationship between BOT and its determinants are corrected within the period. Also we will deduce that BOT being the dependent variable granger causes the independent variables in the long-run since the error correction term (CointEQ1) is negative and significant.

The short-run result of the D(BOT) model revealed that the first and second years lag values of BOT impacts on the current year's BOT positively. This implies the immediate past two years trade balance status will result to an improvement in the current year's BOT. Both the first and second period lag BOT values was found to be significant at 1% level of significance judging by the t-statistics of -9.33 and 3.62 as well as their Prob. Value of 0.0000 as obtained from the OLS

version of the VECM result. This shows that the balance of trade has a positive and significant lag effect on its current value in the short-run.

Unlike in the long-run scenario, in the short-run both the first and second period lag values were found to be positive and insignificantly related with trade balance. Thereby suggesting that a rise in the money supply will improve trade balance and this will occur as a temporary phenomenon. However, these effects are therefore not significant in driving the improvement of BOT as their t-statistics stood at 0.717 and 0.397 respectively.

Similarly, exchange rate was also found to have a positive and insignificant relationship with trade balance in the short-run. This indicated that in the interim, exchange depreciation which speaks of an increase in exchange rate will translate to a positive balance of trade. This can be related to the true picture from the descriptive statistics which revealed a positive effect of exchange rate depreciation on BOT between 1984 to about 2012 and a negative effect on BOT since 2013 till date following an intense and continuous depreciation. The coefficient of the interest rate (LNINTR) ($t = 1.683$, P-Value $=0.09$) showed that interest rate has a positive and significant relationship with trade balance. This implies that a 1% increase in the interest will result to an improvement in the trade balance. The result although revealed that interest rate is statistically significant at 10% in driving BOT but it failed the a-priori expectation. Also the coefficient of credit to private sector is significant at 1% level of significance but was inversely related to BOT) (-369024.3 $t = -2.682$, P-Value $=0.007$). This implies that a one billion rise in credits to private sector will increase the demand for money and therefore deteriorate the trade balance by 369024.3 naira in the long-run. This failed the expected sign.

The coefficient of government expenditure (LNGEXP) being the control variable in BOT model given as (229727.5 $t= 1.74$, P-Value $=0.08$) shows that a positive and significant relationship runs between government expenditure and the trade balance in the long-run. This therefore indicated specifically that a one billion naira rise in government expenditure will result to a trade balance surplus by the value of the coefficient.

The moderating variables (MS_EXR and INTR_EXR) which captured the joint effect of monetary policy (money supply and interest rate) with exchange rate misalignment (depreciation) on the BOT where found to be statistically insignificant in explaining the trade balance status in Nigeria. Specifically, the coefficient of MS_EXR is negative with a value of (-0.019904). This shows that both money supply and exchange rate depreciation will result to severe trade balance deterioration

in the long-run. Meaning a rise in money supply in the face of continuous exchange rate depreciation will adversely affect the trade balance as in the long run.

The coefficient of the interaction of interest rate and exchange rate (INTR_EXR) (-38.80082) which captures the joint effect of interest rate and exchange rate depreciation is also negative and insignificant. This reveals that a rise in interest rate (monetary contraction) alongside exchange rate depreciation will also result to a deterioration of the trade balance in Nigeria. This shows that the effect of interest rate and money supply will outweigh that of exchange rate depreciation in the long-run. In both cases exchange rate was found to have negative effect on BOT in Nigeria in the long-run whereas without combing exchange depreciation with money supply and interest it was found to have a positive impact on BOT in the long-run and a positive relationship with BOT in the short-run.

Post Estimation Diagnostic Tests

In this section, the post VEC estimation diagnostic tests are presented and analyzed. The tests include VEC Granger causality/block exogeneity wald tests for balance of trade, VEC residual autocorrelation and normality test, and the VEC model stability test.

Table 4.8: VEC Granger Causality/Block Exogeneity Wald Tests

Excluded	Chi-Square	Degree of freedom	Probability
D(MS)	7.413156	2	0.0246
D(EXR)	3.328546	2	0.1893
All	10.62412	4	0.0311

Source: Results Extract from Eviews 10.0

As shown in Table 4.8, the results of the block exogeneity Wald test for the first difference of balance of trade equation reveal that the Chi-square test statistic is significant at the 5% level ($\chi^2 = 7.41, p = 0.03$). Therefore, the first differences of money supply and exchange rate jointly determine balance of trade. The above granger causality test gave credence for the three models estimated in the VEC models as well as the joint effect test for MS and EXR.

VEC Residual Autocorrelation and Normality Tests

In order to test for autocorrelation problem in the VEC system, we estimated the VEC residual portmanteau and LM tests for autocorrelations. Also, the VEC residual normality test was conducted. The results are reported in Table 4.9.

Table 4.9: VEC Residual Tests for Autocorrelations and Normality

VEC Residual Tests for Autocorrelations						
	Portmanteau Tests				**LM Test**	
Lags	**Q-Stat.**	**Prob.**	**Adj. Q-Stat.**	**Prob.**	**LM-Stat**	**Prob.**
1	0.509757	NA*	0.512943	NA*	12.91989	0.1663
2	6.227980	NA*	6.303094	NA*	16.54588	0.0563
3	9.581147	0.8452	9.719928	0.8370	3.398469	0.9464

Source: Results Extract from EViews 10.0

Note. *The test is valid only for lags larger than the VAR lag order for the VEC residual Portmanteau tests for autocorrelations

From Table 4.9, the VEC residual portmanteau and LM tests for autocorrelations indicate that there is no residual autocorrelations in the VEC model up to lag order of 3. This is because the Q-statistic ($Q = 9.58,\ P - value = 0.8452$) and the adjusted Q-statistic ($Q = 9.719,\ P - value = 0.8370$) are not significant at the 5% level. Therefore, we cannot reject the null hypothesis of no residual autocorrelation in the VEC model. This depicts that the VEC system is free form the problem of contemporaneous serial correlation problem.

Vector Error Correction Model Stability Test

To test for the stability of the VEC model, the results of the roots of the characteristic autoregressive (AR) polynomial are reported in Table 4.10 as well as the inverse roots of the characteristic AR polynomial in Figure 6.

Table 4.10: Roots of Characteristic Polynomial

Root	Modulus
1.000000 - 3.93e-16i	1.000000
1.000000 + 3.93e-16i	1.000000
0.914930 - 0.270123i	0.953972
0.914930 + 0.270123i	0.953972
0.567836	0.567836
0.003897 - 0.422463i	0.422481
0.003897 + 0.422463i	0.422481
-0.294879	0.294879
-0.147681	0.147681

Source: Results Extract from EViews 8.0

Note. VEC specification imposes 3 unit root(s).

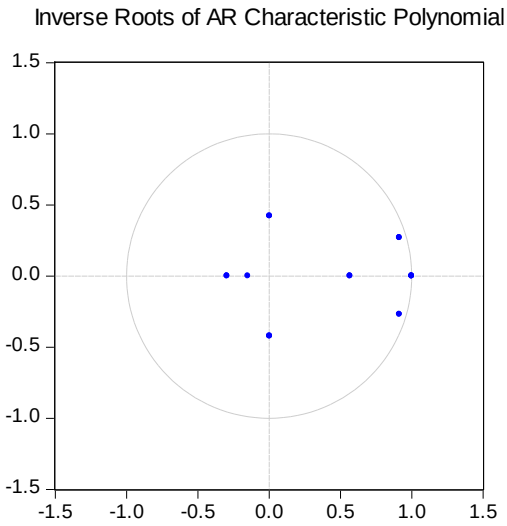

Figure 4.6: Inverse roots of AR characteristic polynomial

Form the results in Table 4.10, all the roots have modulus less than one and they all lie within the unit circle as shown in Figure 6. This shows that the VEC specification satisfies the stability condition. Thus, the VEC model is stable and as such the impulse response functions and forecast error decomposition functions are valid.

Impulse Response Functions

In order to ascertain the interrelationship that runs between the endogenous variables the impulse response function test was carried out. The impulse response shows how BOT variable responds to shocks from itself, MS and EXR ; how MS variable responds to shocks from itself, BOT and EXR as well how EXR variable responds to shocks from itself, MS and BOT over time usually 10 years-time frame. However, for the possible of this study the interest is on how BOT responds to BOT, MS and EXR.

The results are in the form of the dynamic impulse responses of the variables in the VEC model to an increase in each relevant variable equivalent to the sample standard deviation. The results in graphical form are presented in the Figure 7.

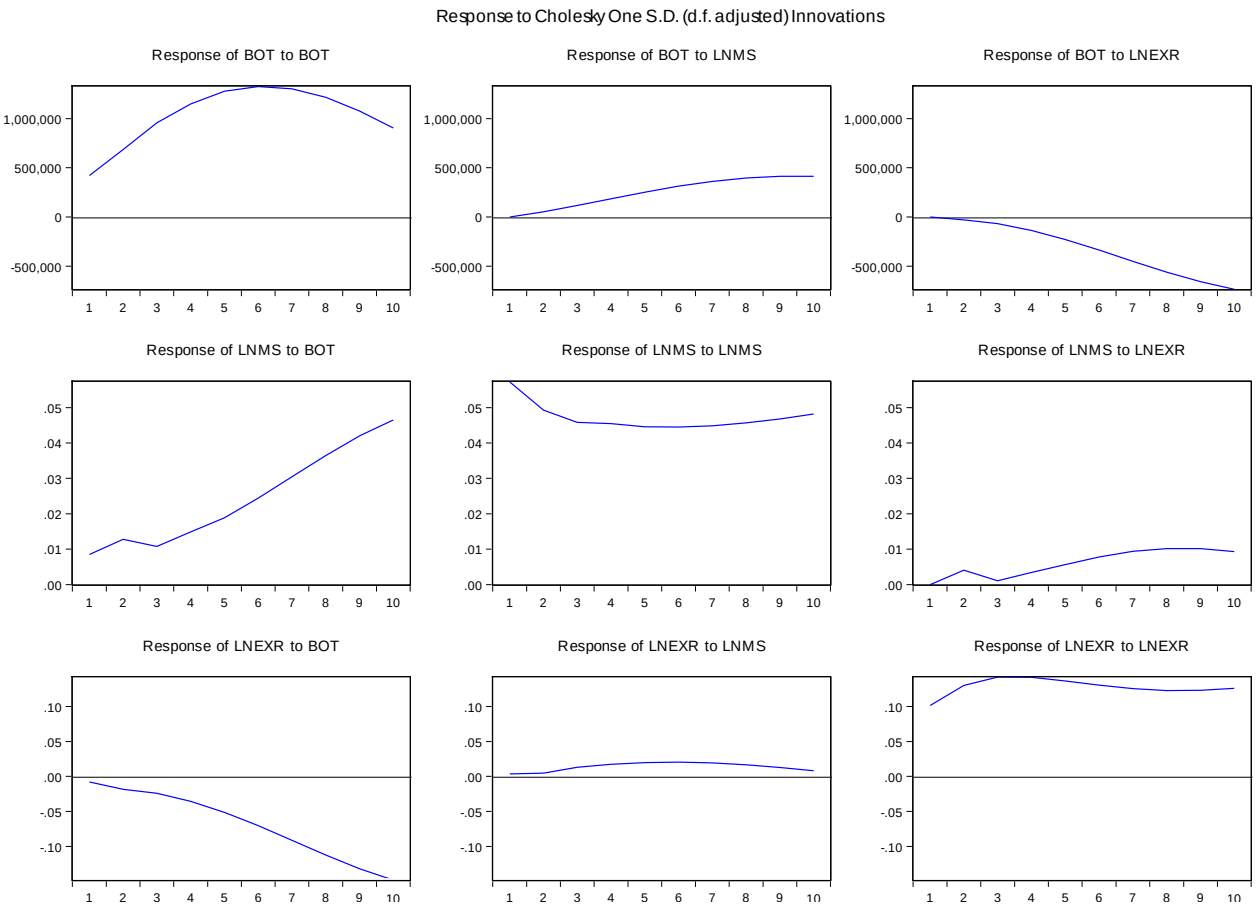

Figure 4.7: Impulse response functions

From Figure 7, the impulse-response function of balance of trade in the VEC model to a shock in itself reveals that balance of trade responded positively throughout the forecast period. The effect rose from 420088.6 in the first period got to its peak in the 9th period with a value of 107765.8 and tapered off at the tenth year of the forecast period. Also, the impulse response functions reveal that balance of trade showed a positive response to shocks in money supply throughout the period of the forecast at the first period BOT had no response to the MS shocks as seen with the value (0.00000) from the second period it response was positive and rose to 413173.2 in the 10th period. Thus, the effect of money supply shock on trade balance is non-transitory. However, the impulse-response function of BOT to a shock in exchange rate reveals that BOT responded negatively throughout the forecast period. However there was no effect in the first year. The effect was explosive throughout the forecast period. Therefore, the effect of trade balance innovations on exchange rate is non-transitory. However, the impulse-response function of exchange rate to a shock in balance of trade reveals that exchange rate responded negatively throughout the forecast

period. The effect was explosive throughout the forecast period. Therefore, the effect of trade balance innovations on exchange rate is non-transitory.

Forecast Error Variance Decomposition Functions

The forecast error variance decomposition functions reflect the proportion of forecast error variance in each variable that is attributed to its own fundamental innovations and innovations in the other variables. The result of the forecast error variance decomposition functions are shown in Figure 8.

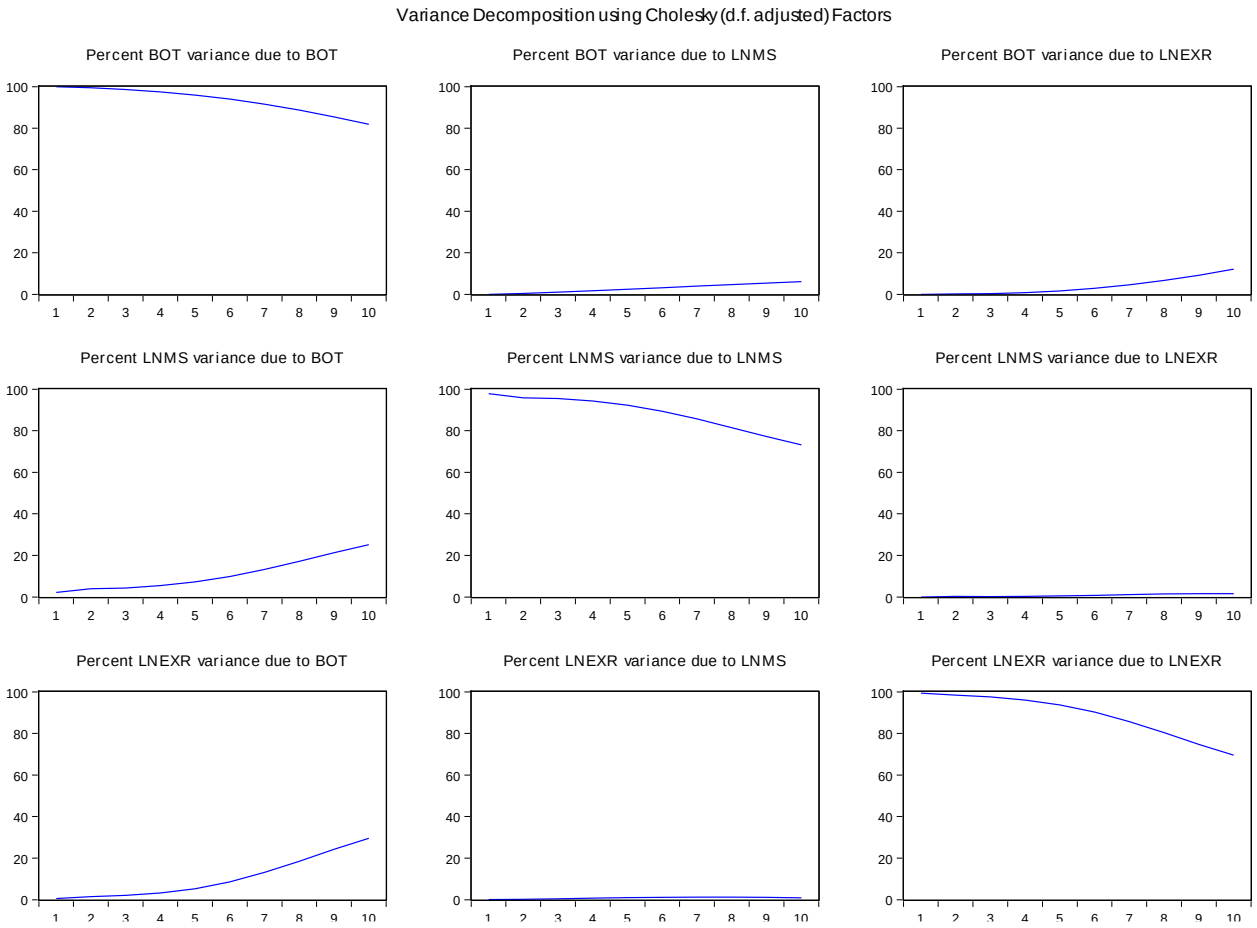

Figure 4.8: Forecast error decomposition functions

From Figure 8, it can be observed that fundamental shocks to balance of trade from itself account for 100% innovations in the first quarter of forecast. The innovations, however, declined from the second quarter through to 81.9% in the last period of the forecast. Innovations in money supply and exchange rate accounted for virtually no variations (0%) in balance of trade in the first quarter of the forecast but increased to 0.4% and 0.14% in the second period this increased further to about

6.02% and 12.04% respectively in the last quarter of the forecast period. Thus, the forecast error decomposition functions show that among the endogenous variables, the predominant causes of variations in balance of trade are associated with own shocks followed by exchange rate and then money supply. Again, it can be observed that fundamental shocks to money supply itself account for 97.8% innovations in the first quarter of forecast. The innovations, however, declined from the second quarter through to 73.2% in the last quarter of the forecast. Innovations in balance of trade accounted for about 2.14% variations in money supply in the first quarter of the forecast and increased to about 25.1% in the last quarter of the forecast period. Innovations in exchange rate did not account for any variations in money supply in the first quarter of the forecast but increased marginally to about 1.63% in the last quarter of the forecast period. Therefore, the forecast error decomposition functions for money supply show that the predominant causes of variations in money supply are associated with own shocks followed by balance of trade and exchange rate. Furthermore, it can be observed that fundamental shocks to exchange rate from itself account for 99.2% innovations in the first quarter of forecast. The innovations, however, declined from the second quarter through to 69.5% in the last quarter of the forecast. Innovations in balance of trade and money supply accounted for 0.58% and 0.11% variations in exchange rate in the first quarter of the forecast and increased to about 29.5% and 0.95% respectively in the last quarter of the forecast period. Thus, the forecast error decomposition functions show that among the endogenous variables, the predominant causes of variations in exchange rate apart from own innovations are from balance of trade followed by money supply.

Result and Interpretation

The discussion of the results of this research is based on the key findings. First, it was discovered that there is a co-integration among balance of trade, money supply and exchange rate. The implication is that there is a long run relationship among balance of trade, money supply and exchange rate. In other words, balance of trade, money supply and exchange rate have a common long run trend; even if any of the variables deviate in the short run, they would converge in the long run. This reveals that there is an inter-relationship among balance of trade, money supply and exchange rate over the period of analysis. This finding is supported by the works of Sakanko, & Akims, (2021); Tarawalie & Kpana (2022) whose finding reveal a co-integrating relations among these variables.

Again, findings of the VEC results from the impulse response functions show that balance of trade responded positively to own shock throughout the forecast period. However, the effect of the shock tapered off towards the end of the forecast period. The implication is that the response of trade balance to own shock is temporary. In other words, balance of trade may experience a disequilibrium in the short term due to own innovations but it will definitely return to equilibrium after a few quarters of the shock. Also, the impulse response functions revealed that balance of trade showed a positive response to shocks in money supply throughout the period of the forecast. In the first period BOT had no response to the MS shocks as seen with the value (0.00000) from the second period it response was positive and rose to 413173.2 in the 10^{th} period. Thus, the effect of money supply shock on trade balance is non-transitory.

Put differently, sudden changes money supply improves balance of trade equilibrium position. In short, unanticipated money supply shock in the economy has a beneficial effect on the balance of trade position in the short-run alone. This finding is consistent with those of Osinusi, Lawal, & Bisiriyu (2022) and Tarawalie, & Kpana, (2022).

However, the impulse-response function of BOT to a shock in exchange rate reveals that BOT responded negatively throughout the forecast period. However there was no effect in the first year. The effect was explosive throughout the forecast period. Therefore, the effect of trade balance innovations on exchange rate is non-transitory. However, the impulse-response function of exchange rate to a shock in balance of trade reveals that exchange rate responded negatively throughout the forecast period. The effect was explosive throughout the forecast period. Therefore, the effect of trade balance innovations on exchange rate is non-transitory.

In addition from the VECM result, it was found that that money supply negatively induces balance of trade in the long run. The implication of this finding is that an increase in money supply will result in balance of trade deficit. This is because a rise in money supply will lead to an increase in consumption of foreign goods and services which in turn will lead to an increase in import bills thereby resulting in balance of trade deterioration. This result is in agreement with Tarawalie and Kpana's. (2022) findings which showed expansionary money supply will cause a deterioration in the balance of trade. It was also discovered that money supply improves trade balance in the short-run but failed the statistical significance test.

Furthermore, it was discovered that though exchange rate had a positive and significant effect on balance of trade in the long run. However, in the short run, the results show that exchange rate had a positive relationship with balance of trade but was found to be statistically insignificant. The implication of these findings is that changes in exchange rate lead to improvement in the balance of trade position but it can only be fully realized in the long-run. These results are consistent with those of Duru et. al; (2022); Iboma (2022); Okonkwo(2019); Olusegun (2018); who found that exchange rate devaluation have beneficial effects on trade balance. The finding therefore negated those of Hakeem (2018) and Nwanosoke et. al (2017).

Moreover, interest rate was found to have a significant positive effect on balance of trade in the long run. The result reveals that interest rate does significantly influence the balance of trade position in Nigeria in the long term. The implication is that a rise in interest rate would bring about an appreciable improvement in the balance of trade position in the long term. However, credit to the core private sector was found to have a negative and significant effect on balance of trade in the long term. This implies that increased provision of credit facilities to the core private sector would retard the balance of trade positive or trigger balance of trade deficit in the long run. This is because the core private sector investment will boost the productivity activities in the economy and increase the aggregate output level which may in turn increase the demand for foreign goods that will cause import values to exceed the export and thus resulting to trade deficit. This result not in line with those of Imoughele & Ismaila (2015); Adamu & Itsede (2010) who showed that credit to private sector impacts positively on balance of trade of a country.

Conclusion

This study set out to examine the interrelationships between monetary policy, exchange rates, and trade balance, with a focus on how money supply, interest rates, and exchange rate management collectively impact trade balance in Nigeria. The findings revealed a co-integrating relationship among money supply, exchange rate, and trade balance, indicating a long-term equilibrium among these variables. In other words, despite short-term fluctuations, money supply, exchange rate, and trade balance exhibit a common long-term trend. Any short-term deviation in one of these variables will likely converge with the others over time, reinforcing the interconnection between them during the period of analysis. It was also found that trade balance responded positively to its own shocks throughout the forecast period, although this effect diminished toward the end of the period.

This suggests that while trade balance may experience short-term disruptions due to internal factors, these are typically temporary, and equilibrium is restored after a few quarters. The impulse response functions further highlighted that trade balance responded positively to shocks in money supply after the forecast period, indicating that the impact of monetary shocks is not merely short-term but extends into the long run. This finding underscores the non-transitory nature of money supply shocks on trade balance.

Additionally, it was observed that in the long run, money supply negatively affects trade balance, meaning that an increase in money supply is likely to worsen the trade balance. This is because an expanded money supply tends to stimulate higher consumption of foreign goods and services, increasing import bills and thus deteriorating the trade balance. This finding suggests that expansionary monetary policies, particularly those that increase money supply without corresponding increases in local production, may lead to a trade deficit by boosting imports.

Moreover, the study found that exchange rate depreciation significantly improves the trade balance in the long run, enhancing the competitiveness of Nigerian exports. However, when monetary expansion is combined with exchange rate depreciation, the outcome is a worsening of the trade balance. This is because while a weaker currency can improve export performance, excessive monetary expansion increases domestic demand for imports, leading to a severe trade deficit.

In conclusion, the study reveals the intricate interrelationship between monetary policy, exchange rates, and trade balance in Nigeria. Policymakers must carefully balance these macroeconomic tools to avoid exacerbating trade deficits. Specifically, while exchange rate depreciation can boost exports, it must be managed alongside disciplined monetary policies to prevent unsustainable increases in imports. The findings suggest that to achieve sustainable development, Nigeria must adopt a coordinated macroeconomic strategy that aligns monetary policy with exchange rate stability and export diversification.

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