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Asymmetric effects of exchange rate volatility on trade flows in Nigeria

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ABSTRACT

Purpose — *This study assesses the symmetric and asymmetric effects of exchange rate volatility on trade flows in Nigeria.*

Method — *The study employs quarterly data and covers the period 1995q1 to 2020q4. The data were sourced from International Financial Statistics (IFS) and Central Bank of Nigeria (CBN) websites. The paper applies both linear ARDL and non-linear ARDL (NARDL) models. These methods are employed to evaluate the symmetric and asymmetric effects of exchange rate volatility.*

Result — *The results from linear ARDL model show that exchange rate volatility has only significant short-run effect on export while it has both short-run and long run effects on the imports. The findings from the non-linear ARDL suggest that exchange rate volatility has neither short run nor long run asymmetric effects on exports. However, the non-linear ARDL model reveals short run and long run asymmetric effects of exchange rate volatility on imports. The findings show that increase in volatility reduces imports while decrease in volatility boosts imports.*

Contribution — *Previous studies have only investigated the symmetric effects of exchange rate volatility on trade balance in Nigeria. This study contributes to the literature by examining the symmetric and asymmetric effects of exchange rate volatility on trade flows, using the GARCH-based measure of exchange rate volatility.*

Keywords: *asymmetric, exchange rate volatility, trade flows, NARDL*

INTRODUCTION

Since the adoption of the floating exchange rate system in 1973, economists have been concerned about the effects of exchange rate volatility on trade flows. Both the theoretical advances and empirical findings indicate that exchange rate volatility impact trade flows (Senadza & Diaba, 2018). However, results from the theoretical and empirical literature show that the effects of exchange rate volatility on trade flows can either be positive, negative or neutral. Theoretically, the impacts of exchange rate volatility will largely depend on the risk attitude of the traders or the degree of risk tolerated by the traders (Grauwe, 1988; Perée & Steinherr, 1989). For a trader that is risk averse, exchange rate volatility will have negative effects on trade flows while for a trader that is risk tolerant, exchange rate volatility will have positive effects on trade flows. This theoretical ambiguity has been supported by empirical findings. For instance, Senadza & Diaba (2018) find negative effects of exchange rate volatility on trade flows, Baek (2013) and Asteriou et al. (2016) find positive effects of exchange rate volatility on trade flows.

A recent strand of empirical literature has evolved showing that the effect of an increase in exchange rate volatility on trade flows might be different from the effects of a decrease in exchange rate volatility on trade flows (Bahmani-Oskooee & Aftab, 2017; Chien et al., 2020; Xu et al., 2022). This asymmetric effect of exchange rate volatility has been attributed to changes in traders' expectations regarding high and low exchange rate volatility. High exchange rate volatility might affect trade in one dimension while low exchange rate volatility affect trade flows in another dimension. Thus, this study investigates the symmetric and asymmetric effects of exchange rate volatility on trade flows in Nigeria.

Previous studies that have examined the effects of exchange rate volatility on trade flows in Nigeria, have only considered the symmetric effects. Aliyu (2010) examines the impact of exchange rate volatility on export trade in Nigeria and reports positive effects of exchange rate volatility on nonoil exports. Yakub et al. (2019) investigate the effects of exchange rate volatility on trade flows in Nigeria. The results show that exchange rate volatility negatively affect export in the short run but not in the long run. Yunusa (2020) examines the effects of exchange rate volatility on crude oil export to 7 Nigerian trading partners. The results indicate that the volatility of exchange rate significantly affect crude oil exports to the trading partners. Ayomitunde et al. (2020) evaluate the impact of exchange rate volatility on exports in Nigeria. The findings show negative effects of exchange rate volatility on exports.

Since the introduction of floating exchange rate regime under the Structural Adjustment Programme (SAP) in 1986, the Nigerian currency (Naira) has depreciated drastically and has become more volatile. The Nigerian currency depreciated sharply from N1.60/$1 in 1986Q3 to N3.32/$1 in 1986Q4. This represents 107.5 percent depreciation rate. Since then, the Nigerian currency has been depreciating in line with market forces except for the brief period between 1993Q1 to 1998Q4 when Nigeria operated a fixed exchange rate system. Following the abandonment of the fixed exchange rate system in 1998, the Nigerian currency depreciated from N21.89/$1 in 1998Q4 to N89.55/$1 in 1999Q1. This represents 309.1 percent depreciation rate. This volatility in exchange rate has been found to impact Nigerian exports and imports (Dogo & Aras, 2021)

This study contributes to the existing literature on the asymmetric effects of exchange rate volatility on trade flows by using the GARCH-based measure of exchange rate volatility. Similar to Bahmani-Oskooee & Aftab (2017) and Bahmani-Oskooee & Arize, (2020), we examine the asymmetric effects of exchange rate volatility on exports and imports in Nigeria using the non-linear ARDL model. Recent studies have shown that impacts of exchange rate volatility on trade flows might be asymmetric and not symmetric (Bahmani-Oskooee et al., 2020). This suggests that traders react differently to an increase and a decrease in volatility.

The theoretical proposition that exchange rate volatility has negative effects on trade can be traced to Ethier (1973). The model is based on decision making regarding trade by a risk averse firm when exchange rate is volatile. Based on this risk averse assumption, exchange rate volatility has adverse effects on trade. Similarly, Clark (1973) developed a model of risk averse that shows that exchange rate volatility decreases exports. However, the theory suggest that perfect forward market could reduce the impacts. Baron (1976) shows that sellers may be uncertain of how much exchange rate risk they will cover if the forward market is not fully developed.

Conversely, some theoretical studies have shown that exchange rate volatility has positive effects on trade flows. Franke (1991) shows that under a monopolistically competitive markets where firm are risk neutral, exchange rate volatility increases the volume of exports. Sercu (1992) concludes that by increasing the probability that the price a trader receives might be greater than the trade costs, exchange rate volatility can have positive impacts on trade. Sercu & Vanhulle (1992) hypothesize an increase in exchange rate volatility increases the value of exporting firm thereby increasing exports.

Empirical studies have investigated the asymmetric effects of exchange rate volatility on trade balance and trade flows. The results have been quite divergent. For instance, Bahmani-Oskooee & Harvey (2021) examine the symmetric or asymmetric effects of exchange rate volatility on commodity trade between the US and Mexico considering 95 exporting and 89 importing industries. The findings show evidence of asymmetric effects in majority of the exporting and importing industries. Bahmani-Oskooee & Arize (2020) examine the asymmetric effects of exchange rate volatility on trade flows in 13 African countries. The results show long-run asymmetric effects of exchange rate volatility on trade flows in African countries. Bahmani-Oskooee et al. (2020) assess the asymmetric effects of exchange rate volatility on trade flows in 8 Asian countries. The results are mixed and country-specific. Increase in exchange rate volatility improves exports of Japan, Singapore and India but hurts exports of Pakistan while decrease volatility increases exports of Pakistan and limits exports of Japan, Singapore and India. Further, increase exchange rate volatility boosts imports in Korea, Singapore and India but hurts imports in Pakistan and Malaysia while decrease exchange rate volatility improves imports in Pakistan and Malaysia but hurts imports in Singapore and India.

In particular, a number of studies have focused on the asymmetric effects of exchange rate volatility on bilateral trade flows. Bahmani-Oskooee & Aftab (2017) examine the asymmetric effects of exchange rate volatility on trade flows at the industry level for the U.S and Malaysia. The estimates suggest both short-run and long-run asymmetric effects of exchange rate volatility on about one-third of Malaysian exporting and importing industries. Bahmani-Oskooee & Baek (2021) evaluate the asymmetric effects of exchange rate volatility on trade flows for the Korea- U.S commodity trade. They find significant long-run asymmetric effects of exchange rate volatility in Korea and the U.S exporting and importing industries. Bahmani-Oskooee & Saha (2021) examine the asymmetric effects of exchange rate volatility on trade flows between India and each of its 14 trading partners. The findings indicate that the asymmetric effects of exchange rate volatility are partner specific. Generally, the results suggest that increase in exchange rate volatility has significant effects on export and imports but decrease in volatility has no effects.

Chien et al. (2020) examine the asymmetric effects of exchange rate volatility on bilateral trade flows between Taiwan and Indonesia for 19 export and import industries. The findings reveal that the long run asymmetric effects of exchange rate volatility has much higher impacts on Taiwan export to Indonesia than imports from Indonesia. However, the short run asymmetric effects cause unstable change on exports and imports industries. Bahmani-Oskooee et al.

(2021) investigate the asymmetric effects of exchange rate volatility on the U.S – UK commodity trade. The results find short-run asymmetric effects of exchange rate volatility on 41 U.S exporting industry and 43 UK exporting industry. Xu et al. (2022) investigate the asymmetric effects of exchange rate uncertainty on China's bilateral trade with its trading partners. The results show more evidence supporting the asymmetric effects of exchange rate volatility on China's bilateral trade with most trading partners.

Owing to these evolving literature and divergent results on the effects of exchange rate volatility and trade flows, this study empirically investigates the symmetric and asymmetric effects of exchange rate volatility on trade flows in Nigeria.

METHOD

This study applied the Autoregressive Distributed Lag (ARDL) and Non-linear Autoregressive Distributed Lag (NARDL) as it is standard in the literature on symmetric and asymmetric effects. Similar to previous studies (Bahmani-Oskooee & Aftab, 2017; Bahmani-Oskooee & Arize, 2020), we specify the export and import models. These studies have also included real income, real exchange rate and a measure of exchange rate volatility. The study used quarterly data that covers the period 1995q1 to 2020q4.

We specify the export model as:

$$lnX_t = \nu_0 + \nu_1 lnY_t^w + \nu_2 lnRER_t + \nu_3 lnV_t + \varepsilon_t \quad \text{.....(1)}$$

$$lnM_t = \gamma_0 + \nu_1 lnY_t^N + \nu_2 lnRER_t + \nu_3 lnV_t + \eta_t$$

Where X_t is the Nigerian export, Y_t^w is a measure of the world income, RER_t is the real exchange rate, and V_t is a measure of real exchange rate volatility based on GARCH. Eq. (1) shows the global determinants of Nigerian exports. If a rise in world income leads to an increase in export, the parameter ν_1 will be positive. In theory, a rise in real exchange rate, depreciation is expected to increase export. Hence, the estimate of ν_2 is expected to be positive. Lastly, since real exchange rate volatility could either have positive or negative effects on exports, the parameters ν_3 can either be positive or negative.

Estimating eq. (1) will only show the long run effects of the exogenous variables on exports. To identify the short run effects and distinguish it from the long run effects of exchange rate volatility on exports, we follow the literature and adopt

the Pesaran et al. (2001) ARDL bound testing approach. This specifies eq. (1) in error-correction model as:

$$\Delta lnX_t = \theta_1 + \sum_{j=1}^{n1} \theta_{2j} \Delta lnX_{t-j} + \sum_{j=0}^{n2} \theta_{3j} \Delta lnY_{t-j}^{w} + \sum_{j=0}^{n3} \theta_4 \Delta lnRER_{t-j} + \sum_{j=0}^{n4} \theta_5 \Delta lnV_{t-j} + b_1 lnX_{t-1} + b_2 lnY_{t-1}^{w} + b_3 lnRER_{t-1} + b_4 lnV_{t-1} + \varepsilon_t \quad \text{.....(2a)}$$

$$\Delta lnM_t = \omega_1 + \sum_{j=1}^{n1} \omega_{2j} \Delta lnM_{t-j} + \sum_{j=0}^{n2} \omega_{3j} \Delta lnY_{t-j}^{N} + \sum_{j=0}^{n3} \omega_4 \Delta lnRER_{t-j} + \sum_{j=0}^{n4} w_5 \Delta lnV_{t-j} + c_1 lnX_{t-1} + c_2 lnY_{t-1}^{N} + c_3 lnRER_{t-1} + c_4 lnV_{t-1} + \eta_t \quad \text{.....(2b)}$$

In eq. (2) , the short run effects are captured by the estimates of assigned to the first-differenced variables and long run effects are represented by the estimates of $c_2 - c_4$ normalized on b_1. According to Pesaran et al. (2001), the $F - test$ is applied to establish joint significance of lagged variable as a sign of cointegration.

The above model in eq. (2) assumes that change in exchange rate volatility has symmetric effects on exports and imports. Recent literature has shown that exchange rate volatility might have asymmetric effects where increased volatility on trade flows might have different effects from decreased volatility. To test for asymmetric effects, we modify Eq. (2) and decompose change in volatility to positive and negative changes. Following Shin et al. (2014) we generate ΔlnV_t which includes positive changes, ΔlnV_t^+ and negative changes, ΔlnV_t^-. We adopt the partial sum approach to construct two new time series variables, where $POSV_t$ represents increased volatility as a partial sum of positive changes and $NEGV_t$ measures decreased volatility as a partial sum of negative changes. The two new variables are:

$$POSV_t = \sum_{j=1}^{t} \Delta lnV_j^+ = \sum_{j=1}^{t} \max(\Delta lnV_j, 0)$$

$$NEGV_t = \sum_{j=1}^{t} \Delta lnV_j^- = \sum_{j=1}^{t} \max(\Delta lnV_j, 0) \quad \text{.....(3)}$$

As proposed by Shin et al. (2014), we substitute eq. (3) in eq. (2) and replace lnV_t with $POSV_t$ and $NEGV_t$ to yield:

$$\Delta lnX_t = \rho_1 + \sum_{j=1}^{n1} \rho_{2j} \Delta lnX_{t-j} + \sum_{j=0}^{n2} \rho_{3j} \Delta lnY_{t-j}^{w} + \sum_{j=0}^{n3} \rho_4 \Delta lnRER_{t-j} + \sum_{j=0}^{n4} \rho_5 \Delta POSV_{t-j} + \sum_{j=0}^{n5} \rho_6 \Delta NEGV_{t-j} + c_1 lnX_{t-1} + c_2 lnY_{t-1}^{w} + c_3 lnRER_{t-1} + c_4 POSV_{t-1} + c_5 NEGV_{t-1} + \varepsilon_t \quad \text{.....(4)}$$

Eq. (4) is an error-correction model called non-linear ARDL model by Shin et al. (2014) while eq. (2) is the linear ARDL model. The construction of partial sum of variables $POSV_t$ and $NEGV_t$ introduced nonlinearity in Eq. (4). Both the linear and nonlinear models are estimated by OLS. Shin et al. (2014) recommends the use of $F-statistics$ to establish cointegration in the two models. After estimating eq. (4) with OLS, we can test the asymmetric hypothesis. A short run asymmetry is established if $\Delta POSV$ takes a lag order different from $\Delta NEGV$. We can also confirm the short run asymmetric effects if the estimate of ρ_5 is different than the estimate of ρ_6. To establish the short run accumulative or asymmetric impacts of exchange rate volatility, the Wald test is applied to determine if the sum of short run estimates assigned to $\Delta POSV_{t-j}$ and $\Delta NEGV_{t-j}$ are statistically different. i.e if $\sum \hat{\rho}_{5j} \neq \sum \rho_{6j}$. Lastly, the long run asymmetric effects of exchange rate volatility on export is established if $\hat{c}_4|-\hat{c}_1 \neq \hat{c}_5|-\hat{c}_1$ in Eq. (4). Also, the Wald test will be applied.

RESULT AND DISCUSSION

Table 1 shows the results for the Augmented Dickey Fuller (ADF) and Phillips Peron (PP) unit root tests. The ARDL method requires variables to be a combination of I(0) and I(1) but not I(2), we apply the ADF and PP to test the stationarity levels. All the variables are non-stationary at levels but stationary at first differences.

Table 1. Unit root tests

	ADF Test		PP Test	
	Level	**First-difference**	**Level**	**First-difference**
ln RER	-1.856	-9.078***	-1.979	-9.078***
ln Y^W	-0.642	-2.755*	-1.106	-21.729***
ln Y^N	-1.549	-9.84***	-1.59	-9.84***
ln $Expt$	-2.251	-12.548***	-1.982	-13.146***
ln $Impt$	-1.742	-15.383***	-2.212	-22.131
ln $Volat$	-2.115	-9.982***	-2.114	-9.984***

Source: processed data (2023)

Table 2 showed the estimates of Nigerian export linear demand model for both the short run and long run. The short run coefficient attached to the measure of exchange rate volatility suggests that Nigerian exports are affected by exchange

rate volatility. The *Δlnvolat* carries at least one significant lagged estimate. Further, the estimates show that world economic activities significantly determine Nigerian export demand in the short run. The estimates, however, indicate that real exchange rate has no significant effects on the demand for Nigerian exports in the short run. However, the short run effects of exchange rate volatility on demand for Nigerian export do not extend into the long run effects. The diagnostic tests are also reported in the table. The Lagrange Multiplier (LM) test is employed to detect autocorrelation and Ramsey RESET is used to detect misspecification. The two tests are insignificant showing that the residual is error free and the model does not suffer from misspecification.

Table 2. Short run and long run estimates of Nigerian linear (ARDL) export demand model

Panel A	**Exports**	
	Short run estimates	**Long run estimates**
ΔlnY^W	2.474 (3.062)**	
$\Delta lnY^W(-1)$	0.06 (0.19)	
$\Delta lnY^W(-2)$	-0.192 (0.608)	
$\Delta lnY^W(-3)$	2.428 (3.143)**	
$\Delta lnrer$	0.108 (1.392)	
$\Delta lnvolat$	0.009 (0.347)	
$\Delta lnvolat(-1)$	-0.052 (2.052)**	
$\Delta lnvolat(-2)$	0.044 (1.785)*	
$\Delta lnvolat(-3)$	-0.021 (0.842)	
$\Delta lnvolat(-4)$	0.034 (1.402)	
$\Delta lnvolat(-5)$	0.022 (0.877)	
$\Delta lnvolat(-6)$	0.031 (1.314)	
lnY^W		0.316 (1.397)
$lnrer$		0.266 (1.302)
$lnvolat$		-0.165 (1.421)
Const.		-4.102 (0.86)
Adj. R^2	0.35	
LM	0.	
RESET	0.136	
F-test	6.508**	

Source: processed data (2023)

Table 3 presents the estimates of Nigerian import linear demand model for both the short run and long run. The results indicate that exchange rate volatility has significant short run effects on Nigerian imports. The *lnvolat* carries at least one significant lagged estimate. Further, the estimates show that Nigerian output and real exchange rate significantly determine Nigerian import demand in the short run. Moreover, the short run effects of exchange rate volatility on demand for Nigerian imports translate into significant and meaningful negative long run effects. This implies that a rise in exchange rate volatility reduces the demand for

imported goods in Nigeria. The diagnostic tests are also reported in the table. The Lagrange Multiplier (LM) test is employed to detect autocorrelation and Ramsey RESET is used to detect misspecification. The two tests are insignificant showing that the residual is error free and the model does not suffer from misspecification.

Table 3. Short run and long run estimates of linear (ARDL) import demand model

	Short run estimates	**Long run estimates**
ΔlnY	-0.014 (0.423)	
$\Delta lnY(-1)$	0.036 (0.818)	
$\Delta lnY(-2)$	-0.175 (2.42)**	
$\Delta lnY(-3)$	0.081 (0.882)	
$\Delta lnY(-4)$	0.218 (2.414) **	
$\Delta lnY(-5)$	-0.01 (0.106)	
$\Delta lnY(-6)$	-0.116 (1.783)*	
$\Delta lnrer$	-0.117 (0.605)	
$\Delta lnrer(-1)$	0.186 (0.553)	
$\Delta lnrer(-2)$	0.829 (2.4)**	
$\Delta lnrer(-3)$	-1.07 (3.062)**	
$\Delta lnrer(-4)$	0.375 (1.588)	
$\Delta lnvolat$	-0.04 (1.533)	
$\Delta lnvolat(-1)$	-0.095 (3.065)**	
$\Delta lnvolat(-2)$	0.082 (2.68)**	
$\Delta lnvolat(-3)$	-0.031 (1.294)	
$\Delta lnvolat(-4)$	0.035 (1.458)	
$\Delta lnvolat(-5)$	0.032 (1.42)	
lnY		0.015 (0.247)
$lnrer$		-0.099 (0.433)
$lnvolat$		-0.382 (5.573)**
Const.		6.679 (13.678)**
Adj. R^2	0.909	
LM	1.252	
RESET	1.379	
F-test		
Cointegrat	-0.346	

Source: processed data (2023)

Table 4 showed the estimates of non-linear model for export demand in the short run and long run. The estimates in the short run show that either increase in volatility ($\Delta Posv$) or decrease in volatility ($\Delta Negv$) carries at least one significant lagged estimate. Further, the table show that at a given lag n, the estimates attached to $\Delta Posv_{t-n}$ is different than the estimates attached to $\Delta Negv_{t-n}$, indicating short run asymmetric effects of exchange rate volatility. The cumulative short run asymmetric effects are presented in the Wald test reported in Table 6. Going by the Wald- test estimates, there is no short run evidence for the cumulative impact of asymmetric effect. Similarly, there is no

long run evidence for the cumulative impact of asymmetric effect of exchange rate volatility on exports.

Table 4. Short run and long run estimates of non- linear (NARDL) export demand model

	Short run estimates	**Long run estimates**
ΔlnY^w	4.918 (3.254)**	
$\Delta lnY^w(-1)$	-2.432 (1.539)	
$\Delta lnY^w(-2)$	-0.579 (1.895)*	
$\Delta lnY^w(-3)$	4.908 (3.255)**	
$\Delta lnY^w(-4)$	-4.169 (1.984)*	
$\Delta lnY^w(-5)$	2.284 (1.529)	
$\Delta lnrer$	-0.139 (0.68)	
$\Delta Post$	-0.069 (1.646)	
$\Delta Post(-1)$	0.097 (2.013)*	
$\Delta Negt$	0.067 (1.534)	
$\Delta Negt(-1)$	-0.179 (3.606)**	
$\Delta Negt(-2)$	0.081 (2.299)**	
lnY^w	-	1.944 (2.919)**
$lnrer$	-	0.486 (2.265)**
$lnPost$	-	-0.094 (0.889)
$lnNegt$	-	-0.015 (0.157)
Diagnostic		
Adj. R^2	0.886	
LM	0.42	
RESET	0.889	
F-test		
Cointegrat		

Source: processed data (2023)

Table 5. Short run and long run estimates of non- linear (NARDL) import demand model

	Short run estimates	**Long run estimates**
ΔlnY	-0.002 (0.052)	
$\Delta lnY(-1)$	0.004 (0.934)	
$\Delta lnY(-2)$	-0.25 (3.376)**	
$\Delta lnY(-3)$	0.126 (1.46)	
$\Delta lnY(-4)$	0.196 (2.922)**	
$\Delta lnrer$	-0.06 (0.333)	
$\Delta lnrer(-1)$	0.201 (0.594)	
$\Delta lnrer(-2)$	1.025 (2.875)**	
$\Delta lnrer(-3)$	-1.322 (3.672)**	
$\Delta lnrer(-4)$	0.288 (0.787)	
$\Delta lnrer(-5)$	-0.448 (1.252)	
$\Delta lnrer(-6)$	0.536 (2,036)*	
$\Delta Post$	-0.005 (0.128)	
$\Delta Post(-1)$	-0.04 (0.63)	
$\Delta Post(-2)$	0.122 (1.925)*	
$\Delta Post(-3)$	-0.048 (0.749)	
$\Delta Post(-4)$	0.111 (1.773)*	
$\Delta Post(-5)$	-0.116 (2.062)**	

$\Delta Post(-6)$	0.087 (2.14)**	
$\Delta Negt$	0.006 (0.126)	
$\Delta Negt(-1)$	-0.156 (2.317)**	
$\Delta Negt(-2)$	0.044 (0.671)	
$\Delta Negt(-3)$	-0.038 (0.563)	
$\Delta Negt(-4)$	-0.002 (0.031)	
$\Delta Negt(-5)$	0.128 (2.937)**	
lnY	-	-0.117 (2.088)**
$lnrer$	-	-0.349 (2.405)**
$lnPost$	-	-0.191 (3.104)**
$lnNegt$	-	-0.223 (4.087)**
Diagnostic		
Adj. R^2	0.926	
LM	0.42	
RESET	0.889	
F-test	0.791	
Cointegrat	-0.609	

Source: processed data (2023)

Table 6. Wald test

	Export	**Import**
Short run	0.311	1.68*
Long run	0.062	3.213**

Source: processed data (2023)

Table 5 show the estimates of non-linear model for import demand in the short run and long run. The estimates in the short run show that either increase in volatility ($\Delta Posv$) or decrease in volatility ($\Delta Negv$) carries at least one significant lagged estimate. Further, the table show that at a given lag n, the estimates attached to $\Delta Posv_{t-n}$ is different than the estimates attached to $\Delta Negv_{t-n}$, indicating short run asymmetric effects of exchange rate volatility. The cumulative short run asymmetric effects are presented in the Wald test reported in Table 6. Going by the Wald- test estimates, there is short run evidence for the cumulative impact of asymmetric effect. Moreover, as supported by the Wald estimates for the long run, there are long run asymmetric effects of exchange rate volatility on import.

Table 6 shows the results for the effects of exchange rate volatility on export and import in the long run. The results support the short run and long run asymmetric effects of exchange rate volatility on imports only. There are neither short run asymmetric effect nor long run asymmetric effects of exchange rate volatility on exports.

Discussion

The research investigated how exchange rate volatility affects trade flows in Nigeria in both symmetric and asymmetric ways. The study found that in the short term, exchange rate volatility has an impact on trade flows in Nigeria, but the effects vary between imports and exports in the long term. Specifically, the study found that the short-term effects of exchange rate volatility on imports persisted into the long term, while the short-term effects on exports did not. This suggests that exchange rate volatility has a more enduring effect on imports than on exports.

Additionally, the study found that exchange rate volatility has no asymmetric effects on demand for exports, both in the short and long term. However, exchange rate volatility has asymmetric effects on demand for imports in both the short and long term. The short-term asymmetric effects of exchange rate volatility on imports continue into the long term. This means that an increase in volatility has a negative impact on imports, while a decrease in volatility has a positive impact on imports.

The findings also reveal that world income has a significant positive effect on the demand for Nigerian exports. This suggests that as global income increases, there is a corresponding increase in demand for Nigerian exports. On the other hand, the study found that Nigerian income has a positive but insignificant effect on the demand for imports. This means that although Nigerian income influences the demand for imports, the effect is not statistically significant, and other factors likely have a more significant impact on import demand.

Overall, the study's findings provide valuable insights into the factors that influence trade flows in Nigeria, including exchange rate volatility and income levels. These findings can inform policymakers and businesses in Nigeria when making decisions related to trade and economic development.

CONCLUSION

The study examined the symmetric and asymmetric effects of exchange rate volatility on trade flows in Nigeria. Previous studies that investigated the effects of exchange rate volatility on trade in Nigeria has assumed a form of symmetric effects. Since the seminar publication by Shin et al. (2014), a new non-linear model examining the asymmetric effects of exchange rate volatility on trade flows had evolved. This new approach separates the effects of increased volatility on trade flows from decreased volatility. This study employs the Pesaran et al. (2001) linear ARDL and Shin et al. (2014) non-linear ARDL models

to investigate the symmetric and asymmetric effects of exchange rate volatility on trade flows in Nigeria.

Generally, the results show that exchange rate volatility affects trade flows in Nigeria and seems to affect demand for imports more than the demand for exports. The linear ARDL results indicate that exchange rate volatility has both short run and long run effects on imports but only short run effects on exports. Further, the non-linear ARDL results suggest that exchange rate volatility has both short run and long run asymmetric effects on demand for imports but no asymmetric effects on demand for exports. Since Nigerian domestic firms largely depend on imported intermediate inputs for domestic production, the practical implication of the results include domestic output volatility, unstable manufacturing production and declining domestic investment.

The study thus recommends that:

(i) The Central Bank of Nigeria (CBN) should formulate appropriate policies to ensure the stability of exchange rate.
(ii) The CBN should periodically intervene in the foreign exchange market to minimize exchange rate volatility and instil investors' confidence in the market
(iii) The CBN should deploy monetary instruments to minimize the pass-through effects of exchange rate volatility to domestic prices.

Further studies can examine the effects of exchange rate volatility at the industry level. This is to evaluate whether the effects of exchange rate volatility on trade flows are industry-specific.

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