



# THE IMPACT OF EXCHANGE RATE VOLATILITY ON ECONOMIC GROWTH IN ECOWAS MEMBER COUNTRIES (2000-2018)

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## ABSTRACT

*This study applied the Dynamic Ordinary Least Squares (DOLS) technique to the panel data from the year 2000 to 2018 to prove empirical evidence on the long-run relationship between exchange rate and economic growth in the Economic Community of West Africa States (ECOWAS) member countries. The study generated the annual data from World Development Indicators (WDI) of the World Bank, data of the fifteen member countries on variables such as real domestic product, per capita income, the interest rate charged by banks on loans to the private sector, exchange rate and labor force. Data collected for those variables were analyzed using the econometrics technique of the panel fixed-effect model. The paper found a negative relationship between exchange rate and economic growth at 0.006 and statistically significant at both 5% and 10% percentages level of significant, the results show negative impact of real interest rate on economic growth at 0.20 and statistically significant at both 5% and 10% (percentages) level of significance in the ECOWAS member countries. The results also show the existence of positive relationships among labor and per capita income on economic growth (GDP) to be 0.24 and 0.41 significant at both 5% and 10% (percentages) level respectively in ECOWAS member countries. The granger causality test results have shown the relationship to be unidirectional causality from economic growth to the exchange rate. This investigation concluded that the exchange rate is a significant factor for policymakers to consider in process of monetary policy formulation in the stimulation of economic growth in ECOWAS member countries.*

**KEYWORDS:** Exchange rate; ECOWAS; Economic Growth; DOLS; Granger Causality.

## CHAPTER ONE

### 1.1 INTRODUCTION

Since the end of World War II, developing and developed countries in the world started experiencing some modern economic transformation and opening up their economies for open trade, wherein taking in to consideration the market forces interactions, with some countries allowing the free movement of the invisible hands on the market, thus ushering in comparative advantage form of trade among countries in the world.

With the introduction of this form of modern trade and the modernization of the production sector most developing countries have very low comparative advantages to that of developed nations that have the

balanced growth path and still at continue on the balanced growth path, they are highly at advantage them poorer countries that are considered partners in trade.

In order words, poorer countries highly depend on richer countries for the major transaction of key commodities to the economies, which the West African countries are of no exception. Jhingan M.L. ( 2009) defined the exchange rate as the rate at which one currency of a particular country is exchanged for another country's currency, he went on to elaborates that it is the value of one currency in terms of another currency. The exchange rate is among those macroeconomics indicators that have a significant



effect on the scope of other macroeconomic aggregates, and most importantly it has a great impact on the Gross Domestic Product (GDP), money supply, interest rate, and inflation rate.

In pursuant of the switch from the Bretton Woods Agreement that considered the exchange rates to a fixed value of the U.S. dollars to that of the price of gold for active nations of interest, to the floating rate of U.S. dollars in the 1973 by President Richard Nixon announcing the removal of the United States from the gold standard, when the postwar excess balance of payments turned into a deficit account, thereby bring into force the move of capital relaxation and causing exponential growth in the exchange rate cross countries financial transactions during the past four and the half decades, a significant excitability and doubt in exchange rate has heavily hidden the foreign exchange market causing it to become a major factor in economic growth.

According Cornell (1982) demonstrated a test establishing a framework between money supply declaration by using a joint hypothesis, and the impact on the real interest rate and that variation in the real interest rate has consequences on the exchange rate in the short run. He, therefore, reckon that the monetary model of the balance of payments means that changes in the dollar value of a country's currency to foreign exchange will eventually have a positive correlated with announced of money supply innovations.

However, the impact of exchange rate on economic growth and the determination of economic performance is key among scholars, academicians and policymaker which most of them pointing at exchange rate excitability as relevant attribute to the financial crisis in the world economic performance and most of all the unpredictable increasing inflation in West African countries, the topic has been a point of controversy considering its contribution on the determination of macroeconomic performance, exchange rate has experienced huge both empirical and theoretical studies. From the standpoint of microeconomic, Shabl (2007) figure out that exchange rate excitability decreases the macroeconomic performance which leads to a huge reduction in savings or Gross Domestic Product as raises the cost of international trade as well as the increasing of capital flows which hampering investment activities and causing macroeconomic instability for the Economic Community Of West African States (ECOWAS)

According to Baltagi (1995) panel data give the historical records for the fact that the countries are heterogeneous in terms of their economic policies drives the macroeconomic performance and standards

within a specific dynamic duration, a condition that can be either found in neither cross-section studies nor time series data. Moreover, in panel data analysis we include all the countries variable of interest" data without having to resort to aggregation or averaging, which of unconditionally eliminates all biases associated with the latter.

Secondly, the study will employed dynamic panel data analysis to account to the perseverance of the effect of exchange rate movements on the macroeconomic variables mentioned. In this vein, dynamic panel data is employed instead of plain OLS as employed in previous empirical studies related to exchange rate volatility on economic growth in ECOWAS countries and furthermore this empirical study also employed new independent variables such as per capita income, interest rate, labor and exchange rate which some of variables have been used to investigate exchange rate excitability on economic growth in ECOWAS ( Jibrin and Gylych, 2017). Thus, the study is intended to fill the gap by using pool panel data of the fifteen West African countries that make up the Economic Community of West African States (ECOWAS), the period for this empirical analysis covered from the year 2000 until 2018.

The results have vital policy inferences as it will help decision-makers to formulate a robust monetary policy in the ECOWAS member countries namely, Niger, Mali, Mauritania, Burkina Faso, Senegal, and The Gambia others include, Guinea-Bissau, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Benin, and Nigeria respectively. Meanwhile, the result of this empirical study reveals satisfactory evidence that there exists a negative relationship between exchange rate excitability and economic growth for the ECOWAS countries. Besides, the empirical results show a unidirectional causality relationship between real exchange rate and economic growth in ECOWAS countries.

The rest of this paper is organized as follows, Section two consist of literature review which deliberated on the theoretical foundation and empirical evidence about exchange rate and economic growth; section three presents the econometrics and methodology used; section four presents the empirical findings of the study and discussion; and section five presents the summary and conclusion.

## 2. REVIEW OF LITERATURE

There exist a plethora of theories to explain the impact of exchange rate volatilities on macroeconomic performance. One variant of literature stresses the impact of exchange rate volatility on trade whilst others



stress on how indifferent exchange rate systems, real and monetary shocks in the international macroeconomics influence the domestic economy; how exchange rate volatilities influence foreign direct investment and economic growth. The theoretical literature is more fully explained below.

According to Taylor, he view exchange rate as an important factor of monetary policy which serves as transmission mechanism in policy-evaluation models, exchange rate serves as arbitrage equation relating the interest rate in one country to the interest rates in other countries through the expected rate of appreciation of the exchange rate, the exchange rate also affects the terms of trade and thus the flow of exports and imports, although, Taylor was pessimistic on difficulties to model exchange rate effect, but he is equally optimistic about how changes in the exchange rate affect the price of foreign goods sold in another country and are then passed through to domestic prices (Taylor, 2001), although, this has been substantiated in the work of (Katz 1973).

The theoretical models on the impact of exchange rate instability on trade is varied and explained by partial equilibrium and general equilibrium models. The partial equilibrium approach has been explained in the literature by Clark (1973), Hooper and Kohlhagen (1978), Makin (1978), Cushman (1983, 1986) among others. The partial equilibrium approach assumes that there exist no hedging possibilities, firms are risk-averse, a higher proportion of incomes and expenses are in foreign currency such that exchange rate excitability negatively influences the level of trade.

This is because firms do not change their output levels following a change in the exchange rate as production plans are made well in advance in anticipation of changes in exchange rates. Cushman (1983, 1986), claims that the impact of exchange rate excitability on trade is alleviated to the extent that if the cost of export is priced in a devalued currency, the depreciation cost that might ascend from the depreciated exchange rate might be offset moderately by incomplete pass through. The partial equilibrium approach also assumes that the only variable that changes is some measure of exchange rate excitability and all other factors persist unaffected. Also, according to Makin (1978) evaluated Clark's view and recommended that hedging potentials to exist such as the impact of trade on exchange rate changes can be prevaricated.

In order, to get a more tangible image of the impact of exchange rate excitability, the universal equilibrium framework considers all major

macroeconomic variables. In this manner, Bacchetta and Van Wincoop (2000) established a simple two countries model wherein uncertainty originates from monetary, fiscal and technology shocks and the level of trade as well as welfare are compared below diverse exchange rate regimes. This theory is based on the evidence that an increase in the money supply in the foreign country is followed by a devaluation of that foreign currency, which causes a decrease in the demand for imports. The author concludes no the relationship between trade level and exchange rate regime.

Though, increased aggregate demand generated by the additional increase in the money supply may stop a part or almost all the exchange rate effects on economic growth. As such, a condition that causes changes in the exchange rate causes the same to changes in other macroeconomic variables that influence the fluctuation of the exchange rate. Tenreiro (2007) and Arize et al (2008) find a negative relationship between exchange rate excitability and exports in new emerging countries. Hondroyannis et al. (2005) observe the relation between exchange rate excitability and export for 12 industrial economies using GMM and random coefficient (RC) regressions and find an insignificant and nonnegative link between exchange rate and trade. Conversely,

Many different empirical works also tested the relationship between investment and exchange rate, Nucci and Pozzolo (2001), Harchaoui, Tarkhani and Yuen (2005) Campa and Goldberg (1999) in the process of formulating these distinct dynamic optimization adjustment-cost model there were some minor variations in the formulation, give the theoretical link between exchange rate and investment. On the other hand, the standard adjustment-cost model assumes that firms must operate in an imperfect market can do the necessary adjustments in addressing the cost conditions through setting up prices as a mark-up over the total costs of production. As a result, there are three sets of dynamics were recognized; the first was to prove that exchange rate instability negatively affected investment through domestic sales and export sales. With continuing money supply of a country's currency leads to the depreciation in that currency causing the goods and services that are produced domestically less value compared to foreign ones, limiting the production power of domestic product and also causing much domestic currency to go after little foreign currency value of goods and services. When the domestic product becomes cheaper it serve as a pooled factor for exportation eventually increase in order to keep those firms functional in the production sector, while firms of



foreign investment based on labor and capital, marginal revenue of the primary input would gradually increase making these firms to then responded by making additional investment in capital Campa and Goldberg (1999).

Instability in the real exchange rate creates unstable conditions for investors to make sound investment decisions because investors heavily rely on their investment decisions based on information on monetary information acquired from the market about the real exchange rates if investments are unstable and exert negative pressure on economic performance (Campa & Goldberg, 1995).

The second aspect of this result is provided by Harchaoui, Tarkhani and Yuen (2005), that depreciation in the country's currency would lead to an increase in the cost of investment with an opposite relationship which in return lowers the investment power and causes the cost of imported commodity to go through intended adjustment costs by the effect of exchange rate changes.

Thirdly, Nucci and Pozzolo (2001) Depreciation in currency would cause an increase in the total production costs and result in the reduction of marginal return on investment. This certainly proved that exchange rate volatility significantly affected investment through the cost of imported commodities. Therefore, the effect on the marginal profitability would be proportional to the share of import of the total inputs required for production. Production costs and therefore reduce marginal profitability. The effect on the marginal profitability would be proportional to the share of imported inputs required for production.

In summary, the three results of exchange rate variation make it difficult to rounder an empirical judgment on the direction in which the changes in the exchange rate would affect the level of investment and eventually economic growth.

Sub-Saharan Africa is the region of the world in which most almost all countries within that are faced with having a slow or experiencing negative economic growth causing these countries to lead to low accumulation of real income from one period to another (Jelilov and Yakubu, 2015). (Adeolu and Godwin, 2013) in their theoretical work, they showed, that there is an extraordinary difference in the performance of their real exchange rates. (Martin, Peter, and Arslan, 2012) their theoretical framework showed that some characteristic with the developing economy is undervaluation, gave reference on the relationship between real exchange rates (RERs) and economic growth, an increase in undervaluation leads to

economic growth just as extraordinarily as a decrease in overvaluation, such relationship holds only for developing nations, in further findings in recognizing the relationship between undervaluation and economic growth (Eichengreen, 2007) and (Rodrik, 2008) presented their empirical framework which they concluded that there is a positive relationship between undervaluation and economic growth only for developing economies. But in the case where the sample size is limited to developed countries that relationship malts down, and it gets more solid the poorer the country.

Many contributing factors cause the slow in the economic growth of Sub-Saharan African countries reaching from corruption, low human capital or labor, high-interest rate, opposing terms of trade, and limit access to foreign loans.

(Daneshwar & Thomas, 1992), showed the external factors that have also contributed to slow in the economic growth rate of developing countries and other factor that are not frequently named are the internal factor which is the political will by the leaders, rule of law, legitimacy and democracy of this region to tackle the major problem frontal and with unbalanced political administrations gave birth to the slow economic growth rate experienced in ECOWAS countries. This implies that the region needs a robust mechanism that can help promote speedy economic growth to upgrade some of these problems Sissoko and Dibooglu (2006).

### 2.1 Situational Analysis in ECOWAS

In order to tackle the issue of exchange and promote economic growth the Sub-Saharan African (SSA) countries have formulated different strategies, key among these are, the unification of Africa in to a one bloc called The Organization of African Unity (OAU) or African Union (AU) and dividing Africa in four regions with each region establishing strong and powerful organization. In the year 1960s, various African countries started breaking away from their colony masters establishing their own currency boards such as the former British colonies and the former French colonies they decided to form a monetary union called "CFA franc zone".

The creation of institutions eventually gives rise to the proliferation of various types of currencies, which are seen as impairment to trade, integration and economic transformation in SSA. In act of limiting these deficiencies and promote economic transformation the West African States by the establishment of ECOWAS on the 28<sup>th</sup> day of May 1975 Lagos Nigeria by Heads Of States of West African countries, in order reduced these impediments



and promote regional integration, rule of law, political regulations and economic development by these countries within the western part of the Sub-Saharan Africa.

Through this fabric effort serious institutions have been established within ECOWAS in addressing these major contributing factors of economic growth, ECOWAS consist of two institutional units that are a focus on polices implementations, are ECOWAS Monetary institutions and the ECOWAS Secretariat. The ECOWAS monetary board established the ECOWAS Bank for Investment and Development including others monetary institutions associated with ECOWAS is West African Economic and Monetary Union (WAEMU), West African Monetary Zone (WAMZ), and the West African Monetary Agency (WAMA) (Central Bank of Nigeria, 2016).

The WAEMU, which is also known as UEMOA in French, is an organization that was established by eight West African states. It was established to promote economic integration among its member states that share the CFA franc as a common currency. Recording its accomplishments of WAEMU, It has adopted a customs union and common external tariff and has combined indirect taxation regulations, in addition to initiating regional structural and sectoral policies and has successfully executed macro-economic convergence criteria and an effective investigation mechanism. ECOWAS and UEMOA have formulated a mutual plan of action on trade liberalization and macroeconomic policy convergence. The organizations have also agreed on common rules of derivation to smooth the movement of trade, and ECOWAS has also accepted to approve WAEMU customs declaration forms and compensation instruments.

Another monetary institution was established called the West African Monetary Institute (WAMI) Issiaka and Blaise, (2013), which has been charged with the responsibility of the creation of a single currency to be known as the ECO and the establishment of circumstances of the launch of ECO. This institute is a burden with the duty to carry out the multilateral establish the status of the Central Bank of West Africa, investigation of macroeconomic performance, and formulate the structure and policy frameworks of the WAMZ monetary union. The lack of macroeconomic convergence has delayed the schedule. The launch date of the ECO has been postponed from 2003 to 2005 and 2009. Taking into cognizance the effects of the global economic crisis on macroeconomic convergence of the members' economies, WAMZ countries have finally decided to reschedule the launching of the ECO after the creation of the Central

Bank in Ghana after which the merger of the Eco and West African CFA franc was planned to be achieved by 2020.

In 1996 ECOWAS created the West Africa Monetary Agency (WAMA) after it changed from the West African Clearing House (WACH), its main goal was to promote multilateral payment facilitation within West Africa. It also served as coordinating and implementing the ECOWAS Monetary Cooperation Program (EMCP) the major characteristics of the ECOWAS monetary union have been defined in this program, that is: management and pooling of all reserves, common monetary policy, and common convertible currency, an agreement on how to create a single was guarantee, and among other reasons in order to this plan achieve they hurry encouraged creation of the ECOWAS single currency.

In December the year 2000, the leadership of ECOWAS reaches a new decision to create more force by developing another strategy that was launched called the "Acceleration".

This new strategy was divided into two stages: the formation in 2003 of a second monetary union WAMZ whose mutual currency will be called "ECO", and the merging of the latter with the WAEMU in 2005. In this perspective, first-order and second-order junction criteria have been defined.

With reference to second-order criteria, they focus on the monetary and exchange rate policies management (stable nominal exchange rate and positive interest rate), and also on the structure of public accounts (no domestic arrears, salary mass lower than 35% of tax revenue, tax revenue greater than 20% of GDP, and public investment greater than 20% of domestic receipts). (Issiaka & Blaise, 2013) The launch of the new currency is being developed by the West African Monetary Institute based in Accra, Ghana. However, several of the WAMZ's countries are facing huge challenges of depreciation in currencies and budget deficits, including a high inflation rate.

### **3. ECONOMETRICS MODEL AND METHODOLOGY**

#### **3.1 Hypothetical Framework**

Robert Solow (1980), he certainly developed a model in order to analyze economic growth by using three basic components for the Gross Domestic Product (GDP) inclusively, Capital (K), Labor (L) and Knowledge or Technological Progress (A).

$$Y = AK^{\alpha}L^{(1-\alpha)} \dots\dots\dots 1$$



A counter-argument was augmented by Romer (1986) and Lucas (1988), that the Solow model should be extended by including the additional variable of interest which is human capital, in their view the inclusion of human capital can better lead to a more fascinated technology and stimulate economic growth. Giving the model in this form:

$$Y = K^\alpha (AH)^{1-\alpha} \dots\dots\dots 2$$

Meanwhile, the inclusion of additional variable in to the endogenous growth model have been allowed, additional review concerning economic growth incorporate various variables in their model such as, exchange rate, Life expectancy, government revenue, inflation, interest rate, government expenditure, labour, consumption expenditure, government budget, Foreign Aid, corruption, population growth rate and financial monetary system Anaman; 2004 and Kogid at el; (2010). Therefore the specification on the model created from Cobb Douglas production function as follows:

$$Y = A_{it} K_{it}^\alpha LAB_{it}^\beta \dots\dots\dots 3$$

Where Y represents total output in the economy, A denotes the level of technological progress K represents the amount of capital shock,  $\alpha$  symbolize output elasticity of capital; and LAB exemplifies the Labour force, whereas  $\beta$  characterizes the output elasticity of the labor force.

We can rewrite equation (1) as:

$$Y_{it} = f(K, LAB, A)$$

The second equation above K is referred to as the total physical capital investment into productivities; it is observed that the capital stock of the economy is not negative, that the factor K affects the output through capital investment.

Therefore, total output (GDP) can be affected by total physical capital and solely depends on technological progress to raise the output growth with an economy. This means that the impact of the exchange rate towards economic growth can be possibly operated through capital accumulation via the level of technological progress of the host nation (Polodoo, Padachi, and Seetanah, 2011) whereas the transfer of capital is done through the exchange rate. Meanwhile, the paramount objective of this empirical study is to analyze the impact of exchange rate excitability on economic growth; it is therefore assumed that the exchange rate (REX) is the function of total physical capital. Wherein equation (3) can be converted as follow:

$$K_{it} = f(A, LK, LRT, EX, LAB)$$

From equation (3) specify the model for the estimation of the impact of exchange rate excitability toward economic growth through the production function, via the GDP as they depend with four independent variables as LK, LRT, EX and LAB. Therefore, the model can be formulated as follow:

$$LGDP_{it} = \alpha_{it} + \beta_1 LK_{it} + \beta_2 LINTR_{it} + \beta_3 EX_{it} + \beta_4 L_{it} + \mu_{it} \dots\dots\dots 5$$

Note;  
 $LGDP_{it}$  = the log of GDP per capita in dollars of the panel data of all 15 ECOWAS member countries,  
 $LK_{it}$  = log of per capita income,  
 $LINTR_{it}$  = log of interest rate charged by banks on loans to the private sector in ECOWAS panel data.  
 $EX_{it}$  = the exchange rate of each country's currency to the United States Dollars  
L = is the percentage of active labour participation in the each country's economy.  
 $\mu_{it}$  = is the unexplained factor or the error term of the model.  
 $it$  = shows the panel natural of the data used in this research.

### 3.2 Empirical Methodology

To estimate the dynamic ordinary least square, using the panel Co-integration technique is used, by using the following steps:

#### 3.2.1 Panel Unit Root

To check the stationarity of the panel data time series, this study used the unit root test to adjust the difference in the variance and the mean within both the explanted/dependent and explanatory/independent variables. A unit problem may exist in data that randomly collected over a large period. In identifying a unit root problem in panel data there are many tests, namely, I'm, Pesaran and Shin (IPS) (2003); Levin, Lin, and Chu (LLC) (2002) and Maddala and Wu (MW) (1999) and Hadri's (2000). Therefore, the unit root tests can be formulated as follows:

$$\Delta Y_{it} = \alpha Y_{it-j} + \sum_{j=i}^{pi} \beta \Delta Y_{it-j} + \varepsilon_{it} \quad i = 1, \dots N: t = 1, \dots T$$



The null hypothesis states that there is an existence of unit root in each of the panel series in the panel, while the alternative hypothesis assumes that some panel does not have a unit root, making it not all individuals to be non-stationary. The LLC tests the hypothesis of  $\alpha=0$ , the null hypothesis states that each time series in the panel is non-stationary, whilst IPS tests  $\alpha=0$  in each country time-series data for stationary. Furthermore, the IPS test form a simple average of the individual's panel to test  $\alpha=0$  by using T-bar statistics. The t-value can be computed as follows:

$$Z_{tbar} = 1/N \sum_{i=1}^n Z_{it}$$

**Panel Co-integration**

After testing to know the stationarity of the panel data and ratifying that each series is integrated of the same order, the second step is used to test to know if these series can be joint together into a single series, making it non-stationary, which can be call co-integration test. Whereas, the Co-integrated series change going in one direction in the long-run relationship and they are in equilibrium relationship-integration, Granger developed the causality tests in the

year 1981 and there was more improvement in 1987 by Engle and Granger. To find an intuitive solution to this problem, scholars introduce panel co-integration which served as an analytical tool for both cross-sectional and time-series data to analyze the relationship among the variables which are non-stationary order I (1). For this study, the extended Engle-Granger co-integration test (1987) employed the Padroni panel co-integration test (1999) to examine the influence of the exchange rate on economic growth in the fifteen countries in the Western part of Africa called ECOWAS in the context of panel data.

Seven co-integration tests are presented by Padroni which are categorized into two dimensions they are: the within dimension based statistics, which is referred to as co-integration statistics comprising of four test panels: panel t-statistics (parametric), panel t-statistics (non -parametric) and v-statistics, panel statistics. And the other category is between- dimension based statistics, which are referred to as group mean panel co-integration statistics. These category tests are divided into three groups namely: group p- statistics, group t-statistics (non -parametric) and group t-statistics (parametric).

1. Panel v statistic:

$$Z_V = \left( \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{-2} \right)^{-1}$$

2. The panel t statistic:

$$Z_V \equiv \left( \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{-2} \right) \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} (\hat{e}_{i,t-1}^{-2} \Delta e_{i,t} - \hat{\lambda}_i)$$

3. The panel t statistic (Non-parametric) :

$$Z_t = \left( \hat{\sigma}_{N,T}^2 \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{-2} \right)^{-1/2} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{-2} (\hat{e}_{i,t-1}^{-2} \Delta e_{i,t} - \hat{\lambda}_i)$$

4. The panel t statistic (parametric):

$$Z_t^* \equiv \left( \hat{S}_{N,T}^{*2} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{-*2} \right)^{-1/2} \sum_{i=1}^N \sum_{t=1}^T \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{-2} (\hat{e}_{i,t-1\Delta}^* \hat{e}_{i,t}^*)$$

5. The group t statistic (parametric):

$$\tilde{Z}_p \equiv TN^{-\frac{1}{2}} \sum_{i=1}^N \left( \sum_{t=1}^T \hat{e}_{i,t-1} \right) \sum_{t=1}^T (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i)$$



6. The group t statistic (non-parametric):

$$\tilde{Z}_t \equiv N^{-\frac{1}{2}} \sum_{i=1}^N (\hat{\sigma}_i^2 \sum_{t=1}^T \hat{e}_{i,t-1}) \sum_{t=1}^T (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\lambda}_i)$$

7. The group t statistic (parametric):

$$\tilde{Z}_t^* \equiv TN^{-\frac{1}{2}} \sum_{i=1}^N (\sum_{t=1}^T \tilde{S}_i^{*2} \hat{e}_{i,t-1}) \sum_{t=1}^T (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t})$$

$$\hat{L}_{11} = \frac{1}{T} \sum_{t=1}^T \hat{\eta}^2 + \frac{2}{T} \sum_{s=1}^K \left[ 1 - \frac{S}{K_1 + 1} \right] \sum \hat{\eta}_{it} \hat{\eta}_{it-s} \hat{\sigma}^2_i = S_i + 2\hat{\lambda} = \frac{1}{T} \sum_{t=1}^T \hat{\eta}_{it} \hat{\eta}_{it} \hat{\sigma}^2_{N,T} = \frac{1}{N} \sum_{t=1}^T \hat{L}^{-2} \hat{\sigma}^2_i$$

$$\hat{S}_i^{*2} = \frac{1}{t} \sum_{t=1}^T \hat{\eta}^{-2} \quad \hat{S}_{N,T}^{*2} = \frac{1}{N} \sum_{t=1}^T \hat{S}_i^{*2}$$

And the residuals  $\hat{\eta}_{it}$ ,  $\hat{\eta}_{it}$  and  $\hat{\eta}_{1t}$  are obtained from the following regression:

$$\hat{e}_{it} = \hat{\gamma}_i \hat{e}_{it-1} + \hat{\eta}_{it} \hat{e}_{i,t} \hat{\gamma}_i \hat{e}_{it-1} + \sum_{k=1}^{Id} \hat{\gamma}_{i,k} \Delta \hat{e}_{is-k} + \Delta \hat{\gamma}_{it} = \sum_{M=1} \hat{b}_{mi} \Delta \chi_{mi,t} + \hat{\eta}_{i,t}$$

The pradroni panel co-integration tests were developed by Philips and Moon and Padroni in 1995, 1999 and 2000 respectively, also, the Dynamic OLS (DOLS) which was developed by Kao and Chiang in 2000. Given the significance of testing the long-run relationship among panel Co-integration results, can be tested using the panel co-integration estimation as follow: Ordinary Least Square (OLS), fully modified OLS (FMOLS) estimators. Because of the biasness of the OLS estimator realized by Kao (1999) found an alternative in analyzing non-stationary data called the full modifier meant to correct the serial correlation and endogeneity of the OLS estimator. Whereas, the null hypothesis state that, there is no co-integration among residuals which are non-stationary. On the other hand, the alternative hypothesis states that there is the existence of stationarity among residuals, there is a co-integration. Finally, fully modified OLS was then developed by Philips and Hansen (1990), and extended to the context of heterogeneous panels by Pedroni (1997).

(1997). This method is the most preferred form of testing as compared to Static OLS and Johansen and Juselius's approach due to the following reasons. Firstly, this method is considered to be more robust and appropriate for a small sample size which infers more efficient and unbiased estimates (Singh, 2010; Majeed, 2007; Masih and Masih, 1996). Furthermore, DOLS was established to be more powerful than FMOLS or other estimation methods. Therefore, it is beneficial in estimating both homogenous and heterogeneous data. This implies that it uses both within and between dimension approaches. The between dimensions estimation provides results for a specific country that is interpreted as the mean value of the co-integration vector which requires the use of the pool mean group to estimate the average. The property of the pool means the group is that to treats variables of larger observations cross-section and period. And within dimension portion gives results which are the same in each country. Therefore, the study used the within dimension estimation since the data does not require averaging.

### 3.2.4 Dynamic Ordinary Least Square (DOLS)

Once, the effect of the long-run relationship among the variables is found by the estimation of the relationship between exchange rate and economic growth, the method employed to brand the estimation is the Dynamic Ordinary Least Square (DOLS), this method of testing was first introduced by Saikkonen (1991) and Stock and Watson (1993) and which was later extended to panel analysis by Kao and Chiang





The DOLS model can be formulated as follows;

$$GDP_{it} = \alpha_{it} + \beta_1 K_{it} + \beta_2 G_{it} + \beta_3 GDP0_{it} + \beta_4 INF_{it} + \beta_5 GDPOP_{it} + \beta_6 FDI_{it} + \sum_{j=-q}^p \varphi_{ij} \Delta LK_{it-j} + \sum_{j=-q}^p \partial_{ij} \Delta LRT_{it} + \sum_{j=-q}^p \phi \Delta EX_{it} + \sum_{j=-q}^p \partial_{ij} \Delta L_{it} + \varepsilon_{it}$$

Whereas, p and q are considered as the number of lags and leads respectively. Where the motive of the use of lag and lead is to capture serial correlation and endogeneity of the regressors that could result in unbiased estimation. The use of DOLS is preferred, even if the variables are co-integrated or may have the problem of endogeneity, the results obtained would still be unbiased. Moreover, the approach does not need the use of instrumental variables nor homogeneity assumptions and would still give robust results when there is the omission of variables that are not co-integrated.

### 3.2.5 Granger Causality

Lastly, once a co-integration relationship exists between two series, there is a causal effect among the variables of the regressors. The next stage is to apply the Granger causality test. The granger causality (Granger 1988) test was performed only on co-integrated variables to examine causal relationships among variables. The Granger method (Granger, 1988)

seeks to determine how much of a variable, Y, can be explained by past values of Y and whether adding lagged values of another variable, X, can improve the explained power. Once the panel co-integration test is complete, this study will systematically undertake the granger causality test to test the causal direction between economic growth, exchange rate, labor, capital and real interest rate in the ECOWAS countries.

## CHAPTER FOUR

### 4. Empirical Results

Table 1 shows the result for the presence of unit root test by using the LLC test method. The results above indicate that the null hypothesis cannot be rejected at level form. Nevertheless, rejection of the null hypothesis of unit root occurs when taken the first difference. Therefore, the results are essential evidence indicating that all the variables are stationary at first order difference I (1).

**Table 1: Panel unit root results (level and first difference)**

Variable	LEVEL		FIRST DIFF			No. OF COINTEGRATION
	CONSTANT	CONS&TREND	CONSTANT	CONS&TREND	P-VALUE	
LGDP	0.22296	0.4118	-2.09114	-2.672282	0.0000**	I(1)
LK	1.44358	0.9256	-8.20743	-2.990651	0.0051**	I(1)
LRT	-0.93579	0.1747	-12.4240	-1.846951	0.0009**	I(1)
EX	-0.006538	0.1432	-3.01361	-1.734720	0.0015**	I(1)
L	1.90295	0.9715	-5.78156	-2.057698	0.0000**	I(1)

**Source:** Author's computation

**Note:** \* denoted a 5 percent significance level.

Testing for the presence of a long-run relationships among variables that said to be integrated of the same variables by the use of panel cointegration techniques, where these variables have both a time-series dimension, at time T, and a cross-section of heterogeneity observations of the same dimension, N, has received much concentration in literature because of significant increase power that may be gained by not only accounting for the time series dimension but to also give an account for the cross-sectional

heterogeneity observations dimension. Despite the fact of the non-rejection of the null hypothesis of cointegration by many studies is strongly suggested by Theory. After getting strong evidence that all series are cointegrated at the order **I(1)**, the Pedroni co-integration test were used for this study for the existence of a long-run relationship among the non-stationary variables. Table 4.3 shows the results for the co-integration test.

**Table 2: Pedroni panel cointegration results**Pedroni Residual Cointegration Test  
Independent Variables: LK LRT L EX

Statistic	Statistic	Prob.
Panel v-Statistic	4.372234	0.0000*
Panel rho-Statistic	2.840881	0.9978
Panel PP-Statistic	-1.211905	0.1128
Panel ADF-Statistic	-3.269105	0.0005*
Group rho-Statistic	3.490268	0.9998
Group PP-Statistic	-1.135141	0.1282
Group ADF-Statistic	-3.669940	0.0001*

**Note:** \* denoted 5% (percent) significance level.**Source:** Author computation

Deterministic intercept and trend employ four-panel statistics and three group statistics to determine the status of the null hypothesis which states that there is no co-integration among the residuals of the variables against the alternative hypothesis showing that there is co-integration. Whereas giving statistical evidence of the case panel on the rejection of the null hypothesis nor fail to reject the null hypothesis, the first-order autoregressive term it is expected for the results across countries to be the same, in the parameters of a group panel statistics the first-order autoregressive term is allowed to vary across countries.

Table 2: Shows that panel co-integration test serve as a statistical evidence on both AR coefficients (between-dimension) and group statistics for co-integration between the variables, evidenced by results the null hypothesis is strongly rejected of co-integration in panel v-Statistics, panel ADF-Statistics, and Group ADF statistics, therefore panel v-Statistics, panel ADF-Statistics, and Group ADF statistics are all rejected at both 5 and 10 percent level of significance. Substantively, the results provided by panel co-integration test shows significance in one of the groups and two of the statistics panel, making it sufficient to say that variables in the growth model are co-integrated with each other.

Table 3: shows the results of the exchange rate and economic growth model for the fifteen ECOWAS member countries based on the DOLS estimator. This method of estimation requires the conclusion of leads and lags to avoid the autocorrelation problem among both the explained and the explanatory variables and to also capture the endogenous of the independent variables. To get the robust results of the estimation of

the lags and leads, by using one-year lags and one year of lead DOLS (1, 1).

Therefore, the estimated result shows clearly that there are negative relationships between the following real interest rate, exchange rate, and economic growth, which implied that a one percent (1%) increase in real interest rate and exchange rate leads to 20, and 0.6 percentages decrease in economic growth (GDP) respectively among ECOWAS countries but they are statistically significant at both 5 and 10 percent level. This simply implies that the impact of exchange rate excitability has a negative influence on the economic growth of these ECOWAS member countries.

To analyze the relationship between exchange rate and economic growth with the new growth theory, it is noted that the two variables (the exchange rate and growth) do not support the new growth theory were increasing in exchange rate automatically negatively affects the long-run growth of the economy through its effects of capital change. This result is regarding the findings provided by (Olisaemeka, Camillus and Nwakoby (2017 and Cassell, 2016) which indicate that there is a negative relationship between inflation and economic growth.

On the contrary, the results concerning the impact of exchange rate on economic growth ECOWAS member countries contrast with previous studies as they suggested that exchange rate on economic growth in ECOWAS member countries (O. O. Nathaniel, O. I. Oladiran and A. T. Oldiran (2019)) which a positive implies that an increase in the exchange rate leads to an increase in economic growth among countries in West Africa relying their results on



study such as McKinnon (1963) concluded that “where countries are small, a fixed exchange rate mechanism may help to maintain liquidity and prevent capital flight” and Kenen (1969) who opined that “where countries are less diversified and less equipped with policy instruments, they should make more frequent changes or perhaps resort to flexible exchange rates”.

This study strongly opposed the view put forth on the positive relationship between the two variables by (McKinnon (1963), Kenen (1969) and O. O. Nathaniel, O. I. Oladiran and A. T. Oldiran (2019)) in that increase in exchange rate in the presence of globalization of the economic activities implies the depreciation of country’s currency mostly due to the negative trade balances. Moreover, West African countries majority of their export products are primary commodities and the values of imported fished goods are greater than export causing depreciation in these ECOWAS member countries’ currencies, therefore policymakers cannot rely on the positive relationship among the two variables (exchange rate and economic growth) in a developing economy region like West Africa.

Moreover, the result also shows that an increase in the level of per capita income (LK) and labor shock will lead to an increase in the economic growth of the Western region of Africa A percent (1%) increase in

per capita income and labor leads to 0.41, and 0.24 percentages increase in economic growth (GDP) respectively among ECOWAS countries but they are statistically significant at both 5 and 10 percent level. This revealed a positive relationship between per capita income, labor, and economic growth also statistically significant at both 5 and 10 % (percent) level respectively. Furthermore, this findings certainly supported the a study done by Alagidede and Ibrahim (2016) they intimated in their finding that excessive volatility in exchange rate is disadvantageous to economic growth, an effective monetary policy requires policymakers to factor capital accumulation and exchange rates in particular in setting monetary policy instrument as this is a conduit to inflation targeting. This result is also consistent with previous findings by Jibrin and Jelilov ( 2017).

Meaning that in order to have an effective macroeconomic performance among developing countries and the ECOWAS countries per capita income and labor should be considered as a significant factors in the process of monetary policy formulation in the stimulation of economic growth this result is consistent with Levy-Yeyati and Sturzenegger (2003) they highlighted that elastic exchange rate regimes are related with low economic growth in developing countries.

**Table 3: Results of DOLS estimate of the long run effect of Exchange rate and Economic growth for ECOWAS countries**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LK	0.408803	0.013295	30.74951	0.0000**
LINTR	-0.200589	0.050898	-3.941028	0.0001*
EX	-0.006538	0.001073	-6.092358	0.0000**
L	0.244771	0.053833	4.546879	0.0000**

**Note:** \* and \*\* reject the null hypothesis of the co-integration at 5 and 10 % respectively significant level.

**Source:** Author Computation.

According to the results of the co-integration test, it is certainly concluded that both dependent and independent variables in the model are co-integrated, and consequently making then causally related to each other. The Granger causality testing method is employed to examine the direction of the causal relationship among the variables.

Table 4 below displays the results of the Granger causality test, which implies that there is the existence

of unidirectional causality relationship between exchange rate and economic growth, this results obtained from the test give concert support to the hypothesis that exchange rate increases economic growth, which is suggested by endogenous growth theory. Moreover, the increase in exchange rate gives a clear indication that the country’s macroeconomic performance is not strong enough to increase gross fixed capital and enlighten the country's economic



weakness highlighting among the Economic Community of West African States (ECOWAS).

**Table 5: Granger Causality Test**

<b>Null Hypothesis:</b>	<b>Obs</b>	<b>F-Statistic</b>	<b>Prob.</b>
LINTR does not Granger Cause LGDP	120	3.11770	0.0012**
LGDP does not Granger Cause LRT		1.61547	0.1062
LK does not Granger Cause LGDP	120	3.67129	0.0002*
LGDP does not Granger Cause LK		0.81014	0.6298
L does not Granger Cause LGDP	120	1.66757	0.0924**
LGDP does not Granger Cause L		1.20200	0.2961
EX does not Granger Cause LGDP	120	0.35487	0.9699
LGDP does not Granger Cause EX		0.84398	0.5970
LK does not Granger Cause LRT	120	2.29546	0.0153**
LINTR does not Granger Cause LK		1.23641	0.2738
L does not Granger Cause LINTR	120	0.60786	0.8181
LINTR does not Granger Cause L		2.77876	0.0035**
EX does not Granger Cause LINTR	120	1.54120	0.1293
LINTR does not Granger Cause EX		2.00159	0.0362
L does not Granger Cause LK	120	1.00807	0.4452
LK does not Granger Cause L		1.78896	0.0662
EX does not Granger Cause LK	120	0.95958	0.4882
LK does not Granger Cause EX		2.14009	0.0242
EX does not Granger Cause L	120	0.66197	0.7708
L does not Granger Cause EX		0.79316	0.6463

*Note:* \* and \*\* represent statistical significance at 10% and 5% respectively.

*Source:* Author computation

To Summarized the results of the Granger causality test, show that it is unidirectional between economic growth and real interest rate whereby only the decrease of real interest rate leads to economic growth. Additionally, the result shows that there is a unidirectional causal relationship between economic growth and capital stocks, whereas, the increase in economic growth causes the growth in capital accumulation. Moreover, the result also shows that there is a unidirectional causality between economic growth and labor, wherein, rise in economic growth certainly leads to an increase in effective labor at 5% significant level in ECOWAS countries during the

period of study. However, these results support the neoclassical growth model.

## 5. CONCLUSION AND POLICY RECOMMENDATION

This study explicitly examined the impact of exchange rate on economic growth in West African countries; these results have proven the significance of the observation of exchange rate movements as a major determinant for the formulation of effective monetary policy in order to have a smooth economic growth in developing countries. This result also showed that, exchange rate as a strong indicator for the



determination of key economic growth in ECOWAS countries.

In an act of contributing to existing knowledge, this study used a sample of all of the fifteen (15) ECOWAS countries for the period that runs from 2000-2018 to assess the relationship of exchange rate on economic growth in ECOWAS countries. The results also proved the statistical significance relationship and Granger causality between the exchange rate and economic growth within ECOWAS countries. These results imply that the exchange rate can negatively influence economic growth in these countries, most especially countries that have low capital accumulation and technological improvement and highly relied on the importation of goods and services. However, the results also proved a positive relationship between capital and economic growth. In order, to have a healthy and robust economic growth in developing countries, especially with ECOWAS member countries there is a need for the government of these countries to create an enabling environment for investment and concentrate on the advancement of effective labor (technology and labor), political stability and promote the rule of law. Finally, ECOWAS member countries should muster the courage of creating enabling environment more investments in the major sectors of the individual member countries, such as agriculture, manufacturing, infrastructural development, health, education, and in research and development to facilitates growth and development in order to promote the economic integration drive within the region.

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