

# EXCHANGE RATE VOLATILITY AND FOREIGN DIRECT INVESTMENT IN SELECTED WEST AFRICAN COUNTRIES

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## ABSTRACT

*This paper empirically investigates the exchange rate volatility-FDI nexus in selected Economic Community of West African States (ECOWAS) countries using time series data from 1986-2017. Using Autoregressive Distributed Lag (ARDL) model and Toda-Yamamoto (1995) causality techniques, the effects of exchange rate volatility on FDI and causality relationship between the two are examined. The empirical results show that the estimated coefficient of nominal exchange rate volatility is negative in all the selected countries but significant only in Ghana, Sierra Leone, and Nigeria. Conversely, the effect of real exchange rate volatility is negatively significant as expected, in Nigeria, Togo, Sierra Leone, and Cote d'Ivoire. However, the effect is positive but statistically insignificant in Ghana and Gambia. Furthermore, the causality test results show unidirectional causality from exchange rate volatility to FDI in all selected countries except in Ghana when the nominal exchange rate is employed. On the other hand, when real exchange rate volatility is employed, there is evidence of bidirectional causality between the two variables only in Nigeria and Sierra Leone.*

**JEL:** F21, F31, F39

**KEYWORDS:** Exchange Rates Volatility, Foreign Direct Investment, Autoregressive Distributed Lag Model, Economic Community of West African States

## INTRODUCTION

Over the past few decades, foreign direct investment (FDI) is widely recognized as the principal engine of economic growth for both developed and developing countries. FDI has proved to be of great benefit to many countries, especially developing countries that are experiencing capital deficiencies and technological backwardness. Kiyota and Urata (2004) opine that FDI not only transfers financial resources but also introduce technology and managerial know-how from investing countries to the recipient or host countries. However, there has been sudden upsurge and uneven distribution of FDI inflows to developed countries compared to developing countries particularly, African countries. To corroborate this assertion, United Nations Conference on Trade and Development (UNCTAD, 2018) reports show that FDI flows to African countries continued to slide, reaching \$42 billion in 2017, about 21% decline from 2016 and the slump in FDI flows to Africa was attributed to weak oil prices and lingering effects from the commodity bust, as flows contracted in commodity-exporting economies such as Egypt, Mozambique, Congo, Nigeria and Angola.

African countries are marginalized in the area of financial globalization (Ndikumana and Verick, 2008), and are experiencing volatile and dwindling FDI inflows. The decline and fluctuation in FDI inflows to these countries have been attributed explicitly to specific determinants, including economic growth, institutional quality, trade openness, political instability, infrastructural availability, economic freedom,

labour productivity, and domestic investment. However, theoretical and empirical literature has shown that among the commonly investigated macroeconomic determinants of FDI, exchange rate volatility is identified as the primary deleterious variable determining FDI flows (Bénassy-Quéré, Fontagné and Lahrèche-Revil, 2001; Kiyota and Urata, 2004; and Ogunleye, 2009).

Several studies have investigated the effect of exchange rate volatility on FDI flows based on cross-country or country-specific, and their empirical findings have produced mixed results. This suggests that the empirical issue remains open for further investigation. For instance, a group of studies provide empirical evidence that the effect of exchange rate volatility on FDI is positive and argued further that exchange rate volatility increase FDI flows to the host countries (see Cushman, 1989; Froot and Stein, 1991; Campa, 1993; Golberg and Kolstad, 1995; Chowdury and Wheeler, 2008; and Dhakal et al. 2010). In contrast, studies conducted by Gorg and Wakelin (2002); Kiyota and Urata (2004); Kyereboah-Kwame (2008); Ogunleye (2009); Bahmani-Oskoe and Hajilee (2013) and Odili (2015) among others suggest a negative relationship between exchange rate volatility and FDI flows. Yet, few studies report no significant relationship among the variables.

Apart from the dynamic relationship between exchange rate volatility and FDI flows, the direction of causality between these variables has also remained a subject of controversy to date in the literature with lack of consensus among the researchers (see, for instance, Benassy-Querre et al., 2001; Kiyota and Urata, 2004; Ruiz, 2005; Ogunleye, 2009 and Zakaria, 2013). Most extant studies argued that the direction of causality runs from exchange rate volatility to FDI inflows. Nevertheless, there is a possibility of feedback or bi-directional causality between FDI and exchange rate volatility, which address the issues of endogeneity bias. Given the dichotomies that exist among the researchers on volatility-FDI nexus, we provide further evidence to the burgeoning debate on the relationship between exchange rate volatility and FDI in the experience of selected Economic Community of West African States (ECOWAS) countries.

In this work, we thus examine the nexus of relationship between exchange rate volatility, and FDI flows using both Autoregressive Distributed Lag (ARDL) model proposed by Pesaran et al. (2001) and Toda-Yamamoto (1995) causality test techniques for selected ECOWAS countries. The study employs both nominal and real exchange rates data to generate exchange rates volatility from Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model proposed by Bollerslev (1986).

The remainder of the paper is set out as follows. Section 2 presents a brief literature review related to exchange rate volatility and FDI flows. Section 3 provides the data and methodology. Empirical results are given in section 4, and section 5 presents the concluding remarks.

## LITERATURE REVIEW

Considerable numbers of studies have examined the effect of exchange rate volatility on foreign direct investment (FDI) flows across the globe. Despite the continuum of studies investigating the volatility-FDI nexus based on country-specific or cross country studies, they have generally provided mixed evidence due to different econometric techniques, choice of time, measures of exchange rate volatility, model misspecification and countries considered among others. Among these studies, Elsharif-Suliman (2006) investigated the effect of exchange rate volatility on foreign direct investment (FDI) for low-income countries of sub-Saharan African countries using two-Stage Least Squares (2SLS) technique over the period 1990-2013. The empirical findings indicate that depreciation of the real exchange rate attracts more FDI to the countries under consideration, but an increase in exchange rate volatility discourages FDI flows to these countries. The author thus concluded that the US dollar peg system is an attractive exchange rate regime for foreign investors in sub-Saharan African countries due to the volatility of the exchange rate.

Kyereboah-Coleman and Agyire (2008) focused on the same issue by examining the effect of real exchange rate volatility on FDI inflow in the case of Ghana. The authors employ both Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models as a measure of exchange rate volatility. They found that real exchange rate volatility has a significant negative effect on FDI flows and concluded that the political factors and market size of a country is one of the primary determinants of FDI flows to a particular country. Similarly, Ogunleye (2009) explored the relationship between exchange rate volatility and FDI flows in sub-Saharan African (SSA) countries with a specific focus on Nigeria and South Africa covering the period 1970-2005. The empirical findings revealed that exchange rate volatility has a significant negative effect on FDI in the case of Nigeria, but a weak and insignificant result in the case of South Africa. The weak impact of exchange rate volatility on FDI flows in South Africa could be attributed to the sound capital flows management policies implemented by the policymakers.

Nyarko, Nketiah-Amponsah, and Barnor (2011) also investigated the effect of the exchange rate regime on FDI inflows in Ghana for the period 1970-2008 using Ordinary Least Square (OLS) and Error Correction Model (ECM) techniques. They found that real exchange rate volatility has no significant effect on FDI flow and therefore suggest that the country's quest to attract FDI should go hand in hand with the sustainability of the democratic regime in the country.

Taking account of endogeneity issues, Ogunleye et al. (2012) examined the effect of real exchange rate volatility on FDI flow in selected sub-Saharan African countries using simultaneous equation and Granger Causality techniques. The results showed that FDI has a significant effect on the exchange rate only in Nigeria, South Africa, and Botswana. The significant impact of exchange rate volatility on FDI is reported in Botswana, Cameroon, Nigeria, and South Africa only. They suggest the need for policy coordination between monetary and fiscal authorities to ensure that fiscal policy does not undermine the efforts of monetary authorities at managing the exchange rate effectively.

Furthermore, an empirical study conducted by Omokunwa and Ikponmwosa (2014) investigated the dynamic relationship between exchange rate volatility and FDI in Nigeria using the Error Correction Model (ECM) technique over the period 1980-2011. They found a weak effect of exchange rate volatility on FDI flow in both short-run and long-run periods. Osei-Fosu et al. (2015) also examined the impact of exchange rate volatility on FDI flows in Ghana using the Two-Stage Least Square estimation technique. They found that the responsiveness of FDI to exchange rate volatility is negative and statistically significant.

Recently, Asmae and Ahmad (2019) examined the effect of price and real exchange rate volatility on FDI flows in Morocco and Turkey over the period 1990-2017. The empirical findings indicate that, in the case of Morocco, real exchange rate volatility has a significant effect on FDI flow in both time horizons. Although, most studies have empirically investigated the impact of the real exchange rate volatility on FDI flow across the countries with little or no consideration on the effect of nominal exchange rate volatility on FDI flows in the case of sub-Saharan African countries, particularly West African countries. As noted by Haile and Pugh (2013) that the impact of both nominal and real exchange rate volatility on trade only differ a long period of time. In essence, both nominal and real exchange rates have no distinct effect on trade in the short run except in the long run period. This study attempts to investigate the differential impact of both nominal and real exchange rate volatility on FDI flow in Selected ECOWAS countries.

## DATA AND METHODOLOGY

We used annual data spanning from 1986 to 2017. The choice of the time frame is informed by the fact that all the selected countries have switched from a fixed system to a flexible exchange rate regimes. Aside from this, these countries implemented comprehensive economic reform policies such as liberalization and privatization reforms. Six Economic Community of West African States (ECOWAS) countries, namely Nigeria, Ghana, and Cote d'Ivoire, Sierra Leone, Gambia, and Togo, are selected for this study based on data availability on real and nominal exchange rates. All variables employed in this study are sourced from World Development Indicators Database (2017). The Definition and the measurement of the variables used in this paper are presented in an Appendix.

### Model

Taking a cue from previous studies including Kiyota and Urata (2004); Kyereboah-Coleman and Agyire-Tettey (2008) and Oyelami (2012), the estimated model to examine the effect of exchange rate volatility on FDI flows is specified as follows:

$$\ln FDI_t = \alpha_0 + \beta_1 \ln PGDP_t + \beta_2 \ln INFR_t + \beta_3 VOL_t + \beta_4 \ln OPEN_t + \varepsilon_t \quad (1)$$

where FDI is the total inflow of foreign direct investment as a percentage of GDP; PGDP is real per Capita Income which measures the market size and growth; INFR is infrastructural availability proxy as the number of telephone subscribers per 100 people; OPEN is trade openness; VOL is the exchange rates volatility decomposed into nominal exchange rate (NVOL) and real exchange rate (RVOL);  $\varepsilon_t$  is the error term and In denotes as the natural logarithmic form. The a priori expectations of the coefficients are expected to be positive except the coefficient associated with the exchange rates volatility that is indeterminate.

## RESULTS

Before we conduct an empirical investigation of the study, it is conventional to determine the stationary properties of the variables to be used to avoid inconsistent and spurious results because time series data are often characterized to be non-stationary which prompted the need to subject the variables to stationary scrutiny using Augmented Dickey- Fuller (ADF) and Phillips-Perron (PP) tests. Due to space conservation, the results of the unit root tests are not present in this study. The unit root test results indicate that most variables are non-stationary at level but become stationary at the first difference, confirming that the variables are integrated of I(0) and I(1).

Given that the variables are integrated of a different order of integration, employing Autoregressive Distributed Lag (ARDL) model proposed by Pesaran et al. (2001) is appropriate for this investigation since it is generally established that ARDL is applicable irrespective of the order of integration of variables. Thus, this study proceeds to estimate the long-run cointegration relationship among the variables using the ARDL Bound test approach. Table 1 reports the results of the ARDL bound test. The results indicate that the computed F-statistic is greater than the upper critical bounds generated by Pesaran et al. (2001) in all the selected Economic Community of West African States (ECOWAS) countries at 5% and 10% significant levels when both nominal and real exchange rates are chosen as one of the explanatory variables separately. The findings validate the existence of long-run relationship between Foreign Direct Investment (FDI) and its determinants.

Table 1: ARDL Bound Test Results

Country	F-statistics	Critical Value (5%)	Critical Value (10%)	Volatility Measure
Cote d'Ivoire	5.70**	2.86-4.01	2.45-3.42	Nominal exchange rate
Gambia	4.09**	2.86-4.01	2.45-3.42	Nominal exchange rate
Ghana	3.65***	2.86-4.01	2.45-3.42	Nominal exchange rate
Nigeria	6.93**	2.86-4.01	2.45-3.42	Nominal exchange rate
Sierra Leone	4.68**	2.86-4.01	2.45-3.42	Nominal exchange rate
Togo	3.89***	2.86-4.01	2.45-3.42	Nominal exchange rate
Cote d'Ivoire	4.12**	2.17-3.21	1.92-2.59	Real exchange rate
Gambia	3.77***	2.17-3.21	1.92-2.59	Real exchange rate
Ghana	3.82***	2.17-3.21	1.92-2.59	Real exchange rate
Nigeria	4.14**	2.17-3.21	1.92-2.59	Real exchange rate
Sierra Leone	4.68**	2.17-3.21	1.92-2.59	Real exchange rate
Togo	3.89***	2.17-3.21	1.92-2.59	Real exchange rate

Note: \*(\*\*) and \*\*\* represents significant at 1(5) % and 10% levels respectively.

Having established that long-run relationship exists between the variables. We estimate our error correction model, i.e., ARDL, which embodies both the long-run and the short-run dynamics. The estimated long-run results of the relationship between exchange rate volatility and FDI in the selected ECOWAS countries are presented in Table 2 using nominal and real exchange rates volatility variable separately for each model. The results show that GDP per Capita is positive and statistically significant in the case of Nigeria, Cote d'Ivoire, Sierra Leone, and Gambia for both nominal and real models and these findings are consistent with our expectations and previous studies. In Ghana and Togo, the effect of GDP per Capita on FDI flows is negative and insignificant in each model, respectively.

The coefficient estimate of trade openness is positive and statistically significant in all the selected countries for both models. This positive finding suggests that countries with a high degree of openness and good business climate attract more foreign investors into their countries, and it is evident that these selected countries have liberalized their trade regime, which creates conducive environment and more competition among the foreign investors.

The effect of infrastructural availability is positively significant on FDI flows in Cote d'Ivoire, Ghana, Gambia, and Nigeria, respectively for the model with real exchange rate volatility. At the same time, Cote d'Ivoire, Ghana, and Nigeria are reported to be positive and significant only for model with nominal exchange rate volatility. This result implies that an increase in infrastructural availability attracts more FDI flows. However, the coefficient estimate of infrastructural availability is negative in the case of Sierra Leone and Togo only for the nominal model, and these negative findings could be attributed to the prevalence of inadequate infrastructural facilities in these countries. Based on these results, infrastructural availability plays a vital role in attracting foreign investors into the country. It also provides foundation and confidence for foreign investors to invest in a particular country.

Furthermore, the findings also show that the coefficient of nominal exchange rate volatility is negative in all the selected countries but significant only in Ghana, Sierra Leone, and Nigeria. In Nigeria, Togo, Sierra Leone, and Cote d'Ivoire, the coefficients of real exchange rate volatility are significant and negative, but positive findings are reported in the remaining countries. The significance of negative exchange rates volatility supports the theoretical literature, especially risk aversion argument that exchange rate volatility increases risks or uncertainties for the risk-averse foreign investors, which affects their profits or relative asset and consequently reduces FDI. Overall, the findings show that real exchange

rate volatility exerts much effect on FDI than the nominal exchange rate volatility in terms of magnitude and significance.

Table 2: Long Run Estimates Results

Countries	Constant	GDP	OPEN	INFR	VOL
<b>Panel A: Nominal Exchange Rate Volatility (NVOL)</b>					
Cote d'ivoire	38.4(1.26)*	1.39(0.57)***	0.71(2.58)*	1.73(2.62)*	-3.52(-1.85)
Gambia	12.7(1.41)	2.20(5.63)**	4.60(1.57)***	3.42(2.58)	-1.93(-2.57)
Ghana	0.64(1.55)**	-1.04(-3.59)	0.71(2.46)**	1.73(1.29)**	-3.52(-1.66)**
Nigeria	9.88(1.47)	1.58(2.40)***	0.91(0.79)***	7.61(0.69)***	-2.57(-3.99)*
Sierra Leone	9.31(4.32)	1.27(3.46)**	9.71(2.48)**	-12.7(-1.63)	-1.47(-1.27)**
Togo	7.10(1.13)	5.06(2.50)*	1.30(1.59)**	-3.18(-1.50)	-2.37(0.26)
<b>Panel B: Real Exchange Rate Volatility (RVOL)</b>					
Cote d'ivoire	5.36(1.49)	2.01(0.73)*	1.82(2.69)*	2.47(1.50)*	-4.55(-1.33)**
Gambia	4.86(1.93)	0.42(1.52)**	6.50(1.21)**	4.28(0.68)**	4.20(1.64)
Ghana	9.30(3.95)***	1.25(2.06)***	1.90(3.46)**	0.74(1.85)**	2.01(0.58)
Nigeria	4.63(1.10)*	1.16(0.89)**	4.30(1.56)***	2.21(0.38)**	-0.51(-1.26)***
Sierra Leone	3.18(2.05)	1.54(0.23)**	3.84(5.47)*	3.74(1.41)	-1.49(-2.08)**
Togo	1.78(3.34)**	-4.98(-2.02)	0.92(3.41)	0.32(2.87)	-3.35(-1.48)*

This table shows the long-run estimates results for both exchange rates. Panel A shows the results for the nominal exchange rate model. Panel B shows the results for the real exchange rate model. Where GDP represents economic growth, OPEN is the trade openness, INFR denotes as infrastructure availability and VOL is the exchange rates, including both nominal real exchange rate and real exchange rate. The values in parenthesis are t-statistic. \*\*\*, \*\*, and \* indicate significance at the 1, 5 and 10 percent levels, respectively.

Given that the long run is estimated, it is essential to examine the short-run dynamics among the variables in selected ECOWAS countries and see how the short run deviations from the long run relationships are corrected for in each selected countries. Table 3 contains the results of the short-run dynamics, along with the diagnostics tests. The results show that the estimated coefficient of GDP per Capita is positive and significant in all the selected countries for both models. Similarly, the coefficient estimate of trade openness is positive and statistically in all the selected countries for the model with real exchange rate volatility, but Nigeria, Ghana, Sierra Leone, and Gambia only are reported to be positively significant in model with nominal exchange rate volatility. In Cote d'Ivoire and Togo, the effect of trade openness is negative and insignificant for the model with nominal exchange rate volatility. The significance of trade openness in these countries suggest that liberalization program and policies put in place by these government is achieving the expected results i.e., attracting more FDI into these countries, and this will further help to create conducive environment for foreign investors.

Also, for both the nominal and real models, the estimated coefficient of infrastructural availability is positively significant in all the selected countries, but negative findings are report in the case of Ghana and Sierra Leone only for the real model. The estimated short-run coefficient of nominal exchange rate volatility is statistically significant and negative in all the countries considered except Gambia that reported positive insignificant findings. Conversely, the coefficient estimate of real exchange rate volatility is negative in all the countries considered but statistically significant only in Ghana, Togo, Nigeria, and Gambia. The error correction term ( $ECM_{t-1}$ ) obtained in all the selected countries is negatively significant, as expected, at a different levels of significance, which indicates a stable convergence to long-run equilibrium level from short-run equilibrium deviations. The magnitudes of the adjustment coefficient vary differently for each country.

Table 3: Short-run Estimates Results along Diagnostic Tests

Countries	GDP	OPEN	INFR	VOL	ECM	LM	Rest	Norm	Heter
<b>Panel A: Nominal Exchange Rate Volatility (NVOL)</b>									
Cote d'ivoire	3.71(1.59)***	-2.49(-1.89)	0.96(2.05)***	-2.51(-1.83)**	-0.81(-1.58)*	0.77	0.82	0.48	1.59
Gambia	5.07(0.94)**	2.78(1.40)*	0.22(1.17)**	-1.40(-2.93)*	-0.69(-1.84)**	0.63	2.86	0.81	0.25
Ghana	0.97(1.53)***	0.71(1.30)**	1.93(2.50)**	-1.83(-1.05)**	-0.54(-1.38)*	0.81	0.58	0.69	0.34
Nigeria	8.32(1.94)***	2.48(5.21)***	5.02(1.40)***	-1.94(-1.81)**	-0.58(-1.94)**	1.68	0.47	0.88	0.63
Sierra Leone	4.79(1.38)**	5.57(2.96)**	1.85(1.77)*	-6.59(-2.71)**	-0.43(-2.50)**	0.89	1.66	0.79	0.81
Togo	1.33(3.19)*	-0.74(-2.85)	3.54(2.02)***	-7.40(-2.68)**	-0.62(-1.32)*	0.43	0.51	0.47	0.38
<b>Panel B: Real Exchange Rate Volatility (RVOL)</b>									
Cote d'ivoire	1.15(2.68)***	0.78(1.89)**	0.16(2.91)**	-3.39(-1.54)	-0.54(-1.93)**	0.41	0.72	0.47	0.63
Gambia	0.22(1.51)**	3.57(2.70)***	3.98(1.40)**	-4.31(-1.20)**	-0.55(-1.68)**	0.39	0.57	0.68	0.32
Ghana	1.11(2.50)**	0.97(4.32)**	-0.65(-1.48)	-1.79(-2.44)*	-0.81(-2.82)**	0.36	0.92	0.81	0.44
Nigeria	1.27(3.05)*	0.30(1.89)**	0.54(2.40)***	-0.12(-2.59)**	-0.42(-4.71)**	0.48	0.35	0.29	0.85
Sierra Leone	3.07(2.81)**	1.68(2.06)***	-5.35(-1.48)	-2.44(-1.91)	-0.79(-2.58)*	0.23	0.49	0.60	0.28
Togo	0.48(2.53)**	3.39(1.05)**	3.50(1.89)**	-4.21(-1.48)**	-0.67(-2.18)**	0.89	0.63	0.94	0.52

This table shows the long-run estimates results for both exchange rates. Panel A shows the results for the nominal exchange rate model. Panel B shows the results for the real exchange rate model. Where GDP represents economic growth, OPEN is the trade openness, INFR denotes as infrastructure availability, and VOL is the exchange rates, including both nominal real exchange rate and real exchange rate. The values in parenthesis are t-statistic. \*\*\*, \*\*, and \* indicate significance at the 1, 5 and 10 percent levels, respectively. LM test denotes as the Lagrange Multiplier test of residual serial correlation; Ramsey Reset test is the test for functional form and omitted variable; Normality test denotes test for normality in the model and ARCH test is the conditional heteroskedasticity

Now, we examine the direction of causality between exchange rate volatility and FDI inflows using the Toda-Yamamoto (1995) causality test approach. Table 4 presents the results of the bivariate causal relationship between exchange rate volatility and FDI in the selected ECOWAS countries. Due to space conservation, the study presents only the results of the variable of interest, namely exchange rate volatility and FDI. The results show that there is evidence of unidirectional causality from nominal exchange rate volatility to FDI flows in four countries namely, Nigeria, Togo, Cote d'ivoire, and Gambia. While, a unidirectional causal relationship between real exchange rate volatility and FDI is found only in Togo, Nigeria, and Sierra Leone. These findings suggest that there is evidence of unidirectional causality for both exchange rates volatility and FDI flows in Nigeria and Togo only.

Interestingly, evidence of unidirectional causality running from FDI flows to real exchange rate volatility is found in Sierra Leone and Nigeria. This finding suggests that FDI inflows cause exchange rate volatility as long as FDI inflows lead to a potential appreciation of domestic currency while FDI outflow can cause possible depreciation of the domestic currency which consequently increases FDI flows (see Kosteletou and Liargovas, 2000; Ogunleye et al. 2012 and Wang, 2013). Thus, we can conclude from these findings that there is evidence of bidirectional causality or feedback effect between real exchange rate volatility and FDI flows in the case of Nigeria and Sierra Leone, which suggest that any foreign direct investment policies implemented by policymakers to attract more FDI flows into a country can spur exchange rate volatility.

Table 4: Bivariate Causality Test Results

Country	Null Hypothesis	Chi Squ	Probability
Cote d'Ivoire	NVOL ≠ FDI	6.05	0.04**
	FDI ≠ NVOL	2.77	0.32
	RVOL ≠ FDI	1.68	0.63
	FDI ≠ RVOL	4.44	0.14
Gambia	NVOL ≠ FDI	2.58	0.01***
	FDI ≠ NVOL	0.10	0.38
	RVOL ≠ FDI	4.21	0.02**
	FDI ≠ RVOL	1.04	0.59
Ghana	NVOL ≠ FDI	5.04	0.11
	FDI ≠ NVOL	0.69	0.94
	RVOL ≠ FDI	1.32	0.73
	FDI ≠ RVOL	6.39	0.13
Nigeria	NVOL ≠ FDI	0.60	0.03**
	FDI ≠ NVOL	2.39	0.31
	RVOL ≠ FDI	3.60	0.06*
	FDI ≠ RVOL	0.12	0.03**
Sierra Leone	NVOL ≠ FDI	0.14	0.11
	FDI ≠ NVOL	2.84	0.24
	RVOL ≠ FDI	7.30	0.02**
	FDI ≠ RVOL	2.66	0.01***
Togo	NVOL ≠ FDI	4.48	0.05**
	FDI ≠ NVOL	9.04	0.41
	RVOL ≠ FDI	0.26	0.02**
	FDI ≠ RVOL	4.12	0.19

This table shows the bivariate causality test results. NVOL denotes nominal exchange rate volatility, RVOL represents the real exchange rate volatility, and FDI is the foreign direct investment. \*\*\*, \*\*, and \* indicate significance at the 1, 5 and 10 percent levels respectively.

## CONCLUDING COMMENTS

This paper empirically investigates the effect of exchange rate volatility on Foreign Direct Investment (FDI) in selected Economic Community of West African States (ECOWAS) countries using time series data over the period 1986-2017. Different estimation techniques are employed for this paper. First, we applied both nominal and real exchange rates volatility using the GARCH model to generate exchange rate volatility. Then, Autoregressive Distributed Lag (ARDL) model and Toda-Yamamoto (1995) causality techniques are employed to estimate the dynamic relationship and direction of causality between the variables. The empirical results show that the estimated coefficient of the nominal real exchange rate is negative in all the selected countries but significant only in Ghana, Sierra Leone and Nigeria. Conversely, the effect of real exchange rate volatility is negatively significant as expected, in Nigeria, Togo, Sierra Leone, and Cote d'Ivoire but the result is positive and statistically insignificant in Ghana and Gambia only.

Furthermore, causality test results show that there is evidence of unidirectional causality from nominal exchange rate volatility to FDI flows in four countries namely Nigeria, Togo, Cote d'Ivoire and Gambia respectively. In contrast, the causal relationship between real exchange rate volatility and FDI is found only in Togo, Nigeria, and Sierra Leone. Interestingly, evidence of unidirectional causality running from FDI flow to real exchange rate volatility is reported in Sierra Leone and Nigeria. This suggests that there



is evidence of bidirectional or feedback effect between real exchange rate volatility and FDI flows in the case of Nigeria and Sierra Leone only.

Given the above findings, the question is what are the policy inferences? Firstly, the empirical results of this paper provide policymakers a better picture of the factors that cause dwindling and unsteady flows of FDI to these selected ECOWAS countries. It is therefore suggest that policymakers should formulate sound and stable macroeconomic policies that will stabilize the foreign exchange rate, which is one of the critical determinants of FDI flows and avoid overvaluation of their domestic currency, which could hamper the inflows of FDI to these selected countries.

Trade openness also plays a crucial role in the determination of FDI flows in these countries. This suggests that conscious efforts should be made by the appropriate authority to institute measures such as financial integration, economic liberalization, reduction of tariff and non-tariff barriers, revisiting their privatization decree and institutional frameworks that would enhance the credibility of the reform process. The results equally suggest the need to increase the per capita GDP for higher FDI inflows. Thus, policymakers must take drastic measures that could increase the efficiency of their market size and thus open up these economies for increased FDI inflows, ensure optimal utilization of their endowed resources, with less stringent taxation policies.

Finally, in countries where evidence shows unidirectional causality running from FDI to exchange rate volatility, policymakers must intensify their efforts to ensure that policies implemented to attract more FDI inflows do not spur fluctuation in the exchange rate. In this paper, six ECOWAS countries are only considered for this investigation due to the availability of data for both nominal and real exchange rates of these countries. Nevertheless, future research might examine the nexus between exchange rates volatility and FDI in the case of the whole ECOWAS countries or some selected sub-Saharan African countries.

## APPENDIX

### Appendix 1: Table Description of Variables

Variable	Definition and Measurement of the Variable	Source
FDI	Foreign direct investment is the total inflow of FDI as a percentage of GDP	WDI (2017)
RVOL	Real exchange rate volatility is the unpredictable fluctuation in the exchange rate that measures the worth of a domestic currency in terms of another country.	Generated via GARCH model
OPEN	Trade openness is the sum of export and import as a percentage of GDP	WDI (2017)
PGDP	Gross domestic product is used as a proxy of domestic market potential and growth	WDI (2017)
NVOL	Nominal real exchange rate volatility is the unpredictable fluctuation in the exchange rate that measures the amount of domestic currency required to purchase a given amount of foreign currency	Generated via GARCH model
INFR	Infrastructural availability measures the number of telephone subscriber per 100 people	WDI (2017)

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