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Article

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EuroEconomica

Provided in Cooperation with:
Danubius University of Galati

Reference: Uzoma-Nwosu, Damian Chidozie/Orekoya, Samuel (2019). Exchange rate volatility and foreign direct investment in Nigeria. In: EuroEconomica 38 (2), S. 227 - 242.

EE
E u r o E c o n o m i c a
Issue 2(38)/2019 *ISSN: 1582-8859*

Exchange Rate Volatility and Foreign Direct Investment in Nigeria

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Abstract: Foreign direct investment (FDI) is an investment geared towards controlling ownership in a business enterprise in domestic country by an entity based in a foreign country. It is one of the major sources of capital inflows to developing countries, from the resource surplus countries and among developing countries themselves, and has been widely considered to be important in contributing to growth in productivity in the receiving country. FDI is vital to any economy, it augments domestic investment. Developing sub-Saharan African (SSA) countries and especially Nigeria has been a major beneficiary of technological spill overs, job creation, improved managerial skills and other benefits from these inflows. The fluctuation of exchange rate can lead to currency depreciation or appreciation. When exchange rate appreciates, it causes the cost of production to rise in a country's economy, and this will lead to low and volatile FDI. Poverty, high inequality and underdevelopment also will ensue with the attendant huge deficit that will be recorded in the domestic country's balance of trade and of payment.

Keywords: FDI; exchange rate volatility; Saharan African Countries; poverty

JELClassification: P34

1. Introduction

Foreign direct investment (FDI) is an investment geared towards controlling ownership in a business enterprise in domestic country by an entity based in a foreign country. It is one of the major sources of capital inflows to developing countries, from the resource surplus countries and among developing countries themselves, and has been widely considered to be important in contributing to growth in productivity in the receiving country. FDI is vital to any economy, it augments domestic investment. Developing sub-Saharan African (SSA) countries and especially Nigeria has been a major beneficiary of technological spill overs, job creation, improved managerial skills and other benefits from these inflows. This flow of goods, services, and capital in and out of a country is influenced by political and legal environment of the host country, inflationary pressure, domestic savings, physical and social infrastructure, fiscal and monetary policy, indigenous technology, among other macroeconomic factors. In addition to the above, two very important factors that foreign investors think about before allowing their goods to flow to any country are risks associated with exchange rate and its volatility.

Exchange rate is the price of one country's currency in terms of another's. It is a vital macroeconomic variable regarded as an indicator of the competitiveness of the currency of any economy. As one of the most important prices in an open economy, it influences international flow of goods, services, and capital

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among countries, and therefore commands a strong pressure on balance of payments, inflation and other macroeconomic variables. The fluctuation of exchange rate can lead to currency depreciation or appreciation. When exchange rate appreciates, it causes the cost of production to rise in a country's economy, and this will lead to low and volatile FDI. Poverty, high inequality and underdevelopment also will ensue with the attendant huge deficit that will be recorded in the domestic country's balance of trade and of payment. On the other hand, depreciation in exchange rate creates competitive advantages in international trade. It makes domestic goods cheaper and increases the demand for export goods, it causes an increase in international demand for domestic goods while import decreases. This impacts positively on FDI inflow into the domestic country. An equilibrium foreign exchange can assist decision makers to reduce the air of uncertainty caused by volatility in exchange rate and hence growth and development. The volatility in exchange rate leads to uncertainty, which has a negative effect on trade flows. Therefore, the need to stabilize this factor in a bid to discourage risk averse agents from redirecting their activity to other lower risk market occupies a critical aspect of economic management of any country in this globalized world.

The motivation to commit ones resources to investment in any economy depends to a large extent on the stability of exchange rate. The Nigerian economy is in dire need of effective foreign exchange rate management that will encourage the inflow of FDI and help diversify the economy. However, despite the various efforts of the government to stabilize the exchange rate, much success has not been recorded in terms of FDI inflow. Therefore, the objective of this study is to examine the long and short run relationship between exchange rate volatility and FDI inflow in Nigeria, and also propose policies geared towards mitigating the risk associated with unexpected and unpredictable movement in the exchange rate. Specifically, the paper will attempt to find the direction of causality between FDI inflow and exchange rate volatility in Nigeria. The evidence presented will add an extra dimension to the literature and provide a basis with which future studies can be compared. The contributions from this study will increase knowledge of the degree to which exchange-rate volatility affects FDI, an important information that will aid the design of both exchange rate and trade policies. The study covers a period of 1980 to 2017 this period was chosen based on data availability.

This rest of the paper is divided into six sections. Following this introduction closely is section two where background to the study of exchange rate and FDI in Nigeria are examined. Existing literature are reviewed in section three, while section four contains the model, data source and methodology of study. Results are presented and discussed in section five while section five concludes the study.

2. Background to the Study in Nigeria

This section examines the behavioural movement of FDI and exchange rate in Nigeria.

2.1. Foreign Direct Investment Inflow

Udoh, and Egwaikhide, (2008) identified that in the 1960s and 1970s, the pace of economic activities in all sectors of the Nigerian economy was low because the policy thrust of government was to limit political and economic domination of Nigeria by foreigners through their investment in the country. The Nigerian Enterprises Promotion Decree (NEPD) which was promulgated in 1972 (amended in 1977) to regulate FDI, granted only maximum of 60% equity participation by foreign investors in Nigerian

business. From table 1 below, between 1970 and 1979, only a mean annual FDI inflow of $309.60 million was recorded in the country. This accounted for less than 1% of the country's GDP and about 2% of gross fixed capital formation in the 1970s. However, different governments over the years have engaged in policies towards attracting FDI inflow into the country, the abrogation of the Indigenization Decree in 1978, the promulgation of the Nigerian Investment Promotion Commission Decree No. 16 of 4th January 1995 and the Foreign Exchange Monitoring and Miscellaneous Provision Decree No. 17 of 1995 are some of them. Also, governments have engaged in privatization of publicly owned institutions to allow both local and foreign investors alike in the ownership and management of these corporations. These are some of the pull factors that made Nigeria one of the top destinations of FDI in African over the years, especially before the just exited recession. For instance, while average annual FDI inflows into the country in the 1970s was worth $309.60 million, the figure rose to $433.99 Million in 1980s, $1.5 billion in 1990s, $3.4 billion in the 2000s. This inflow has risen to about $5.4 billion between 2010 and 2017 despite the economic recession that grounded economic activities in Nigeria in the last three years. (See table 1 below)

The consistent increase in FDI inflow into the country which oscillated below 3.17%, has not made any significant contribution to GDP growth between 1970 and 2017. In the 1970s, 1980s, 1990s, and 2000s and from 2010 to 2017, FDI contributed marginal 0.59%, 0.57%, 2.74%, 1.99% and 1.27% respectively to Nigeria's GDP. On the other hand, FDI per capita has grown consistently from a mean annual figure of $5 million in the 1970s and 1980s to about $34 million between 2010 and 2017. As a percentage of gross fixed capital formation (GFKF), the highest contribution of FDI was 35.5% in 2005. The impressive contribution of FDI to gross fixed capital formation from the 1970 began to nosedive from 2012 (See Table 1).

Table 1. FDI Inflow into Nigeria, 1970-2017.

Year	FDI Inflows (Million $)	FDI Inward Stock (Million $)	FDI Inflow Per Capita (Million $)	FDI Inward Stock Per Capita (Million $)	FDI Inflow as % of GDP	FDI Inward Stock as % of GDP	FDI Inflow as % of GFKF
1970-1979	**309.60**		**5.06**		**0.59**		**2.18**
1980-1989	**433.99**	**4425.88**	**4.89**	**52.36**	**0.57**	**4.71**	**4.65**
1990-1999	**1494.06**	**15526.91**	**13.93**	**142.21**	**2.74**	**28.27**	**21.42**
2000	1309.67	23786.39	10.66	193.58	1.76	31.89	17.59
2001	1277.42	25063.81	10.14	198.90	1.80	35.31	16.69
2002	2040.18	27103.99	15.79	209.71	2.15	28.51	21.52
2003	2171.39	29275.38	16.38	220.81	2.00	26.91	14.17
2004	2127.09	31402.47	15.64	230.84	1.51	22.23	14.32
2005	4978.26	26345.00	35.66	188.70	2.76	14.60	35.51
2006	4897.81	31242.81	34.17	218.00	2.09	13.36	17.81
2007	6086.73	37329.54	41.36	253.68	2.27	13.95	17.28
2008	8248.64	45578.18	54.58	301.61	2.47	13.62	20.82
2009	8649.53	54227.71	55.73	349.39	3.17	19.90	18.45
2000-2009	**3386.49**	**29275.67**	**24.15**	**213.32**	**1.99**	**21.10**	**17.11**
2010	6 099.0	60326.67	38.26	378.40	1.65	16.35	9.98
2011	8 914.9	69241.56	54.44	422.80	2.15	16.72	13.86

2012	7 127.4	76368.94	42.36	453.93	1.55	16.57	10.92
2013	5 608.5	81977.41	32.45	474.36	1.09	15.92	7.69
2014	4 693.8	86671.23	26.45	488.35	0.83	15.25	5.47
2015	3 064.2	89735.40	16.82	492.51	0.62	18.14	4.18
2016	4 448.7	94184.14	23.79	503.69	1.04	23.20	9.20
2017	3 503.0	97 687.1	18.35	511.76	N/A	24.40	7.20
2010-2017	**5 432.4**	**82024.06**	**31.61**	**465.72**	**1.27**	**18.32**	**8.56**

Source: Compiled by the author from UNCTAD Foreign Direct Investment Online Database.

2.2. Exchange Rate Movement in Nigeria

Exchange rate is a vital macroeconomic variable regarded as an indicator of the competitiveness of the currency of any economy, and remains one of the most important factors in a firm's FDI decision and a country's foreign direct investment drive. The depreciation, appreciation or deliberate manipulation of a country's currency in relation to another's in one way or the other determines the movement of exchange rate, and also the types and volume of investment that is attracted by such a country. Fapetu, and Oloyede, (2014), Obi. et al. (2016), Obi. (2017) traced the fluctuations in exchange rate in Nigeria to the different exchange policies that the country's central bank has embarked on before the Structural Adjustment Programme (1960-1985) and after (1986-till date), (see Table 2). SAP came with a sharp exchange rate depreciation which was expected to discourage importation and make export-oriented multinationals gain on their investment. Udoh and Egwaikhide, (2008) found that SAP also recorded a wide fluctuation in exchange rate with inflation rate uncertainty in the economy.

Another important factor that determined movement in exchange rate during this period was external shocks resulting from the global vagaries of agricultural commodities and oil prices, both of which are major sources of Nigerian exports and foreign exchange earnings (Ogunleye, 2009). In the 1970s when agricultural was the mainstay of the economy, with many trading partners' currencies, involved, there was less fluctuations in prices and exchange rate did not face much volatility. However, in the current oil era, Nigeria is experiencing severe shocks in terms of trade as a result of the steady fluctuations in the global oil price.

Table 2. Scheme of Events in Exchange Rate Management in Nigeria

S/N	Year	Event	Remark
1	1959-1967	Fixed Parity Solely with the British Pound Sterling	Suspended in 1972
2	1968 - 1972	Included the US dollar in the parity exchange	Aftermath of the 1967 devaluation of the pound and the emergence of a strong dollar
3	1973	Revert to fixed parity with the British Pounds	Devaluation of the US dollar
4	1974	Parity to both pounds and dollars	To minimize the effect of devaluation of the individual currency
5	1978	Trade (import) – Weighted basket of currency approach.	Tied to seven currencies; British Pounds, US Dollars, German Mark, French Franc, Japanese Yen, Dutch Guilder, Swiss Franc.
6	1985	Reference on the dollar	To prevent arbitrage prevalent in the basket of currencies
7	1986	Adoption of the second tier foreign exchange market	Deregulation of the economy

8	1987	Merger of the first and second tier markets	Merger of the rates
9	1988	Introduction of the interbank foreign exchange market	Merger between the autonomous and the FEM rates
10	1994	Fixed Exchange rate	Regulate the economy
11	1995	Introduction of the Autonomous Foreign Exchange Market (AFEM)	Guided deregulation.
12	1999	Re-introduction of the inter-bank foreign exchange market (IFEM).	Merger of dual exchange rate, following the abolition of the official exchange rate from January 1st.
13	2002	Re-introduction of the Dutch Auction System (DAS).	Retail DAS was implemented at first instance with CBN selling to end-users through the authorized users (banks)
14	2006-2010	Introduction of Wholesale DAS	Further liberalized the market
15	2016	Interbank Foreign Exchange Market	Closure of Official window

Source: Central Bank of Nigeria Bullion (various years).

3. Literature Review

The issue of whether exchange rate volatility influence the movement of FDI is a topical issue in the literature. Theoretically, Goldberg (2009) classified FDI and exchange rate volatility nexus into (i) production flexibility arguments which argues that more volatility is associated with more FDI ex-ante, and more potential for excess capacity and production shifting ex-post, after exchange rates are observed; and (ii) risk aversion arguments which requires that investors be compensated for risks that exchange rate movements introduced into the returns on investment. Osinubi, and Amaghionyeodiwe (2009) emphasized that FDI add to investment resources, capital formation, and also serves as an engine of technological development which benefits the host country through transfers of production technology, skills, innovative capacity, and organizational and managerial practices. The attraction of foreign backed resources to a domestic economy depends on the stability of the business climate whether political, market, regulatory or technological potentials. Udoh and Egwaikhide (2008) outlined certain push and pull factors that drive FDI to their various destinations. According to them, the push factors attribute the direction of capital flows to what happens on the international front such as increasing tax burdens of multinational corporations in their home countries, while the pull factors trace the causes of capital flows to domestic factors such as macroeconomic performance, the investment environment, infrastructure and resources and the quality of institutions. Okulegu, et al. (2013) buttressed that foreign investment, like other forms of investment, also depends on non-economic factors such as risk, political instability and macroeconomic volatility, and that volatility represents the degree to which a variable changes over time.'

The relationship between exchange rate volatility and FDI inflow has become a major source of concern for policymakers and academics alike. Given the capital deficient nature of SSA countries, Nigeria inclusive, and the benefits accruable from these activities, FDI is essential for growth and development in the region, (Ogunleye, 2009). As Bahmani-Oskooee and Gelan, (2017) opined, the primary source of growth in most African countries is a sharp rise in the volume of international trade. The volatility of exchange rate may therefore, instigate uncertainty among profit-maximizing investors and curtail the

level of their engagement in the export and import sectors, leading to a diminished volume of investment and weakened economic growth. The argument here is that if exchange rates are highly volatile, the expected values of investment projects from FDI are reduced accordingly. This has prompted a lot of work in the recent past to unravel the direction and magnitude of their relationship and moderate such volatility in order to improve trade inflows.

Arize, et al. (2000) examined the impact of real exchange-rate volatility on the export flows of 13 less developed countries (LDC's) using quarterly data between the periods of 1973 to1996. The major results show that increases in the volatility of the real effective exchange rate, approximating exchange rate uncertainty, exert a significant negative effect upon export demand in both the short and long-run in each of the eight Latin American countries. These effects according to them may result in significant reallocation of resources by market participants. Serenis and Tsounis (2013) assessed the relationship between Exchange Rate Volatility and Foreign Trade in Cyprus and Croatia between 1990:Q1 and 2012:Q1 using error correction model. The study's results suggested significant negative effects from volatility on exports for Croatia and no effect for Cyprus. Šimáková (2016) undertook the Gravity Modelling of the relationship between exchange rate volatility and Foreign Trade in Visegrad Countries (Czech Republic, Hungary, Poland and Slovakia). Using Panel Regression on quarterly data from 1999:Q1 to 2014:Q3, the study found that exchange rate volatility leads to a decrease in foreign trade turnover at bilateral level.

Ogunleye, (2009) studied Exchange Rate Volatility and Foreign Direct Investment in Sub-Saharan Africa, using annual data between 1970 and 2005 from Nigeria and South Africa. Deploying system two-stage least squares methodology, the study found that exchange rate volatility has deleterious effect on FDI inflows, with FDI inflows aggravating exchange rate volatility in both countries. Similarly, Asmah and Kwaw. (2013) worked on exchange rate volatility and foreign direct investment in Sub-Saharan Africa using data from 1975 to 2011. The Generalized method of moments (GMM) and Dynamic linear panel model result obtained finds a robust negative and significant impact of exchange rate volatility on FDI in African countries. Bahmani-Oskooee and Abera (2017) undertook the study of exchange rate volatility and international trade performance in 12 African Countries. The results from the Bounds-testing approach and error-correction model show that while exchange rate volatility affects trade flows of many of the countries in their sample in the short run, the long-run effects were restricted only on the exports of five countries and on the imports of only one country. The data spanned from early 1970s to 2015. Temitope, (2017) examined the causal relationship between Exchange Rate Volatility and Trade Balance in Sub-Saharan African Countries, using Pairwise Granger causality on data from 2000 to 2015. The result shows that there is unidirectional causality between exchange rate volatility and trade balance, and the direction of causality runs from trade balance Granger-causing exchange rate volatility. Also, the result shows that there is bidirectional causality between real exchange rate and exchange rate volatility.

For country specific studies, Ellah, (2011) investigated Exchange rate volatility and foreign direct investment behaviour in Pakistan, employing auto regressive distributed lag (ARDL) and error correction model on annual time series data from 1980 to 2010. Findings from the study shows that exchange rate volatility has negative impact on FDI inflow in the short run but positive in the long run. Bakhromov, (2011) conducted a study on Exchange Rate Volatility and the Trade Balance of Uzbekistan

using co-integration and error correction results and found that real exchange rate volatility has a substantial impact on the exports and imports of the country between 1999 and 2009. The result also showed further that increases in the volatility of the real exchange rate have significant negative effects on equations of exports and imports in the long-run dynamics. Tatliyer and Yigit, (2015) examined the influence of Exchange Rate Volatility on Foreign Trade using annual data from Turkey between 1990 and 2015. The vector error correction model and the VAR Granger causality test within the framework of the Toda-Yamamoto procedure shows that Exchange rate volatility has a positive effect on Turkish exports in the long-term; this relationship disappears in the short-term. Kenneth, et al (2017) investigated the Short and Long Run Effects of Exchange Rate Volatility on Foreign Direct Investment in Kenya using annual data from 1980 to 2014. The long run Error Correction Model from their estimation shows that an increase in exchange rate volatility will lead to a reduction in foreign direct investment.

The issue of exchange rate volatility and foreign direct investment flow has generated a lot of interest in Nigeria. Specific studies on the topic include; Udoh and Egwaikhide, (2008) who investigated Exchange Rate Volatility, Inflation Uncertainty and Foreign Direct Investment in Nigeria using data from 1970 to 2005. The estimation results found that exchange rate volatility and inflation uncertainty exerted significant negative effect on foreign direct investment during the periods reviewed. Osinubi and Amaghionyeodiwe, (2009) examined Foreign Direct Investment and Exchange Rate Volatility in Nigeria between 1970 and 2004. The Error correction estimation result revealed that exchange rate volatility has a positive relationship with foreign direct investment. Okulegu, et al. (2013) analysed the causality between Real Exchange Rate Instability and Foreign Private Investment in Nigeria between 1986 and 2008, using Error correction model. The estimation result shows that an increase in Real Exchange Rate on the average leads to a decrease in Cumulative Foreign Private Investment. Using data between 1971 and 2012, Odili, (2015) examined the nexus between Real Exchange Rate Volatility, Economic Growth and International Trade in an Emerging Market Economy. The results revealed that both in the short and long-run, exports and imports were chiefly influenced by real exchange rate volatility. It revealed further that exchange rate volatility depressed exports and imports in the long-run while the result from pair wise Granger causality test revealed unidirectional causality running from export to exchange rate volatility and from exchange rate volatility to import. Danladi, (2015) also examined Exchange Rate Volatility and International Trade in Nigeria, using data from 1980 to 2013. The findings revealed that a causal relationship exists between international trade and exchange rate volatility, and that exchange rate volatility negatively affects international trade. Adaramola, (2016), employed Johansen Multivariate approach and co-integration in his study of the Effect of Real Exchange Rate Volatility on Export Volume in Nigeria form 1970Q1 to 2014Q4, found that real exchange rate uncertainty had significantly and positively impacted on the volume of trade in the Nigerian economy. Mbanasor, (2017) investigated Exchange rate fluctuations and foreign private investments in Nigeria using Two-stage least square (2SLS) and Granger Causality on data from 1987 to 2011. The result shows that exchange rate volatility has negative but non-significant impact on Nigeria's foreign private investment. Murtala, (2017) examined the impact of Exchange Rate Fluctuations on Foreign Direct Investment in Nigeria using data from 1990 to 2015. Findings from the Correlation and Ordinary Least Square analyses show that there is a strong positive relationship between FDI and exchange rate in Nigeria on one hand and there is a weak positive relationship between FDI and GDP on the other hand. Obi, (2017) also investigated the impact of Foreign Exchange Volatility on Foreign Direct Investment

in Nigeria, using data from 1999 to 2016. The Ordinary least squares results finds that fluctuations in exchange rate have a positive and significant impact on foreign private investment in Nigeria.

These literature reviews show that a significant relationship exists between exchange rate volatility and FDI in different countries. However, most of these studies focused only on inflow FDI, imports and/or exports, without considering the net FDI inflow. Again, there is no study to date that settles the empirical disputes of the effect of movement in exchange rate and its volatility on FDI inflow. This study will attempt to bridge these lapses.

4. The Model, Data and Methodology.

4.1. The Model and Data

The empirical function for this study takes the following form:

$$FDI = f(RERV, INTR, GDP, POP)$$

where: FDI is the dependent variable, calculated as the annual real inflow of FDI from all sources to Nigeria. It is the inward FDI at current prices as a percentage of gross domestic product (GDP). The size of this variable is a good indicator of the relative attractiveness of an economy to foreign investment. It is also a vehicle for the economic growth of developing countries. $INTR$ is the interest rate. It measures the country's return on investment as an attracting factor for FDI. $INTR$ is expected to be negatively signed. GDP is the growth rate of real GDP. It measures the size of the home economy and it is included in order to control for the supply of FDI. The assumption is that growth in the host country is likely to attract a greater inflow of FDI. The growth rate of real gross domestic product (GDP) also captures the size of the potential market for the foreign investors' products. It is taken as a measure of the level of development in a country and therefore reflects the purchasing power of individual consumers. It is also a proxy for the comparative return on investing in different countries. It is believed that as economic growth rate increases, the real return to capital will rise and therefore raise net foreign direct investment. The a priori expectation of this variable is positive. Growth rate of population (POP) measures the market size and its potential of population, the higher the population, the higher the interest of foreign investors on that economy, this variable is expected to have a positive influence on FDI inflows.

$RERV$ is the real effective exchange rate volatility. This volatility variable is generated using the GARCH methodology. The estimation was done in two stages. First, the GARCH model was estimated using the relevant lags of the variables concerned. Second, the residuals were obtained. Volatility is captured by the variance of the residuals. GARCH has the ability to distinguish between predictable and unpredictable elements in the real exchange rate formation process, and therefore superior to the standard deviation measures that ignores the stochastic process of generating the exchange rates, thereby underestimating the effects of volatility on decisions (Ogunleye, 2009). $RERV$ is expected to have a negative relationship with FDI.

This study covers the periods 1980 to 2017.

4.2. Methodology.

In estimating the relationship between FDI and exchange rate volatility in Nigeria, VECM estimation technique with particular attention given to the Granger Causality test was used. Several other

specification and diagnostic tests were undertaken to authenticate our results and establish their robustness. Some of the tests performed included Unit Root and the Co-integration tests, variance decomposition and impulse response functions (IRFs). Granger Causality tests are employed to further investigate the relationship between the variables. In addition to forecasting, VARs have been used for two primary functions-testing Granger Causality and to identify cumulative influences taking into consideration the dynamic reactions (response) between FDI inflow and Exchange rate volatility.

4.3. Vector Error Correction (VECM) Model

After determining that the variables of the model are co-integrated, a VAR model is estimated which shall include a mechanism of error correction (ECM). The models are presented below;

$$FDI_t = a_0 + \sum_{i-1}^{k} a_{1t} FDI_{t-i} + \sum_{i-1}^{k} a_{2t} RER_{t-i} + \sum_{i-1}^{k} a_{3t} GDP_{t-i} + \sum_{i-1}^{k} a_{4t} POP_{t-i} + \sum_{i-1}^{k} a_{5t} ECM_{t-1}$$

4.4. Presentation and Discussion of Results

Before estimating the model, a look at the descriptive statistics of the variables concerned were carried out, to enable us unravel the nature of the distribution from which the data emanate. In this regard, the Jarque–Bera was used to consider the normality, and this was fortified by the values of the skewness and the Kurtosis of the variables. The skewness is a measure of the symmetry of the histogram while the kurtosis is a measure of the tail shape of the histogram. For a symmetry distribution, such as a normal distribution, the skewness should be zero while the kurtosis should be three.

Table 5.1. Descriptive Statistics

	FDI	POP	RERV	GDP	INTR
Mean	1.717895	2.588421	153.2832	3.427368	-0.055526
Median	1.625000	2.595000	99.58000	4.240000	2.680000
Maximum	5.790000	2.860000	531.8200	14.60000	18.18000
Minimum	-1.150000	2.490000	48.92000	-13.13000	-65.86000
Std. Dev.	1.323960	0.080925	120.6031	5.968748	14.76570
Skewness	0.953882	0.908996	1.665225	-0.868572	-2.547299
Kurtosis	4.656722	4.393064	4.942434	3.839520	11.80052
Jarque-Bera	10.10846	8.305723	23.53617	5.893906	163.7231
Probability	0.006382	0.015719	0.000008	0.052499	0.000000
Sum	65.28000	98.36000	5824.760	130.2400	-2.110000
Sum Sq. Dev.	64.85623	0.242305	538169.2	1318.160	8066.956
Observations	38	38	38	38	38

Source: Arthur's compilation from E-Views 10.

Table 5.1 provides the summary of descriptive statistics of the variables of the study. All the variables have 38 observations. As can be observed, the mean, median, standard deviation, skewness, kurtosis and even the jarque-Bera of our variables are given. The Jarque-Bera statistic result shows that all the variables are normally distributed.

Another descriptive statistics that was computed is the correlation matrix between the series. This was calculated to gain insight into the nature of the relationship between the variables in the model. This

relationship falls between 0 and 1, measuring the strength of the linear association between values. The correlation matrix in Table 5.2 reveals that only GDP and RINTR have strong positive relationship with each other, while FDI has negative relationship with both POP and RERV. The relationship between FDI and RERV is in line with a priori expectations, and in agreement with the findings of Osinubi and Amaghionyeodiwe, (2009), etc.

Table 5.2. Correlation Matrix

	FDI	POP	RERV	GDP	INTR
FDI	1				-
POP	-0.47	1			
RERV	-0.46	0.03	1		
GDP	0.2	-0.04	-0.39	1	
RINTR	-0.04	-0.04	-0.19	0.50	1

Source: Arthurs' compilation from E-views 10.

The unit root results present the orders of integration of the variables considered using the Augmented Dickey-Fuller (ADF) and the Philips-Perron (PP). The results as presented in Table 5.4 below shows that all but one variable, RERV, which is the volatility variable is stationary at level, i.e. I(0). It becomes therefore imperative to establish the cointegration properties of the equation.

Table 5.3. Augmented-Dickey Fuller (ADF) Test:

Variable		Augmented Dickey-Fuller (ADF) Test						
		Level			First Difference			
		Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Decision
FDI		-3.66*	-3.48**	-1.76***	-8.50*	-8.52*	-8.62*	I(O)
GDP		-3.95*	-4.65*	-3.33*	-4.96*	-5.18*	-5.01*	I(O)
INTR		-4.46*	-5.53*	-4.53*	-12.35*	-12.51*	-12.33*	I(O)
POP		-4.45*	-4.48*	-0.46	-5.33*	-5.67*	-5.40*	I(O)
RERV		-1.85	-1.94	-1.49	-4.17*	-4.14**	-4.21*	I(1)
CRITICAL VALUES	1%	-3.62	-4.23	-2.63	-3.63	-4.23	-2.63	
	5%	-2.94	-3.54	-1.95	-2.95	-3.54	-1.95	
	10%	-2.61	-3.20	-1.61	-2.61	-3.20	-1.61	

*The Null hypothesis is the presence of unit root. Model 1 includes a constant, model 2 includes a constant and a linear time trend, while model 3 includes a none in the test regression as exogenous lags are selected based on Schwarz info criteria. (*), (**) and (***) indicate significant at 1%, 5% and 10% levels respectively.

Table 5.4. Philips-Perron (PP) Test:

Variable		Phillips-Perron (PP)Test						
		Level			First Difference			
		Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Decision
FDI		-3.61**	-3.42***	-1.60	-12.56*	-22.71*	-12.37*	I(O)
GDP		-3.94*	-4.70*	-3.3*	-15.22*	-25.79*	-13.75*	I(O)
INTR		-4.43*	-5.54*	-4.53*	-11.83*	-12.35*	-11.70*	I(O)

POP		-3.67*	-4.15*	-0.88	-4.22*	-3.40***	-4.38*	I(O)
RERV		-.197	-2.25	-1.52	-4.17	-4.72	-4.06	I(1)
CRITICAL VALUES	1%	-3.62	-4.23	-2.63	-3.63	-4.23	-2.63	
	5%	-2.94	-3.54	-1.95	-2.95	-3.54	-1.95	
	10%	-2.61	-3.20	-1.61	-2.61	-3.20	-1.61	

*The Null hypothesis is the presence of unit root. Model 1 includes a constant, model 2 includes a constant and a linear time trend, while model 3 includes a none in the test regression as exogenous lags are selected based on Schwarz info criteria. (*), (**) and (***) indicate significant at 1%, 5% and 10% levels respectively.

It is also very important to test whether a linear combination of two or more variables integrated of the same order is stationary or if a long run relationship exists between the variables under study, hence, a Johansen-Juselius cointegration test was carried out. However, the optimum lag of VECM model was established to be four (4,) using the Akaike Information criteria (AIC), assumed to be the best criterion for choosing optimum lag of sample sizes. The result shows that both Max-Eigen and Trace tests indicate 4 cointegrating equations each at 5% level, (see Table 5.6). The autocorrelation properties of the error terms in each regression was also checked using the Ljung-Box Q-statistic. The Q-statistic shows that at lag 4, the p-values of Q-statistic are greater than 0.05, and hence, the error terms are not statistically significant and therefore have no autocorrelation problem.

Table 5.5. Johansen-Juselius Maximum Likelihood Co-integration Test Result: Model: (FDI, POP, INTR RERV GDP)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	Critical Value 5 Percent	Trace Statistic	Critical Value 5 Percent
None	0.963735	109.4575	33.87687	212.6031	69.81889
At most 1	0.837409	59.94515	27.58434	103.1456	47.85613
At most 2	0.530959	24.98315	21.13162	43.20047	29.79707
At most 3	0.415878	17.74229	14.26460	18.21733	15.49471
At most 4 *	0.014292	0.475032	3.841466	0.475032	3.841466

* denotes rejection of the hypothesis at the 0.05 level.

Max-eigenvalue and Trace tests indicate 4 cointegration each at the 0.05 level.

5.1. Short and Long run Models and Results.

Having satisfied that the variables are cointegrated, it becomes necessary to estimate the vector error vector correction model (VECM) and the long run equation. The short run Granger causality test was also carried out, using the Granger Causality/Block Exogeneity Tests, where the dynamic causal interactions among the variables are phrased in a vector error correction form. This allows us to assess both long-run and short-run causality, respectively, on the χ^2 -test of the lagged first differenced terms for each right-hand-side variable and the t-test of the error correction term. The analysis of the dynamic interactions among the variables in the post-sample period is conducted through variance decompositions (VDCs) and impulse response functions (IRFs) so as to find out the dynamic properties of the system since the result of VECM indicating exogeneity or endogeneity of a variable in the system or the direction of Granger-causality within the sample period, do not provide this.

5.2. Granger Causality Test

After estimating the long-run VECM model, the statistical significance of the coefficient of the error correction term in VECM equation was used for the long run causality test while the short run Granger causality test was conducted using the Wald test. The result shows that in the short run, FDI does not granger-cause any of the explanatory variables, while a unidirectional relationships, running from RERV to POP, GDP to RERV, and from INTR to FDI, POP and GDP, exist and among the variables. The relationship between RERV and INTR is a bidirectional one in the short run.

However, no relationship exists between the variables under study in the long run. This is established by the insignificance of the ECM variables. This result is presented in table 5.7.

Table 5.6. Granger Causality Results Based on VECM

Dependent Variables	**-statistics of lagged First differenced term {p-value}** x^2 **Independent Variables**					**ECM_{t-1} coefficient [t-ratio]**
Variable	**D(FDI)**	**D(POP)**	**D(RERV)**	**D(GDP)**	**D(INTR)**	**Variable**
D(FDI)	-	2.367021 {0.6686}	0.269050 {0.9917}	4.967775 {0.2906}	2.11022 {0.7155}	-0.46451 [-1.05611]
D(POP)	1.369573 {0.8495}	-	0.521503 {0.9714}	2.40842 {0.6611}	8.525984 {0.0741}	0.003877 [1.60544]
D(RERV)	4.157393 {0.3851}	10.36016* {0.0348}	-	3.483534 {0.4804}	10.24009* {0.0366}	-14.1811 [-0.82216]
D(GDP)	6.013666 {0.1981}	2.416979 {0.6596}	9.640964* {0.0469}	-	3.722022 { 0.4449}	-1.37445 [-0.97554]
D(INTR)	18.75427** {0.0009}	13.28926** {0.0099}	21.67933** {0.0002}	27.00738** {0.0000}	-	-8.67245 [-3.78941]

*Source: Author. Note: ** and * denotes significant at 1% and 5% significance level, respectively.*

5.3. Variance Decomposition

The variance decomposition tests the proportion of changes in the dependent variable that had been explained by the changes in the independent variables. The results of the variance decomposition based on FDI and RERV are presented in tables 5.8 and 5.9 below. The results indicate that exchange rate volatility (RERV) was not accountable to any change in the net inflow of foreign direct investment in the first period (short run). In the second period, an insignificant 1% change in RERV reduced net inflow of FDI to 96%. Between the eighth and tenth periods, RERV explained about an average of 13% change in the mean net inflow of FDI of 73% into the country within the period. In table 5.9, depicting the variance decomposition of RERV, FDI accounted for about 9% of changes in exchange rate volatility (RERV) in the first period, and went down to 3% in the third period , 17% in the seventh period and then averaged about 16% between the eighth and the tenth period. While these figures represent the importance of each of these variables on the other, they reinforce the result of the long run VECM result where they both have negative relationship with each other because as one variable gains some percentage, the other loses some, and also corroborate the granger causality result which shows that RERV does not granger cause FDI, both in the short and long run.

Table 5.7. Variance Decomposition of FDI

Period	S.E.	FDI	POP	RERV	GDP	INTR
1	1.209951	100.0000	0.000000	0.000000	0.000000	0.000000
2	1.418959	96.16598	0.004597	0.929265	2.349228	0.550931
3	1.707684	91.76823	1.415313	1.686087	4.732057	0.398313
4	1.858692	84.88085	2.647314	4.627657	7.450641	0.393536
5	1.967040	85.29836	2.388040	5.269165	6.676408	0.368030
6	2.051284	83.69969	2.461387	6.863640	6.634641	0.340643
7	2.098286	81.30263	2.378674	8.672932	7.294143	0.351618
8	2.293831	76.18692	3.072870	13.38866	6.992552	0.358998
9	2.402817	73.58692	3.181695	13.38870	9.514537	0.328149
10	2.539204	74.68569	2.928337	13.02241	8.974937	0.388626

Source: Arthur.

Table 5.8. Variance Decomposition of RERV

Period	S.E.	FDI	POP	RERV	GDP	INTR
1	47.45018	9.328231	8.078477	82.59329	0.000000	0.000000
2	68.99926	4.414188	13.27605	75.40590	5.939482	0.964387
3	83.55394	3.319596	10.26076	78.99095	5.798019	1.630676
4	96.33114	5.122351	8.680652	79.67198	4.428229	2.096785
5	113.0054	15.70488	6.950905	72.25946	3.268535	1.816216
6	122.4681	18.16512	6.911380	70.09818	2.866292	1.959023
7	128.5953	17.17929	7.700215	70.29451	2.815789	2.010195
8	133.6230	15.97108	9.154659	70.21648	2.691249	1.966532
9	137.2294	15.48658	9.877274	69.93483	2.667251	2.034069
10	142.0140	15.77307	10.92298	68.20766	3.066150	2.030141

Source: Arthur.

5.4. Impulse Response Functions (IRFs)

The figures below present the impulse response functions of both FDI and RERV on each other. Figure 1 shows the response of FDI to shocks from RERV. The shocks to FDI from RERV in the first (immediate impact), fourth and eighth periods were zero, positive in fifth, nineth and tenth periods and negative in other periods. The graph shows that the shocks from RERV to FDI are not stable, do not fizzle out nor deviate from the mean. They are negative at some periods and positive at others. The immediate impact of shocks from REV to FDI is in agreement with the result of the variance decomposition result where RERV accounted for 0% change in FDI in the first period i.e. the short run. The graph also shows that the negative impacts last longer than the positive impacts of the shocks. Figure 2 presents the response of RERV to shocks from FDI. Like figure 1, the shocks from FDI to RERV is zero, negative and positive at some points. It shows that these shocks are not stable, do not fizzle out and do not deviate from the mean also.

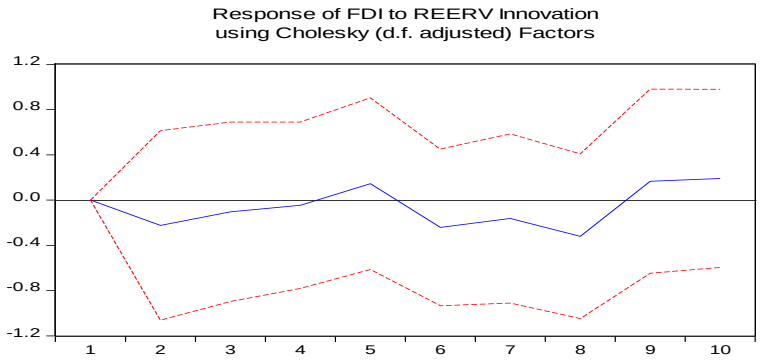

Figure 1. Response of FDI to a Shock from RERV

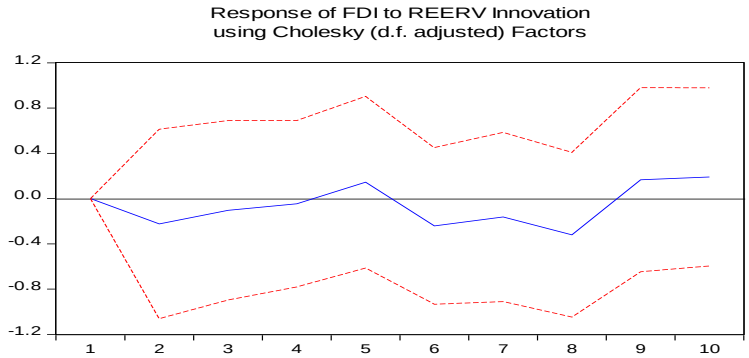

Figure 2. Response of RERV to a Shock from FDI

6. Conclusion

This study examined the relationship between FDI inflow and exchange rate volatility in Nigeria. After a careful literature review, the study considered some determinants of FDI from the literature. The outcome of the estimation using Granger Causality Results based on VECM was that exchange rate volatility has no relationship with net FDI inflow into Nigeria, both in the short and long run. This conclusion is robust to the findings from both variance decomposition and impulse response functions.

The study suggests that since there are other drivers of FDI inflow, policy makers should be more holistic in their investment drive. Market participants should think in the way of reallocation of resources, and adopt other macroeconomic variables which will encourage the inflow of foreign direct investment to the country. It is also important to re-examine the transmission mechanism of exchange rate to FDI and vice versa so as to determine the appropriateness of policies in Nigeria. The study concluded that neither FDI nor RERV is important in determining each other in Nigeria.

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