Innovations

Exchange Rate Dynamics and Foreign Portfolio Investment in Developing Economies: Evidence from Nigeria

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Abstract: *This studyexamines how exchange rate fluctuations relate to foreign portfolio investment in Nigeria. We analysed the data gathered from the Central Bank of Nigeria, Nigeria Exchange Group and World Development Indicatorsof the World Bank from 2014 to 2021 using GARCH, Johansen Cointegration and Vector Error Correction Model. The result demonstrates a long run relationship between foreign portfolio investment and exchange rate volatility. The result shows that exchange rate volatility adversely impacts foreign portfolio investment flows to Nigeria. In addition, market capitalisation exerts a positive butinsignificant link with foreign portfolio investment in Nigeria. This finding implies that the government, through the Apex Bank,should adopt an improved exchange rate management policy to stabilise the rate. Moreover, it is vital for the stakeholders, especially the policymakers, to continue to develop the capital market and improve the business environment to attract foreign investment inflows.*

Keywords: *Foreign Portfolio Investment, Exchange Rate Fluctuations, Market Capitalization, Developing Economy, VECM, GARCH, Johansen Cointegration*

1. Introduction

In recent times, developing nations are facing a growing concern about unemployment, poverty and income inequality, which require adequate investment and funding to enhance the situation (Al-Smadi, 2018; Jannat, 2020; Ekanayake&Dissanayake, 2022; Onabote, Adama, Obasaju, Ohwofasa, Eluyela&Popoola, 2022).According to Evans (2017), the government believes thatcapital flows from foreign investment could be a significantboost for industrialisation for emerging economies, especially in the long run. It is a good source of foreign exchange, particularly for developing economies, to finance current account deficits (Singhania& Saini, 2017; Makoni, 2020).However, attracting foreign inflows has been a challenge for most developing countries,

which poses an important question of whether thefluctuation of exchange ratescould beresponsible for the decreasing capital flows, particularly foreign portfolio inflowsin emerging market economies.Interestingly, the exchange rate is an important economic variable that affects economic activities and the size of the economy.

Several studies have demonstrated the significance of foreign capital flows across economic boundaries to promote the productivity and development of the host nation.However, these studies have focused mainly on foreign direct investment (FDI) with minimal attention to the connection betweenexchange rate volatility andforeign portfolio investment (FPI)(Sokang, 2018; Jannat, 2020; Onabote et al., 2022). Moreover, the few studies that attempted to examine foreign portfolio investment and exchange rate have mixed results (Garg&Dua, 2014; Adekoya&Fagbohun, 2016; Singhania& Saini, 2017; Anggitawati&Ekaputra, 2018).Thus, understanding the behavioural relationship between exchange rate fluctuations and foreign portfolio investment is imperative to further policy direction on the economy. According to Verikios(2018), foreign portfolio investments are a source of liquidity that relies on the functioning of the financial markets and are often held by investors who have no intention of managing a foreign firm. The international finance theory posits that FPI is a channel for foreign investors to diversify the risks associated with portfolios and enhance their investment returns (Singhania& Saini, 2017; Makoni, 2020). Increased FPI may help the host economies bridge the gap between saving and investment facilitate increased production levels, employment generation and economic expansion.

Against this backdrop, weexamine how exchange rate fluctuations relate to foreign portfolio investment in Nigeria. In other words, the present study investigates the connection between exchange rate fluctuations and foreign portfolio investment in Nigeria. Given the current economic situation in Nigeria, where the poverty level, income inequality and unemployment rate are high, it is essential to examine whether exchange rate fluctuations affect foreign portfolio flow in Nigeria.Also, Nigeria is a mono-cultured economy which rely on foreign earnings from the sale of crude oil at the international market. On the other hand, the country import a lot of goods and services from other parts of the world. Consequently, an unstable exchange rate will affect economic activities in the country, especially when it is unfavourable. This study will help policymakers design good policies to manage exchange rates, which isvital to enhance foreign portfolio investment and drive economic growth and development.This studyutilises the Vector Error Correction Model (VECM) inanalysis. This technique helpsmeasure the consequences of exchange rate fluctuations and shocks on the foreign portfolio investment received in Nigeria.This study established evidence that exchange rate volatility exerts an inverse relationship with foreign portfolio inflows in Nigeria.

The present study contributes to the literature in different ways. First, whereas most of the studies that examine capital flows concentrated on the FDI, especially theForeign Institutional Investor component, this study examines the link between exchange rate fluctuation andFPI flows to Nigeria.Second, the study employs the Vector Error Correction Model to estimate exchange rate dynamics and foreign portfolio investment in an emerging nation. The VECM is one of the few techniques currently used to explore macroeconomic variables because of its ability to achieve parsimony. Third, looking at the influence of macroeconomic variables on economic performance, it becomes necessary to investigate the connectionbetween exchange rates and FPI flows in Nigeria. Finally, the study demonstrates that exchange rate fluctuation is an important determining factor of FPI in Nigeria. Hence, the monetary authority needs to reassess the current exchange rate policy, develop programmes and policies to manage volatility effectively and stabilise the rates to enhance FPI flows into the country.The remaining part of the paper is structured in the following order. Section two discusses the theoretical and empirical literature review on this issue. In section three, we discussed the data source and technique of analysis used, while section four reports the results and discussion. The last section focuses on the concluding remarks and recommendations for policymakers.

2. Literature Review

A number of studies have established the imperative of exchange rate stability for economic growth (Singhania& Saini, 2017; Al-Smadi, 2018; Ekanayake&Dissanayake, 2022). Exchange rate instability can be a source of concern to the stakeholders.According to Ogundipe et al. (2019), exchange rate fluctuations affect interest rates, inflation, unemployment, money supply, and other economic variables that affect the performance of countries that have openedto the world.On the contrary, Ndubuaku, Onwuka, Onyedika, and Chimezie(2019)affirmedthat exchange rate stability does not contribute to economic growth, especially if this is done through large-scale government intervention to maintain the exchange rate regime.They suggested that targeting them may be more effective when complete unemployment and excessive dependence on imported capital goods create a significant network that affects the economy.

Thebalance of payments theory of exchange rate, which the present study is anchored, arguesthat the value of a domestic legal tenderin terms of foreign currency is a function of the market forces of foreign exchange at the foreign market, which in turn determine the balance of payments position in the economy (Dogruel, Dogruel & Izmen, 2010; Sokang, 2018; Makoni, 2020).According to the theory, a deficit balance of payment indicates that the demand for foreign exchangeoutstrips the supply of financial assets (Mlambo& McMillan, 2020).

Therefore, a favourable balance of payments position in the economy increases the exchange rate favourably, while a deficit balance of payment harpers the opportunity for the economy to experience a favourable exchange rate. Also, the demand and supply of foreign currencies can significantly influence the currency exchange rate in a country, especially when no inflows are coming into the country.One key issue with this theory is that it assumes a perfect completion and does not consider the government's effort to influence the foreign exchange market(Al-Smadi, 2018).

Empirically, Dogruel, Dogruel, and Izmen(2010) examined the impact of the rise in the value of the Turkish Lira onthe manufacturing sector. The study used the regression method to estimate the data from 1995 to 2007. The findings showed that the level of foreign inputs to total inputs and profits made varies with the exchange rate. They concluded that the Dollar and the Euro are important factors in determining the competitiveness ofthe Turkish manufacturing sector. Similarly, Garg and Dua (2014) used the Autoregressive DistributedLag (ARDL) technique to examine the contributing factorto portfolio flows to India from 1995 to 2011. They established that portfolio flows respond positively to lower exchange rate volatility and superior risk diversification. Furthermore, they reported that domestic equity output, exchange rate,domestic production growth and interest rate differential are other causes of portfolio flows. Alagidede and Ibrahim (2016) investigatedthe causes and effects of exchange rate volatility on Ghanaian economic growth using the GARCH model and the Generalised Method of Moments (GMM). The result showed that exchange rate shocks tend to move away from equilibrium, and misalignments take a long time to correct. They opined that exchange rate shocks can be detrimental in the near term as such economic players must adjust how they spend and invest their money. They concluded that too much volatility harmed economic growth. However, this is only partly so sinceother factors may also aid growth.

By means of the VAR panel method, Rafi and Ramachandran (2018) investigated the connection between capital inflows and exchange rate instability in developing economiesusing quarterly data from 1997–2017. The results from the impulse response analysisrevealed a response to the portfolio capital shocksfrom exchange rate volatility.Mlambo and McMillan (2020) assessed the power of exchange rates to influence industrial productivityin the Southern African Customs Union (SACU) countries between 1995 and 2016. The SACU nationsinclude Lesotho, Botswana, South Africa, Namibia, and Swaziland. TheFully Modified Ordinary Least Squares (FMOLS), as well as Pooled Mean Group (PMG) techniques,were used in the study. They reported that exchange rates, imports and FDIhave a negative impact on output. Both inflation and exports have a significant impact on production performance. Makoni (2020) investigated theimpact of capital openness andreal exchange rate on foreign portfolio

investments between 2009 -2016. The author utilised the Fixed Effects model to estimate panel data gathered from Chinn and Ito and the World Bank databases for nine African countries. The results demonstrated that while the rate of inflation and real exchange rates exert a negative relationship on FPI inflows, previous periods of stock market advancement, real economic growth rate, and FPI have a positive relationship on FPI.

In Nigeria, Adekoya and Fagbohun (2016) evaluated the impact of currency depreciation on industrial production development between 1980 and 2014. The Ordinary Least Squares, cointegration, and the Granger causality test were used to analyse long-term connections. The study indicated that currency depreciation negatively influences industrial output growth except imports, which did not affect the rise. The causality test also revealed a one-way link between the exchange rate, imports, and private-sector loans, all connected to industrial production. Similarly, Ndubuaku et al. (2019) exploredthe effects of fluctuations in exchange rates on various Nigerian economic factors between 1981 and 2016. The ARDL technique was applied in the analysis. The study concluded that the currency's valuedid not substantially affect the gross domestic product of the agricultural, industrial, or service sectors. Nonetheless, the shift in exchange rate had a substantial and favourable effect on GDP. Yunusa (2020) used the GARCH and ARDL methods to analyse the monthly data from 2006 to 2019 in a bid to investigate the effect of exchange rateinstabilityon Nigerian crude oilexport to its trading partners. The results of the GARCH analysis revealed that the trading partners' exchange rates are volatile and strong enough to influence Nigeria's decision on trading partners. The ARDL result indicated that the instability of the Nigeria exchange rateis statistically significant for the seven (7) trading partners listed as Brazil, Canada, France, Italy, Spain, UK and USA, though at different magnitudes.

3. Data and Methodology

3.1. Data source

This study examines how exchange rate dynamicsrelateto foreign portfolio investment received in Nigeria.The study employs monthly data sourced from the Central Bank of Nigeria,Nigeria Exchange Group(NGX) and World Development Indicators(WDI) from the World Bank between 2014 and 2021 with 96 monthly observations.The study period was primarily influenced by the significant drop in portfolio flows, especially after the 2015 general election and the 2016 economic recession. The National Bureau of Statistics reports that the capital inflow to Nigeria dropped to $9.6m in 2015 from $20.8m in 2014, representing a decline of 53.53 percent. The decrease in inflow was alarming in 2016, declining by 46.86 percent from the 2015 value. It grew to $23.9m in 2019 and declined by 59.65% in 2020 when the country had a negative 1.92 percent growth in GDP.The study is based on empirical evidence from Nigeria since it is one of the largest emerging

markets in Africa, with high exchange rate volatility in recent times. Also, Nigeria is a liberalised country that allows capitalto flow in and out of the economy.The study adopts foreign portfolio investment as theobserved variable and exchange rate fluctuations, exchange rate and stock market capitalisation as theexplanatory variables.Theexchange rate volatilitythroughout the study period is estimated using the exchange rate between the American dollar and the Nigeria Naira.The study employsinflation, real gross domestic productgrowthand trade openness as control variablesto account for other factors influencing foreign portfolio investment received in the country. The measurement of the variables ispresentedin Table 1.

Table 1: Description of variables

Variable	**Symbol**	**Measurement**	**Reference**
Foreign Portfolio Investment	FPI	Measured as the ratio of foreign portfolio investment received to gross domestic product	Anggitawati&Ekaputra (2018);Ogundipe et al.,(2019)
Exchange rate volatility	EXRVOL	Estimated using the GARCH (1, 1) model to generate the volatilities	Ogundipeet al., (2019)
Exchange rate	EXR	Exchange rate of the home country in terms with US$	Singhania& Saini (2017)
Inflation	INF	Consumer price index	Al-Smadi (2018);Makoni (2020)
Market Capitalisation	MCAP	It is measured as the sum of all outstanding shares multiplied by the current market price of each share.	Ogundipe et al.,(2019)
Real Gross Domestic Product Growth	RGDP	Percentage growth in real gross domestic product	Singhania& Saini (2017)
Trade Openness	TOPEN	The ratio of total trade to nominal GDP	Singhania& Saini (2017); Makoni (2020)

3.2. Model Specification

The study employs time series data, which are usually known to be non-stationary. Using such data in the form they are gathered may lead to a spurious statistical analysis. Therefore, to guide against such occurrences and improve the performance of the analysis, the Augmented Dickey-Fuller (ADF) testis employedto check for thestationarity of the variables.The ADF test is givenas:

$$\lambda_t = \varpi_0 + \beta_1 \lambda_{t-1} + \sum_{j-1}^{p} \phi_j \lambda_{t-j} + \varepsilon_t \quad (1)$$

Where p is the required number of lags to address any issue about autocorrelation of the residuals and ε_t is a white noise error term. The null hypothesis (H_0) that there is no unit root is $\Lambda = 0$, while the alternative hypothesis (H_1) that there is a unit root is $\Lambda < 0$. The Johansen cointegration technique for estimation is employed in the study to establish whether a connectionexists amongst the variablesin the long run. Moreover, the study utilised the Akaike Information Criterion (AIC) topick the optimal lag length automatically.

This study employs Generalized Autoregressive Conditional Heteroscedasticity (GARCH) to measure exchange rate fluctuations (Bollerslev, 1986; Ogundipe et al.,2019). Compared to the standard deviation used to measure volatility, the GARCH can account for the realvolatility power in a system and recognise asset clustering and time-varying properties.These are challenges associated with standard deviation as a technique to measure the volatility connected with movement in exchange rates (Furceri& Borelli, 2008).The GARCH model is essential to estimate exchange rate instability since it can deal with issues of heteroscedasticity sufficiently. Contrary to the ordinary linear models, the ARCH as well as GARCH models are intended to evaluate conditional variance. Moreover, the GARCH (1, 1) model can use its lag to resolvethe issue of autocorrelation associated with variables. For this study, the GARCH (1, 1) model is expressed as follows;

$$\delta_t^2 = \psi_0 + \chi_i \varepsilon_{t-1}^2 + \phi_j \delta_{t-1}^2 \quad (2)$$

We expressed equation (2) further as

$$\delta_t^2 = \psi_0 + \sum_{i=1}^{p} \chi_i \varepsilon_{t-1}^2 + \sum_{i=1}^{q} \phi_j \delta_{t-1}^2 \quad (3)$$

Where δ_t^2 is the conditional variance in time t, ψ_0 denotes the mean, $\chi$and $\phi$are non-negative, ε_{t-1}^2 represents the ARCH term and δ_{t-1}^2 is the GARCH term. Furthermore, $\sum_{i=1}^{p} \chi_i + \sum_{i=1}^{q} \phi_j$ must be < 1 to make certainthe stationarity of the model.We expresseda model with the necessary control variablesto investigate the connection between exchange rate fluctuations and the amount of private

investment received from foreign investors. Foreign portfolio investment (FPI) is expressed as the observed variable in the model, while exchange rate volatility (EXRV), exchange rate (EXR) and market capitalisation (MCAP)represent the regressed variables. The control variables are real gross domestic product growth rate (RGDP), inflation (INF),and trade openness (TOPEN).The model for this study is stated as follows:

$$FPI = f(EXRVOL, EXR, \text{MCAP}, INF, \text{RGDP}, \text{TOPEN}) \quad (4)$$

Where f is the functional relationship between the variables. The explicit form of the model is thus specified as:

$$FPI_t = \alpha_0 + \beta_1 EXRVOL_t + \beta_2 EXR_t + \beta_3 MCAP_t + \beta_4 INF_t + \beta_5 RGDP_t + \beta_6 \text{TOPEN}_t + \mu_t \quad (5)$$

Since we are using time series data that is assumed to trend, it is essential to transform the variables into a more normalised dataset to improve the analysis outcome. In other words, to take care of the possibility of a non-linear relationship among the variables, all variables are transformed into natural logarithms(ln)for the analysis. Furthermore, we presumed that the past performance of the dependent variable may have a significant relationship with its current performance. In this instance, the past value of the observed variable is introduced to the equation.Thus, equation 5 is written as:

$$FPI_t = \alpha_0 + \beta_1 InEXRVOL_t + \beta_2 InEXR_t + \beta_3 InMCAP_t + \beta_4 InINF_t + \beta_5 InRGDP_t + \beta_6 \text{InTOPEN}_t + \beta_7 InFPI_{t-1} + \mu_t \quad (6)$$

Where$\alpha_0$is the intercept or constant term, β_1 - β_7 are the coefficients of the independent and control variables, and t represents time. Furthermore, FPI_{t-1} is the lag value of the observedvariable to control for the dynamic effects of the variable on current inflows, and μ is the error term.The Nigerian economic environment is one of the most unstable environments in the world that spurs exchange rate volatility. The exchange ratefluctuation is predicted to have a negative and significant causal connection with the level of portfolio investment from foreign investors in Nigeria during the study period.On the contrary, market capitalisation and the control variables are expected to positively influence the level of foreign portfolio investment received in Nigeria during the study period.

To analyse the sourced data and establish empirical evidence on how exchange rate dynamics influence FPI, we estimate our model using the VECM.Thisapproach is essential for more efficient estimates and to establish both the system variables' short-run behaviour and the long-run cointegrating relationship. It also helps to estimate the short-run adjustment coefficients of the system. In addition, VECM is ideal for studying open economies where dynamic economic issues such as exchange rate fluctuations are a significant concern (Rosoiu&Rosoiu, 2013). The VECMestimation techniqueis rewritten as:

$$\Delta\lambda_t = \alpha_0 + \sum_{i-1}^{p-1} \phi_i \Delta\lambda_{t-i} + \sum_{i-1}^{p-1} \varpi_i \Delta X_{t-i} + \delta EC_{t-1} + \varepsilon_t \quad (7)$$

Where Δ is the difference operator and λ_t is the dependent variable. The$\alpha_0$is the constant, and p is the optimum lag length. While $X_t$denotes then×nk matrix, which is theshort run response matrices among the explanatory variables,ϕ_i, ω_i and δrepresent the coefficients. The $EC_{t-1}$is defined as the error correction term,and ε_t is the vector of the structural disturbance term.Given that the VAR model cannot effectively measure short-run shocks, this study utilised the impulse response function (IRF) as well as the Variance Decomposition (VD) to examine how FPI responded to shocks and how variations in FPI wereaddressed or decomposed by the explanatory variables in the study.We used Cholesky's decomposition of the covariance matrix to detect shocks and produce the impulse response functions. The IRF and VD help overcomethe difficulty of interpreting the VAR model coefficients.

4. Results and Discussion

4.1. Analysis of real exchange rate volatility

We commence this section with a preliminary analysis. The descriptive statistical analysis and correlation matrix results are reported in Table A1 and A2 in the appendix. The correlation coefficients of the explanatory variables are not high, which implies that multicollinearity is not an issue in the model to be estimated. The variance inflation factor (VIF) result in Table A2 also confirms the absence of multicollinearityin the dataset.We used the ARCH Lagrange Multiplier (LM) test to examine the series of exchange rate fluctuations. Table2 reports the finding of the conditionalheteroscedasticity test for the series, which shows an F-statistic of 1.10684with a p-value of 0.01011 and Prob. Chi-Square of 0.00344. This result is statistically significant at the 5% level of significance. This denotes an ARCH effect in the variables since thep-value is less than 5%. By implication, this result establishes the power of the previous period's exchange rate fluctuations to influence the present exchange rate instability. This implies that periods of low (high)exchange rate fluctuations are preceded by periods of low (high) fluctuations over time.

With the result indicating the ARCH effect, we go on to model exchange rate volatility employing the GARCH (1, 1) model. The result in Table3indicates that the coefficients of ARCH and GARCH terms are positive as well as significant at the 5% significance level. The exchange rate is volatile since the sum of the ARCH and GARCH coefficients is greater than the value of one. This is consistent with the findings of Yunusa (2020). The persistence of shocks in the volatility of the variables, as demonstrated in the GARCH (1, 1) test result, suggests that volatility persists over the study periods. It, therefore, suggests that the periods of low

(high) exchange rate shocks are likely to be trailed by periods of low (high) exchange rate shocks for an extended period.

Table 2: ARCH Lagrange Multiplier (LM) Test

Statistics	estimate
F-stat. (Prob. F(1,189))	16.10684 (0.0011)
Obs*R^2	11.0283
Prob. Chi^2(1)	0.0030

Table 3: Estimation of real exchange rate volatility

Variable	**Coefficient**	**Prob.**
Mean equation		
Intercept	-0.1430	0.0100
$InEXR_{t-1}$	1.0716	0.0004*
Variance equation		
Intercept	0.0151	0.1714
$ARCH_{t-1}$	0.1163	0.0067**
$GARCH_{t-1}$	0.2635	0.0000**

Note: * and ** mean1% and 5% statistical significance

4.2. Unit root test for stationarity

We employthe ADF technique to conduct the unit root test. The ADF findingsreported in Table 4, the unit root analysis results show that the study variables are stationary and integrated of order one, that is, I(1) in their first difference. In this instance,we proceed to estimate the cointegration test using the Johansen cointegration technique after observing the level of stationarity and order of variable integration as I(1) from the ADF test results.

Table 4: ADF Test for unit root analysis (Trend and Intercept)

Variable	At 1^{st} difference	5% Critical Value	Order of Integration
FPI	-5.0212	-4.0275	I(1)
EXRVOL	-4.1837	-3.3127	I(1)
EXR	-4.0338	-3.0716	I(1)
MCAP	-3.7000	-2.6848	I(1)
INF	-3.6270	-2.8398	I(1)
RGDP	-4.1084	-2.6926	I(1)
TOPEN	-3.3022	-2.7472	I(1)
FPI_{t-1}	-3.1027	-2.0275	I(1)

4.3. Johansen cointegrationtest for a relationship

To establish if there is a long run cointegrating relationship among the variables in this study, we use the Johansen cointegration test technique. The trace test resultsin Table 5 indicate four cointegrating equations with a p-value below 5% confidence level. Similarly, the results of the maximum eigenvalue in Table 5showcointegration among the variables. In a nutshell, the outcome of the Johansen cointegration tests, both in trace and max–eigen statistics, demonstratescointegration among the variables. This result suggests that there is evidence to conclude that a long-run connectionexists between portfolio investment from foreign investors and exchange rate fluctuations. Since the variables' unit root analysis results indicate order I(1) and the trace and max-eigen statistics value indicate a long run relationship between the variables, we move further to conduct the VECM to determine the causal-effect connection and the corresponding speed of adjustment.

Table 5: Johansen cointegration test results

Hypothesised No. CE(s)	Eigen value	Trace Test			Max-Eigenvalue Test		
		Trace Statistic	5%Critical Value	Prob.**	Max-Eigen Statistic	5%Critical Value	Prob.**
None	0.5346	228.3802	164.9730	0.0000	67.1663	63.4706	0.0000
At max 1	0.3084	148.8822	133.7493	0.0309	56.6747	50.4111	0.0191
At max 2	0.3902	93.6721	58.7483	0.0244	45.6755	38.6423	0.0042
At max 3	0.3701	68.8930	50.7211	0.0003	32.6881	36.1322	0.1111
At max 4	0.3501	40.3771	45.3209	0.1062	28.4238	30.0279	0.2030
At max 5	0.3005	26.9788	33.7005	0.2013	22.0040	28.1161	0.4342
At max 6	0.3827	23.7025	30.9372	0.3116	18.4804	23.3826	0.1306
At max 7	0.0693	8.8093	4.8002	0.1101	8.7306	4.7035	0.3313

4.4. Estimation of the Vector Error Correction Model

To estimate the model to investigate exchange rate dynamics on foreign portfolio investment in Nigeria, first, we carried out the lag selection, which indicates lag 2 as the optimum lag for the model.The results reported in Table 6 demonstratethat the explanatory variables in the study exert a relationship and influence on FPI at the 5% significance level. The error correction term (ECT) revealshow shortrun deviations from the mean are adjustedbased on the swiftness of adjustment. Overall, the estimation results, which give the short run relationship among the variables,suggest that 78%of the exogenous variables explain the variations in investment from foreign portfolios. Given the χ^2 of 3.07011 and p-value of 0.00000,the results indicate that the variables in the model are jointly significant at a 5%significance level. The result of the ECTshows anadverse and statisticallysignificant influence, which suggests that due to shock in the short run,

about 5.3% deviation from long run equilibrium iscorrected in the subsequent period between exchange rate fluctuations and FPI. The study reveals that a lag value of exchange rate instability and inflation exhibits a negative connection with foreign portfolio investment in Nigeria. On the other hand, a lag value of GDP, exchange rate and market capitalisation indicate a positive but insignificant relationship with foreign portfolio investment in Nigeria.The result is consistent with the findings of Adekoya and Fagbohun (2016)and Makoni (2020).It is also in line with GargandDua (2014), whoreported that exchange rate volatility has anadverse and significant associationwith portfolios in India.

The finding, nevertheless, contradicts the findings of Singhaniaand Saini (2017), who established an insignificant association between exchange rates and foreign portfolios in evolving countries.The negative influence of exchange rate instability on foreign portfolio investment explains the power of exchange rate dynamics to discourage foreign investment inflow into Nigeria's economy through the financial markets. The finding of this study implies that a rise in exchange rate volatility will discourage inflows of FPI to Nigeria since investors prefer appreciation of the host nation's currency to realise appreciable gains in investment.The weak inflows of foreign investment and its consequences on the economywere evident in the study period. Exchange rate volatility drives interest rates, which discourages borrowing from the financial market for investment.

Similarly, inflation reveals a negative and significant connection with FPI in Nigeria.This result correlates with the findings of Singhania and Saini (2017), Al-Smadi (2018) andMakoni (2020).The inverse association between FPI and the inflation ratecould be connected to weak productive economic activities, especially from the agricultural and manufacturing sectors. It also suggestsfirms' constant increase in prices of products and services owing to the rise in the cost of production occasioned by exchange rate volatility, interest rate, multiple taxationsand overall harsh business environment. The implication of this result is that policymakers must do everything possible to improve the economic environment and diversify the economy to other sectors like agriculture and mining. The analysis indicates that GDP exerts a positivebut insignificant relationship with FPI. This result is expected given the fact that the economy, over time, witnessed a weak GDP growth rate. The positive but insignificant effect of the GDP on FPImay beconnected to exchange rate volatility and the high interest rate that continues to affect economic and business activities in the country. This finding is consistent with the result reported by Makoni (2020), who argued that a high GDP growth rate may further attract foreign portfolio investors and reward them with better returns.

Furthermore, while market capitalisation and the lag value of FPI demonstrate a positive and insignificant connection with FPI, there is evidence that trade

openness has an inverse relationship with FPI in Nigeria. Thefindings are in line with the findings of Garg and Dua (2014),Ogundipe et al (2019) and Makoni (2020). The result implies that market capitalisation and past FPI trends are important predictors of FPI flows in the future.The findingshows that a well-functioning capital market is essential to attract FPI into the economy. Given that a unit increase in market capitalisation leads to a rise in FPI,it is important for the stakeholders, especially the government, to continue to develop the capital market and improve the business environment to encourage listing and attract foreign investment inflows. Another implication of this result is that as a developing nation, Nigeria should take advantage of this opportunity to open up other sectors of the economy to attract investment inflows. The negative association between FPI and trade openness, which is similar to the findings by Garg and Dua (2014) and Makoni (2020),is a clear indication that in Nigeria, there are still restrictions such as multiple taxations, difficulties to repatriate proceeds by investors and weak institutions, which to a large extent deter investors from bringing inflows into the country.

Table 6. Estimation of theVector Error Correction Model

Variable	Coefficient	Stand. Error	z–statistic	p-value
ECM_{t-1}	–0.0538	0.0330	–1.6298	0.0306**
$D(InEXRVOL_{t-1})$	-0.0680	0.0493	-1.3791	0.0021**
$D(InEXR_{t-1})$	0.0583	0.0821	0.7104	0.2109
$D(InINF_{t-1})$	-0.0150	0.0125	-1.2034	0.0031
$D(InMCAP_{t-1})$	0.0259	0.0021	12.4567	0.1820*
$D(InRGDP_{t-1})$	0.0131	0.0132	0.9939	0.2012
$D(InTOPEN_{t-1})$	-0.0491	0.0411	-1.1939	0.0052
$D(InFPI_{t-1})$	0.0840	0.0239	3.5170	0.0219
Constant	–0.3741	0.1532	–2.4413	0.1424
R^2	0.7839			
Adjusted R^2	0.6698			
F-stat.	7.4692			
Prob (F-stat.)	0.0030			
χ^2	3.0701			
p-value	0.0000			
Durbin-Watson stat	1.9083			

Note: * Significant at 1% significance level and ** Significant at 5% significance level.

4.5. Analysis of impulse response and variance decomposition

We performed the impulse response function to examine the reaction of the dependent variable to external shocks. In Figure 1, the impulse response function considers the reaction of FPI to a standard deviation shock to each explanatory variable. Evidently, over the 10 period interval, FPI experienced some influence from other variables. Specifically, there is evidence in Figure 1 that FPI has a relationship with the shocks to the explanatory variables from the first period. Starting from the first to the tenth period, FPI demonstrated a negative response to shocks emanating from exchange rate volatility. The same is seen in FPI response to shocks coming from inflation. This result implies that the behaviour of the exchange rate negatively and strongly influences foreign portfolio investment inflows in Nigeria. It, therefore, suggests the need for policymakers to device strategies to stabilise the exchange rate to encourage capital inflows. Similarly, market capitalisation maintained a negative and consistent shock on FPI, indicating the capital market development level to support the economy. The extent of financial market development is one indicator that boosts investors' confidence and drives inflows into the economy. A one standard deviation shock to RGDP initially has a little positive effect on FPIfrom period one to six, and thereafter, it exerts a negative but low effect on FPI.

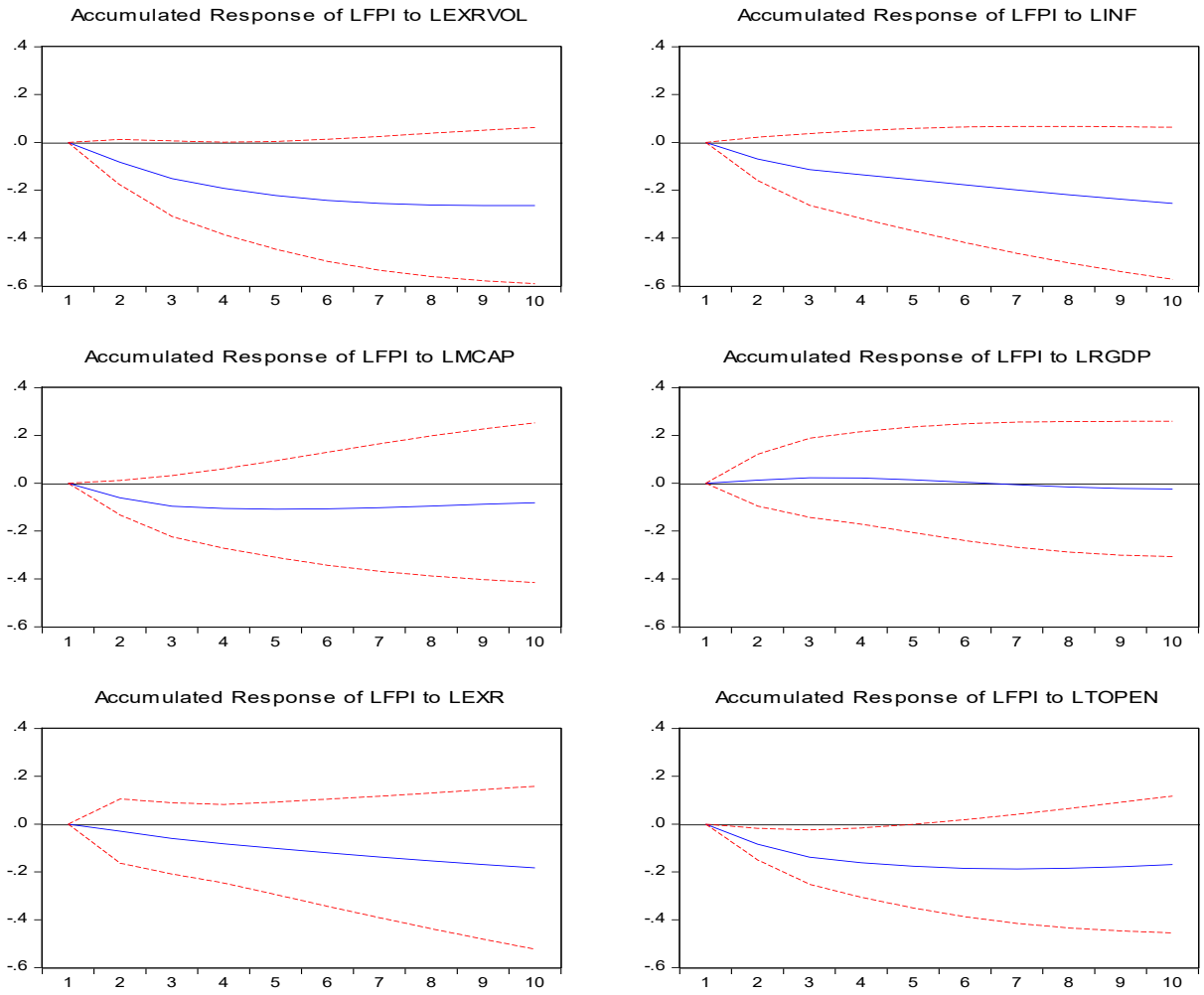

Figure 1. Accumulated Response of Foerign Portfolio Investment

Table 7 showsvariancedecomposition analysis, which examineshow shocks in the explanatory variables like exchange rate volatility, market capitalisation and inflation relate to variance or changes in FPI.The results reveal that in the first period, the largest source of shock to FPI was caused by the variations in FPI itself, which contributed about 100% before it started to experience a decline. This result implies that none of the explanatory variables could explain the variations in FPI in the short run.However, from the second period, it is observed from the table that exchange rate volatility is responsible for the changes or variations in FPI in Nigeria. For instance, exchange rate volatility had shocks of about 8% in the second period and increased to 20% and 24% in the 8th and 10th periods, respectively. This reduced net FPI inflows to Nigeria by approximately 8% in the second period and increased to 20% and 24% in the 8th and 10th periods, respectively.Market capitalisation also contributed to the shocks in FPI, with about a 3% reduction in net FPI in the second period anda 15% reduction in FPI in the 10th period. Other independent variables were responsible for small changes or variations in the FPI in Nigeria.

Table 7: Analysis of variance decomposition

Period	S.E.	FPI	EXRVOL	INF	MCAP	EXR	RGDP	TOPEN
1	1.3095	100.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	1.5084	98.1354	8.9373	1.0800	1.5837	3.1033	3.3028	0.5975
3	1.7194	93.9604	12.6747	2.4895	3.3028	5.0253	5.7883	0.3821
4	1.8078	86.5868	15.6026	3.6073	4.3796	5.7845	8.4522	0.3903
5	1.9795	87.6534	16.2284	3.3804	6.3003	9.0256	7.6739	0.3720
6	2.0965	85.4645	24.7949	3.4004	7.3937	7.1836	7.6073	0.3008
7	2.1425	83.8966	22.6094	3.3064	7.3593	9.0674	8.2005	0.3082
8	2.3765	78.2461	20.3486	4.0459	6.3802	13.0647	7.9178	0.3649
9	2.5108	75.9664	18.3023	4.1353	8.3082	14.1183	1.5795	0.3744
10	2.7686	76.7816	24.0764	3.9120	15.3028	14.4630	9.9003	0.3739

4.6. Diagnostic tests

We performed appropriate diagnostic checks, such as model stability, autocorrelation, normality and heteroscedasticity, as reported in Table 8. The analysis of autocorrelation using the LM test reveals no evidence to suggest autocorrelation of the residual among the variables at a 0.05%significance level. The Breusch-Pagan test of heteroscedasticity indicates that there is no problem withheteroscedasticityin the study, which implies that the null hypothesis should not be rejected. The normality of residual distribution using the Jarque-Bera test suggests that the residuals are normally distributed. Furthermore, the model is stable and can generate impulse responses to examine the connection between the dynamic effects of exchange rate instability on foreign portfolio investment in Nigeria.

Table 8: Estimation of diagnostic test

Estimate	Technique	Statistics	P-value
Heteroscedasticity	Breusch-Pagan-Godfrey test	16.0602	0.1609
Serial Correlation	Breusch-Godfrey LM test	7.2047	0.0832
Normality	Jarque-Bera test	0.7350	0.3533
Stability	Ramsey RESET test	2.5400	0.2147

5. Concluding Remarks

One of the principal challenges facinggovernmentsworldwide is the lack of adequate resources to support economic growth and development. In this instance, foreign investment is a good source of funding for the government, especially in emerging nations, to enhance economic growth. Thus, this study empirically investigatesthe relationship between exchange rate dynamics and foreign portfolio investment in Nigeria. The study is based on monthly time series data from 2014 to 2021 and used the GARCH, Johansen Cointegration and VECM for analysis.Moreover, the study employs the Impulse Response Function to look at how FPI respond to shocks and the Variance Decompositiontechnique to examine how variations in FPI wereaddressed or decomposed by the explanatory variables.

Following the data analysis, we established evidence of a long run relationship between exchange rate fluctuations and foreign portfolio investment in Nigeria. The result demonstrates that the exchange rate is volatile,and shocks in the variables indicate that volatility is persistent over time. Furthermore, the result revealsthat exchange rate instability has aninverseand significant association with FPI in Nigeria.Theimpulse responsefunction as well as variance decomposition,demonstrate that exchange rate volatility is important to determineforeign portfolio investment response and variance in Nigeria. This finding implies that a higher exchange rate fluctuation would produce a low FPI response in the short run, which will impact the economy in the long run. Furthermore, the result reveals that inflation and trade openness have an inverseandsubstantial relationship with FPI in Nigeria.The result indicates that GDP exerts a positive with FPI. On the other hand, the results demonstrate that market capitalisation and past FPI trends are important predictors of FPI flows in the future. The implication of this result is thatit is vital for the stakeholders, especially the policymakers, to continue to develop the capital market and improve the business environment to encourage listing and attract foreign investment inflows. Moreover, there is a need for the government to diversify the economy to other sectors like agriculture and solid minerals to attract foreign investors and improve foreign earnings.

Also, through the apex bank, the governmentshould adopt an improved exchange rate management policy to mitigate exchange rate fluctuations and stabilise the rate. The government should limit further exposure of the economy to exchange rate fluctuations by boosting local production to reduce the dependence on imports.This current study relies on the exchange rate between the US dollar and the Nigerian Naira for the analysis. This could be a limitation since the relationship between exchange rate fluctuations and FPI may differ when other major currencies are considered in the model.The study period was influenced by available data and geographical coverage, which could be a limitation. Thus, using currencies such as the Pound or Euro to model the link between exchange rate and FPI will broaden the frontier. Moreover, examining this issue across multiple countries and over a different period will significantly benefit everyone and complement our findings.

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Appendix:

Preliminary analysis

Table A1: Descriptive Analysis Table

	FPI	EXR	INF	MCAP	RGDP	TOPEN
Mean	1.0463	6.0379	6.0474	0.3620	0.4351	-1.8303
Std. Dev.	0.4660	5.1093	3.9082	5.0352	3.2006	0.3342
Max	3.0674	10.081 1	18.0544	4.0273	9.4726	-1.7292
Min	-4.0512	-8.8151	8.1573	-2.0648	-4.0524	-2.0547
Skewness	1.0630	-0.7056	-0.1517	-0.0485	-0.6880	1.4122
Kurtosis	4.1113	2.5438	1.6034	6.0027	4.1001	4.0646
Jarque-Bera	12.3874	6.0109	3.0618	9.0188	7.0843	4.2609
Prob.	0.0000	0.0101	0.0439	0.0000	0.0013	0.0000
Observations	96	96	96	96	96	96

Table A2: Correlation matrix and Variance Inflation Factor

Variable	FPI	EXRVOL	EXR	INF	MCAP	RGDP	TOPEN	VIF	1/VIF
FPI	1.0000								
EXRVOL	-0.3038	1.0000						1.2047	0.8301
EXR	0.0297	0.0086	1.0000					1.0982	0.9106
INF	-0.0647	0.5033	-0.0179	1.0000				2.1937	0.4559
MCAP	0.0432	0.3030	0.3082	0.4140	1.0000			1.4150	0.7067
RGDP	0.1903	0.1976	0.0263	0.3177	0.3880	1.0000		1.3033	0.7673
TOPEN	0.4444	0.4061	0.0108	0.3965	0.1028	0.6119	1.0000	1.3905	0.7192