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RESEARCH PAPER

# The Dynamics of Monetary Policy and Output Growth in Economic Community of West African States (ECOWAS)

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## Abstract

This study examined the dynamics of monetary policy and output growth in the Economic Community of West African States between 1980(Q1) and 2019(Q4). Time-series data spanning was utilized from 1980 (Q1) to 2019 (Q4), which was sourced from the World Bank and International Monetary Fund databases. This study uses the panel co-integration ARDL approach and panel vector autoregressive model estimation techniques. The pooled data results for ECOWAS countries confirmed that all interest variables were stationary after the first difference. The study's findings revealed a long-run relationship between output growth and monetary policy variables in Anglophone and Francophone ECOWAS countries. The results of both the long-run and short-run models of the ARDL regression estimate showed that interest rate and money supply growth were significant determinants of output growth in ECOWAS Countries. In contrast, the exchange rate is an insignificant determinant of output growth in ECOWAS countries. In addition, the study observed that the exchange rate has a negative and significant impact on output growth in Anglophone ECOWAS countries, while on the contrary exchange rate has a positive and significant effect on output growth in Francophone ECOWAS countries. Based on the findings of this study, there is a need for ECOWAS countries to work towards achieving an effective real exchange rate that will help to increase output growth.

**Keywords:** Monetary Policy Dynamics, Panel Co-integration, Output Growth, ECOWAS and Panel VAR.
**JEL Classification:** E52, E58.

## Introduction

Monetary policy is seen as a conscious action undertaken by the monetary authority to influence the quantity, availability, and cost of money with the view of achieving some pre-determined macroeconomic policy objectives. The objectives of monetary policy include Price Stability, maintenance of balance of payment equilibrium, increase in output, and promotion of employment. These set of objectives are fundamental to every country (developed and developing). However, there are some objectives that are peculiar to developing Countries; such as elimination of economy of dualism, environmental protection, equitable distribution of resources and debt management (Ogunsakin, 2016).

The desire of every nation, either developed or developing is the attainment of rapid economic growth if sustained that will transform into economic development. However, the global economic and financial crisis in recent years poses a lot of challenges for countries in the ECOWAS sub-region in the implementation of monetary policy towards achieving a

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sustainable economic growth. This is because most of the countries in this sub-region depend largely on importation of goods making them an import dependent economy which makes their economies prone to the effects of external economic shocks beyond their control. Therefore, due to the continuous occurrence of these various external shocks, countries in the ECOWAS sub-region introduced and implemented series of policies such as monetary policy, income policy, trade or commercial policy, debt management policies etc. so as to minimize the effects of external shocks on their domestic economies; therefore, to cope with these external shocks, macroeconomic policy instruments are subjected to frequent changes in order to cope with [1] prevailing situations presented by external forces at a certain period of time (AfDB, 2014). This is referred to as monetary policy dynamics. The dynamics of monetary policy is captured through some specified monetary policy variables such as interest rate, money supply and exchange rate. The volatility in these three variables owing to external shocks has important implications on the growth of Sub-Sahara Africa countries including ECOWAS countries (Afful and Asiedu, 2013). Furthermore, the International Monetary Fund (IMF) places great emphasis on monetary policy in its programs for developing countries, especially Sub-Saharan Africa (SSA) because it views such policy as crucial in managing inflation and stabilizing exchange rates. Furthermore, developing countries (including ECOWAS countries) have introduced not only different monetary policies but also exchange policy to improve their macroeconomic performance yet much is not achieved. However, failure of these policies to meet up with their targeted objective might be as a result of not taking cognizance of the dynamics of monetary policy. Therefore, the broad objective of this study is to investigate monetary policy dynamics and output growth in ECOWAS sub-region.

There have been studies on the relationship between economic growth and its instruments; monetary policy, fiscal policy, trade or commercial policies, debt management policies, Ajisafe and Folurunsho (2002), Ogunsakin (2016). However, most of these studies either considered specific country or Africa countries together. The difference of this study with previous ones is to make a comparative analysis between Anglophone and Francophone COWAS countries; and an aggregate study of the ECOWAS bloc as a whole. The remainder of the paper is structured with section 2 that presents the literature review. This is followed by section 3 which deals with methodology. Section 4 presents results and their interpretations, while section 5 gives an explicit conclusion.

## Literature Review

Several Studies have been conducted on the relationship between macroeconomic policy objectives and instruments used to achieve these objectives. Some of these studies are presented here empirically to guide and provide a foundation for the model of this present study. Rafiq and Mallick (2008) examined the effects of monetary policy on output in Germany, France and Italy using the VAR identification procedure. Quarterly observations from 1981 – 2005 were used. The results suggested that monetary policy innovations were most potent only in Germany while it remained ambiguous as to whether a rise in interest rates coincides with a fall in output, thereby showing a lack of homogeneity in the responses. In the same line of the study, Arratibel and Michaelis (2014) examined the impact of monetary policy and exchange rate shocks in Poland. The study used a time-varying VAR method and they found significant time-varying effects from exchange rate shocks on output and consumer prices. Specifically, consumer prices were more responsive to exchange rate than the response from other macroeconomic variables.

Also, Star (2005) investigated the relationship between monetary policy variables and both

1. The Anglophone ECOWAS Countries include Nigeria, Ghana, Sierra-Leone, Gambia, and Liberia while, the Francophone ECOWAS Countries include Togo, Burkina-Faso, Cote-D'Ivoire, Benin and Senegal.

output and prices in the post-stabilization period in four core commonwealth of independent states countries of Russia, Ukraine, Kazakhstan and Belarus, using quarterly data from 1995 to 2003. The study employed granger causality test as the estimation technique. Results of the study provided little evidence of real effects of monetary policy in the four core commonwealth of independent states countries with the notable exception that interest rates have a significant effect on output in Russia. In his own view, Bhuiyan (2008) examined the effects of monetary policy shocks in Canada using co-integration estimation technique. He used the overnight target rate as the monetary policy instrument and found that there was a transmission of monetary policy shocks to real output operates through exchange rate and interest rate. Berument and Dincer (2008) measured the effects of monetary policy for Turkey through structural VAR technique covering the period 1986 – 2000. The empirical results showed that a tight monetary policy has a temporary effect on output, causing output to decline for three months. Alexey (2011), investigated the Dutch-Disease and monetary policy in an oil-exporting economy with special focus on Russia. He employed a DSGE framework. The result showed that monetary policy based on the Taylor-principle performed poorly in promoting economic growth in Russia. Ibrahim and Amin (2005) assessed the relationship between exchange rates, monetary policy and manufacturing output growth in Malaysia. The study showed that exchange rate shocks have a significant impact on manufacturing output more than the overall growth of the economy. The study further revealed that manufacturing output responds sharply to both monetary and exchange rate shocks more than overall output of Malaysia. Gul et al. (2012) examined the linkages between monetary policy instruments and growth in Pakistan. The method of ordinary least square was employed as estimation technique. The results showed that monetary policy tightening with appropriate balance adjustment in inflationary rate, exchange rate, interest rate will have a positive impact on growth of Pakistan. Also, Abrade-Otoo et al. (2003) reported for Ghana through a VECM that a rise in interest rate using a tight monetary policy would lead to a temporary increase in inflation before it starts to fall at the expense of a fall in output that lasts for 3 to 4 years.

Havi and Enu (2014) examined the relative importance of monetary policy and fiscal policy on economic growth in Ghana over the period of 1980-2012. OLS was used as estimation technique. The results showed that money supply as a measure of monetary policy had a positive and significant impact on the economy of Ghana. Kamaan (2014) investigated the effect of monetary policy on economic growth in Kenya using the VAR method and showed that the interest rate channel was the most operational channel of monetary policy transmission on inflation in Kenya. Balogun (2007) employed the Generalized Least Squares (GLS) in his study of monetary policy and economic performance of West African monetary zone countries namely Gambia, Ghana, Guinea, Nigeria and Sierra-Leone from 1991–2004. The study used the variables of money supply (M2), minimum rediscount rate, banking system credit to private sector, banking system credit to central government and exchange rate of the national currency to the US Dollar. Findings from the study showed that monetary policy is a source of stagnation as it hurts real domestic output of these countries. Harmse and Khabo (2005) studied the impact of monetary policy on a small and open economy in South Africa for the period 1960–1997 using M3 to measure Monetary policy. The OLS method was employed as well as the Augmented Dickey Fuller test to check for stationarity of variables. Results of the study showed that money supply and inflation were significantly related to changes in economic growth. Palesa and Precious (2014) in their study of economic growth in South Africa, concluded that exchange rate and money supply were insignificant monetary policy instruments that drive growth in the country while inflation was established as an important influence of economic growth. Nneka (2012) investigated the performance of monetary policy on the manufacturing sector in Nigeria. The study used interest rate, inflation rate, exchange rate and money supply, company tax rate as independent variables. Vector

error correction model was used and granger causality test was carried out among the variables. The study found a positive relationship between money supply and an index of manufacturing production, while other variables such as interest rate, inflation rate and exchange rate showed negative relationship.

Conclusively, from the review of empirical literature, it is obvious that previous studies on the dynamics of monetary policy and output growth were examined either on a country specific basis or few selected countries. In addition, to the best of my knowledge no study examined the dynamics of monetary policy and output growth by making a comparison between Anglophone and Francophone ECOWAS countries. This present study filled the gap by examining the dynamics of monetary policy and output growth in Anglophone and Francophone ECOWAS countries. This was achieved by carrying out a cross-sectional study in ECOWAS region by making a comparison between Anglophone and Francophone ECOWAS countries.

## Research Method

*Theoretical Framework*

This study adopts a simplified view of the endogenous growth theory as its theoretical framework. The model lays emphasis on the influence of capital and macroeconomic policy on growth in the long-run, which can be expressed through the AK production function below:

$$Y = Af(K) \tag{1}$$

In equation (1), Y represents real output (RGDP), A is the efficiency of production, K is the volume of capital stock. Output per capital in equation (1) is given as:

$$\frac{y}{L} = Af\left(\frac{K}{L}\right) \tag{2}$$

$$y_t = AK_t \tag{3}$$

Capital (Kt) can be divided into human capital and physical capital as demonstrated by Lucas (1988). Therefore:

$$K_t = (K_H^{\beta}, K_P^{\psi}) \tag{4}$$

Incorporating equation (4) into equation (3), we have:

$$y_t = AK_H^{\beta}, K_P^{\psi} \tag{5}$$

According to Sequeira (2020), Gil and Igiesias (2020) and, Jones and Manuelli (1995) monetary policy variables are significant endogenous variables that influence output growth, thus incorporating monetary variables (INTR, MSGR, EXR) in equation (5) becomes:

$$y_t = f(K_H^{\beta}, K_P^{\psi} INTR^{\gamma} MSGR^{\mu} EXR^{\alpha}) \tag{6}$$

In addition, Sala-i-Martin et al. (2004) argued that the robustness of output growth estimates (such as equation (6)), can only be guaranteed by including more output growth determinants. More so, Ciccone and Jarocinski (2010) opine that it is possible to select as

many growth determinants as possible as long as there is enough pooled-country data and degrees of freedom to handle the analysis. Consequently, the study included other control variables such as trade (net export) and fiscal expenditure. These variables have been identified as significant determinants of economic growth (see Chirwa and Odhiambo, 2016; Were, 2015; Kimaro et al., 2017). Incorporating net export and fiscal expenditure into equation (6) becomes:

$$y_t = f(K_H^{\beta} K_P^{\psi} INTR^{\aleph} MSGR^{\mu} EXC^{\alpha} CONEXP^{\lambda} GOVEXP^{\phi} NEX^{\delta}) \quad (7)$$

*Model Specification*

Expressing equation (7) in linear form becomes:

$$y_t = A + \beta K_H + \psi K_P + \aleph INTR + \mu MSGR + \alpha EXC + \lambda CONEXP + \phi GOVEXP + \delta NEX + \varepsilon_{it} \quad (8)$$

From equation (8), $y_t$ is output growth ($RGDPgr_{it}$), $K_H$ is human capital($HC_{it}$), $K_P$ is physical capital ($GCF_{it}$), $INTR$is interest rate, $MSGR$ is money supply growth rate, $EXC$ is exchange rate, $CONEXP$ is consumption expenditure, $GOVEXP$ is government expenditure, and $NEX$ is net export. From the above, equation (8) can be re-written as:

$$RGDPgr_{it} = \alpha_0 + \alpha_1 HC_{it} + \alpha_2 GCF_{it} + \alpha_3 INTR_{it} + \alpha_4 MSGR_{it} + \alpha_5 EXC_{it} + \alpha_6 CONEXP_{it} + \alpha_7 GOVEXP_{it} + \alpha_8 NEX_{it} + \varepsilon_{it} \quad (9)$$

where $A$ is $\alpha_0$representing the constant term, and the coefficients $\beta, \psi, \aleph, \mu, \alpha, \lambda, \phi$, and $\delta$ represent $\alpha_1$, $\alpha_2$, $\alpha_3$, $\alpha_4$ , $\alpha_5$, $\alpha_6$, $\alpha_7$, and $\alpha_8$ respectively. The GDP growth rate is the dependent variable. It is measured by annual growth rate of the GDP of each country (i) at time period (t).

This study made use of time series data spanning over a period of thirty-six years from 1980 to 2019. The data was obtained from the World Bank database and the International monetary fund database.

## Results and Discussion

*Pooled Unit Root Tests*

The results on Table 1 showed that all the series were non-stationary at their levels but were made stationary at their first difference. This indicates that all the variables are integrated of Order I(1).

Under this test, there are four basic types of tests designed for the purpose of testing for panel co-integration. The tests were conducted based on both asymptotic distribution and cross-sectional dependence. Results of the asymptotic distribution for the four tests are shown in Table 2 above. Each test includes trend and constant terms. The Lag and Lead lengths were selected based on AIC and Barlett Kernel Window. The width is set according to 4 $[\frac{1}{100}]^{\frac{2}{n}}$ which gave approximately 3 in this study. From the results in Table 2 above, two tests out of the four basic tests designed for the purpose of testing for panel co-integration showed a clear rejection of the null hypothesis of no long-run relationship between output growth and macroeconomic variables. This is an indication that there is a long-term correlation between output growth and macroeconomic variables in the selected African countries. The results from long-run estimation enabled us to proceed to estimate the error correction model from the ARDL estimate. The results are presented in Table 3 below.

**Table 1.** Im Pesaran and Shin (IPS) Unit Root Test

| Variables | IPS Unit Root Test | | |
|---|---|---|---|
| | t-Statistics | P-Value | Order of Integration |
| GDPgr | -9.6377 | 0.0000*** | I(1) |
| INTR | -5.2940 | 0.0000*** | I(1) |
| MSGR | -8.7368 | 0.0000*** | I(1) |
| EXR | -10.0748 | 0.0000*** | I(1) |
| CONEXP | -11.5231 | 0.0000*** | I(1) |
| GCF | -13.2270 | 0.0164** | I(1) |
| GOVEXP | -4.1915 | 0.0218** | I(1) |
| NEX | -13.5117 | 0.0000*** | I(1) |
| HCAP | -7.3966 | 0.0000*** | I(1) |

**Source:** Research finding, 2020.
**Note:** (***) and (**) represent statistical significance at 1% and 5% respectively. Each model includes trend and constant term.

*Error-Correction based Panel Co-Integration Test*

**Table 2.** Westerlund Panel Cointegration Test: Asymptotic Distribution Value

| Statistics | Value | Z-Value | P-Value |
|---|---|---|---|
| Gt | -8.136 | 0.513 | 0.009 |
| Ga | -0.785 | 4.345 | 0.910 |
| Pt | -12.076 | 0.176 | 0.001 |
| Pa | -1.504 | 4.613 | 0.715 |

**Source:** Research finding, 2020.

**Table 3.** ARDL Regression Results on Gross Domestic Product Growth rate (GDPgr) and Macroeconomic Variables

| Variables | Long-run Model | | |
|---|---|---|---|
| RGDPgr | Coefficient | Standard Error | Probability |
| INTR | -0.126944 | 0.040986 | 0.0021 |
| MSGR | 0.051054 | 0.015098 | 0.0008 |
| EXR | 0.001201 | 0.000932 | 0.1984 |
| CONEXP | 0.395445 | 0.037165 | 0.0000 |
| GCF | 0.538342 | 0.188524 | 0.0045 |
| GOVEXP | 0.475634 | 0.185349 | 0.0107 |
| NEX | -0.044450 | 0.029738 | 0.1361 |
| HCAP | 0.028164 | 0.026338 | 0.2856 |
| **Variables** | Short-run Model | | |
| DINTR | -0.167098 | 0.045355 | 0.000 |
| DMSGR | 0.293904 | 0.083911 | 0.001 |
| DEXR | 0.008441 | 0.053804 | 0.875 |
| DCONEXP | 0.045910 | 0.019841 | 0.021 |
| DGCF | 0.766311 | 0.408433 | 0.062 |
| DGOVEXP | 0.461135 | 0.212475 | 0.031 |
| DNEX | 0.053215 | 0.037861 | 0.161 |
| DHCAP | 0.167314 | 0.148075 | 0.259 |
| Constant | -0.016173 | 1.725492 | 0.993 |
| Sigma-U | 0.1201386 | | |
| Sigma-e | 0.4811052 | | |

| | |
|---|---|
| Rho | 0.0539671 |

**Source:** Research finding, 2020.
**Note:** F. Stat = 3.0521, Prob>F=0.0000, R-Squared: Within =0.81, between=0.04, Overall=0.77

The results were divided into two parts: the long and short run relationships. The first part showed the Variables in their non-difference forms and thus indicating long-run relationship, while the second part showed the Variables in their differenced forms which imply the short-run relationships. The results from both long and short-run Model indicated that interest rate, money supply growth rate, consumer expenditure, gross capital formation and government expenditure showed significant impacts on the output growth. This implies that these variables pose as the major determinants of output growth in ECOWAS countries during the period under review. The results further showed that out of the five variables, only interest rate had negative and significant impact on gross domestic product growth rate while the remaining variables (i.e. MSGR, CONEXP, GCF and GOVEXP) had positive and significant impacts on gross domestic product growth rate. However, the results from both long and short-run model showed that exchange rate, net export, and human capital do not have significant impact on gross domestic product growth rate. The overall R-squared value of 81% in these results indicates that the model in this study satisfied the requirement for goodness of fit. The computed statistics showed that 81% of the total variation in output growth is accounted for by all the macroeconomic variables considered in this study, while 19% of the changes in gross domestic product growth rate were attributed to the influence of other factors not included in the regression equation. The estimated model was also statistically significant considering the F-statistics p-value of 0.0000 which was less than 5%. The implication is that the macroeconomic variables may jointly have a significant impact on output growth in ECOWAS Countries during the period under review. Furthermore, because of the possibility of cross-sectional dependence among the cross-sectional units, it is very necessary to test for cross-sectional dependence among ECOWAS countries in this study. This is quite pertinent because most African countries share common characteristics particularly the ECOWAS countries thereby giving room for the tendency of sharing similar factors among themselves. The results of the cross-sectional dependence test which is based on the correlation matrix of the residual and Breusch-Pagan LM test of independence are presented in Table 4.

**Table 4.** Correlation Matrix of Residuals

| | **e1** | **e2** | **e3** | **e4** | **e5** | **e6** | **e7** | **e8** | **e9** |
|---|---|---|---|---|---|---|---|---|---|
| e1 | 1.0000 | | | | | | | | |
| e2 | 0.1511 | 1.0000 | | | | | | | |
| e3 | 0.1482 | -0.0223 | 1.0000 | | | | | | |
| e4 | -0.0681 | 0.2086 | -0.0314 | 1.0000 | | | | | |
| e5 | -0.0710 | -0.0284 | 0.1507 | -0.1023 | 1.0000 | | | | |
| e6 | 0.2371 | 0.1105 | 0.0159 | -0.0611 | -0.1807 | 1.0000 | | | |
| e7 | -0.5153 | 0.0071 | -0.1049 | -0.1784 | 0.0147 | 0.1820 | 1.0000 | | |
| e8 | 0.1987 | 0.0351 | -0.1783 | 0.1365 | 0.0395 | 0.0112 | -0.0591 | 1.0000 | |
| e9 | 0.1163 | 0.0956 | 0.2216 | -0.0943 | -0.1402 | 0.3286 | 0.2487 | 0.1689 | 1.0000 |

**Source:** Research finding, 2020.
**Note:** Breusch-pagan LM tests of independence: chi2 (36) = 324.065, Pr= 0.0049, Ho: There is no cross-sectional dependence.

Table 4 above shows the results of the cross-sectional dependence test. From the results, the null Hypothesis of no presence of cross-sectional dependence is rejected as the probability Value (0.0054) is less than 5% level of significance. This result therefore implies that

ECOWAS countries respond differently to their common factor shocks. Also, the presence of cross-sectional dependence in this study necessitates the testing for bootstrapping in order to obtain a reliable result. Persyn and Westerlund (2008) describe the bootstrapping option as a means of getting a robust P-Value even in the presence of cross-sectional dependence. The results of Panel co-integration test taking into consideration cross-sectional dependence are presented in Table 5.

**Table 5.** Panel Co-Integration Test with Cross-sectional Dependence

| Statistics | Value | Z-Value | P-Value | Robust P-Value |
|---|---|---|---|---|
| Gt | -11.615 | 0.203 | 0.009 | 0.002 |
| Ga | -9.681 | 0.312 | 0.932 | 0.030 |
| Pt | -10.184 | 0.135 | 0.003 | 0.006 |
| Pa | -8.172 | 0.312 | 0.810 | 0.016 |

**Source:** Research finding, 2020.

Each test includes trend and constant terms. The lag and Lead lengths are selected based on AIC and Bartlett Kernel Window. The results in table 5 above showed that with the consideration given to cross-sectional dependence, the co-integration test rejected the null Hypothesis of no co-integration in all the four tests unlike in the panel co-integration test without cross-sectional dependence where just two tests confirmed the presence of co-integration. The results from this test therefore showed a more robust confirmation that there is a long-term co-movement between macroeconomic variables considered in this study and output growth in ECOWAS countries.

*Panel Vector Autoregressive (P-VAR) Model*

The presence of cross-sectional dependence in this research work further necessitated the use of alternative estimation technique to examine the response of ECOWAS countries to their common factors separately. This is as a result of the fact that the responses of these ECOWAS countries to their common factor shocks might be at varying degrees due to different economic effects and independent preferences that characterize each of the ECOWAS countries which is in line with the study of Chudik and Pesaran (2013). In this regard, this study therefore adopts panel vector autoregressive (P-VAR) Model to examine how ECOWAS countries respond differently to their common factor shocks. This was done by separating our data into two blocs: Anglophone and Francophone Countries.

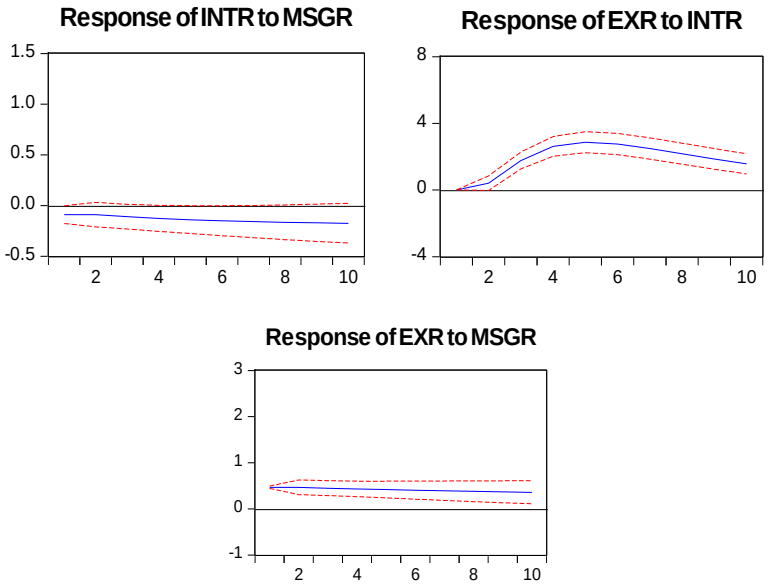


**Figure 1**. Dynamics in the Relationship among Monetary Policy Variables in Anglophone ECOWAS Countries
**Source:** Research finding.

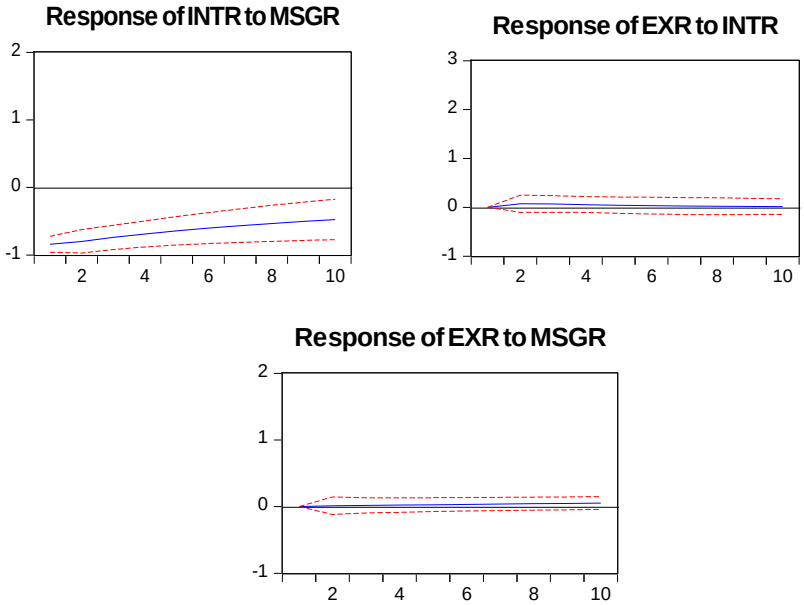


**Figure 2.** Dynamics in the Relationship among Monetary Policy Variables in Francophone ECOWAS Countries
**Source:** Research finding.

Figures 1 and 2 above displayed the impulse response functions. Results from the two figures depicted that the response of interest rate to a standard deviation shock from money supply growth rate was negative and significant in both Anglophone and Francophone ECOWAS countries. Results from Figure 1 also showed that the response of Exchange rate to a standard deviation shock from Interest rate was positive and significant in Anglophone ECOWAS countries. But the case was quite different in Figure 2 as a standard deviation shock from Interest rate exerted insignificant impact on Exchange rate in Francophone ECOWAS countries. In addition, the response of Exchange rate to a standard deviation shock from Money supply growth rate was positive and significant in Anglophone ECOWAS countries. However, reverse was the case in Francophone ECOWAS countries as the standard

deviation shock from money supply growth rate had insignificant impact on exchange rate.

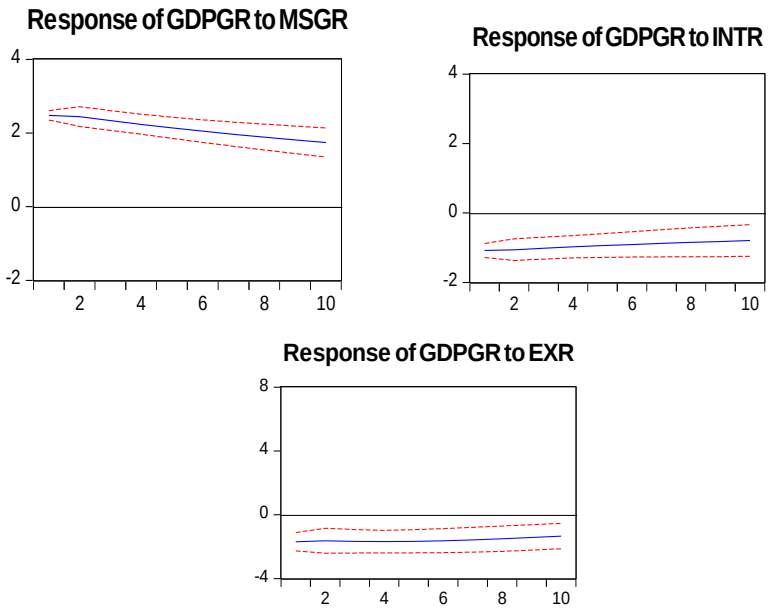


**Figure 3.** Interactions between Monetary Policy Variables and Output Growth in Anglophone ECOWAS Countries
**Source:** Research finding.

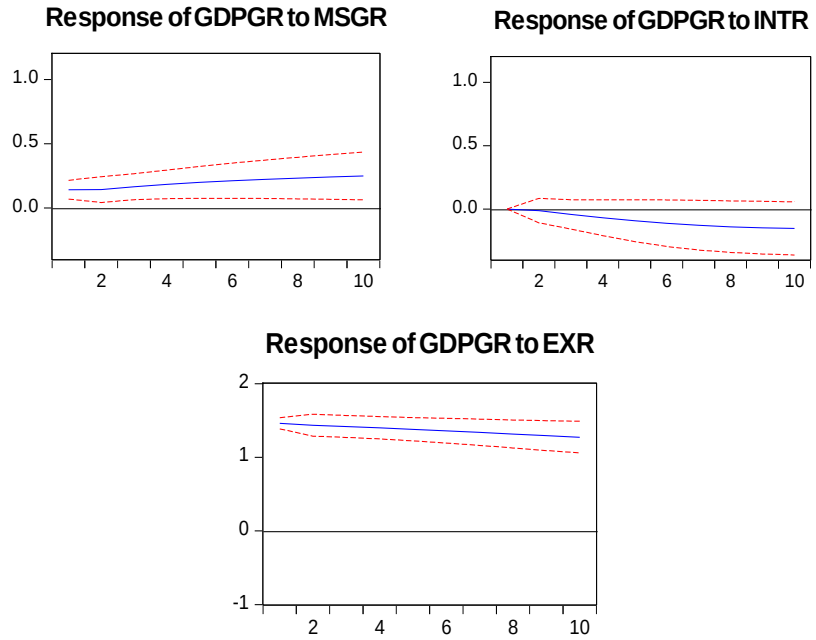


**Figure 4**. Interactions between Monetary Policy Variables and Output Growth in Francophone ECOWAS Countries
**Source:** Research finding.

Figures 3 and 4 above showed the responses of Output Growth (RGDPgr) to monetary policy variables in both Anglophone and Francophone ECOWAS Countries. Results from Figures 3 and 4 showed that the response of Gross Domestic Product Growth rate to a standard deviation shock from Money Supply Growth rate was positive and significant in both Anglophone and Francophone ECOWAS Countries. Results from Figures 3 and 4

showed that a standard deviation shock from Interest rate was negative and significant in both Anglophone and Francophone ECOWAS Countries. Results from Figure 3 showed that the response of Gross Domestic Product Growth rate to a standard deviation shock from Exchange rate was negative and significant in Anglophone ECOWAS countries. The result was quite different in Figure 3 as the standard deviation shock from Exchange rate had a positive and significant impact on Gross Domestic Product growth rate in Francophone ECOWAS Countries.

*Panel Variance Decomposition*

**Table 6.** Variance Decomposition of Interest Rate in Anglophone ECOWAS Countries

| Period | S.E | EXR | INTR | MSGR |
|---|---|---|---|---|
| 3 | 12.15666 | 0.00027 | 89.30037 | 10.24211 |
| 6 | 14.00891 | 0.00732 | 84.45993 | 5.12627 |
| 9 | 14.64947 | 0.00821 | 81.17965 | 3.50124 |
| 12 | 14.96590 | 0.00841 | 78.75389 | 2.52752 |

**Source:** Research finding, 2020.

**Table 7.** Variance Decomposition of Exchange Rate in Anglophone ECOWAS Countries

| Period | S.E | EXR | INTR | MSGR |
|---|---|---|---|---|
| 3 | 99.34512 | 84.15725 | 32.12512 | 10.51252 |
| 6 | 99.65213 | 86.42015 | 45.57251 | 12.21613 |
| 9 | 99.88104 | 87.57815 | 50.31252 | 15.32153 |
| 12 | 100.41216 | 88.12527 | 55.10211 | 20.31315 |

**Source:** Research finding, 2020.

In a bid to examine the dynamics in the relationship among some monetary policy variables and to complement the results of impulse response functions in Figure 1, Tables 6 and 7 showed the variance decomposition of interest rate and exchange rate respectively in Anglophone ECOWAS countries. Results from Table 6 depicted that money supply shock explained about 10% of the variation in interest rate in third quarter and its proportionate explanation power decreased significantly as the quarter progresses to 2.5% at the $12^{th}$ quarter. This result actually aligned with the results of impulse response function in Figure 1 in which the response of interest rate to a standard deviation shock from money supply is negative and significant. In addition, results from table 7 showed that interest rate shock explained about 32% variance in the exchange rate in quarter 3 with its innovative power increasing significantly to about 55% in the $12^{th}$ quarter. Also, in the same Table 7, money supply shock explained about 10.5% of the variation in exchange rate in the $3^{rd}$ quarter and increased to about 20% at the $12^{th}$ quarter. This result also conformed to the result of impulse response function in Figure 1 in which the response of exchange rate to a standard deviation shock from both interest rate and money supply growth rate is positive and significant in Anglophone ECOWAS countries.

**Table 8.** Variance Decomposition of Interest Rate in Francophone ECOWAS Countries

| period | S.E | EXR | INTR | MSGR |
|---|---|---|---|---|
| 3 | 4.311241 | 0.008817 | 99.13130 | 55.25214 |
| 6 | 4.775560 | 0.007398 | 98.28207 | 50.59244 |
| 9 | 4.866785 | 0.007145 | 97.63184 | 25.40216 |
| 12 | 4.890208 | 0.007126 | 97.23087 | 15.51561 |

**Source:** Research finding, 2020.

**Table 9.** Variance Decomposition of Exchange Rate in Francophone ECOWAS Countries

| Period | S.E | EXR | INTR | MSGR |
|---|---|---|---|---|
| 3 | 53.41457 | 98.89829 | 0.007311 | 0.006881 |
| 6 | 70.48954 | 98.02515 | 0.029627 | 0.007819 |
| 9 | 81.30587 | 97.12956 | 0.042785 | 0.034641 |
| 12 | 88.95544 | 96.40348 | 0.051420 | 0.051204 |

**Source:** Research finding, 2020.

Tables 8 and 9 showed the variance decomposition of interest rate and exchange rate respectively in Francophone ECOWAS countries. Results from Table 8 showed that money supply shock explained about 55% variations in interest rate in the 3rd quarter which later decreased significantly to 15.5% in the 12th quarter. In its own case, results from Table 9 showed that the shocks from both interest rate and money supply recorded as low as 0.007% and 0.006% variations in exchange rate respectively in the 3rd quarter. This insignificant explanatory power of innovation in both interest rate and money supply cut across the entire forecast horizon. These results also agreed with the one from impulse response function in Figure 2 which showed that the standard deviation shocks from both interest rate and money supply exerted insignificant impacts on exchange rate.

**Table 10.** Variance Decomposition of Output Growth (GDPgr) in Anglophone ECOWAS Countries

| Period | S.E | EXR | GDPgr | INTR | MSGR |
|---|---|---|---|---|---|
| 3 | 88.595089 | 40.706639 | 91.57755 | 30.56574 | 50.459051 |
| 6 | 80.503831 | 35.770850 | 72.41071 | 21.71682 | 65.48081 |
| 9 | 80.161412 | 32.760091 | 63.71179 | 15.77721 | 68.18006 |
| 12 | 80.092923 | 30.743901 | 60.67063 | 12.11644 | 72.34872 |

**Source:** Research finding, 2020.

**Table 11.** Variance Decomposition of Output Growth (GDPgr) in Francophone ECOWAS Countries

| Period | S.E | EXR | GDPgr | INTR | MSGR |
|---|---|---|---|---|---|
| 3 | 3.458052 | 15.738846 | 67.61985 | 30.20345 | 11.7033 |
| 6 | 3.753801 | 25.037363 | 66.48571 | 25.22633 | 20.3840 |
| 9 | 3.815275 | 33.837164 | 65.42710 | 20.87191 | 34.4512 |
| 12 | 3.835066 | 45.306077 | 64.86476 | 16.10677 | 41.4493 |

**Source:** Research finding, 2020.

Tables 10 and 11 shows the variance decomposition of output growth in both Anglophone and Francophone ECOWAS countries. Results from Tables 10 and 11 showed that money supply growth rate shock recorded about 50.5% and 11.7% variations in output growth (GDPgr) for Anglophone and Francophone ECOWAS countries respectively in the 3rd quarter. The explanatory power of innovation in money supply growth rate increased significantly to 72% and 41% for Anglophone and Francophone ECOWAS countries respectively in the 12th quarter. In addition, Tables 10 and 11 also showed that interest rate shock explained about 30.5% and 30.2% of the variations in output growth (GDPgr) in the 3rd quarter for Anglophone and Francophone ECOWAS countries respectively. The explanatory power of innovation in interest rate decreased significantly as the quarter's progress to 12% and 16% in the 12th quarter. All these results are in line with the results of the impulse response function exhibited earlier on. In another dimension, results from table 10 showed that the shock from Exchange rate explained about 40.7% variation in output growth (GDPgr) in the 3rd quarter and later decreased significantly to 30% in the 12th quarter in Anglophone ECOWAS countries. On the contrary results from Table 11 showed that exchange rate shock

recorded about 15.7% variation in output growth (GDPgr) and later increased significantly to about 45% in the 12th quarter for francophone ECOWAS countries.

## Conclusion and Policy Recommendation

This study examined the dynamics of monetary policy and output growth in Economic Community of West African States between 1980(Q1) and 2019(Q4). This study employed panel co-integration ARDL approach and panel vector autoregressive estimation techniques. Findings from the results of both the long and short-run ARDL estimate confirmed that interest rate and money supply growth rate are significant determinants of output growth in ECOWAS countries. This finding is in line with the work of Irfan and Amen (2011), Ahmad and Suleiman (2011), Henri and Henri (2011) but in contrast to the work of Bahmani-Oskooee and Hegerty (2010). The impulse response function estimate from the panel vector auto-regressive confirmed that the response of output growth to a standard deviation shock from money supply growth rate is positive and significant in both the Anglophone and Francophone ECOWAS countries. In addition, the impulse response function results showed that a standard deviation shock from interest rate exerted a negative and significant impact on output growth in both Anglophone and Francophone ECOWAS countries. More so, the impulse response function result showed negative and significant response of output growth to the shock from exchange rate in Anglophone ECOWAS Countries. This result was different for Francophone ECOWAS countries as the shock from exchange rate exerted positive and significant impact on output growth. Based on the above findings, this study therefore recommends that ECOWAS countries should review their interest rate policy appropriately so as to stimulate output growth. In addition, there is a need for Anglophone ECOWAS countries to work towards achieving an effective real exchange rate that will help to increase output growth.

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