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EXCHANGE RATE VOLATILITY AND MANUFACTURING OUTPUT IN ECOWAS ECONOMIES

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ABSTRACT: This study examined the impact of exchange rate volatility on manufacturing output in the ECOWAS, using time series data spanning from 1970 to 2019. The study employed panel data analysis to examine the relationship between exchange rate volatility and manufacturing output among all the ECOWAS countries. GARCH was used to establish the existence of volatility; Dumitrescu & Hurlin Granger non-causality test for causality direction between manufacturing and exchange rate, while Panel fixed, and random effect model was used to assess the magnitude of the effects of exchange rate volatility on manufacturing output in ECOWAS. The result of the volatility test from GARCH confirmed the presence of volatility in Exchange rates across all the countries in ECOWAS. Furthermore, the random effect model results showed that exchange rate volatility has a positive and significant impact on manufacturing output in ECOWAS. Based on the findings of this study, it is therefore recommended that exchange rate policies such as floating exchange rates and exchange rate sterilized intervention that will pave the way for competitiveness should be formulated by monetary authorities in ECOWAS.
KEY WORDS: Exchange rate, Manufacturing Output, Trade Openness, ECOWAS

1. INTRODUCTION

Many economies are primarily engaged in actionable policies that would ensure their economic viability and robustness. In developing economies, this quest is more intense than in developed countries. Developing economies are actively adopting policies that boost productivity and position them in a very competitive standing in the global economy to achieve this laudable goal. One of the strategies pursued by African countries in the ECOWAS regional bloc is controlling their exchange rate level to promote productivity. This move is consistent with the assumption that exchange rate instability continues to be a source of concern because currency values partly influence the price paid or earned for production, affecting the earnings and wellbeing of supply chain economic agents (Chowdhury, 2000). This means that exchange rate fluctuations can impact the amount of output an economy can manufacture since the exchange rate value dictates the cost of production. The Economic Community of West African States (ECOWAS) is a regional organization that was established on May 28, 1975, to promote regional collaboration and integration among member states. Until Mauritania's withdrawal in 2001, ECOWAS had sixteen member countries (Oriakhi and Osaze, 2013). ECOWAS was formed with fifteen member African economies, with the objective of promoting regional growth and unity in all spheres of social and economic trends through elimination of all forms of trade barriers, promoting free movement of labour, and a free trade zone for businesses, and formulating regional sector policies.

Despite ECOWAS' aim to create a standard monetary zone and promote a common market, recent developments in various ECOWAS economies point towards macroeconomic variable fluctuations and extreme hardships among the citizenries. Businesses in Liberia, for example, shut down in February 2017 to pressurise the government due to a higher exchange rate regime and rises in taxes and prices of goods and services, which disproportionately impacted the manufacturing sector (Adeolu & Godwin, 2019). This issue in Liberia likens to cases found in Nigeria and Senegal, among other ECOWAS member economies where the exchange rate is volatile, thereby crippling the manufacturing sector. Increases in the overall price level of goods and services, slow or falling industrial production, currency devaluation, and poor economic growth, among other things, are reflected in practically all ECOWAS economies. In the case of Nigeria, the value of Naira (N) was N1 to $1 in 1981, an average of N100 to $1 in 2000, over about N128 to $1 in 2003, and N361 to $1 in 2018 (CBN, 2016). This fall in the value of the Naira corresponds to a period of high inflation in Nigeria. This unwanted development has resulted in a significant drop in the typical Nigerian citizen's standard of living.

Also, in the case of Ghana, the Ghanaian cedi rose from GHC0.0036 to the U.S. dollar in 1984 to GHC0.0054 to the U.S. dollar in 1985, which represents 33.3%, while growth in its RGDP dropped from about 8.7% to about 5.1& during this period. In 2010, the cedi value further rose from about GHC 43 to the U.S. dollar in 2010 to about GHC1.51 to the U.S. dollar in 2011, showing about 5.4%, while growth in RGDP almost doubled when it moved from about 7.9% to about 14.05% during this period. This is also evident in Francophone countries; the worth of West African CFA Franc Burkina Faso, the West African CFA Franc witnessed a rise from about CFA271.73 per U.S. dollar in 1981 to about CFA328.61 per U.S. dollar in 1982, showing about 20.93% while RGDP in Burkina Faso also rose from about 4.55% to almost 9.56% during this period (WDI, 2016) cited in Olomola and Adejumo (2016).

In an economy such as ECOWAS member nations that are import-dependent, the exchange rate stands as the most vital factor that affects the successes or failures of critical sectors of the economy. These include the oil, manufacturing sector and service sector, which are the major sectors (Ajakaiye, 2001).

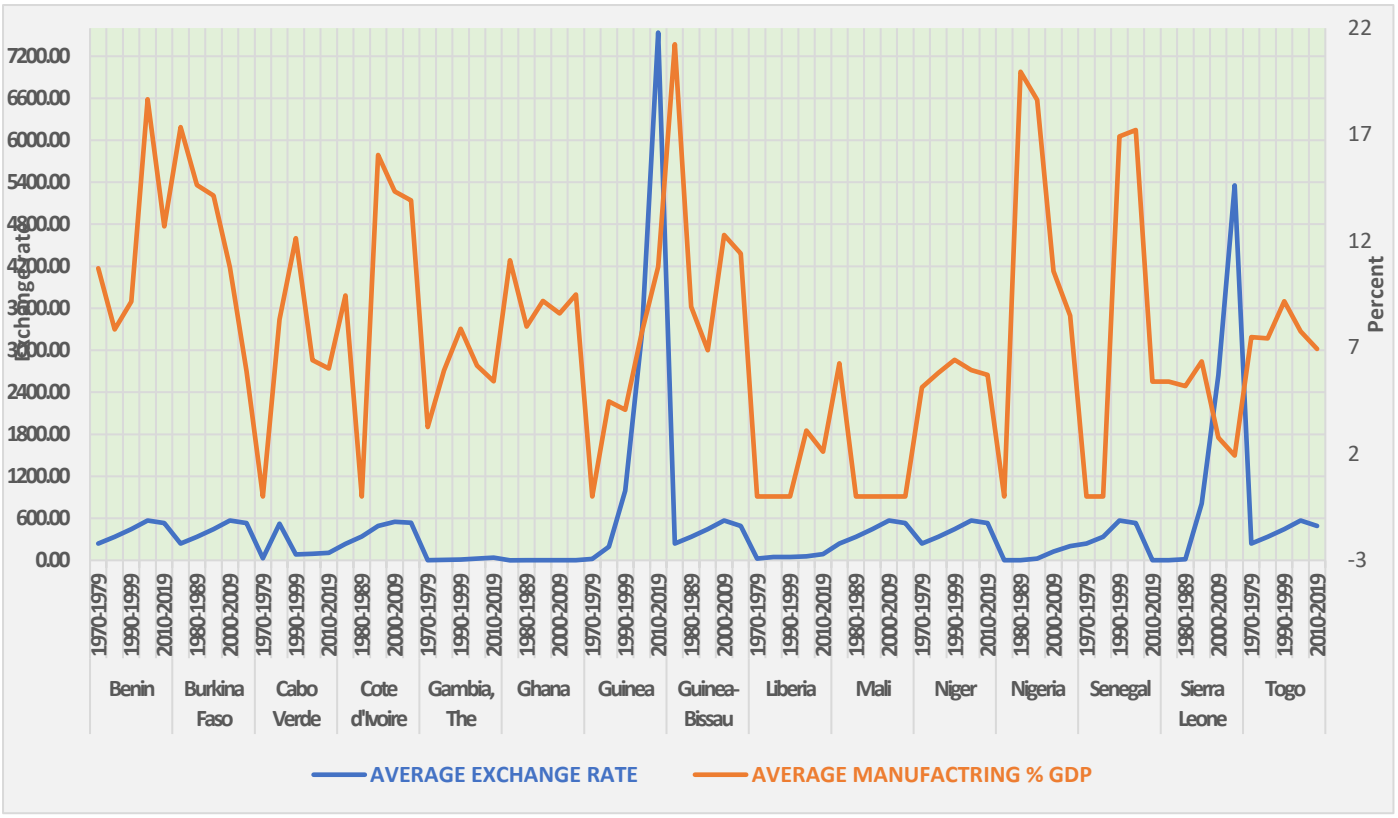

Figure 1. Trend of Exchange Rate and Manufacturing Sector in ECOWAS Member States 1970-2019.
Source: World Development Indicators 2020

Some policy researchers such as Askari and Krichene (2010) doubted the feasibility of adjustment in the real exchange rate to improve the trade balance of ECOWAS member nations because of the existence of elasticity of their low export, others like Olomola and Adejumo (2016) believe that structural policies targeted to improve the operating environment of industries could, however, cause the long-term trends in terms of trade and the prospects for export-led growth and rise in manufacturing sector output. This is obvious in the ECOWAS member countries as there is a poor infrastructure to improve their manufacturing sector. A typical case is the Nigerian manufacturing sector, which proliferated from 1974-to 80 and coincided with the country's oil boom era (CBN, 1984). During this time, manufacturing value-added grew at a pace of roughly 12 percent each year on an average. However, after the conclusion of the oil boom, the manufacturing sector was immediately damaged by a steep drop in local demand (due to a sharp drop in aggregate income) and a severe reduction in the country's import capacity (Olomola and Adejumo, 2016).

Figure one summarizes both exchange rate trends and manufacturing sector percentage contribution to GDP from 1970 to 2019 across all the member nations of the ECOWAS. As seen in the figure, the exchange rate was experiencing a rising trend across ECOWAS countries from 1970 to 2019 with various breaks in its' trend, while the manufacturing sector witnessed a high fluctuating trend from 2017 to 2019. Also, there is a high instability in the manufacturing value-added to GDP axis, which is relatively connected with the rising exchange rate trend. Although the exchange rate and manufacturing trend exhibit a negative relationship, the relationship is weak. These trends suggest that the exchange rate and the manufacturing sector have been experiencing an uncoordinated relationship.

Figure two summarises the trend of manufacturing sector output and trade openness in ECOWAS on a ten-year average from 1970 to 2019. As seen in the graph, both variables have been on the rise over the average year period, but trade openness has not risen above 10 percent, while the manufacturing output has not risen above 80 percent. The trend suggests an improvement and some degree of association between the two variables.

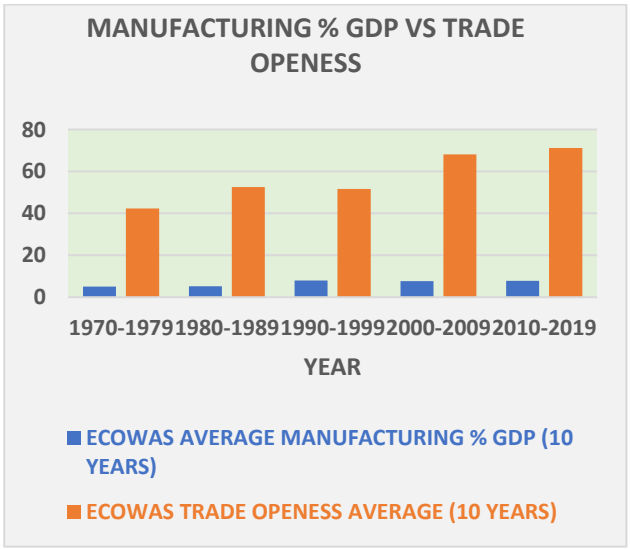

Figure 2. Trends of the Manufacturing Sector & Trade Openness in ECOWAS (1970-2019).

Source: World Development Indicators 2020

The problems of the ECOWAS nations' economies however are seen as failures of the manufacturing sector, which is characterized by fluctuating exchange rate system, low level of foreign investment in manufacturing, low-capacity utilization, low value-added, high production cost, absence of a sound

technological base, poor returns, low contribution to Gross National Products. The performance of the manufacturing sector has been poorly attributed to macroeconomic instability and inconsistency in the exchange rate. The manufacturing sector is weak and heavily import-dependent. It is a net user of foreign exchange contributing less than 1% of foreign exchange earnings and utilizing about 64% of foreign exchange earned (Olomola and Adejumo, 2016). The source of concern comes from the structure of the manufacturing sector. Among these problems are also the issue of the unstable exchange rate, high level of unemployment, and poverty due to declining manufacturing sector growth, hence the need for the present study.

The broad objective of the study is to examine the impact of exchange rate volatility on manufacturing sector output in ECOWAS member nations from 1981 to 2019. The specific objectives include examining whether exchange rate volatility has a significant impact on manufacturing sector output in ECOWAS member countries; ascertaining whether there is a significant impact of trade openness on manufacturing output in ECOWAS countries and determining the direction of causality between exchange rate and manufacturing sector output growth in ECOWAS countries.

2. LITERATURE REVIEW

Mundell-Fleming Model (MFM) was adopted as the theoretical framework for this study. The Mundell-Fleming model, popularly known as the IS-LM-BP model, is an economic model first developed and used in the 1960s by Mundell (1963) and Fleming (1962) (Olivier, 2006). The model was developed independently by the two proponents. Dornbusch (1976) released a series of publications on exchange rate policy in 1976 to improve the model further, codifying these contributions into what he dubbed the Mundell-Fleming model. That concept has dominated the literature on open-economy macroeconomics. The theory is an extent of the IS-LM model. Whereas the known IS-LM Model covered the closed economy (under autarky), the Mundell–Fleming model describes an open economy. The Mundell–Fleming model portrays the underlining short-run feature between a country's nominal exchange rate, interest rate, and output (in contrast to the closed-economy IS-LM model, which focuses only on the relationship between the interest rate and output). Classically, the Mundell-Fleming model explains the equilibrium exchange rate in terms of a traditional macroeconomic model and the foreign currency supply and demand market model. Mundell-Fleming Model has been a workhorse macroeconomic analytical framework for studying the interaction between exchange rate and economic outcomes. The Mundell-Fleming Model framework is also preferred because of its flexibility. It integrates both the open economy and domestic economic outcomes.

Empirically, Fapetu and Oloyede (2014), using a time series of annual data, examined the foreign exchange management and Nigeria's economic growth from 1970 to 2012, adopting the error correction model (ECM) within the OLS methodology. The study observed that managing the economy's foreign exchange rate does affect quite a several economic variables like the volume of export, inflation, the volume of imports, foreign direct investment, which in turn affects growth in the economy; thus, it recommends exchange rate as an effective tool in policy implementation. Gnimassoun (2015) adopted a panel data analysis using the Bayesian averaging (BMA) technique to examine the relevance of the exchange rate regime in restraining current account imbalance in Sub-Saharan African countries from 2000-to 2013. The study showed that flexible exchange rate regimes are more effective in preventing disequilibria. The study recommends that candidates for membership in monetary unions discuss the possible adjustment mechanism widely before forming such unions to share the external shocks at the regional level. Akinlo and Lawal (2015) also tried to look at the impact of the exchange rate on industrial production in Nigeria using a time series annual data of 1986 - 2010 and employing the Vector Error Correction Model. The study saw a strong long-run relationship between industrial production, exchange rate, money supply, and exchange rate. Finally, their study recommends that the supply of Money explains a substantial proportion of variation in industrial production in Nigeria and should not be overlooked.

D-Adamo and Rovelli (2015) adopted the Balassa-Samuelson OLS to examine the significance of the exchange rate regime in the real and nominal convergence process in E.U. nations using panel data from 1990-to 2013. Their findings showed that for nations that used the euro currency, the impact of an increase in the dual productivity growth (the difference in productivity growth between the tradable and non-tradable sectors of the economy) on the dual inflation differential is twice as large as those inflexible countries. The work recommended that too early use of the euro currency may foster excess inflation in such an economy in catching-up economies. Adekoya and Fagbohun (2016) researched vigorously the impact of currency devaluation on manufacturing output growth in Nigeria using an annual time series data spanning from 1980 to 2014 while adopting the Engel-Granger co-integration, Ordinary Least Squares, and Granger causality test for causal relationships.

The work revealed that the rate of inflation, exchange, rate of interest, and export variables excluding imports positively affect manufacturing output growth. The research, therefore, recommended that both monetary and exchange rate policies in the Nigerian economy were not successful in achieving the growth of the manufacturing sector and thus should not be used. Agyapong & Adam (2017) examined the impact of exchange rate stability on economic integration in the ECOWAS from 1980 to 2017 using panel analysis. panel data were used for the study. Data on trade openness, real gross domestic product, per capita income, transport cost, common language, tariff, and exchange rate. The findings suggest that a unit increase in exchange rate regimes will lead to a 0.13% deepening of the economic integration in the ECOWAS. The study concluded that exchange rate stability plays an important role in promoting economic integration in the ECOWAS, and there is a need to achieve such stability.

Tams-Alasia, Olokoyo, Okoye, and Ejemeyovwi (2018) investigated the impact of exchange rate deregulation on manufacturing output performance in the Nigerian economy using annual data from the period 1980-to 2016. The normalized co-integration technique was adopted to check for the long-run impact between exchange rate and manufacturing output, while the granger causality test was also adopted to test the causality direction between them. The study findings observed that the exchange rate has a non-significant positive long-run effect on manufacturing industry output. Nonetheless, the unidirectional causal impact of the exchange rate on manufacturing output was established using the pairwise granger causality test. The work thus recommended that although a unidirectional causal effect exists, it is not positive,

and policymakers should enact an exchange rate policy that is manufacturing friendly.

Adeolu & Godwin (2019) try to examine the empirical analyses of the impact of exchange rate on gross domestic product and other macroeconomic aggregates in ECOWAS nations using a pane data spanning from 1990 to 2014 while adopting the Classical Linear Regression model (CLRM) for ten ECOWAS economies. The finding of the analysis indicated how significant exchange is in determining the gross output (GDP) in four (4) countries, and inflation was only significant for three (3) countries, while interest rate was only significant in one country. The study ended by suggesting that diversification of the economy from import to export-based economy is fundamental for industrial growth and development. Ndlela & Ndlela (2019) examined the impact of exchange rate volatility on output growth in the ECOWAS, using time series data spanning from 1980 to 2017. The study employed panel data analysis to examine the relationship between exchange rate volatility and output growth among the selected countries within the ECOWAS countries. GARCH was used to establish the existence of volatility, while Panel ARDL was used to assess the magnitude of the effects of exchange rate volatility on output growth in ECOWAS. The result of the volatility test from GARCH confirmed the presence of volatility in the Real Effective Exchange Rate (REER) across all the selected countries in ECOWAS. The study recommended that ECOWAS countries should endeavor to add more value to their products before exporting them to other countries. Oladunjoye, Olagbaju, & Akinbobola (2019) investigated the impact of exchange rate regimes' economic integration in the ECOWAS from 1980 to 2015. Secondary annual data were used for the study. Annual data on variables such as trade openness, real gross domestic product, per capita income, transport cost, common language, tariff, and exchange rate covering 1980 to 2018. The study found that the coefficients of per capita income, transport cost, common language, and exchange rate regimes have positive and significant effects on economic integration in the ECOWAS. In contrast, coefficients of real gross domestic product and tariffs negatively affect economic integration in the ECOWAS. The study concluded that exchange rate regimes play an important role in promoting economic integration in the ECOWAS.

3. METHODOLOGY

This work is conducted by employing an econometric methodology to research. The methodology used in this research work is the Panel GARCH model and Panel fixed-effect model. That is the Fixed or Random effect methodology. Also, the granger causality analysis on a panel series will be used to capture the causality effect. Economic, statistical, and econometric tools will be used to analyze and present data. Choice of variables selection is based on what obtains in theoretical premise, especially concerning the unified models of exchange rate volatility affect manufacturing output, exchange rate volatility, and direction of causality between exchange rate and manufacturing output growth which is a synthesis of the mainstream of the research.

Modeling the Impact of exchange rate volatility on manufacturing sector output in ECOWAS member countries adopting the Panel GARCH.

$$Yit = \alpha 0 + \sum \alpha it\ \varepsilon 2it\text{-}1 + \sum \beta it\ Yit\text{-}1 + Vit \quad (1)$$

Where: ε2it-1 (the panel ARCH term) captures the volatility of the previous periods and is measured by the lag of squared residuals from the mean equation; and Yit-1 (the panel GARCH term) which is the variance from the previous period.

Modeling the Impact of trade openness on manufacturing sector output in ECOWAS member countries. Adopting the Panel Fixed and Random Effect model.

Fixed Effect:

$$Yit = \alpha 0 + \beta 1Xit + \varepsilon it \quad (2)$$

$$MANi\ t = \beta 0 + \beta 1TOPit + \beta 2INFit + \beta 3INTit + \beta 4EXRit + \varepsilon it \quad (3)$$

Random Effect:

$$Yit = \alpha 0 + \beta 1Xit + \mu i + \varepsilon it \quad (4)$$

$$MANi\ t = \beta 0 + \beta 1TOPit + \beta 2INFit + \beta 3INTit + \beta 4EXRit + \mu i + \varepsilon it \quad (5)$$

Where: μi = random characteristic of the i-th unit observation; εit = random characteristic combination of cross-section and time series.

In general, MAN denotes Manufacturing % contribution to GDP, EXR denotes Exchange rate, INF denotes Inflation rate, INT denotes Interest rate, TOP denotes Trade Openness, β0 denotes the intercept term, β1, β2, β3, β4 representing the slopes or parameters of their respective variables, εit denotes a random characteristic combination of cross-section and time series, i represents the ECOWAS countries, and t represents the time. The data series was gotten from the World Bank World Development Indicators.

4. EMPIRICAL RESULTS

Table 1 presents the descriptive statistics of the variables to be applied in the econometric model. The table reveals that the manufacturing % to GDP has an average value of 8.7, a minimum value of -13, and a maximum of 22.3. On the other hand, the exchange rate has an average value of 526.6, with a minimum value of 0 and a maximum of 9899.1. Also, Trade Openness has an average value of 60.2, with a minimum value of -93.6 and a maximum value of 81.4.

Table 1. Summary Statistics of the Variables.

Variables	Observation	Mean	Standard Deviation	Minimum	Maximum
Manufacturing % GDP	750	8.725247	5.871341	-13.0049	22.33632
Exchange rate	750	526.5547	1192.494	0.000102	9899.089
Trade Openness	750	60.2224	2.323186	-93.5511	81.3541
Interest rate	750	9.912466	20.6798	-65.85715	122.874
Inflation rate	750	9.422976	15.19177	-17.72285	122.8745

Adopting the Levin, Lin, and Chu panel unit root test on the five variables for the study, we note that there was a presence of unit root for manufacturing percentage to GDP, Exchange rate, Trade openness, and Interest rate non-stationary. However, applying the first differencing, they all became stationary. Also, the inflation rate was stationary at level form as there was no presence of unit root.

Table 2. Panel Unit Root Test.

Variable	Prob* Level Form	Stationary/Not Stationary	Prob* 1st Difference	Stationary/Not Stationary
Manufacturing % GDP	0.6340	NST	0.0000	ST
Exchange rate	1.0000	NST	0.0000	ST
Trade Openness	0.0794	NST	0.0001	ST
Interest rate	0.3926	NST	0.0000	ST
Inflation rate	0.0066	ST	-	-

Decision Rule: Reject Ho, if p-value < 0.05 at $\alpha = 5\%$, otherwise do not reject
Note: NST implies not stationary, and S.T. implies stationary.

Having known the order of integration, the next stage is to test for the existence of a long-run relationship between the variables. The co-integration test aims to determine whether a group of non-stationary series is co-integrated or not. Therefore, with the manifestation of unit root I (0) and I (1) by variables of interest, which is a precondition for an unstable linear relationship, we employ the Pedroni panel co-integration test.

Table 3. Pedroni Panel and Augmented Dickey-Fuller Co-integration Test

	Statistics	Probability Value
Phillips-Perron t	-2.6744	0.0037
Augmented Dickey-Fuller t	-1.9607	0.0250

Decision rule: Reject H_0 if the statistics were more significant than the critical values at a 5% significance level and fail to reject it otherwise.

The panel cointegration results from Table 3 provide evidence of cointegration since most Pedroni test statistics reject the null hypothesis of no cointegration for the estimated model. The same interpretation can be drawn from the Augmented Dickey-Fuller t statistics, where the null is rejected in both cases. This indicates that there is cointegration in the model.

The study progresses by testing for heteroscedasticity in the exchange rate dataset since one of the problems in this study is to check for volatility clusters in the exchange rate. The lag length was set to four. Table 4 displays the results of the ARCH LM test. Ho= Homoscedasticity.

Table 4. Volatility Test

F-Statistics	12.08027	Prob. F		0.0000
Obs*R-squared	50.66247	Prob. Chi-Square		0.0000

Decision rule: reject null hypothesis if p-value < 0.05, otherwise do not reject.

The ARCH (4) test results are shown in the table. The null hypothesis of no heteroskedasticity is rejected since the probability of F-statistics and chi-square are zero. This shows that ARCH (volatility) is present in exchange rate data across ECOWAS members. With this information, the research uses the ARCH/GARCH technique to determine the degree of data volatility.

Table 5. GARCH Model

Variable	Coefficient	Standard Error	P-value
Exchange rate	0.000141	0.221471	0.071
Trade openness	0.009840	0.000639	0.000
Inflation	0.006751	0.002097	0.243
Interest rate	0.044409	0.008646	0.000
Variable	**Coefficient**	**Standard Error**	**P-value**
ARCH L1.	0.9792	0.1398	0.000
GARCH L1.	0.1305	.0662	0.049

Exchange rate: The exchange rate coefficient is **0.000141**, evidently showing that the exchange rate has a positive relationship with manufacturing sector output. The result also shows that the exchange rate is a significant factor responsible for manufacturing sector output in ECOWAS countries. Empirical evidence has shown that holding other variables constant, a 1 percent increase in the degree of exchange rate leads to a 0.004 percent increase in manufacturing sector output in ECOWAS.

Trade Openness: From the coefficient of trade openness (**0.00984**), it is observed that economically, there is a positive relationship between trade openness and the manufacturing sector. Economically this result tells us that a percentage increase in trade openness will lead to a 0.09 percent increase in manufacturing sector output; by implication, trade openness accounts for a 0.09 percent increase in the manufacturing sector output in ECOWAS countries.

Inflation rate: The inflation rate has a coefficient of (**0.006751**) indicating that every 1 percent increase in the inflation rate leads to an increase in manufacturing sector output in ECOWAS countries by 0.06 percent.

Interest Rate: The coefficient of interest rate is (**0.044409**), which implies that if other variables are held constant, a percentage increase in interest rate will, on average, lead to an increase in manufacturing sector output in ECOWAS countries by over 0.4 percent.

The ARCH term is the volatility from previous period measures as the lag of the square residual from the mean equation is 0.9792, and the GARCH term is the last period forecast variance is 0.1305 in Table 5. They are both significant at the 5% level. The rule of thumb for determining the presence of volatility after summing the root of the autoregressive model is that:

If $\alpha + \beta$ is less than 0.5, there is no volatility,

If $\alpha + \beta$ falls between 0.5 and 1, there is volatility,

If $\alpha + \beta$ is greater than 1, this is a case of overshooting.

The sum of the two coefficients is 1.1097, more significant than 1.0. This shows that the exchange rate in the ECOWAS is overshooting; that is, a high level of volatility is present in the exchange rate.

Table 6. Fixed and Random Effects Model

Variables	Fixed Effects	Random Effects
Exchange Rate	0.0004**	0.0004**
	(0.003)	(0.003)
Trade Openness	-0.0028*	-0.0027*
	(0.495)	(0.490)
Inflation Rate	0.0409***	0.0403***
	(0.000)	(0.000)
Interest Rate	-0.0204**	-0.0193**
	(0.035)	(0.045)
R-Squared	0.0054	0.0050
F-Statistics	95.35***	
	(0.0000)	
Wald		20.39**
		(0.0004)
Hausman Prob		0.7823

Note: *, ** and *** denotes statistical significance at 10%, 5% and 1%. Dependent Variable: Manufacturing percentage to GDP. Random effect model standard error adjusted for autocorrelation and heteroskedasticity.

Results from table 6 reveal the impact of the exchange rate on the manufacturing output of ECOWAS economies. The results from the fixed-effects model show that exchange rate and inflation rate have a positive and significant impact on manufacturing output, whereas Trade openness and interest rate exact a negative impact on manufacturing output. However, only the interest rate exacts a negative and significant impact.

Similarly, in the random effect model, it is also revealed that exchange rate and inflation rate have a positive and significant impact on manufacturing output, whereas Trade openness and interest rate exact a negative impact on manufacturing output. While trade openness has a negative but insignificant impact on the manufacturing output, interest rate has a negative and significant impact.

The result of the Hausman, which has a probability value greater than 5%, indicates that the random-effects model is the most preferred and, as such, inference should be based on the random-effects model.

The economic implication of this result is that when the exchange rate appreciates, ECOWAS manufacturing sector output experiences a boom. Also, a rise in inflation improves the sectoral manufacturing growth. A decrease in interest rate economically suggests that manufacturing output will grow as there will be an increase in sectoral investments. Finally, the insignificant result of trade openness suggests that manufacturing output has been insensitive to the changes in trade openness as ECOWAS countries are yet to participate significantly in international trade.

The Dumitrescu & Hurlin Granger non-causality test will be employed to test for Granger-causality between exchange rate and manufacturing output.

Table 7. Granger Test

Granger Test	Z-Bar Stats	P-Value	Lag
EXR does not Granger-cause MAN	0.7370	0.4611	2
MAN does not Granger-cause EXR	1.3535	0.1759	2

Decision rule: reject the null hypothesis if the p-value is less than 0.05 at a 5% significance level; otherwise, do not reject.

The Granger causality is not found to run from the exchange rate to manufacturing output in terms of the exchange rate. The null hypothesis of exchange rate does not Granger Cause manufacturing output is not rejected at the 5 percent level of significance where the probability value is 0.4611. Also, Granger causality is not found to run from manufacturing output to exchange rate. The null hypothesis of manufacturing output does not Granger Cause exchange rate is not rejected at the 5 percent level of significance with probability 0.1759.

Table 8. Post Estimation Test

Test	P-Values	Decision
Wooldridge Autocorrelation Test	0.0001	Autocorrelation
Breusch and Pagan Lagrangian multiplier test	0.0000	Heteroskedasticity

Table 8 shows the post-estimation result. There are both issues of autocorrelation and heteroskedasticity, indicating that the Panel's error term is correlated and has no constant variance. However, the study employed a robust random effect method of regression and an adjusted random effect standard error.

Discussion of Results

In the study, the GARCH and the fixed and random effect models were specified to capture exchange rate volatility and trade openness impact on manufacturing growth.

In the GARCH model, exchange rate volatility existed as the exchange rate was positively significant in the model. The result equally found other factors in the model like interest rate and trade openness that statistically impacts on manufacturing sector output of ECOWAS countries. Based on the volatility test, it can be deduced that the volatility exists. From the above empirical evidence, we reject the null hypothesis, which states that Exchange rate volatility has no significant impact on manufacturing sector output in ECOWAS member countries and conclude that exchange rate volatility significantly impacts manufacturing sector output in ECOWAS member countries.

The second objective adopted the random effect model as efficient based on the Hausman test. The model result shows that trade openness has a negative and insignificant impact on manufacturing sector output. With this evidence, this study does not reject the null hypothesis that states trade openness has no significant impact on manufacturing sector output in ECOWAS member countries.

The third research objective states that no clear direction of causality exists between exchange rate and manufacturing sector output in ECOWAS member countries. No causality was found to exist. Based on this empirical evidence that we firmly conclude that there exists no clear direction of causality between exchange rate and manufacturing sector output in ECOWAS member countries.

6. CONCLUSIONS AND POLICY RECOMMENDATIONS

Based on the results and findings of this study, the following conclusions were made: Judging from the analysis of the impact of exchange rate volatility on the manufacturing output growth in ECOWAS, the study revealed that exchange rate volatility and inflation rate have a significant positive impact on manufacturing output growth in ECOWAS countries while interest rate has a negative significant impact. However, variables like trade openness showed a negative and insignificant relationship with manufacturing output growth within the ECOWAS region. We, therefore, conclude that increase in exchange rate volatility is proportionally significant to output growth in ECOWAS. It was therefore concluded that exchange rate volatility has little or no impact on manufacturing output in ECOWAS. This may be attributed to different monetary policies and a lack of proper institutional

framework being put in place within this sub-region and these, in turn, have an impact on the level of exchange rate movement and manufacturing output in ECOWAS.

Given all the findings in this research work, the following recommendations are therefore put forward. Firstly, there is a need for an exchange rate policy that will pave way for competitiveness and should be formulated and implemented by the monetary authorities within the ECOWAS sub-region. Also, ECOWAS countries should endeavor to add more value to their export commodities before exporting them to other countries. Furthermore, there is a need for efforts to be made to look at the manufacturing sector of the ECOWAS economy, in other to broaden ECOWAS countries and diversify their export base. Last but not the least, given the positive and significant effect of the inflation rate on manufacturing output, this suggests that an increase in the inflation rate reflects a mild increase in imports. Therefore, this indicates the implementation of an effective monetary policy aimed at controlling inflation.

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