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Assessment of the Effects of Monetary Policy Shocks from ECOWAS Member Countries to Nigeria

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Abstract

The paper evaluated the effects of monetary policy shocks from ECOWAS Member Countries to Nigeria using a combination of quarterly, annual time-series and panel data spanning from 1995–2021. The Standard Global Vector-Autoregressive (GVAR) Model of analysis was used to draw structural inference for the study using data on: consumer prices, international commodity prices (oil, agricultural raw material and metal ore), exchange rate, interest rate (short and long run), real output, money supply, and export diversification index. The result of the Impulse Response Function (IRF) revealed that shocks resulting from monetary policy transmission from the ECOWAS member Countries to Nigeria has diverse effects on Nigeria and is largely determined by the extent of monetary policy accommodative stance. The shock that may occur is likely to be country-specific because ECOWAS is an economic union that hardly has the foundation to share common economic or monetary risk. Additionally, the extent of trade flow between Nigeria and the rest of ECOWAS, determines the tendency that such shocks affect Nigeria. Finally, whether ECOWAS is a shock source, or a channel of transmission determines how much of an impact shocks from that region will have.

Keywords: monetary policy shocks, Ecowas Member Countries, Nigeria, Global VAR

1. Introduction

The inequalities in size, economic structure, levels of economic development, and monetary policy frameworks, pose some important challenges in creating an integrated Currency area for ECOWAS, (Eswar, 2020). Countries seek to have independent monetary policy because of the need to have a firm grip of exchange rate and interest rate which are critical to drive growth. In this situation, the option of monetary integration with other nations is seen as a deliberate decision made by the government of which the implications of such monetary integration to the domestic economy is taken into consideration. Where such a decision is made, simple rational economic principles suggest that such a decision must prioritize addressing one or more monetary issues, i.e., issues that the nation encounters when determining its monetary policy and that it is unable to address effectively on its own. Therefore, it is crucial to evaluate the progress of monetary integration in West Africa using a thorough analysis of the financial challenges that the region's countries face both separately and jointly.

To assess the Nigerian economy's susceptibility to shocks from the economies of ECOWAS member states, this paper emphasizes the growing diffusion of regional monetary policy shocks among nations because of rising financial globalization and integration. Given the connections between two groups of countries' financial aid, international capital flows, and trade interdependencies, the focus is on Nigeria's economy because of its susceptibility to monetary policy shocks coming from ECOWAS member countries and great free-market nations like France and the Euro Area. This argument is specifically motivated by Nigeria's position as the ECOWAS country with the strongest financial ties to the world financial system. We opted to assess how monetary policy shocks are transmitted while taking macroeconomic policy and investment factors into account. From a policy view, the design of Nigeria's domestic policy may become more difficult if the spillover effects of the global monetary policy shocks are not properly understood and successfully managed because they have the potential to disrupt capital flows and alter how much financial friction tightens or loosens. Additionally, when looking at investments, foreign investors should be curious to understand how these risks affect their portfolios as they seek diversification in developing countries like Nigeria.

West African countries, particularly Nigeria, Ghana, and Senegal, which are regarded as frontier markets of Sub-Saharan Africa, have seen growth in portfolio capital inflows in recent years as a result of monetary easing in industrialized countries and the diversification of the portfolios of investors from industrialized and emerging nations. Even though, most frontier markets in Sub-Saharan Africa were exempted from the difficulties that face emerging economies, changes in monetary indicators were observed after the capital withdrawal started by industrialized nations in May 2013. The Naira slightly depreciated and state bond yields rose in Nigeria following the initial round of the massive sale in May 2013. Ghana's currency also declined in value.

The dissemination of monetary policy decisions to ultimate goals is still insufficient as (Sodokin and Gammadigbe, 2013) argue that BCEAO leading rates do not influence the

trajectory of lending rates of commercial banks within WAEMU due to structural over-liquidity of the banking system and the uncompetitive structure of the WAEMU banking industry. In the case of Ghana, (Buchs and Mathisen, 2005) considered the lack of competitiveness of the banking sector as a handicap in steering monetary policy.

There are two main categories into which West Africa's financial problems can be divided, according to an analysis of the situation. The first group of problems includes those that can, in part, be resolved through national initiatives taken by each nation separately. These include having insufficient capacity or weakened monetary policy transmission channels. The second group concentrates on other, more complex problems like the independence of monetary authorities or world issues that need a supranational strategy to be effectively solved. This second category includes the operational flaws in the global financial system, the destabilizing effects of global capital flows, or the oversight of cross-border financial flows. The second category of issues mentioned above undoubtedly plays a significant role in determining the overall effectiveness of monetary policy in the current environment of globalization, where cross-currency exchange rates represent an essential component of economic competitiveness and performance for countries.

The paper evaluates and examines the scope and effects of non-trade shocks from ECOWAS member countries on Nigeria. The monetary shocks and the non-trade shocks are related. Cabo Verde, The Gambia, Ghana, Guinea, Liberia, Sierra Leone, and Nigeria are the only ECOWAS nations with independent monetary policies while Benin, Burkina Faso, Cote d'Ivoire, Guinea Bissau, Mali, Niger, Senegal, and Togo are among the nations without such policies. Specifically, the paper assesses the effects of monetary policy shocks from ECOWAS member countries to Nigeria. The remainder of the document is organized as follows: The relevant literature is reviewed in Sub-section 1.3, while data presentation and methodology are covered in Section 2.0. The empirical results and interpretations are discussed in Section 3.0, while section 4 draws conclusion and proffer recommendations for the paper.

1.1 Significance of the Study

The establishment of the ECOWAS is germane and significant to ensuring a free and smooth flow of trade in the sub-region. While the monetary union has its pros and cons, countries surrender their monetary policy independence to attain a higher configuration of monetary policy because of the expected benefits that can accrue to them in the likely events of joining the union. Assenting to such a significant monetary union, however, necessitates that nations like Nigeria conduct a country-specific analysis of the impact or cost-benefit analysis of joining or not joining the monetary union, including the implications for monetary policy and the attendant transmission of shocks (both positive and negative shocks) to the Nigerian economy.

1.2 Literature Review

Monetary policy shocks have received a lot of attention since the integration of countries within a specific region and the creation and adoption of the Euro in 2002 as the sole

currency of the 19-member European Monetary Union. The main element of the model used in this study is the interest rate channel of the monetary policy transmission mechanism. It highlights how monetary policy decisions made in another country may affect how monetary policy is transmitted to a domestic economy. This section outlines the conventional interest rate-based channel for domestic monetary policy transmission. It explains how shifts in the nominal money supply or short-term interest rates caused by policy have an impact on employment, inflation, and other real-world indicators.

The liquidity preference theory is the central idea of Keynesian monetary economics (Belke & Polleit, 2009). This theory holds that the demand for money is determined by price, or by the interaction of income and interest rate. According to Keynes, either the price of money should be directly or indirectly controlled by causing changes through real income in order to affect the demand for money. Theoretically, all other things being equal, a change in interest rates affects individual preferences for holding liquid (cash) and illiquid assets.

Keynesian monetary theory acknowledges the active role of money in the economy as it influences short-term economic activity, trade volume, financial intermediation levels, and its own price, or interest rate. (Romer, 2006) demonstrates that because money is endogenous, Keynesians have abandoned the use of the money supply as a tool for policy. As an alternative, the policy rate target is established and maintained by open market operations to keep interest rates near that level.

It is not new to study how changes in monetary policy are transmitted to developing nations and from one nation to another. According to the literature, several well-known financial and commercial channels, such as those for interest rates, foreign exchange, domestic credit, and asset prices are used by these shocks to enter these economies. The empirical literature has since flourished, largely using alternative modifications of widely accepted vector autoregressive (VAR) models to test the theoretical claim, with most shocks being transmitted internationally. As a result, key research questions and findings from a sample of the literature are presented.

In other to determine the extent of monetary policy shocks amongst ECOWAS member countries, (Fielding and Shields, 2001) used four variables in a typical Vector-Auto Regressive (VAR) model, namely: inflation, output growth, growth in monetary indicators, and external inflation to recognize price and output shocks for UEMOA. In all of ECOWAS, they found a strong connection between inflation shocks, the output correlation shocks, however, are not all equal. (Moses Tule, Augustine Ujunwa, and Ajilore Taiwo, 2019) examined whether monetary policy shocks from Nigeria are a significant source of macroeconomic fluctuations in WAMZ economies using the Global VAR (GVAR) Method and data from Nigeria and a subset of WAMZ countries between 1980 and 2016. They found that a sudden change in Nigeria's monetary policy would lower the value of the Naira relative to the US dollar, promote economic expansion, reduce inflation, and in the short-term, increases the country's money supply. They also found that currency depreciation, slow growth, and significant short-term inflationary effects are experienced in Ghana in a manner similar to Nigeria's monetary policy shocks. They therefore recommend that, in terms of

policy, the regional monetary authorities should cooperate to address the problem of how to stabilize the economy in the wake of shocks to the system brought on by Nigeria.

The GVAR model was also used by (Mohammed Tumala, Afees Salisu, Ngozi Atoi, and Baba, Yaaba, 2021) to track the transmission of monetary policy shocks from three significant sources of global financial and trade shocks (the US, Europe, and China) to the two largest emerging economies in Sub-Saharan Africa (SSA) (Nigeria and South Africa). According to the findings of the impulse response function, a tight monetary policy in the United States and the European Union controls prices in Nigeria while causing inflation in South Africa. Secondly, both the South African Rand and the Nigerian Naira are positively and sustainably impacted by the same policy shock. Finally, in comparison to similar policy decisions made in the EU, decisions made in China and the US have a greater impact on Nigeria's and South Africa's monetary policies.

In a similar vein, (Hoffmaister, A.W., Roldos, and Wickham, 1998) used a five-variable VAR model (terms of trade, the global interest rate, real exchange rate, output, and prices) to analyze changes in macroeconomic variables across nations in Sub-Saharan Africa. They discovered that these countries' macroeconomic fluctuations are primarily caused by external shocks, with the effects being particularly pronounced for the UEMOA countries. (Adebayo A. Kutu, and Harold Ngalawa, 2017) used the Panel Structural Vector Autoregressive (P-SVAR) Model from 1995 to 2016 to examine how monetary policy shocks affect industrial output in BRICS countries. They found that changes in exchange rates have the biggest impact on the industrial output of the BRICS countries. In their 2017 study, Jonathan O. Famoroti and Christian K. Tipoy studied the impact of monetary policy shocks on economic growth in the 14 (Fourteen) ECOWAS Member Countries using Panel Structural Vector Autoregressive (P-SVAR) Method over the period 1980–2017, and their findings indicate that external shocks significantly affect the stability and economic growth of ECOWAS.

(Oyenyinka S.O. and Lumengo B.B., 2021) examined the degree to which shocks to economic growth in South Africa and Nigeria spread to three regional organizations: the Economic Community of West African States (ECOWAS), Southern African Development Community (SADC), and Central African Economic and Monetary Union (CEMAC) (ECOWAS). This was done using the Factor-augmented Vector-autoregressive (FAVAR) model. The result showed that the trade route is effective in bringing growth from South Africa and Nigeria to the three regional blocs. With the exception of the financial channel between South Africa and the SADC region, no evidence of growth spillover from the financial channel was also found. The study recommends backing any initiative to boost trade on the continent, such as the African Continental Free Trade Area (AfCFTA).

Panel Structural Vector Autoregressive (P-SVAR) was used by (Famoroti, Jonathan Olusegun, and Omolade Adeleke, 2022) to examine the effects of monetary policy shocks on economic growth in 12 member nations of the Economic Community of West African States (ECOWAS) from 1980 to 2017. According to the findings, monetary policy changes have a significant impact on the overall level of prices but little on economic growth. The study also reveals that the exchange rate is consistently a crucial mechanism that profoundly affects the real

economy's variables. (Romain Houssa, 2006) discovered low positive and negative correlations between supply shocks in West African nations, indicating that these nations would struggle to cope with supply shocks if they joined forces to form a monetary union. He concluded from his study, which was based on Dynamic Factor (DF) models, that demand shocks are more comparable among the French-speaking countries in the region (WAEMU).

Despite some weak institutional challenges attributed to Nigeria, (Michael A. Akume, Abdurrahman Isik, and Moses O. Oduh, 2021) examined the potential for internationalization of the Naira in the quest for a common West African currency using data from 1995 to 2018. They found that greater levels of macroeconomic and financial development are required for the internalization of the naira in West Africa by using a two-stage currency internationalization modeling approach and pooled OLS regression (POLS). The reserve ratio of the Naira is consistently higher than that of the CFA franc, according to the results of the policy simulation, indicating that the Naira is a better reserve currency anchor for the proposed single currency in West Africa than the CFA franc.

Using the Auto-Regressive Distributed Lag (ARDL) model, (Goni, 1992), examined the extent to which Nigeria is likely to lose independent monetary policy by joining the ECOWAS monetary union. The research centered on the ECOWAS member states' diminished independence because of their monetary unionization. He concluded that Nigeria does not stand to lose much by giving up its independence from an ECOWAS-wide body in terms of monetary policy. Based on this premise, (Balolgun E. D., 2007) used data on WAMZ countries from 1987 to 2007 and a Dynamic Stochastic General Equilibrium (DSGE) Model to examine the monetary and macroeconomic stability perspective for joining a monetary union. The study concludes that, it would be preferable for ECOWAS member countries to give up their independence from the proposed regional monetary union arrangements under the right circumstances. The reviewed empirical evidence points to the ECOWAS region's dependence on imports and susceptibility to global shocks, in addition to the fact that monetary policy shocks in the region come from either the interest rate channel or the exchange rate channel. Nigeria can achieve stable monetary policy if all ECOWAS members share similar sources of shock and similar shock patterns. Such an investigation justifies the need for the study.

1.3 Statement of Hypothesis

Policymakers in countries that implements macroeconomic stabilization measures must consider how monetary policy shocks affect the output of the economy. The pathways by which shocks spread heavily influence decision-making in this field.

The research hypotheses driven by the paper’s specific objective is:

Ho1: There are no effects of monetary policy shocks from ECOWAS member countries to Nigeria.

1.4 Theoretical Framework

The Keynesian Monetary Theory, put forth by John Maynard Keynes, serves as the

theoretical foundation for this study. The theory highlights how monetary policy decisions made in one country may have an impact on how monetary policy is transmitted in a domestic economy and describes the typical interest rate-based channel for domestic monetary policy transmission.

The theory is based on the interest rate channel of monetary policy transmission mechanism's, which explains how changes in the short-term nominal interest rate or the nominal money stock brought on by policy have an effect on real variables like total output, inflation, and exchange rate. According to the traditional Keynesian theory, monetary tightening has the following effects on the real economy:

$$M \downarrow \Rightarrow i \uparrow \Rightarrow I \downarrow \Rightarrow Y \downarrow \quad \ldots\ldots (1)$$

where M↓ stands for contractionary monetary policy, which raises the cost of capital and real interest rates i↑, respectively. This in turn leads to a decrease in investment spending I↓, which in turn causes a decline in aggregate demand and a decrease in output Y↓. On the other hand, central banks could influence expansionary monetary policy M↑, by lowering the policy rate. Through a decline in long-term real interest rates i↓, this has an impact on the amount of liquidity in the economy, boosts investment I↑, and increases consumption of durable goods. Prices and overall output Y↑ increase in tandem with changes in aggregate demand. This explains how a shock to domestic monetary policy typically spreads.

2. Method

The aim of this study is formulated using the Global Vector Autoregressive (GVAR) method. Time series, panel data, and factor analysis techniques were all combined in this global macroeconomic modeling to tackle a variety of economic and financial issues, from risk management to policy analysis. The GVAR method was proposed by (Pesaran, Shuermann, and Weiner, 2004), and (S. Dees, F. di Mauro, M. Pesaran, L. Smith, 2007). The method has been widely used in studies by (Bussi ère, Matthieu & Saxena, Sweta C. & Tovar, Camilo E., 2012), (Galea & Lombardi, 2009), and (Vasishtha & Maier, 2013) on international shocks and their spillover effect among nations. They are particularly helpful for explaining how economic connections can amplify contagious shocks in the GVAR procedure. Equation 2 is an adaptation of the model specification from the condensed versions of (Smith & Galesi, 2017) and (Tumala et al, 2021). With a parsimonious lag order VAR-X (1,1), the vector autoregressive with exogenous variables (VAR-X) is defined as:

$$z_{it} = \Phi_i z_{i,t-1} + \Lambda_{i0}\overline{z_{it}} + \Lambda_{i1}\overline{z}_{\hat{\imath},t-1} + \varepsilon_{it,} \quad \ldots.(2)$$

where: (i) represents the set of fifteen (15) member countries of ECOWAS, such that:

$$i = 0,1,2 \ldots \ldots 14, \quad \ldots. (3)$$

and (0) is the country of interest, Nigeria, while others are either the source or channel of shock transmission; (z_{it}) is (vector) set of $(k_i x 1)$ domestic variables, example money supply (MS), inflation (Dp), real exchange rate (Ep), real output (y), short and long term interest rates (R and L), export-output ratio (TRD), and export diversification index (DVRS);

while $(\overline{z}_{it})$ is vector $(\overline{k}_i x1)$ foreign variables, the euro area short-and long-run interest rate, real output, exchange rate, inflation, export-output ratio, and diversification; and global variables such as international commodity prices: crude oil (POIL), agricultural raw material (PARM), and metal ore (PMOM). Therefore, in its simply form (z_{it}) and $(\overline{z}_{it})$ could be defined as:

$$z_{it}: (k_i x1) \sim \text{vector domestic variables} \quad \ldots.(4)$$

$$\overline{z}_{it}: (\overline{k}_i x1) \sim \text{vector foreign variables} \quad \ldots.(5)$$

where:

$$\overline{z}_{it} = \sum_{j=0}^{N} w_{ij} z_{jt}\,, w_{ii} = 0, \quad \ldots.(6)$$

Given that the matrix $(w_{ij}),(j = 0,1 \ldots . N)$ is a set of weights for ECOWAS countries computed with GDP, PPP (current international USD) using the average (1995-2021), which sums to unity as in equation (7).

$$\overline{z}_{it} = \sum_{j=0}^{N} w_{ii} = 1, \quad \ldots.(7)$$

While, (ε_{it}) captures the weakly cross-sectionally correlated serially uncorrelated country-specific idiosyncratic shocks such that:

$$(\overline{\varepsilon}_{it}) = \sum_{j=0}^{N} w_{ii}\, \varepsilon_{jt} \xrightarrow{p} 0, \text{ as N} \to \infty \quad \ldots.(8)$$

where: $\left[\xrightarrow{p}\right]$ represents probabilistic convergence.

The interaction between the domestic and foreign variables leads to the following domestic-foreign variable interaction: (GVAR) can be calculated in reduced form using the following recoverable parameters:

$$z_{it} = \begin{pmatrix} z_{it} \\ \Delta p_{it} \\ s \\ E_p \\ Ms \\ T_{rd} \\ D_{vrs} \end{pmatrix}, \quad \overline{z}_{it} = \begin{pmatrix} \overline{z}_{it} \\ \Delta \overline{p}_{it} \\ s \\ \overline{E}_p \\ \overline{Ms} \\ \overline{T}_{rd} \\ \overline{D}_{vrs} \end{pmatrix} \quad \ldots.(9)$$

Although all the variables were defined as before, the following domestic identities held in terms of computation:

$$y_{it}=\log\left(\frac{\mathrm{GDP}_{it}}{CPI_{it}}\right) \quad \ldots (10)$$

$$\Delta p_{it} = p_{it} - p_{it-1}, p_{it} = log(CPI_{it}) \quad \ldots (11)$$

$$S_{it} = 0.25\, log\left(1+\frac{R}{100}\right) \quad \ldots (12)$$

(Δp) represents changes in the consumer price index (CPI) is the rate of inflation, GDP is nominal gross domestic output, while (R) denotes the annualized short-term interest rate. In terms of foreign variables, the following identities hold:

$$\overline{y}_{it} = \sum_{j=0}^{N} w_{ij} y_{jt} \quad \ldots . (13)$$

$$\overline{p}_{it} = \sum_{j=0}^{N} w_{ij} \Delta p_{jt} \quad \ldots . (14)$$

$$\overline{s}_{it} = \sum_{j=0}^{N} w_{ij} s_{jt} \quad \ldots . (15)$$

The GVAR modeling approach entails combining the components of country-specific VARX estimation as well as incorporating the VARX for each country into a global model.

2.1 Data

In the model covering the period from 1995 to 2021, annual and quarterly data were combined for estimation purposes. The quarterly component served as the estimation database, and the annual data were used to build the input-output trade matrix. The final model was estimated as the interaction between the flow variable (given a country-specific data code) and the country-specific variables. The matrix, a diagonal matrix, was computed with the global trade flow (later transformed into the model's flow variable). We performed three data transformations before estimating the model. First, the missing observations needed to be nowcast, especially in the Francophone West African nations. Second, the long-term interest rate for ECOWAS countries was calculated using HP-filter, and the input-output matrix was created using global trade flows, with an emphasis on ECOWAS-Global Trade flow. The real exchange rate variable was finally based on the nominal exchange rates of the ECOWAS, the Eurozone, and France in relation to the price ratio between the United States and the country or group of countries.

Consumer Price Index (Dp), global commodity prices (oil (Poil), agricultural raw materials (Parm), and metal ore (Pmom)), exchange rates (ep), long (lr)- and short (r)-term interest rates, real output (y), money supply (eq), and the export diversification index (trd) were used

for the analysis. Because the desired frequency of the data series could not be obtained, data series were interpolated to quarterly series using the Chow and Lin (1971) regression-based interpolation method.

2.2 Trace of Shocks

Since ECOWAS is an economic union, the shocks are genuine ones. The reactions, however, go beyond actual shocks and financial reactions. Thus, there are three main variables: Nigeria, ECOWAS (comprised of all fifteen members), and the world economy.

3. Results

3.1 Unit Roots and Lag Selection Criteria

We used the weighted symmetric-ADF unit root test developed by (Park and Fuller, 1995) to assess the stationary properties of the model variables because of its foundation in the stationary autoregressive process's ability to reverse to its mean.

Table 1. Unit Root test for domestic variables at the 5% Significance Level

Domestic	Statistic	Cri. Value	GHANA	GUINEA	G. BISSAU	LIBERIA	MALI	NIGER	NIGERIA	SENEGAL	S. LEONE	TOGO
y (with T)	ADF	-3.45	-1.54619	-1.46135	-1.56682	-3.4115	-1.59305	-0.85455	-0.85673	-1.73987	-2.15792	-0.46829
y (no T)	ADF	-2.89	1.902449	1.253272	0.440754	-3.9	-2.48373	2.515549	-0.79735	-0.29132	-0.18888	0.920766
Dy	ADF	-2.89	-2.31502	-2.82254	-3.87927	-2.70628	-3.62879	-3.74169	-2.93951	-3.28005	-3.24192	-2.57035
Dp (with T)	ADF	-3.45	-3.36852	-2.16644	-1.97524	-1.23566	-4.91285	-5.17445	-8.50771	-4.2023	-3.53196	-3.46602
Dp (no T)	ADF	-2.89	-3.59721	-1.21106	-2.37745	-1.73363	-5.10817	-5.27796	-9.05685	-4.1299	-1.97225	-3.51506
DDDp	ADF	-2.89	-9.91816	-6.91162	-12.4617	-7.19025	-7.93496	-6.67881	-9.19934	-7.57435	-6.44938	-7.55684
eq (with T	ADF	-3.45	1.490951	-2.4303	-1.78596	-2.75774	-0.88279	-0.84803	-1.87223	-2.0259	-1.5791	-2.13395
eq (no T)	ADF	-2.89	3.292324	-0.42057	-0.55616	-0.65701	-1.02174	3.116347	1.46212	1.118639	2.705108	0.494163
Deq	ADF	-2.89	-2.65374	-3.86026	-3.76123	-2.08286	-5.1545	-3.44055	-2.82914	-2.90672	-3.03982	-3.18496
ep (with T)	ADF	-3.45	-1.50817	-4.80439	-3.5298	-1.92658	-2.35564	-2.03074	-1.81917	-2.29444	-1.97024	-2.14846
ep (no T)	ADF	-2.89	-1.21455	-5.24808	-3.36372	-1.7638	-1.96167	-1.75505	-1.7244	-2.25577	-1.49963	-1.59493
Dep	ADF	-2.89	-3.19031	-3.05834	-3.63029	-3.15659	-2.98775	-2.62318	-3.23331	-2.86883	-2.49709	-2.85271
r (with T)	ADF	-3.45	-1.65128	-2.7685	-1.60721	-2.59391	-1.60721	-1.60721	-2.08532	-1.60721	-2.12389	-1.60721
r (no T	ADF	-2.89	-1.53851	-2.68548	-0.96304	-2.38577	-0.96304	-0.96304	-1.96379	-0.96304	-1.20213	-0.96304
Dr	ADF	-2.89	-5.31717	-9.16342	-3.33707	-10.5686	-3.33707	-3.33707	-3.90433	-3.33707	-7.7909	-3.33707
lr (with T)	ADF	-3.45	-5.70608	-9.70633	-1.49217	-4.3255	-3.7472	-3.7472	-2.8555	-3.7472	-4.608	-3.7472
lr (no T)	ADF	-2.89	-6.42597	-5.87712	-5.01443	-4.83388	-4.9699	-4.9699	-0.3432	-4.9699	0.059296	-4.9699
Dlr	ADF	-2.89	-4.51115	-3.09584	-1.76368	-6.18828	-1.76525	-1.76525	-4.45883	-1.76525	-3.91137	-1.76525
trd (with T)	ADF	-3.45	-1.7653	-0.7598	-1.45223	-1.3368	-1.92436	-1.144	-1.66653	-2.25301	-1.79934	-1.53775
trd (no T)	ADF	-2.89	-1.83977	0.290271	-1.0577	-1.50176	-2.23043	-1.22482	-0.0097	-2.24972	-0.19113	-1.36435
Dtrd	ADF	-2.89	-3.77839	-1.75236	-4.8815	-2.94791	-4.23706	-3.47674	-4.75786	-4.29645	-3.27942	-3.81634
dvrs (with T)	ADF	-3.45	-1.80843	-1.81245	-2.84145	-2.09488	-2.1943	-2.40809	-0.49306	-1.52413	-1.53612	-3.84692
dvrs (no T)	ADF	-2.89	-1.87353	-2.02609	-1.95073	-1.56082	-1.31516	-1.49054	-1.31182	-2.3817	-1.15194	-1.61039
Ddvrs	ADF	-2.89	-4.52945	-4.63497	-5.08644	-4.39052	-4.27028	-4.8457	-3.44314	-3.66381	-4.07869	-4.34112

Based on the type of the data's variance, the convergence of the G-VAR reliably behaves itself. As a result, the model finds a suitable mean reverting state in the variables before the estimation.

Table 2. Unit Root Test for Global Variables at the 5% level of Significance

Global Variables	Test	Critical Value	Statistic
poil (with trend)	ADF	-3.45	-1.68355831
poil (no trend)	ADF	-2.89	-1.61240259
Dpoil	ADF	-2.89	-8.39940639
parm (with trend)	ADF	-3.45	-2.45559356
parm (no trend)	ADF	-2.89	-1.63299812
Dparm	ADF	-2.89	-6.37135447
pmom (with trend)	ADF	-3.45	-1.82187788
pmom (no trend)	ADF	-2.89	-1.17175031
Dpmom	ADF	-2.89	-5.71728835

Source: Authors Computation using Matlab

The variables are typically both trend and non-trend-stationary, as shown in the tables above (after one-period difference). As a result, it can be inferred that all the applied variables are I(1) processes, ensuring that they don't deviate for a very long time before returning to their means. The unit root test is applied to domestic variables in Tables 1 such as real output, money supply, short- and long-term interest rates, inflation, exchange rate, trade, and diversification index while the unit root test is applied to foreign variables (commodity prices of crude oil, agricultural raw material, and iron ore) in Table 2.

The model initially suggests an infinite lag order but leaves room for actual model selection considering country-specific quirks.

Table 3. Optimal Autoregressive (p) and Distributed Lag (q) Length

Country/Test Statistics	p	q	AIC	SBC	logLik	F-Value	Fcrit_0.05	y	Dp	eq	ep	r	lr	trd	dvrs
BENIN	1	1	1421.984	1102.009	1677.984	F(4,54)	2.54	2.35	7.87	1.74	2.22	8.70	3.80	8.56	8.72
BENIN	2	1	1721.622	1321.653	2041.622	F(4,46)	2.57	6.97	12.69	11.24	8.23	6.33	2.45	8.80	18.62
BURKINA FASO	1	1	1560.558	1240.583	1816.558	F(4,54)	2.54	4.89	6.24	7.75	8.92	6.63	6.28	4.85	8.88
BURKINA FASO	2	1	1793.928	1393.959	2113.928	F(4,46)	2.57	8.71	5.40	10.24	10.45	2.51	11.98	4.66	12.53
CABO VERDE	1	1	1489.03	1169.055	1745.03	F(4,54)	2.54	6.97	7.04	11.24	6.56	9.77	25.35	11.95	14.37
CABO VERDE	2	1	1742.003	1342.033	2062.003	F(4,46)	2.57	10.46	7.50	9.93	11.58	17.40	6.15	8.60	17.56
COTE D'IVOIRE	1	1	1186.071	866.0949	1442.071	F(4,54)	2.54	8.19	7.67	1.65	8.85	8.24	6.56	8.36	19.29
COTE D'IVOIRE	2	1	1389.726	989.7564	1709.726	F(4,46)	2.57	7.15	8.45	9.90	11.47	11.75	6.39	19.54	25.49
EURO	1	1	2327.867	2007.891	2583.867	F(4,54)	2.54	5.73	8.60	5.78	12.22	1.62	14.00	9.63	9.16
EURO	2	1	2341.095	1941.125	2661.095	F(4,46)	2.57	12.77	24.67	12.91	13.66	6.27	11.58	13.65	13.37
FRANCE	1	1	2885.467	2565.492	3141.467	F(4,54)	2.54	7.24	5.63	13.01	3.21	14.22	11.19	12.79	4.72
FRANCE	2	1	3071.339	2671.37	3391.339	F(4,46)	2.57	6.11	11.51	9.49	4.71	11.68	7.22	6.65	8.72
GAMBIA	1	1	1296.101	976.1253	1552.101	F(4,54)	2.54	19.95	11.17	7.72	12.72	12.87	9.34	10.19	9.95
GAMBIA	2	1	1561.988	1162.019	1881.988	F(4,46)	2.57	19.07	21.08	6.16	13.15	20.88	14.40	8.30	16.90
GHANA	1	1	1346.204	1026.229	1602.204	F(4,54)	2.54	6.78	12.22	9.66	17.88	8.90	9.11	7.74	13.11
GHANA	2	1	1672.766	1272.796	1992.766	F(4,46)	2.57	10.72	21.36	12.04	26.54	9.27	6.25	8.29	17.80
GUINEA	1	1	683.007	363.0313	939.007	F(4,54)	2.54	16.14	4.58	16.25	2.79	6.29	5.72	25.28	23.16
GUINEA	2	1	917.1495	517.18	1237.15	F(4,46)	2.57	26.08	7.17	16.09	7.33	16.25	10.08	22.71	32.95
GUINEA BISSAU	1	1	962.2313	642.2557	1218.231	F(4,54)	2.54	4.04	13.70	3.27	3.08	8.73	7.50	7.11	1.06
GUINEA BISSAU	2	1	1234.791	834.8218	1554.791	F(4,46)	2.57	8.15	18.57	9.17	3.42	10.17	2.06	10.64	10.69
LIBERIA	1	1	643.8704	323.8948	899.8704	F(4,54)	2.54	8.29	2.42	14.50	30.78	19.24	2.69	15.59	4.94
LIBERIA	2	1	908.0471	508.0775	1228.047	F(4,46)	2.57	18.69	3.92	5.37	24.47	30.34	1.25	22.00	5.81
MALI	1	1	1327.683	1007.708	1583.683	F(4,54)	2.54	8.08	10.68	4.96	17.74	3.19	5.55	14.63	10.83
MALI	2	1	1614.835	1214.866	1934.835	F(4,46)	2.57	9.94	10.22	11.34	13.97	3.56	2.68	10.31	24.65
NIGER	1	1	1265.718	945.7424	1521.718	F(4,54)	2.54	19.26	7.80	11.13	2.90	8.13	7.52	1.90	10.70
NIGER	2	1	1528.73	1128.76	1848.73	F(4,46)	2.57	25.83	14.10	20.36	4.53	11.43	9.44	3.79	22.05
NIGERIA	1	1	887.0147	567.039	1143.015	F(4,54)	2.54	5.90	9.38	6.39	10.04	9.67	13.65	10.41	5.70
NIGERIA	2	1	1133.882	733.9126	1453.882	F(4,46)	2.57	10.12	19.89	10.22	9.54	9.06	7.65	10.91	11.38
SENEGAL	1	1	1335.41	1015.434	1591.41	F(4,54)	2.54	7.57	6.86	5.38	1.17	5.24	11.97	5.79	9.00
SENEGAL	2	1	1614.613	1214.644	1934.613	F(4,46)	2.57	7.61	4.91	13.66	5.08	8.25	4.44	5.01	19.08
SIERRA LEONE	1	1	468.8406	148.8649	724.8406	F(4,54)	2.54	10.53	2.28	12.33	6.98	14.34	5.52	5.41	11.20
SIERRA LEONE	2	1	692.0771	292.1075	1012.077	F(4,46)	2.57	15.82	6.20	10.05	4.26	14.76	4.70	8.78	14.94
TOGO	1	1	1190.069	870.0935	1446.069	F(4,54)	2.54	15.35	7.90	6.34	16.08	9.89	10.42	21.10	15.91
TOGO	2	1	1493.958	1093.989	1813.958	F(4,46)	2.57	21.23	13.73	7.00	10.84	10.79	4.66	23.28	17.47

Source: Authors Computation using Matlab

Note: p=lag of domestic variables, q= lag of foreign variables

The actual estimation was based on a GVAR 1(1) - first order difference and a first-order ideal lag length, as shown in table 3. The table also offers details on the ideal distributed lag (q) and autoregressive (p) lengths. Additionally, it displays the selection criteria (AIC and SBC), the loglikelihood (logLik), and the countries (including the dominant countries) for each variable (y, Dp, ms, ep, r, and lr) in the model.

We use the rest of the world (ROW) represented by the USA interest rate, ECOWAS, EURO area (excluding France), and France as the dominant countries, which also correspond to the dominant countries' exogenous variables in the model, in terms of the choice of the dominant country. Because the model estimator/software (MATLAB) can handle a multi-country dominant-specification, it is possible for the model to run a system of multiple constraints and shocks at once, so the selection of multiple dominant units does not present estimation challenges.

3.2 Input-Output Matrix (IOM)

To assess the effects of monetary policy shock from ECOWAS to Nigeria, the effects and magnitude of the three adverse shocks, which were introduced simultaneously, are first estimated, along with the trade input-output matrix and the Nigerian economy. The euro area as a whole, the fifteen-member ECOWAS states, including Nigeria, and some macroeconomic fundamentals are thought to have caused the first shock, which was anticipated to come from primary commodity prices (specifically real exchange rate, price, and monetary policy).

The matrix is a twenty-four-loop matrix with 6,600,666 interactions among 17 countries over the course of twenty-six (26) years. The trade IOM matrix is calculated by dividing each nation's export and import volume by the sum of all nations' trade. Such matrices come in two varieties. While the second matrix is dynamic, the first matrix is fixed. The dynamic component is based on time-variant flow, and the static or fixed matrix is computed using fixed-time flow. The goal in both situations is to enable the transmission of impulses between trading partners/regions given their respective trade weights, which interact with each economy's size based on average GDP and purchasing power parity (PPP) in recent global trade.

Table 4. Upper Loop of Fixed Trade Input-Output-Metrix for ECOWAS Countries

country	Benin	Burkina Faso	Cabo Verde	Cote D'ivoire	Gambia	Ghana	Guinea	Gambia	Liberia	Mali	Niger	Nigeria	Senegal	Sierra Leone	Togo
Benin	0	0.003	0.000	0.008	0.000	0.010	0.000	0.001	0.000	0.000	0.022	0.001	0.014	0.000	0.049
Burkina Faso	0.001	0	0.000	0.020	0.000	0.005	0.000	0.000	0.000	0.004	0.008	0.004	0.005	0.000	0.012
Cabo Verde	0.003	0.000	0	0.000	0.000	0.000	0.000	0.003	0.054	0.000	0.000	0.000	0.002	0.000	0.000
Cote D'ivoire	0.054	0.224	0.011	0	0.000	0.059	0.105	0.015	0.000	0.286	0.102	0.062	0.040	0.196	0.057
Gambia	0.000	0.000	0.000	0.002	0	0.000	0.002	0.000	0.001	0.000	0.000	0.000	0.008	0.000	0.000
Ghana	0.047	0.024	0.000	0.021	0.230	0	0.000	0.000	0.001	0.000	0.031	0.059	0.001	0.001	0.031
Guinea	0.000	0.000	0.001	0.014	0.001	0.000	0	0.000	0.000	0.000	0.000	0.001	0.006	0.000	0.000
Gambia	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000	0.000	0.004	0.000	0.000
Liberia	0.000	0.000	0.002	0.005	0.000	0.000	0.000	0.000	0	0.000	0.000	0.000	0.000	0.013	0.000
Mali	0.000	0.005	0.000	0.032	0.002	0.000	0.000	0.000	0.000	0	0.00252	0.000	0.043	0.000	0.001
Niger	0.004	0.004	0.000	0.007	0.000	0.006	0.001	0.000	0.002	0.001	0	0.008	0.001	0.000	0.004
Nigeria	0.011	0.063	0.000	0.094	0.005	0.234	0.012	0.000	0.000	0.004	0.166574	0	0.091	0.069	0.048
Senegal	0.045	0.014	0.014	0.013	0.124	0.001	0.009	0.038	0.001	0.085	0.002624	0.013	0	0.018	0.009
Sierra Leone	0.000	0.000	0.000	0.004	0.003	0.000	0.001	0.000	0.000	0.000	0.000	0.001	0.002	0	0.000
Togo	0.006	0.025	0.000	0.008	0.001	0.005	0.000	0.000	0.000	0.001	0.006995	0.002	0.005	0.000	0

Source: Authors Computation using Matlab

The interaction between the annual flow variable and the quarterly series is shown in Table 4's upper loop (specimen) of the input-output matrix (IOM). The output is guaranteed to be non-explosive, and the global interaction is brought back to a point of unity's convergence. With a country-specific unit vector at the vertical axis of each of the twenty loops, it has a zero vector at the major diagonal of each loop.

3.3 Cointegration Test

We adapted the methods outlined in Dees et al. (2007) to test for the null of no cointegration between the relevant model variables and the cointegration alternative using the augmented VARX (Pesaran, Shin, and Smith, 2000).

Table 5. Cointegrating Relations in Country-Specific Models

Countries	**BN**	**BF**	**CV**	**CD**	**EU**	**FR**	**GA**	**GH**	**GU**	**LB**	**MA**	**NG**	**NGR**	**SE**	**SL**	**TG**
Domestic	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Foreign	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cointegration	2	5	2	3	2	2	2	2	3	4	2	3	3	2	4	2

Source: Authors Computation using MATLAB

We estimated the cointegrating VAR model using appropriate lag order selection criteria (AIC), as shown in Table 3, where the AIC chooses a maximum lag of 2 for domestic variables and 1 for external variables. By doing so, we can ascertain the rank of the cointegrating space for each county in the model.

According to the results, Cote d'lvoire (CD), Guinea (GU), Niger (NIG), and Nigeria (NGR), have 3 cointegrating relations, while most countries have 2 cointegrating relations. Sierra Leone (SL) and Liberia (LB) have 4 cointegrating relations, while Burkina Faso has the highest cointegrating vector of 5. The cointegration test indicates that there are long-term

relationships between the domestic and foreign variables.

3.4 Estimates of the Individual Vector Error Correction (VECMX) Model and Residual Serial Correlation

Table 6 displays the results for the single shock correlation for each individual country model. A low correlation indicates that the GVAR is successful in capturing the shared effects underlying the endogenous variables.

Table 6. Residual Serial Correlation Result

	BN	BF	CV	CD	ER	FR	GAM	GH	GUI	GB	LB	ML	NIG	NGR	SEN	SL	TG
	F(4,64)	**F(4,61)**	**F(4,64)**	**F(4,63)**	**F(4,64)**	**F(4,64)**	**F(4,64)**	**F(4,64)**	**F(4,63)**	**F(4,64)**	**F(4,62)**	**F(4,64)**	**F(4,63)**	**F(4,63)**	**F(4,64)**	**F(4,62)**	**F(4,64)**
Fcrit_0.05	**2.515**	**2.523**	**2.515**	**2.518**	**2.515**	**2.515**	**2.515**	**2.515**	**2.518**	**2.515**	**2.520**	**2.515**	**2.518**	**2.518**	**2.515**	**2.520**	**2.515**
y	2.14	3.05	4.95	4.75	1.71	3.00	6.56	5.81	12.22	5.11	4.13	3.25	11.17	6.36	1.58	4.74	6.26
Dp	3.35	3.91	4.59	5.91	3.54	3.52	6.97	8.10	0.57	13.34	4.45	3.95	5.67	2.49	1.75	0.76	3.69
eq	2.87	3.09	9.70	1.31	1.89	3.85	6.61	4.64	7.17	4.51	3.69	13.22	8.20	3.13	4.60	2.75	5.18
ep	0.86	4.25	6.32	3.22	3.36	4.37	6.12	5.92	3.55	2.54	10.93	3.79	6.30	6.72	4.04	3.21	10.62
r	4.32	1.87	16.61	4.64	1.30	7.70	5.74	5.18	2.13	4.16	4.97	2.31	7.66	1.62	5.50	7.39	4.07
lr	0.64	12.30	2.88	5.36	1.11	14.57	7.93	3.12	9.16	0.77	1.14	1.57	11.14	6.89	4.93	3.91	2.64
trd	7.25	3.39	7.09	21.18	3.61	7.90	5.00	4.55	15.98	15.83	12.53	7.77	1.30	7.30	1.91	2.25	8.68
dvrs	15.42	6.82	7.38	18.03	2.65	1.97	3.81	7.74	19.77	0.83	5.09	13.53	7.89	3.01	11.90	4.17	11.11

Source: Authors Computation using MATLAB

The real GDP growth and exchange rate in Nigeria have quite high cross-section correlations of 6% and 6%, respectively, as shown by the data in Table 6. This suggests a strong connection between the exchange rate and the expansion of output. The cross-section correlations in Nigeria between the short-term interest rate and inflation are only 2% and 1%, compared to 3% and 1% for the money supply and trade diversification, respectively. However, the cross-section correlation between real GDP growth and exchange rate rises as we move from level to first difference.

3.5 Exogeneity Test

The model presupposes that the foreign variables are only marginally exogenous with regard to the long run restrictions for the nation-specific VAR-X models. The weak exogeneity assumption for cointegration between the foreign and domestic variables implies no long run feedback or trade implications from the domestic to the foreign variables, without necessarily excluding lagged short-run feedback between the two sets of variables.

The results are presented in Table 7, which shows that the null of the exogeneity is not rejected at 5% level of significance, indicating that the variables are only indirectly exogenous and that the model's reliability and convergence requirements have been met.

Table 7. Weakly exogeneity Test of the Domestic and Foreign Variables

Country	F test	Fcrit_0.05	ys	Dps	eqs	eps	rs	lrs	trds	dvrss	poil	parm	pmom
BENIN	F(2,67)	3.133762	0.456737	1.758436	1.294748	1.275971	1.196303	0.147574	0.193937	1.023386	0.973135	1.137696	3.026973
BURKINA FASO	F(5,64)	2.358318	1.565371	1.355378	1.853769	0.982727	1.05973	0.656041	0.539577	0.188228	0.336027	2.522901	0.54227
CABO VERDE	F(2,67)	3.133762	0.207117	0.606818	3.659862	0.531864	2.327269	0.59003	0.921127	1.099774	0.259254	1.924024	4.009466
COTE D'IVOIRE	F(3,66)	2.743711	0.425518	0.763314	0.60411	0.301883	1.088478	0.489648	3.418304	1.065316	0.820342	2.251864	1.73982
EURO	F(2,55)	3.164993	1.15343	7.103266	0.514519	3.330105	1.308151	0.056227	0.427501	1.774453	0.363623	1.078373	0.385137
FRANCE	F(2,67)	3.133762	3.082361	1.655838	0.648976	0.275592	0.76165	2.334487	2.298453	0.051375	1.327826	0.649098	0.535499
GAMBIA	F(2,67)	3.133762	0.573712	0.592063	0.319029	0.126345	0.808183	0.428832	0.83071	0.185302	0.365238	0.141139	6.176122
GHANA	F(2,67)	3.133762	0.207966	1.061669	0.231775	0.1942	0.339716	0.334057	0.283035	0.221227	0.416856	0.163614	1.890148
GUINEA	F(3,66)	2.743711	0.925001	1.155792	0.257877	0.004316	1.15239	1.493554	0.437549	1.254448	1.175426	0.576975	1.249881
GUINEA BISSAU	F(2,67)	3.133762	0.591324	1.482127	1.752895	1.113851	0.884421	4.65918	0.505868	0.758757	0.025885	0.806509	0.28333
LIBERIA	F(4,65)	2.51304	0.20076	1.444406	0.48443	1.462295	1.648176	0.615365	0.53242	1.167165	0.290149	1.387863	1.186274
MALI	F(2,67)	3.133762	0.746211	0.617676	0.501284	0.49094	3.208817	0.149303	0.002042	0.040648	0.731693	0.990674	0.743123
NIGER	F(3,66)	2.743711	0.574224	0.90753	1.060563	0.671548	1.340891	0.09696	0.750602	0.26386	0.234094	0.925055	1.247581
NIGERIA	F(3,66)	2.743711	1.125041	1.037936	0.167261	1.329178	0.422084	0.637182	1.09276	0.106297	0.754408	0.937368	0.370472
SENEGAL	F(2,67)	3.133762	1.084962	1.390218	0.673127	0.2539	0.549554	0.408209	0.616563	0.10237	0.062532	1.034092	0.159185
SIERRA LEONE	F(4,65)	2.51304	0.28033	0.430065	0.128057	0.610086	0.813661	1.261628	0.527707	0.178877	0.547507	1.110361	0.861982
TOGO	F(2,67)	3.133762	0.061546	2.90175	0.0692	0.016774	0.177312	0.508027	1.589713	0.389481	0.357424	0.945036	1.492431

Source: Authors computation using MATLAB.: Weak Exogeneity at the 5% Significance Level

3.6 Analysis of shock – Impulse Response Function

To determine how shocks are transmitted from ECOWAS member countries to Nigeria, we focus on the responses of the four endogenous variables in the model to the unexpected shocks to the country's monetary policy. We predict that for ECOWAS countries (isolating the first effects of monetary integration), shocks will be transmitted through trade (second round effect), whereas the effects on monetary policy are anticipated to take longer, especially for the WAMZ and Cabo Verde countries that have not yet implemented any monetary union. Typically, the nature of each shock whether it be monetary, trade, or a global exogenous variable like commodity prices determines its effects and magnitude to a large extent.

3.6.1 ECOWAS as Transmission Channel- Shocks to Primary Commodity Prices

This section examines how changes in global factors, such as the price of crude oil, agricultural raw materials, and iron ore, impact ECOWAS members. As was already mentioned, these shocks are instructive because they highlight country-specific vulnerabilities and the propensity for such effects to spread to Nigeria. We investigate how a favorable shock would affect world oil prices in Figures 1.

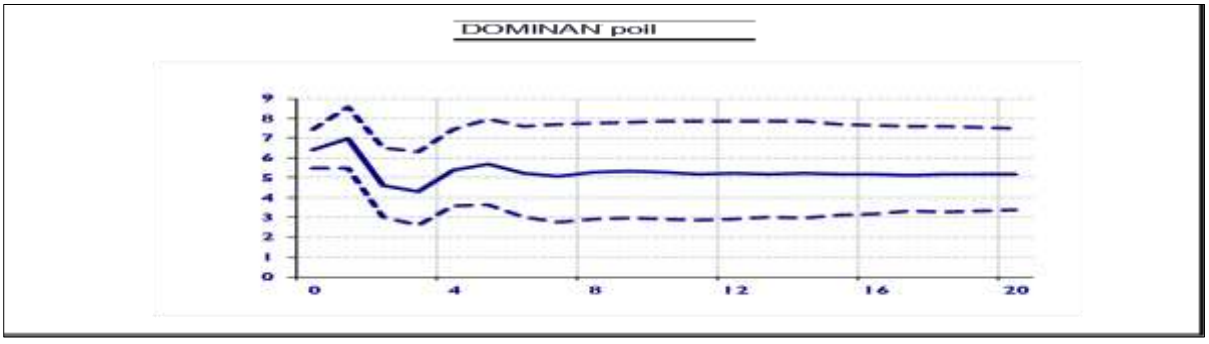

Figure 1. A positive Shock to International Prices of Crude Oil

3.6.1.1 Real Output Effect of Oil Price Shock

Although it continued to be generally positive, a positive shock to the price of oil initially drives the price up by 7% before falling sharply after the second quarter. It bounces back once more After the third quarter, before stabilizing just above 5%.

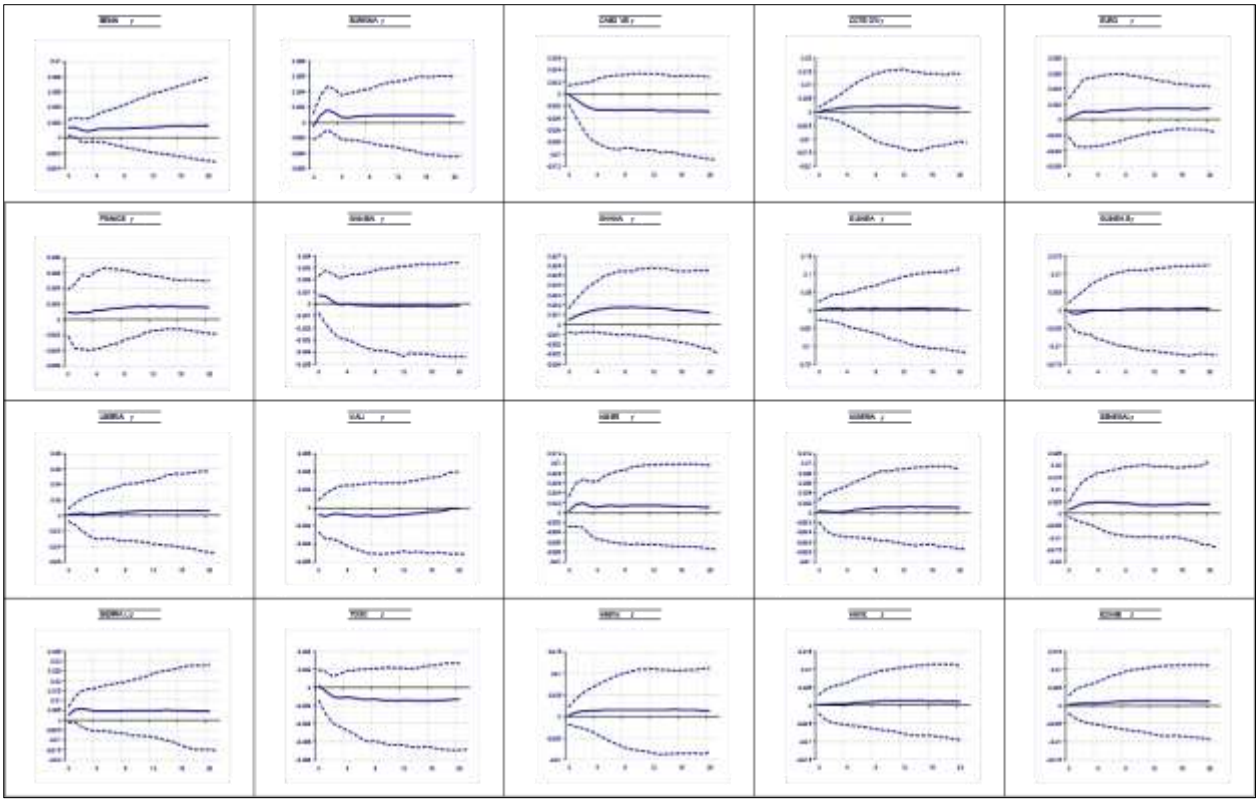

Figure 2. ECOWAS Country-Specific Effects of the Movement in Oil Prices

For each of the ECOWAS nations, Figure 2 shows the results of the change in oil prices depicted in Figure 1 above. Except for Gambia, Mali, Togo, Gabon, and Guinea, all of the ECOWAS countries experienced a decline in real output during the first four quarters. However, there was a general increase in output at the subregional level, with WAEMU benefiting most while Ghana dominated at the national level.

3.6.1.2 Commodity Price Effect

The second impact of the change in the global oil price caused by a favorable shock to the oil price is depicted using two different charts. Figure 2 illustrates how it affects the prices of agricultural raw materials and iron ore as well as other commodities. It also has an impact on exports, and it may force some nations to turn their focus from export concentration to export diversification. However, the effects on export diversification depend on at least two factors: (a) whether an economy is affected negatively or positively; and (b) whether an economy is intent in the economic axiom that "Good things endure forever, while bad things are transient" also known as the resource curse.

In the first scenario (case a), a country's response could be unclear, regardless of whether it is

negatively or positively impacted. Theoretically, countries that are negatively impacted are expected to work toward diversification more likely, while a country caught in the resource curse is expected to focus heavily on diversification if the shock creates a booming industry. In the latter scenario (case b), nations affected by the resource curse or the Dutch disease may also fall victim to the fallacy that booms last forever while busts are fleeting. If that occurs and the shock sparks a thriving industry or causes a depression, it might not encourage the economy to take proactive measures. They will consider the current downturn to be a passing occurrence that will pass eventually, allowing the cycle to restart with the boom era.

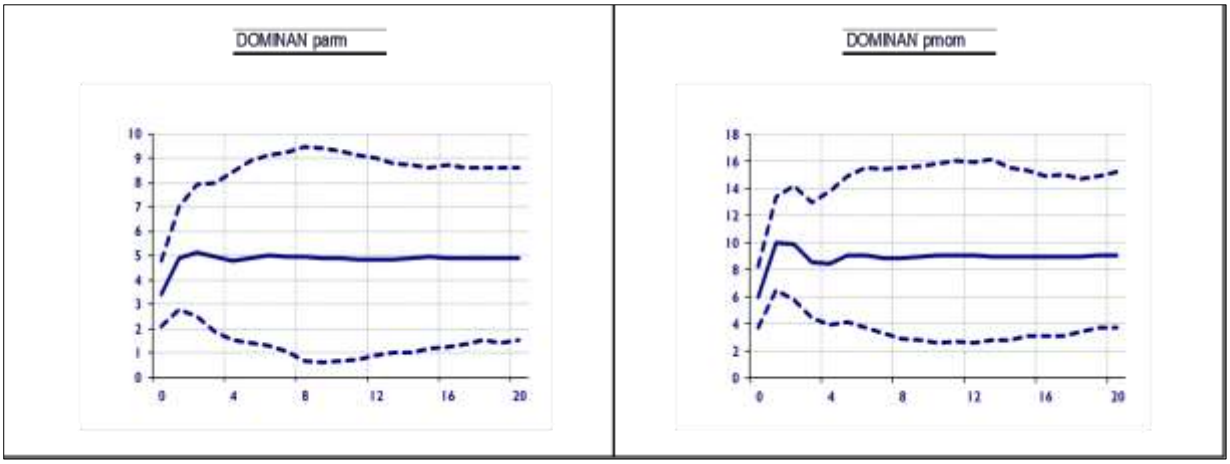

Figure 3. Oil price shock and price of Agricultural Raw Material and Iron Ore

Figure 3 depicts how the prices of iron ore and agricultural raw materials have changed over time. Commodity prices increase after a positive shock to the price of crude oil until the second quarter before falling in the third, as shown in Figure 1. It fluctuated like the oil price in Figure 1 for a while before stabilizing after the fourth quarter. To put it another way, a brief increase in the price of oil raises the cost of other commodities as well as the opportunity cost of export concentration.

3.6.1.3 Trade Effect

The contribution of exports to domestic output is used to quantify the trade impact of the global commodity shock. Instead of being producers, most African nations are consumers. Since all the economic union's members are primary, mono-product economies, an effort is made in this section to examine the extent of export expansion and the shock that would result in the sub-region. Figure 4 presents the outcome. Except for Burkina Faso, The Gambia, Guinea, and Niger, every country has seen an increase in their export-to-output ratio. Both the WAEMU and WAMZ experienced declining export growth at the regional level, with the WAEMU experiencing marginal growth but continuing along the path of steady growth. Implicitly, the shock had a greater impact on the WAMZ export than it did on the WAEMU. Given Nigeria's status as an ECOWAS oil exporter, this is not shocking. The WAMZ's initial response is a brief rise in the first two quarters, which continued into the fourth quarter before peaking and stabilizing.

The increase in commodity prices and the favorable shock to the price of oil's impact on trade,

or export spillover, results in an increase of about 0.5% in the export contribution to domestic output. Exports therefore continued to support growth, albeit at a slower rate. Second, export follows swings, a typical feature of exogenously driven commodity prices like crude oil, contribute to the shock's early stage.

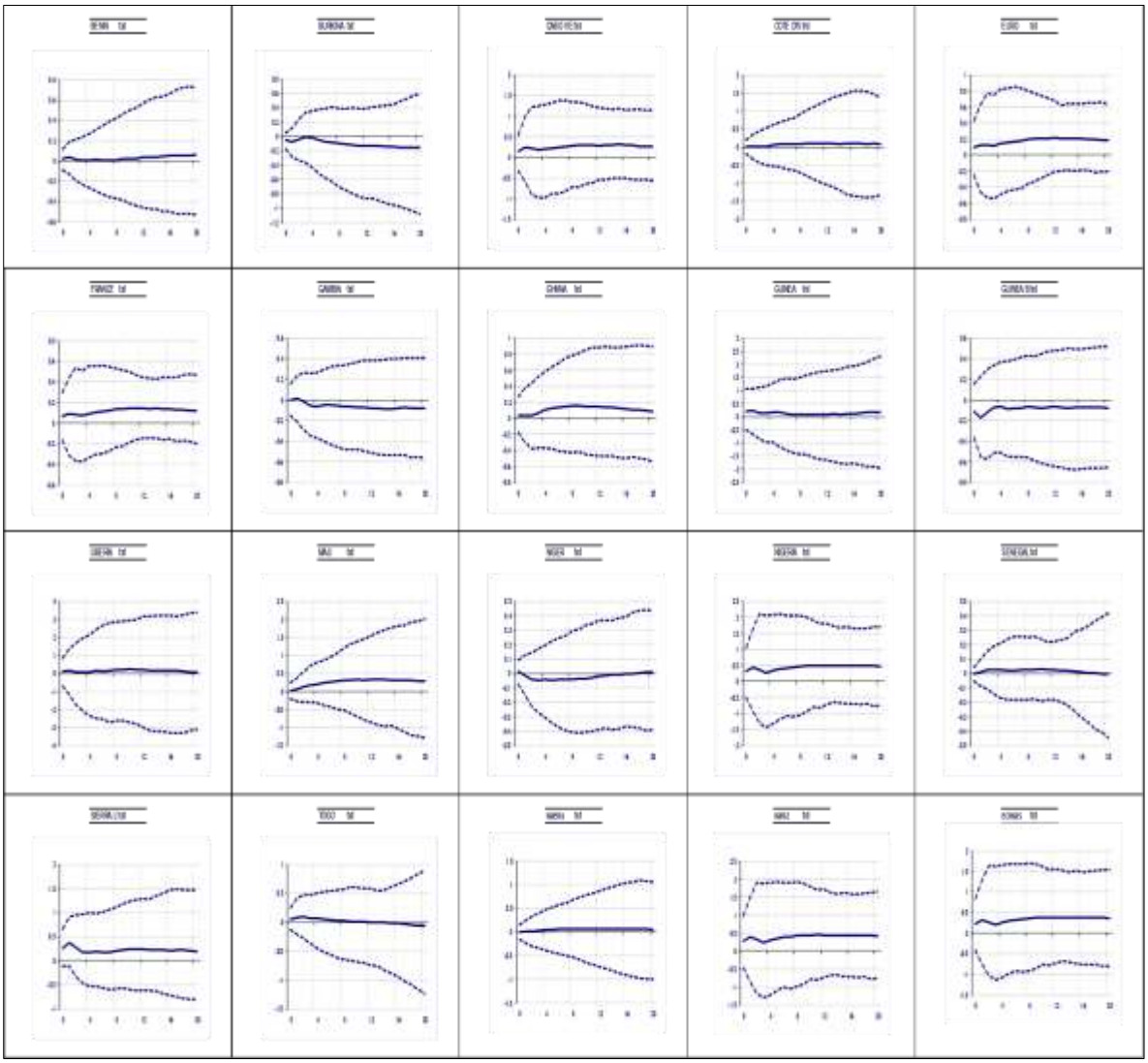

Figure 4. Trade Effect of Global Commodity Shock

In terms of growth and fluctuations in the contribution of export to growth, the major oil exporting nations in the ECOWAS region and the WAMZ countries follow a similar pattern. Compared to the WAMZ and ECOWAS regions, the WAEMU countries are more stable and are therefore more likely to return to the steady state first.

3.6.1.4 Real Exchange Rate Effect

Cabo Verde and the two regions that make up ECOWAS have never agreed on how oil price shocks should affect the region's economy. This is because the zones uphold various systems for setting exchange rates. While the WAEMU maintains a fixed exchange rate that is correlated to the euro, the WAMZ countries either maintain a flexible exchange rate or its

variants. Figure 6 depicts the effect of rising oil prices on the ECOWAS subregion's real exchange rate. It includes the WAMU, WAMZ, and ECOWAS. Nigeria was also included for comparison since it experienced both oil and exchange rate shocks. A common claim made in light of this is that the WAMZ countries have a more volatile exchange rate regime than the WAEMU countries.

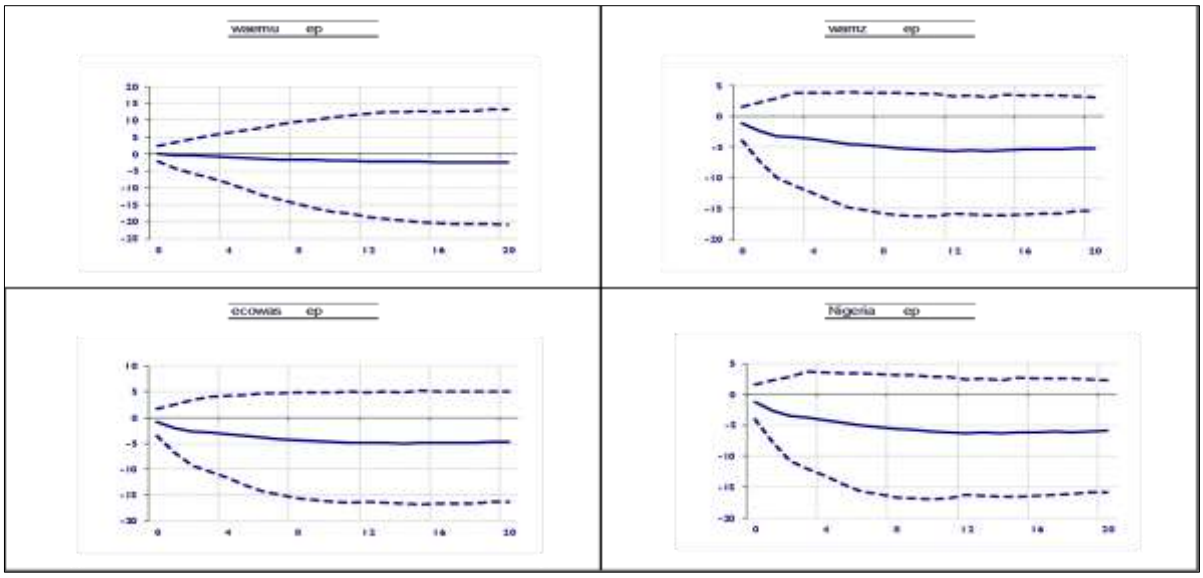

Figure 5. Exchange Rate Effects of Global Oil Shock in WAEMU, WAMZ, ECOWAS and Nigeria

The movement of the real exchange rate in the three zones follows a pattern that is consistent with the oil price's shock-induced brief uptick and its protracted decline before its upward trend. Positive oil price shocks would have similar effects on the three groups of monetary and economic integration as real exchange rates rising in the three zones. However, if the effect were to be included in a country-specific analysis, the result would be different. The outcome might also vary if the shock came from primary commodity prices other than oil. The findings show that despite some similarities, the WAEMU real exchange rate is more stable and moves closer to steady state after the initial displacement effect, while the real exchange rates of the WAMZ and, by extension, Nigeria and the ECOWAS appreciated more than the WAEMU. This analysis makes use of real exchange rates and subjects the WAEMU countries to two distinct shocks: the effects of rising global prices, which have an effect on real exchange because the nominal value is price neutral. The second shock is indirect and is related to changes in the macroeconomic fundamentals of the eurozone, particularly France, which serves as the domicile for the CFA franc, the benchmark currency for the WAEMU. By creating an oil-stabilization fund, which would collect taxes and accumulate funds during times of high oil prices while disbursing transfers during times of low oil prices, this disagreement could be resolved. As a result, the stabilization fund would provide consumption smoothing to consumers who do not have access to financial markets. This would help to stabilize the economy of the union.

3.6.1.5 Inflation Effect

Figure 6 shows the relationship between commodity prices and oil prices, showing that rising oil prices increase the cost of domestic production. Prices rise and domestic inflation increase because of the increased production costs being partially or entirely passed along to consumers. Figure 6 shows the inflationary effects of a favorable crude oil shock as well as the brief increase in oil prices that affects the WAEMU, WAMZ, and ECOWAS and results in an initial rise in inflation.

It also shows the impact of the global oil shock on inflation (Dp), where the positive shock to oil, initially causes a spike in the price of oil and later decline before rising again.

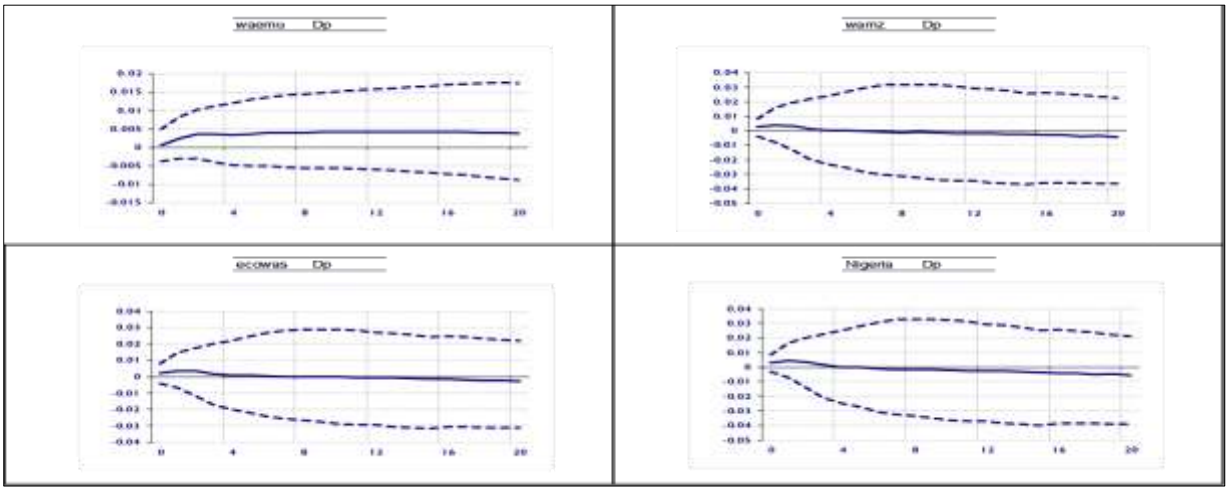

Figure 6. Inflation Response to Oil Price Shock in WAEMU, WAMZ and ECOWAS

In all the three zones, the WAEMU, WAMZ, and ECOWAS, inflation rises as oil price rises and falls as oil price falls, reaching the lowest by 0.2 percentage point of deflation in all the zones in the entire 20 quarter-horizon, except in WAEMU where inflation remained positive in the entire period. Considering the interaction between the price of oil and the exchange rate, on the one hand, and the price and the exchange rate, on the other. This finding in Figure 6 is consistent with Figure 7, which shows that the WAMZ and ECOWAS regions felt the marginal effects of the oil shock on the real exchange rate appreciation more so than the WAEMU region.

In terms of stability on how quick the economy recovers and stabilizes inflation; the lower panel of Figure 7 shows one of the reasons. First, inflation in all the three zones responded to the shock and eventually stabilized after four quarters. Second, in the WAMZ and the entire ECOWAS regions, inflation data were quick to cluster around their steady state, but the WAMZ returned faster (approximately 12 quarters) relative to ECOWAS (18 quarters). The delay in the return of the ECOWAS to its steady state was due to spillover effects from the WAEMU as the second bloc of ECOWAS.

The ability of the monetary policy to be either proactive or reactive will determine how domestic prices are affected by fluctuations in global commodity prices. The pass-through is higher when monetary policy is too accommodative, but the impact is reduced when it is

restrictive. The analysis in the following section is based on the monetary policy response to the effects of global oil shocks on the exchange rate, output, and inflation.

3.6.1.6 Monetary Policy Response

We analyze the monetary policy's response to the rise in oil prices (Figure 1). Due to the fixed exchange regime and ensuing loss of monetary policy independence, we excluded the WAEMU after they had constrained the region in the model. As a result, their monetary policy response is anticipated to be passive. Instead, we depicted the response of the EURO area (Figure 8) to illustrate how the region is anticipated to respond to the oil shock and its accompanying price effects, including inflation, interest, and exchange rate.

Figure 7 shows the ECOWAS's response in terms of monetary policy, which in this case only pertains to the WAMZ region. It demonstrates that all countries, except for Cabo Verde, adopted a tight monetary policy in response to the shock (negative growth in the supply of money). After the initial disruption, when the shock forced the economy into monetary expansion in the first two quarters, Sierra Leone and Guinea were quick to return to their policy course, quicker than other nations. In contrast, Liberia sustained the shock at an earlier stage but was forced to tighten monetary policy after the first four quarters. WAMZ (without Cabo Verde) and ECOWAS reflect what occurred at the national level at the regional level.

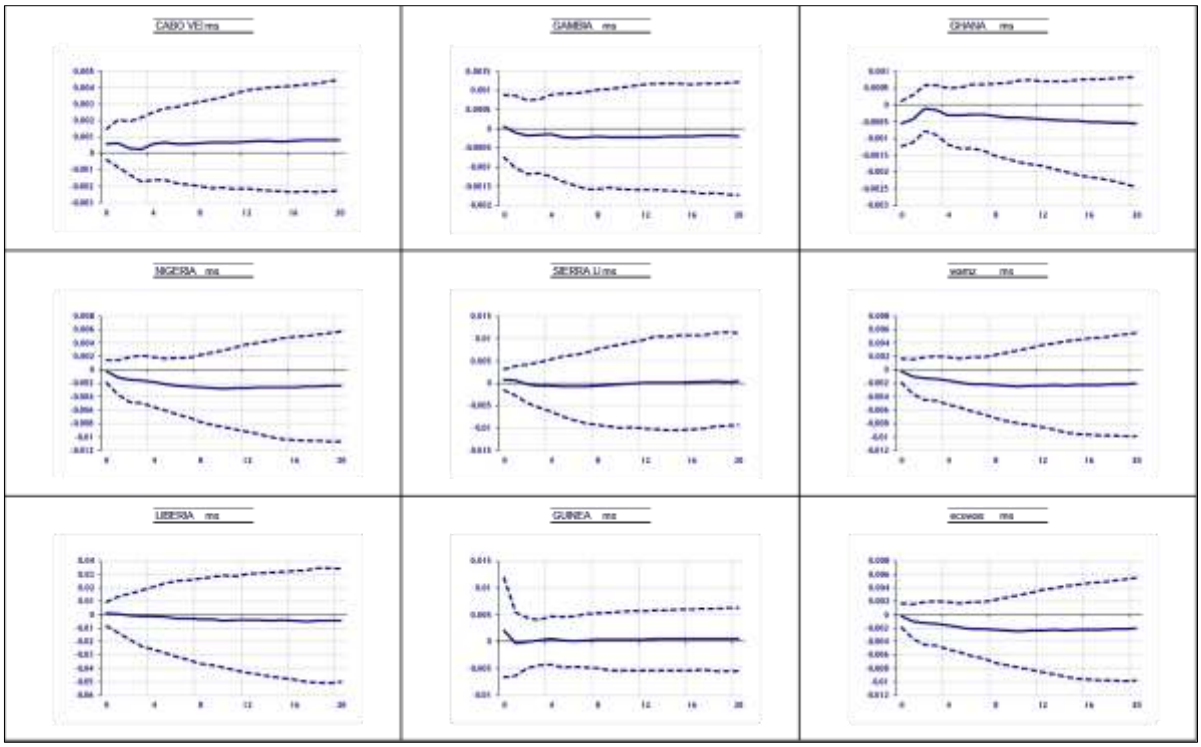

Figure 7. Monetary Policy Response to Oil shock in ECOWAS and WAMZ countries

Similar to the circumstances in Sierra Leone and Guinea, the euro area (Figure 7) also experienced an initial monetary expansion before returning to the predetermined course of monetary policy at the steady state. After assuming that the WAEMU has a monetary policy trilemma, we use the France CFA to link the WAEMU central banks' monetary policy responsibilities to the euro. We therefore anticipate that the WAEMU region's response to

monetary policy will follow a similar pattern. Implicitly, the UEMOA will initially increase its monetary base in response to a positive shock, but with a more stable financial situation than the WAMZ.

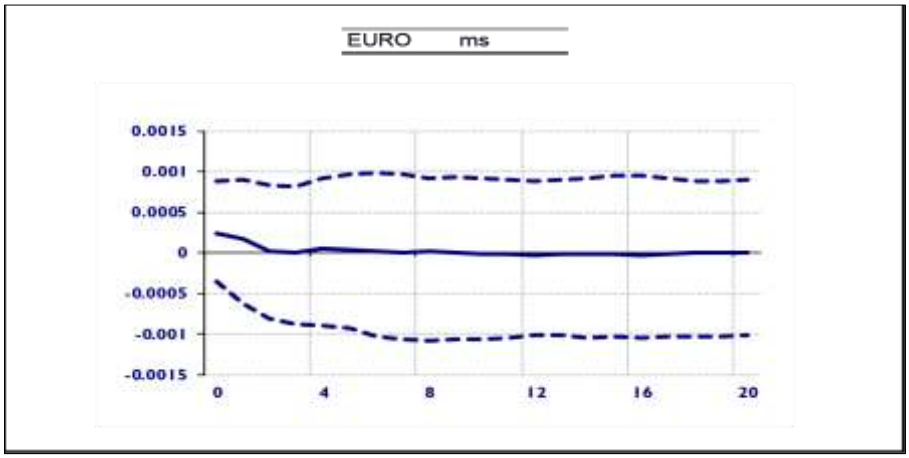

Figure 8. Monetary Policy Effect of oil Price Shock in the EURO Area

The previous analysis, which considered the ECOWAS nations as potential shock transmission routes even though they are not the sources of such shocks, has implications for Nigeria. Given that there were conflicting results from the shock, it follows that nations with strong trade ties to Nigeria could also spread such shocks via trade. For instance, one of the top markets for Nigerian manufactured goods in the fourth quarter of 2018 was Ghana. According to data from the NBS, Nigeria exported a total of about N5.57 trillion to Ghana during that time. Because Ghana is an oil-producing economy, any shock to the price of oil that affects domestic output will also affect the volume of trade between the two countries. Furthermore, it is anticipated that such a trade effect will balance out any direct shock that Nigeria experiences as a result of the global oil shock.

3.6.2 Oil-induced Commodity Price Shocks and the Nigerian Economy

The effects of exogenous shocks from changes in global commodity prices are examined in this section with a focus on Nigeria. This is crucial because it enables us to comprehend how shocks from ECOWAS as a source of shock transmission and home-grown shocks from ECOWAS interact. The response of the domestic Nigerian economy to the global oil shock (as shown in Figure 1) is therefore discussed here because our objective is to analyze how the Nigerian economy responds to shocks from ECOWAS. It is crucial to comprehend how the country will react to shocks from the outside before thinking about how it will react to shocks from ECOWAS.

3.6.2.1 Real Exchange Rate Effect (Ep)

How the exchange rate reacts to the global oil shock depends on the direction of monetary policy and how quickly it reacts to the shock. For nations with flexible exchange rate regimes (especially managed floats), like Nigeria, an increase in commodity prices makes it simpler for the monetary authority to intervene in the foreign exchange market after the increase in external reserves. The outcome depends on how domestic and foreign prices compare under

fixed regimes and in countries that export commodities. Starting with the real exchange rate effect (Ep), Figure 9 demonstrates how domestic prices (exchange rate, inflation, and interest rate) reacted to shocks from the price of crude oil internationally.

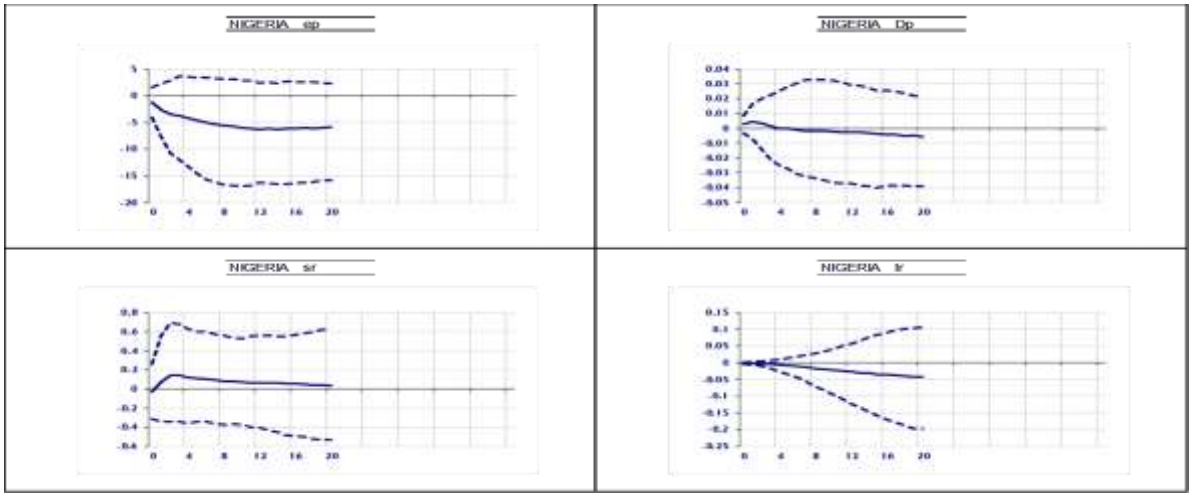

Figure 9. Nigeria Domestic Price Response to International Oil Shock

Tight monetary policy causes the domestic currency to appreciate because of the increase in world oil prices in the event of a positive shock. Under a fixed regime, the real exchange rate declines when domestic prices rise relative to foreign prices. Figure 9 shows how the real value of the naira rises across the entire horizon due to the rise in global oil prices and its effects on other commodity prices before gradually returning to its steady state.

It shows that the value of the naira increased in real terms by a minimum of 1.2% in the first quarter, a maximum of 5.3% in the short-run (first eight quarters), and 6.27% in the long-run before moderating to its stable path. This backs up the assertion that the domestic monetary base shrinks as a result of monetary policy's reaction to an oil price increase caused by a positive oil shock. It was then demonstrated that due to a tight monetary stance and a negative growth rate of the total money supply, the response of monetary policy was contractionary, which caused a contraction of domestic prices. The positive shock to the global oil price lowers (appreciates) the real exchange rate of the naira because the higher oil price feeds into higher foreign reserves for market intervention and the decline in domestic prices.

3.6.2.2 Monetary Policy Response

The standard augmented Taylor rule states that when inflation rises, the short-term rate also rises, whereas the broad money supply growth rate moves in the opposite direction. The scenario is the exact opposite for real exchange rate appreciation. The conclusion implies that delaying the effects of commodity price shocks on the domestic economy is partially the fault of monetary policy responses to limit the feedback effects of an increase or decrease in international commodity prices. Figure 9 shows, for instance, that the short run interest rate (SR) fell in ECOWAS countries that adopted negligent policies in response to falling oil prices while increasing in countries like Nigeria that adopted strict policies in response to rising oil prices.

The long-run interest rate (LR), which was displaced in the first four quarters but now remains there (Figure 9), limits the effectiveness of conventional monetary policy. But after sixteen quarters, depending on the initial conditions of the nation and the exchange rate regime, this starts to trend either upward or downward. For the majority of countries with fixed exchange rates, it trended up while for those with flexible exchange rates, it trended down (monetary policy effect).

3.6.2.3 Interest Reaction and Real Output Effect

Allowing monetary policy responses to lessen the shocks from oil has resulted in an increase in interest rates and a decline in real output. The short run deposit rates (SR) and long run deposit rates (LR) are used to estimate the anticipated effects of the positive shock to commodity prices through the real exchange rate effects and the ensuing monetary policy response. The use of deposit rate is predicated on the assumption that an increase in deposit rate will be followed by an increase in lending rate, or that lending rate will at the very least remain unchanged, given the information available for ECOWAS countries.

The strict monetary policy put in place to counter the effects of inflation and the exchange rate on the domestic economy has led to an increase in domestic interest rates. This supports some findings in the literature that assert that, despite the link between monetary policy and the domestic economy, the rise in domestic interest rates is primarily due to monetary policy being less accommodating in the event of external shocks. Impact on economic growth is the second effect of a less accommodating monetary policy posture in the event of an external shock. A tight policy stance's impact on interest rates is directly transferred to the economy through its effects on production. Therefore, depending on how accommodating the monetary policy is, the response to an external shock will either slow or stop growth. Figure 2 already demonstrates how the domestic output will respond by continuing its upward trajectory unaffected after the first quarter before being displaced and expanding in real terms. Figure 9's period of rising interest rates corresponds to the real output segment that is unaffected. However, as the short-term interest rate declined and stabilized, real output started to trend upward.

3.6.2.4 Trade Effect

The growing effects of the reactions may limit or strengthen the nation's ability to export. Figure 3 has already shown how Nigeria's exports contribute to domestic output by examining how the domestic economy reacts to trade diversification shocks. For most ECOWAS countries, including Nigeria, we have demonstrated that the shock's trade effect increased exports (Figure 5) and increased the possibility of export concentration (Figure 4). However, a crucial finding of the analysis is that, except for the euro area, none of the nations with a notable increase in the contribution of exports to domestic output are oil exporting nations. For the sub-oil region's exporting nations, where oil accounts for a sizable portion of foreign earnings but only a small portion of the increase in domestic output, this is not at all surprising. This also clarifies how earlier research on the relationship between the opportunity cost of export concentration and diversification and the shock to commodity prices.

4. Conclusion

The result of the preceding Impulse Response Analysis is that there are varying degrees of real shock transmission from the ECOWAS to Nigeria, which is largely influenced by how accommodating the monetary policy is. The shock that may occur is likely to be country-specific because the ECOWAS is an economic union that hardly has the foundation to share common economic or monetary risk. Additionally, the degree of intra-extra-trade, or the amount of trade between Nigeria and the rest of ECOWAS, determines the likelihood that such shocks will affect Nigeria. The final factor that determines how much of an impact shocks from that region will have is whether ECOWAS is a shock source or a channel of transmission.

The conclusion from the foregoing Analysis is that the transmission of monetary policy shocks from the ECOWAS to Nigeria is diverse and largely determined by the extent of monetary policy accommodative stance adopted by each country. Given that the ECOWAS is an economic union that hardly have the basis to share common economic or monetary risk, the shock that may likely arise are country specific.

4.1 Recommendation

Based on the results obtained in this study, the following recommendation is made.

i. The fact that Nigeria views output shock as the real threat in comparison to trade shocks is just one of the many topics covered in the paper. As a result, any prolonged output shock forces the economy to lower the opportunity cost of non-trade diversification. Therefore, we suggest that export diversification be introduced in the region to properly conceptualize the relationship between export diversification and the domestic economy for better adaptability even in the obvious shocks within the regional block. This will lessen the impact of the nation's monetary policy shock vulnerability to ECOWAS and the opportunity cost of export concentration. The regional monetary authorities should address the issue of how to stabilize the economy in response to monetary policy shocks coming from Nigeria as a group in terms of policy.

References

Adebayo, A. K., & Harold, N. (2017). Monetary Policy Shocks and Industrial Output in Brics Countries. *SPOUDAI Journal of Economics and Business, 66*(3), 3-24.

Balogun, E. D. (2009). *Inflation Differential in the West African Monetary Zone(WAMZ) Area:* Implications for Unionization MPRA Paper No. 13045. Retrieved from http://mpra.ub.unimuenchen .de/13045/

Balogun, E. D. (2007). *Monetary Policy and Economic Performance of West African Monetary Zone Countries.* MPRA Paper, 4308. Retrieved from http://mpra.ub.uni-muenchen.de/4308/

Bayoumi, T. (1994). A formal model of optimum currency areas. Staff Pap. *Int. Monet. Fund, 41*(4), 537-554. https://doi.org/10.2307/3867519

Belke, A., & Polleit, T. (2009). *Monetary Economics in a Globalized Financial Markets*. London: Springer Dordrecht Heidelberg. https://doi.org/10.1007/978-3-540-71003-5

Bussière, M., & Saxena, S. C., & Tovar, C. E. (2012). Chronicle of currency collapses: Re-examining the effects on output. *Journal of International Money and Finance, 31*(4), 680-708. https://doi.org/10.1016/j.jimonfin.2012.01.008

Dees, S. di Mauro, F. Pesaran, M. L., & Smith, L. (2007). Exploring the international linkages of the euro area: a global VAR analysis. *J. Appl. Econ., 22*(1), 1-38. https://doi.org/10.1002/jae.932

Eswar, P. (2019). *Ecowas Currency Union: Options and Considerations.* Cornell University, Brookings Institution, and NBER. A paper presented at the Central Bank of Nigeria, May, 2019.

Famoroti, J. O., & Omolade, A. (2022). Impact of Monetary Policy Transmission Mechanism in West African Countries. *Studia Universitatis Economics Series, 32*(1). https://doi.org/10.2478/sues-2022-0002

Fielding, D., & Shields, K. (2001). Modelling Macroeconomic Shocks in the CFA Franc Zone. *Journal of Development Economics, 66,* 199-223. https://doi.org/10.1016/S0304-3878(01)00161-4

Galesi, A., & Lombardi, M. J. (2009). *External shocks and international inflation linkages: A Global VAR analysis* (European Central Bank, Working Paper Series No. 1062). European Central Bank: Frankfurt. https://doi.org/10.2139/ssrn.1414192

Goni, U. (1992). *Monetary integration in ECOWAS and loss of independent monetary policy: a case study of Nigeria*. Kent Academy Repository. Retrieved from https://kar.kent.ac.uk/86090/

Hoffmaister, A. W., Roldos, J., & Wickham, P. (1998). Macroeconomic Fluctuations in Sub-Saharan Africa. *IMF Staff Paper, 45,* 132-160. https://doi.org/10.2307/3867332

Mohammed, M. T., Afees, A. S., Ngozi, V. A., & Baba, N. Y. (2021). International monetary policy spillovers to emerging economies in Sub-Saharan Africa: A global VAR analysis. *Scientific African, 14*(2021), e00976. https://doi.org/10.1016/j.sciaf.2021.e00976

Moses, T., Augustine, U., & Ajilore, T. (2019). Monetary Policy Contagion in the West African Monetary Zone. *Foreign Trade Review, 54*(4), 375-398. https://doi.org/10.1177/0015732519874219

Michael, A. A., Abdurrahman, I., & Moses, O. O. (2021). Internationalisation of the naira, institutional reforms, and a common currency for the ECOWAS. *Journal of African Studies and Development, 13*(4), 89-105. https://doi.org/10.5897/JASD2020.0568

Oyenyinka, S. O., & Lumengo, B. B. (2022). Intra-regional spillovers from Nigeria and South Africa to the rest of Africa: New evidence from a FAVAR model. *The World Economy, Wiley Blackwell, 45*(1), 251-275. https://doi.org/10.1111/twec.13140

Pesaran, M., & Smith, R. (2006). *Macroeconometric modelling with a global perspective*. Cambridge Working Papers in Economics 0604, Faculty of Economics, University of Cambridge. https://doi.org/10.2139/ssrn.877204

Pesaran, M., Schuermann, T., & Scott, M. W. (2004). Modeling Regional Interdependencies Using a Global Error-Correcting Macroeconometric Model. *Journal of Business & Economic Statistics, 22*(2), 129-162. https://doi.org/10.1198/073500104000000019

Pesaran, M., Yongcheol, S., & Richard, S. (2000). Structural analysis of vector error correction models with exogenous I(1) variables. *Journal of Econometrics, 97*(2), 293-343. https://doi.org/10.1016/S0304-4076(99)00073-1

Romer, D. (2006). *Advanced Macroeconomics*. (3rd ed.) New York: McGraw-Hill/Irwin.

Romain, H. (2006). Monetary union in West Africa and asymmetric shocks: A dynamic structural factor model approach. *Journal of Development Economics, 85*(2008), 319-347. https://doi.org/10.1016/j.jdeveco.2006.05.003

Sodokin, K., & Gammadigbe, V. (2013). *A la recherche de la dynamique du pass-through des taux d'intérêt dans l'UEMOA*. BCEAO Economic and Monetary Review, June 2013.

Smith and Galesi, (2014). *Global VAR (GVAR) Modelling Resources*. Retrieved from https://www.econ.cam.ac.uk/people-files/emeritus/mhp1/GVAR/GVAR.html

Thierry, B., & Johan, M. (2005). *Competition and Efficiency in Banking: Behavioral Evidence from Ghana*. IMF Working Paper African Department, WP/05/17. https://doi.org/10.5089/9781451860368.001

Vasishtha, G., & Maier, P. (2013). The impact of the global business cycle on small open economies: A FAVAR approach for Canada. *The North American Journal of Economics and Finance, 24*, 191−207. https://doi.org/10.1016/j.najef.2012.10.005