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Article

Inflation-balance of trade nexus in Nigeria: The impact of exchange rate pass-through

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Abstract: The relationship between exchange rate (EXR) and foreign trade (FT) in Nigeria has been a contentious issue since Nigeria's independence in 1960. This study investigated the link between exchange rate and foreign trade through the prism of exchange rate pass-through (EXRPT) to domestic prices, utilizing monthly data from 2011 to 2022. The study was built on two models—the base and main models, respectively. Employing the VAR technique and its Vector Error Correction Model (VECM) extension, the paper found that EXRPT to consumer prices is incomplete in the short run, but its effect was found to be higher on imports than on consumer prices. It follows that the impact of EXRPT diminishes along the price chain. Results from the main model indicate that the impact of domestic prices on balance of trade was found to be negative with an elasticity of −0.437541 and is also statistically significant, thus confirming the Marshal-Lenner condition. The Marshal-Lenner condition and findings of this study provide evidence that depreciating exchange rate is not recommended for an import-inelastic country like Nigeria.

Keywords: exchange rate; inflation; foreign trade; depreciation; imports
JEL Classification: F31; E31; F1; F14

1. Introduction

Since no country exists in isolation, foreign trade is, therefore, important for the survival of most economies. Not only does it aid interactions and promote economic growth, employment, exchange, and market expansion, it also enhances economic outcomes or fortunes for countries around the world [1]. The discovery of oil in the early 1970's changed the narrative for Nigeria, which engaged in the exportation of crude oil as her major source of earnings. This huge revenue inflow became overwhelming for Nigeria, which had no plans of how to reinvest the excess revenue but instead resorted to importing everything. Unfortunately, when the windfall from oil ended around 1977, Nigeria had become an import-oriented country and has remained so up until today.

There are basic factors influencing foreign trade among nations, especially that between Nigeria and other countries. They include inflation, national income, world commodity prices, and volume of exports and imports, amongst others. In Nigeria, inflation has been a very strong determinant of our exchange rate since the SAP period owing to the interaction between the domestic economy and the external economy. This interaction can affect the volume of exports and imports and subsequently our balance of trade. More so, in terms of world commodity prices, crude oil is a world commodity that Nigeria exports in large volumes and is not supplied by one country.

Thus, the prevailing oil price supplied by the OPEC affects the balance of trade values since crude oil is a component of both Nigeria's exports and imports. In line with this, one of Nigeria's biggest trading partners is the United States. Since we import a large volume of goods from the United States, it is assumed that the prevailing domestic condition in the US will affect their producer prices. Thus, when importing, we are importing at producers' price index after they have taken into consideration their own domestic inflation. This makes the United States Producers' Price Index more sufficient to substitute import prices since it is evident that we also import not just goods but inflation from them too. Furthermore, another major factor affecting foreign trade is the exchange rate [2]. This is because the extent to which a country's currency is traded against that of the other countries matters so much since, according to Auwal and Hamzat [3], different economies are connected either directly or indirectly through the asset and/or goods markets as well as the currency market. Foreign exchange rate links the price systems of different countries, enabling foreign trade to compare traded goods directly. This makes it possible to compare domestic prices with prices elsewhere. However, at the international trade market, a much sufficient measure empirically for exchange rate is the effective exchange rate, which is a measure of the value of a country's currency against a weighted average of several foreign currencies. When the nominal effective exchange rate (NEER) is divided by a price deflator or index of costs, the result is the real effective exchange rate (REER) [4]. More so, for developing nations, when the nominal index is adjusted for relative changes in consumer prices, the result is the real effective exchange rate index, and as such, an increase represents an appreciation of the local currency and the decrease is depreciation. However, a movement backwards, the magnitude (elasticity) of the increase shows the pass-through of exchange rate changes to the consumer prices. Since the exchange rate influences both export trade and import trade, it therefore follows that it could affect a country's balance of payments position. Therefore, an exchange rate that is well managed offers great economic benefits to countries that engage in international trade. Conversely, if it is not managed well, it contributes a lot to price instability and inflation [5]. In Nigeria, the volatile exchange rate over the years has contributed to price instability and inflation. Bada et al. [6] opines that when the exchange rate depreciates, it brings about a rise in inflation, and this is known as exchange rate pass-through to inflation.

Aliyu [7] defined exchange rate pass-through (EXRPT) as the change in domestic prices that can be attributed to a prior change in the nominal exchange rate. EXRPT measures the portion of inflation in a country caused by depreciation of the domestic exchange rate. When there is a depreciation of the exchange rate, the resulting impact on the balance of trade is largely influenced by the pass-through to the prices in the domestic economy as well as the speed of its transmission to other macroeconomic variables, including the balance of trade. EXRPT increases the cost of production in the domestic country, thereby making export commodities less competitive at the international market and, as such, diminishes the balance of trade. In a normal situation, a depreciating exchange rate should be accompanied by an increase in exports, but in the case of Nigeria, the reverse is obtained. Not only has our exchange rate been depreciating, we have also experienced an increase in importation, majorly owing to the fact that we are import-dependent and goods imported are highly inelastic

and used for domestic production. These two scenarios occurring at the same time have led to an increase in our inflation readings (which can be attributed to a prior change in the nominal exchange rate), leading to a persistent rise in the value of domestically produced goods, which will subsequently make the cost of our exports high, thus leading to a balance of trade deficit in the country. Therefore, it is necessary to empirically investigate the relationship between the portion of domestic prices affected by exchange rate depreciation (through the pass-through) and its impact on the balance of trade in Nigeria.

Previous studies on exchange rate and balance of trade have not sufficiently investigated the impact of exchange rate pass-through to inflation on balance of trade in Nigeria. However, ample studies exist explaining the impact of exchange rate on inflation in Nigeria, such as Aliyu et al. [5], Fatai and Akinbobola [8], Aisen et al. [9], etc. These studies found that exchange rate pass-through had a significant effect on domestic prices. This present study differed from previous empirical studies because it investigates the impact of exchange rate pass-through to inflation on the balance of trade in Nigeria, taking into cognizance the use of CPI instead of inflation. CPI is used as a proxy for inflation because it supports the definition of exchange rate pass-through to domestic prices, and CPI data also help economists measure the total value of goods and services produced by an economy, with the effect of inflation stripped out. The significance of this study lies in the fact that it would shed light on the relationship between exchange rate depreciation and trade balances using the Marshall-Lerner condition of balance of payment (utilizing the elasticity approach) in Nigeria. It will contribute tremendously in answering the question whether the depreciation of the value of Nigeria's currency experienced constantly in Nigeria does improve or worsen Nigeria's trade balances. It would also help in detecting the demand elasticity on imports and exports, thus becoming a tool for recommending appropriate policies to improve Nigeria's trade balance. Furthermore, since this study focuses on balance of trade, it would also become a good framework for further studies to investigate the relationship that exists between EXRPT and other significant macroeconomic variables.

Having concluded the first section of this paper, which is the introduction, the second section reviews related literature and some theoretical foundations for the study. Model specification and the method adopted for data analysis are discussed in Section 3 of this study. Result presentation, interpretation, and discussion of results were taken care of in Section 4. The paper is then concluded in Section 5 and relevant policy recommendations proffered.

2. Literature review

This study is built on two models, the base model and the main model respectively. The base model hangs on the relative purchasing power parity theory while the main model is founded on Marshall-Lerner hypothesis.

2.1. The relative purchasing power parity

Our base model is anchored on the relative purchasing power parity theory, which is a sub-theory from the general theory of the purchasing power parity model

propounded by Swedish economist Professor Gustav Cassel in 1918. The basic concept can be explained with an example such as if $4 buys one carton of milk in the United States, and if 120 Chinese yuan exchanges for $1, then the price of a carton of milk in China should be 480 Chinese yuan (4 × 120). Thus, there should be parity between the purchasing power of one US dollar in the United States and the purchasing power of its exchange value in China.

The theory anchors on the assumptions that there are no transaction costs, no transportation costs, free movement of goods (trading without tariffs or quotas), and that the goods are homogeneous across different markets. Cassel believed that if an exchange rate was not at parity, it was in disequilibrium and that either the exchange rate or the purchasing power would adjust until parity was achieved [10]. The reason is arbitrage. If a carton of milk sold for four dollars in the United States and for six hundred yen in Japan, then arbitragers could buy wheat in the United States and sell it in Japan and would do so until the price differential was eliminated. With this background, our base model will be stated thus:

$$\text{CPI} = F\,(\text{NER, USPPI, OILP}) \tag{1}$$

The econometric form is stated as

$$\text{CPI} = \beta_0 + \beta_1\text{REER} + \beta_2\text{USPPI} + \beta_3\text{OILP} \tag{2}$$

where REER = Real effective exchange rate for the base model (naira to US dollar); CPI = Consumer price index; OILP = World oil prices; USPPI = United States Producers Price Index; β_0 = Constant term (i.e., the intercept); $\beta_1 - \beta_4$ = Coefficients of the explanatory variables.

2.2. Marshall-Lerner condition of balance of payment: The elasticity approach

This study is anchored on the doctrine of the Marshall-Lerner Condition theory of balance of payment espoused in 1890 by Alfred Marshall and Abba Lerner. Jean and Lsabelle [10] assert that the elasticity approach probes how changes in the relative prices of domestic goods and foreign goods due to changes in the rates of exchange affect the trade balances of a country, especially the balance of payment (current account). One of the assumptions of this theory is that income level and domestic prices remain constant within the devaluing country. The second assumption is that the sum of elasticities of demand for a country's imports and exports has to be greater than unity for exchange rate depreciation to have a positive effect on a country's balance of payments (BoPs). On the other hand, where the sum of these elasticities is less than unity, then the country's BoP position is worsened; however, revaluation can make improvements. This condition can be expressed mathematically as follows:

$$\Delta B = KXf\,(\text{e1m} + \text{e2m} > 1) \tag{3}$$

where: ΔB = Change in the trade balance; K = Depreciation in percent; Xf = Value of exports expressed in foreign currency; e1m = First (devaluing) country's demand elasticity for imports; e2m = Second country's demand elasticity for exports from the devaluing country. Thus, e1m + e2m should be greater than 1 for Marshall Lerner condition to be fulfilled.

2.3. Empirical literature review

Various studies have investigated the impact of exchange rates on foreign trade in various locations, some of which include studies on Nigeria. For instance, Duru et al. [11] investigated the impact of exchange rate volatility on exports in Nigeria and found that exchange rate volatility had a positive and insignificant relationship with exports. Similar to the results of Duru et al. [11], Nuraddeen et al. [12] investigated the asymmetric effect of exchange rate volatility on trade balance in Nigeria. Results of the study indicate an insignificant relationship between the real exchange rate and the volume of Nigeria's international trade. The findings above are similar to the works of Ewubare and Merenini [13], who examined the impact of exchange rate fluctuations on foreign trade in Nigeria from 1980–2014 and found that exchange rate fluctuations have a positive but non-significant relationship with trade in Nigeria. The results above contradict the findings of Yakubu et al. [14], who examined the impact of exchange rate volatility on trade flows in Nigeria utilizing monthly time series for the period 1997–2016 and found that fluctuations in the exchange rate impacted negatively on Nigeria's trade flows only in the short run. Similar to the findings of Yakubu et al. [14], Ikechi and Nwadiubu [15] investigated the impact of exchange rate volatility on international trade in Nigeria and found that an inverse relationship exists between export, import, and REER. Apanisile and Oloba [16] utilized the non-linear autoregressive distributed lag technique to determine the asymmetric effect of exchange rate changes on cross-border trade in Nigeria. The study indicated that exchange rate appreciation had a statistically significant but negative relationship with cross-border trade in Nigeria.

Furthermore, Aliyu et al. [5] investigated exchange rate pass-through to consumer price index and import in Nigeria utilizing quarterly time series of 1986Q1 and 2007Q4, anchoring the work on the basis of vector error correction methodology. The findings reveal that exchange rate pass-through in Nigeria is significantly low, but compared to the consumer prices, it is slightly higher in the import prices. Aisen et al. [9] conducted an empirical assessment of exchange rate pass-through on domestic prices in Mozambique. The results suggest that exchange rate variations have an asymmetric effect on domestic prices. Azeez et al. [17] empirically investigated exchange rate pass-through to domestic prices in Nigeria. Results of the study suggest that the exchange rate pass-through is incomplete, low, and fairly slow. In line with this, Fatai and Akinbobola [8] also empirically examined the impact of exchange rate pass-through (ERPT) to import prices, monetary policy, and inflation in Nigeria and found that during the period under review, ERPT in Nigeria is moderate, significant, and persistent in the case of import prices and low and short-lived in the case of inflation.

This present study makes significant theoretical (Marshal-Lenner condition) and empirical contributions by employing the elasticity approach to explaining exchange rate depreciation and balance of trade in Nigeria through the medium of exchange rate pass-through. This study not only examines exchange rate pass through to inflation through the elasticity prism of Marshall-Learner theory (the base model) but takes a step further by investigating the impact of the exchange rate pass through to inflation on Nigeria's trade balances (the main model). In order to achieve this, the residual of

the base model is fed into the main model in order to capture this effect following the work of Chen et al. [18].

3. Methodology

3.1. Data and sources

This work utilized monthly time series data from 2011–2022. Monthly time series empirically is more useful than other frequencies of time series as it is useful for capturing fluctuations in key variables, including exchange rate fluctuations, price fluctuations (inflation), and other variables employed. This is also an improvement in existing studies. Secondary data on relevant variables were sourced from the World Bank database, the Central Bank of Nigeria (CBN), and the United States Statistical Bulletin. US dollars per unit of the Nigerian naira at the black market rate are used to measure the exchange rate. This is because a couple of years ago, the naira was usually bought using black market rates, so the naira's depreciation was expressed as a fall in the value of the naira. Exchange rate data were sourced from the Central Bank of Nigeria statistical bulletin. The United States Producers Price Index was used to measure prices of imports. This is because the United States is Nigeria's biggest trading partner. The data for the United States Producers Price Index were obtained from the US Bureau of Labor statistics. Also, from the Central Bank of Nigeria statistical bulletin, we obtained the consumer price index, which is measured by composite CPI (November 2009 = 100). Data for crude oil prices were sourced from the World Bank commodity price data bank (the pink sheet). The balance of trade and the export data were sourced from the CBN Statistics Database. All variables used for the study had to be seasonally adjusted due to the monthly time series employed to allow for a more meaningful comparison of the economic conditions during the period investigated.

3.2. Model specification

The study used two models to examine the impact of the pass-through of the exchange rate to inflation on the balance of trade in Nigeria. The base model is a three-variable VAR model used to investigate EXRPT to inflation. The main model is a 5-variable VAR model with reference to Bada et al. [6] and a VECM extension. The baseline model has nominal exchange rates (NER), import prices (USPPI), and oil prices (OILP) as independent variables, while the dependent variable is the consumer price index (CPI). An increase in oil prices leads to higher oil receipts, leading to an appreciation in the rates of exchange and a decline in the rate of inflation [6].

In the main model, the residual of the base model (residual of CPI) and exports were included. The residual of the base model is used to proxy the impact of domestic prices (inflation) on the balance of trade in Nigeria. The residual of CPI in this work consists of other factors affecting trade balances other than exchange rate, oil prices, exports, and import prices. Therefore, when RGDP increases, output increases, which increases domestic commodities for exports and, of course, improves the balance of trade. Also, an increase in money supply, ceteris paribus, will encourage consumption, which will also have a positive impact on GDP and so improve trade balances.

Although, when money supply increases, the demand for imported goods will increase, especially in the case of an import-dependent country like Nigeria, through the income absorption effect, which therefore causes imports to increase accompanied by an unfavorable balance of trade. It is worthy to note that if output increases more than money supply in the long run, it may trade off the negative impact of inflation or domestic prices. Hence, the impact can be positive or negative. Thus, we expect that exchange rate and crude oil prices will have vector coefficients that will be positive or negative on the balance of trade. Import prices will be negative and export prices will be positive.

Thus, the exchange rate pass-through to Nigeria's inflation and the subsequent impact on the balance of trade are stated as follows:

Base model is stated thus:

$$CPI_t = \beta_0 + \beta_1 CPI_{t-1} + \beta_2 REER_{t-1} + \beta_3 USPPI_{t-1} + \beta_4 OILP_{t-1} + \varepsilon_t \quad (4)$$

Main model is stated thus:

$$BOT_t = \beta_0 + \beta_1 BOT_{t-1} + \beta_2 REER_{t-1} + \beta_3 USPPI_{t-1} + \beta_4 OILP_{t-1} + \beta_5 EXPT_{t-1} + \beta_6 RESCPI_{t-1} + \varepsilon_t \quad (5)$$

3.3. Definition of the coefficients in base and alternative models

BOT = Balance of trade; REER = Real effective exchange rate for the base model (naira to US dollar); CPI = Consumer price index; OILP = World oil prices; USPPI = United States Producers Price Index; EXPT = Export; RESCPI = Inflation, proxied by Residual of CPI; ε_t = Stochastic disturbance or error term; β_0 = Constant term (i.e., the intercept); $\beta_1 - \beta_4$ = Coefficients of the explanatory variables.

The VAR and VECM estimation techniques are employed in this study, similar to Bada et al. [6]. The VAR model is stated thus:

$$Y_t = c + \sum \Phi_i Y_{t-1} + \varepsilon_{ti} \quad (6)$$

where: Yt is the endogenous variables vector, c equals constant's vector, Φi equals the autoregressive coefficient's vector. εt stands for white noise processes vector.

The VECM extension of Equation (6) is stated as follows:

$$\Delta y_t = c + \prod Y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \, \Delta Y_{t-1} + \varepsilon_t \quad (7)$$

where Δ = Operator differencing and $\Delta y_t = y_t - y_{t-1}$, Y_t = Vector variable endogenous with the 1st lag. ε_t = Vector residual; c = Vector intercept; Π = Matrix coefficient of cointegration. Γ_i = Matrix with order $k \times k$ of coefficient, endogenous of the i-th variable.

To start the analysis of our model, we subjected our variables to descriptive statistics to investigate their individual characteristics. Augmented Dickey Fuller (ADF) tests were employed to check the time series properties of the variables in order to establish the order of integration of the series. The Johansen and Juselius cointegration test was carried out to investigate the existence of long run cointegration. The VAR is advantageous since it gives efficient coefficient estimates.

3.4. Justification of variables for the study

Consumer price index (CPI): According to International Monetary Funds (IMF), consumer price indexes (CPIs) are index numbers that measure changes in the prices of goods and services purchased or otherwise acquired by households, which

households use directly, or indirectly, to satisfy their own needs and wants. The consumer price index serves as a relevant proxy for inflation because it expresses the price level, which measures the current prices of goods and services produced in the economy in a specific region or country at a specific time. According to Zubair et al. [19], the consumer price index (CPI) is the best measure for inflation because it tracks the changes in prices paid by consumers for a basket of goods and services over time. This then justifies using it to investigate exchange rate pass-through to inflation. It is represented as CPI in our base model. This is our dependent variable in the base model.

3.5. Residual inflation (RESCPI)

It is the residual of the consumer price index (residual of the results on CPI gotten from the base model) that is inputted into the main model to investigate the effect of the pass-through of the exchange rate to domestic prices (inflation) on balance of trade. Since it has been established that the pass-through of exchange rate to balance of trade is not a direct relationship, the residual of the base model becomes relevant to the main model to investigate the impact of inflation on balance of trade. From this, we can say that the residual of the base model thus serves as the portion of general inflation affected by exchange rate depreciation or pass-through (which affects the domestic economic variables such as real GDP and money supply, amongst others). One might want to argue that the residual also includes results of the import prices and oil prices, but we were careful to select external variables that are affected by the exchange rate, and thus their residual would have an underlying pass-through of exchange rate implications to all variables that are subsequently inputted into the domestic economy, such as oil and imported goods. We ensured that the residual of the base model passed through all the relevant tests, including multicollinearity, heteroscedasticity, and serial correlation tests, before inputting it in the main model. We did these tests of the residual of our base results to clear suspicion of endogeneity and other residual errors as suggested by Chen et al. [18].

3.6. Balance of trade (BOT)

Foreign trade, or international trade, is the exchange of goods and services between two countries in the international market. Balance of trade (BOT) is the difference between the value of the exports of a country and the value of the imports of that country for a given period. Given this, balance of trade serves as a relevant proxy for foreign trade in this model. When the value of imports is higher than that of exports, it is a balance of trade deficit, and when the value of exports is higher than imports, it is a balance of trade surplus. This is our dependent variable in the main model. It is represented as BOT in our model above.

3.7. Real effective exchange rate (REER)

According to the International Monetary Fund [4], the nominal effective exchange rate is a measure of the value of a country's currency against a weighted average of several foreign currencies. When the nominal effective exchange rate is divided by a price deflator or index of costs, the result is the real effective exchange rate.

The World Bank stressed that when the nominal effective exchange rate index is adjusted for movements (relative) in national price or cost indicators of the home country, selected countries, and the euro area, it results in the real effective exchange rate. The index ratio for the nominal effective exchange rate index (expressed on the basis 2010 = 100) is the index of a currency's period-average exchange rate to a weighted geometric average of exchange rates for currencies of selected countries and the euro area. Advanced countries have their weights derived from trade in industrial or manufactured goods. For developing countries, the goods manufactured and primary products traded with partner or competitor countries set the base for the nominal effective exchange rate. More so, for these developing nations, when the nominal index is adjusted for relative changes in consumer prices, the result is the real effective exchange rate index, and as such, an increase represents an appreciation of the local currency. A market-based economy evidences their choices about resource allocation being influenced by relative prices, including the real exchange rate, real wages, real interest rates, and other prices in the economy. Relative prices also reflect their choices to a large extent. Therefore, relative prices convey vital information about the interaction of economic agents in an economy and with the rest of the world.

Under the fixed exchange rate regime, an upward adjustment of the rate of NEER is termed revaluation, and a downward adjustment reflects devaluation. However, in a flexible exchange rate regime where the forces of demand and supply determine the exchange rate, the upwards and downwards adjustments are called appreciation and depreciation, respectively. It is important to note that in this study on inflation-balance of trade nexus, we adopted the concepts of devaluation and depreciation simultaneously, as we are only interested in the outcome of the policy and not in the definition of the concepts themselves. They both lead to a fall in the exchange rate, whether imposed by the government or enabled by the flexible exchange rate regime.

A depreciating exchange rate or one devalued by the government does not improve the balance of trade for an import-dependent country like Nigeria. This is because it would encourage the importation of necessary goods that aid domestic production and consumption but make export goods too costly due to imported production goods. Therefore, despite the depreciating rate of exchange, there is no improvement in trade surplus due to import inelasticity. This will further increase the prices in the domestic economy, making the production of export goods expensive and thus reducing the volume of export. The response of domestic prices to changes in exchange rates is called exchange rate pass-through. This has profound implications for not only the domestic economy but, subsequently, the balance of trade. Oluyemi and Isaac [20] defined exchange rate pass-through (ERPT) as the percentage change in local currency prices resulting from a one percent change in the exchange rate between the exporting and importing economies. It refers to the changes in domestic prices as a result of the depreciation of the exchange rate. The resulting impact of a pass-through of exchange rate to domestic inflation has a subsequent impact on balance of trade; however, the pass-through effect is not direct. This is why the pass through in the CPI model is inputted in the BOT model. In the CPI model, we would want to see the magnitude of the pass-through of this exchange rate to domestic inflation and if the pass-through elasticity is complete. If it is complete (up to 1), there would be no need to input in the main model as there would be no elasticity to impact

a change; however, if the elasticity is not complete, the residuals of the base model will be inputted to the main model to investigate the pass-through of exchange rate to domestic inflation on balance of trade in Nigeria. In the main model, we are concerned with the direct impact of exchange rate pass through on balance of trade in Nigeria.

The real effective exchange rate is more sufficient than the nominal effective exchange rate or the nominal exchange rate in itself because it is useful for long-term analysis of a country's competitiveness and trade balances by taking into account the impact of inflation on trade.

It is also important to note that the real effective exchange rate is not the same as the exchange rate pass-through. The exchange rate itself is the price of the currency used to trade at the international market; when adjusted for inflation, it is the real effective exchange rate. When it is devalued, it is detrimental to an import-dependent country like Nigeria. This will lead to an increase in the prices of domestic goods and lead to inflation. The pass-through in itself is the transfer of the effect of exchange rate changes to the domestic economy. It shows the portion of the domestic inflation contributed by the devaluing or depreciation of the exchange rate at the international market. If it is complete, this implies that the whole inflation in the domestic country is due to exchange rate changes; however, if it is not complete, the value of the real effective exchange rate elasticity shows us the portion of the domestic inflation attributed to the changes in the exchange rate at the international market.

To stress this, the study by Ikechi and Nwadiubu [15] using the VAR model estimates indicates an inverse relationship between export, import, and REER in current periods. Variance decomposition analysis suggests that the shocks partially explain fluctuations in REER, as well as exports and imports. The impulse response analysis indicates a negative association between exports and the real effective exchange rate, while it was majorly positive for imports throughout the ten periods. This impact on import prices can subsequently be passed into the domestic economy, causing the exchange rate to pass through. Results show evidence of the volatility of REER clustering on import and export trading activities in Nigeria.

However, the study by Fatai and Akinbobola [8] based on SVAR analysis found that ERPT in Nigeria during the period under review is moderate, significant, and persistent in the case of import prices and low and short-lived in the case of inflation. The fact that ERPT was found to be incomplete shows the dependence of exchange rate pass-through on REER.

3.8. The United States Producer Price Index (USPPI)

United States producer price indices in manufacturing measure the rate of change in prices of products sold as they leave the producer. They exclude any taxes, transport, and trade margins that the purchaser may have to pay. It is relevant in the balance of trade model to proxy import prices to Nigeria's trade balances since the United States is one of Nigeria's largest trading partners. In this work, import and export demand elasticities are governed by the demand side of the economy. This makes the import variable relevant to our base model because the responses of aggregate imports to changes in relative prices depend on consumers' willingness to substitute domestic goods for foreign goods. Thus, inputting the import variable in the base model is

expected to give us an elasticity to verify this stance. Therefore, drawing the elasticities of import demand in our base model becomes imminent even for theoretical justification (Marshall-Lerner elasticity condition).

3.9. World oil prices (OILP)

Crude oil is the world's most widely traded and used commodity. Oil and its derivatives still power the bulk of global transportation and serve as cooking and heating sources in developing countries. It is relevant to the models because the world remains so reliant on crude oil, and it accounts for a large portion of Nigeria's receipts on trade. Its price is heavily dependent on the pace of economic growth, which affects demand prospects and domestic inflation. This translates into rising general prices with an attendant decrease in aggregate demand, and in this case, real GDP growth performs negatively as well as trade balances. This is also one of our control variables. It is represented as OILP in both base and main models.

3.10. Exports (EXPT)

Exports are goods and services that are produced in Nigeria and sold to buyers in other countries at the international market. Nigeria's foreign trade is affected by our exports, and the balance of trade is determined by the difference between the exports and imports. When exports are high, it leads to a balance of trade surplus and vice versa. Therefore, it is relevant in the model to investigate the balance of trade movements and values. More so, our theoretical reference hinges on the elasticity of this export variable. According to Danladi et al. [21], the price elasticity of imports is a trade-weighted average of the sectoral elasticities of substitution of the domestic consumer (affecting the consumer price index); the price elasticity of exports is similar, but the average is now taken both across sectors and destination markets (trade balances). The international dispersion in import price elasticities depends mostly on preference parameters, whereas export price elasticity varies with the composition of trade. Thus, to justify the Marshal-Lerner elasticity condition in our work, the export values and elasticity become important.

4. Results and discussion

The descriptive statistics in **Table 1** helps to understand times series data and its properties. It presents the mode, mean, median, standard deviation, skewness, kurtosis, and Jarque-Bera statistics.

Table 1. Descriptive statistics of the variables (main model).

	BOT	REER	USPPI	OILP	EXPT	CPI	RESCPI
Mean	695.91	79.00160	115.4863	74.40736	5398.624	241.3637	-4.75×10^{-16}
Median	627.42	76.90000	111.9000	68.83000	5017.460	214.6400	0.642363
Maximum	5707.68	107.3500	141.0980	117.7900	10906.09	499.4000	15.64076
Minimum	−3726.46	59.01000	103.7000	21.04000	1920.610	115.5900	−18.61756
Std. Dev.	1847.55	11.13770	9.090714	25.58903	2106.435	103.7642	5.700243
Skewness	0.161	0.492554	1.424110	0.069293	0.399680	0.750033	−0.333902
Kurtosi	2.68	2.490818	4.342443	1.645554	2.172574	2.518829	3.733537

Table 1. (*Continued*).

	BOT	REER	USPPI	OILP	EXPT	CPI	RESCPI
J. Bera	1.216	7.378230	59.487	11.122	7.831	14.89	5.822233
Prob	0.544188	0.024994	0.000000	0.003844	0.019927	0.000584	0.054415
Obs	142	144	144	144	142	144	144

Source: Authors' computation, 2024.

The values of the mean of the variables indicate that EXRPT has the highest monthly mean, followed by BOP and CPI. The maximum values are 5707.680, 107.3500, 141.0980, 117.7900, 10906.09, 499.4000, and 15.64076, respectively, for BOT, REER, USPPI, OILP, EXPT, CPI, and RESCPI. The minimum values are −3726.460, 59.01000, 103.7000, 21.04000, 1920.610, 115.5900, and −18.61756 respectively for BOT, REER, USPPI, OILP, EXPT, CPI, and RESCPI. The values of the standard deviation revealed the measure of variability of the variables from their long-term mean values, respectively, every month.

4.1. Stationary test (ADF TEST)

The unit root test (ADF) result of the main model is presented in the **Table 2** below.

Table 2. Summary of unit root test for the variables.

Variables	ADF stat	ADF critical value	Order of integration
CPI	−3.485673	−3.443704	Level (1)
BOT	−9.081032	−3.498692	Level (1)
REER	−11.56742	−3.441777	Level (1)
USPPI	−11.86552	−3.442006	Level (1)
OILP	−8.983128	−3.442006	Level (1)
EXPT	−14.00191	−3.442238	Level (1)
RESCPI	−11.02598	−3.442955	Level (1)

Source: Authors' computation, 2024.

The stationarity test from the table implies that all the variables are stationary at first difference. So, the cointegration test can now be conducted, as this meets the condition under which the test could be applied.

4.2. Co-integration test

Here, we seek to establish the existence of long-run relationships or cointegrating relationships among these variables. The empirical result from the Johansen cointegration analysis is presented in **Table 3** for the main model.

Table 3. Summary of co-integration test for main model.

Hypothesized No of Ces		Trace stat		Max eigen Val		Prob. Val	
	Eigen Val	Stat. Val.	Critical Val.	Sta Val	Critical Val		
						Trace	Max-eigen
None	0.842036	189.5189	95.75366	83.04246	40.07757	0.0000*	0.0000*

Table 3. (*Continued*).

Hypothesized No of Ces		Trace stat		Max eigen Val			Prob. Val
	Eigen Val	Stat. Val.	Critical Val.	Sta Val	Critical Val		
						Trace	Max-eigen
At most 1	0.661345	106.4765	69.81889	48.72480	33.87687	0.0000*	0.0004*
At most 2	0.554852	57.75170	47.85613	36.42073	27.58434	0.0045*	0.0028*
At most 3	0.291240	21.33097	29.79707	15.49074	21.13162	0.3373	0.2560
At most 4	0.113409	5.840230	15.49471	5.416725	14.26460	0.7143	0.6886
At most 5	0.009367	0.423504	3.841466	0.423504	3.841466	0.5152	0.5152

Source: Authors' computation, 2024.

From the outcome of the Johansen cointegration using the trace statistics, we conclude that there is a long-run relationship that exists among the variables for the main model. In this regard, we will investigate the base and main models using VAR to investigate the pass-through of the exchange rate to domestic prices (inflation) on trade balances in the short and long run.

4.3. The vector auto regression (VAR) model of the base model

The relationships between the variables of the base model were investigated using the VAR model to generate the coefficients of the parameters of the model. The result is presented in **Table 4**:

Table 4. Summary of the base model vector auto regression (VAR) results.

	Coefficient	Std. error	*t*-statistic	Prob.
LNCPI (1)	1.257249	0.082905	15.16494	0.0000
LNCPI (2)	−0.263592	0.082484	−3.195677	0.0017
LNREER (3)	0.006219	0.009247	0.672503	0.5024
LNREER (4)	−0.006313	0.009362	−0.674347	0.5013
LNUSPPI (5)	0.042775	0.039943	1.070904	0.2862
LNUSPPI (6)	0.009511	0.039419	0.241273	0.8097
LNOILP (7)	−0.000333	0.003746	−0.088938	0.9293
LNOILP (8)	−0.004545	0.003941	−1.153370	0.2508
C (9)	−0.185194	0.110572	−1.674878	0.0963

Source: Authors' computation, 2024 using E-Views 10.

The short-run pass-through of exchange rate elasticity to domestic prices is 0.006 for REER at lags 1 and 2. It evidenced a value of 0.04 for USPPI at lag 1 and 0.10 at lag 2, however, not statistically significant at the 5 percent level, whereas OILP with values of 0.0003 and 0.005 show incomplete elasticities too. A thorough look at what constitutes the CPI basket on average indicates that the CPI basket includes about 0.19% of goods and services that were produced in the country using locally sourced materials, leaving the balance of about 0.81% to be imported. The consumer price index on food alone was about 0.98% per cent of the total CPI, indicating a high rate of food inflation. Import demand had a positive impact on the domestic price level during the period investigated, implying that, on average, increasing import prices may

lead to an increase in the domestic price level, with values of 0.04 and 0.10 at respective lags despite not being too significant. The positive relationship is in line with theory. As a result, the exchange rate pass-through effect impacted mainly on commodities imported and used in production domestically, due to the fact that foreign currencies are required to import them.

Evidence from the study also shows that the real effective exchange rate (REER) exhibits a positive relationship with domestic prices at lag 1 and a negative relationship at lag 2. Thus, if other variables are held constant, an increase in the real effective exchange rate of 1% will cause, on average, a rise in the domestic price of 0.006% and a decrease by the same value at lag 2. This is also in line with theory, because when the exchange rate of the domestic currency increases, the domestic price level increases too. Also, if a large portion of a country's trade is dominated by the demand for foreign currency, exchange rate fluctuations will strongly affect the rate of inflation. On the other hand, the impact of world oil prices (OILP) is seen to be negative on domestic prices in Nigeria, implying that if other variables are held constant, an increase in world oil prices by 1% leads to a decrease in domestic prices by 0.003% on average at lag 1 and 0.005% at lag 2.

4.4. The main model

The VAR result for the main model is presented in **Table 5**.

Table 5. Summarized VAR for the main model.

	Coefficient	**Std. error**	***t*-statistic**	**Prob.**
C (1)	−0.251882	0.099732	−2.525585*	0.0154
LNBOT (−1)	−0.312191	0.154938	−2.014941*	0.0503
LNBOT (−2)	−0.204830	0.143818	−1.424229	0.1618
LNREER (−1)	−3.706961	3.770808	−0.983068	0.3312
LNREER (−2)	−4.747804	7.434920	−0.638582	0.5266
LNUSPPI (−1)	−3.433536	53.42053	−0.064274	0.9491
LNUSPPI (−2)	−104.0289	58.09037	−1.790811**	0.0805
LNOILP (−1)	1.131309	5.218370	0.216794	0.8294
LNOILPI (−2)	−9.593715	6.278189	−1.528102	0.1340
LNEXPT (−1)	−0.271338	1.103908	−0.245797	0.8070
LNEXPT (−2)	−0.756618	1.026226	−0.737282	0.4651
RESCPI (−1)	−0.157158	0.066137	−2.376262*	0.0221
RESCPI (−2)	−0.035121	0.023858	−1.472102	0.1484
C	0.167690	0.154584	1.084778	0.2842
R-squared	0.501445	Mean dependent var		−0.032063
Adjusted *R*-squared	0.347130	S.D. dependent var		0.882920
S.E. of regression	0.713403	Akaike info criterion		2.374777
Sum squared resid	21.37563	Schwarz criterion		2.881115
Log likelihood	−52.49375	Hannan-Quinn criter.		2.571083
F-statistic	3.249497	Durbin-Watson stat		2.230733
Prob(*F*-statistic)	0.001864			

Source: Authors' computation, 2024; *5% significance, **10% significance.

From **Table 5**, it is observed that the composition of the trade basket indicates that the short-run elasticity of domestic prices on balance of trade is incomplete at 0.15 and 0.04 for lags 1 and 2, respectively, where lag 1 is statistically significant and lag 2 is statistically insignificant at 5%. Evidence from the table also shows that the relationship between BOT and REER is negative at lag one and lag 2, including that of EXPT (RESIDCPI) and import prices (USPPI). However, the relationship between BOT and OILP (oil prices) is positive in lag 1 and negative in lag 2. Post-estimation tests such as autocorrelation, heteroscedasticity, and multicollinearity tests were conducted. The correlation of the VAR residuals reveals that no contemporaneous correlation exists in the model. In general, the results of the residual tests indicate that there is no serial correlation and that we have homoskedastic residuals. We then go ahead and investigate the pass-through effects for the main result using the VECM estimation technique.

4.5. Long run VECM results

For the main model, the long-run elasticity of the VECM results in **Table 6** shows the relationship that each of the independent variables has with the dependent variable. Evidence from the table shows that in the long run, the relationship between BOT and REER is positive in line with that of USPPI and EXPT. However, the relationship between BOT and OILP (oil prices) is negative in line with residual CPI in the long run. Although, for the RESCPI coefficient, the absolute value 0.44 implies that ceteris paribus, when there is a percentage increase in inflation or domestic prices, it will lead to a 0.44% decrease in BOT in the long run. It is statistically significant at 5% in the long run. Post-estimation tests such as autocorrelation, heteroscedasticity, and multi-collinearity tests were conducted. The correlation of the VECM residuals reveals that no contemporaneous correlation exists in the model. In general, the results of the residual tests indicate that there is no serial correlation and that we have homoskedastic residuals.

Table 6. Vector error correction model (VECM) results—The long run results.

	Vector error correction estimates						
CointegratingEq:	**LNBOT (−1)**	**LNREER (−1)**	**LNUSPPI (−1)**	**LNOILP (−1)**	**LNEXPT (−1)**	**RESCPI (−1)**	***C***
CointEq1	1.000000*	1.084098	15.97387*	−1.251063	4.161733**	−0.437541*	−118.3033
		(2.00454)	(6.55787)	(2.95865)	(2.27808)	(0.21713)	
		[0.54082]	[2.43583]	[−0.42285]	[1.82686]	[−2.01507]	

The result in brackets and parenthesis are t-statistics and standard error respectively while 1 and 2 asterisks represent significance at 5% and 10% levels respectively.
Source: Researchers' computation, 2024.

4.6. Impulse response test for the main model

The impulse response plots (**Figure 1**) represent the response of balance of trade given an impulse in other variables. In the first graph, we plot the impulse response of BOT to REER. When REER goes up by 1 unit of measurement, BOT falls by twice the amount, but the next month's witness over 200% increase in balance of trade to a positive value of 2, but the impact of a shock on REER today on future BOT goes to 0 towards the end of the time period. The distance of the responses (red lines) from

the impulse (blue line) shows that this impact is statistically significant in all periods.

More so, when OILP goes up by 1 unit, BOT goes up at a steady rate from 0–1 month. From the second till the third month, there is a steady increase in the response of the balance of trade on the shock of OILP, but a decline is seen from the third till the fourth month, which is still positive. This result is similar to that of the variance decomposition, as the impact of OILP on the balance of trade was steadily increasing till it started experiencing a decline from the third period. This trend has been consistent till the last period, although not in the same magnitude. However, the impact was positive and above 10%. The distance of the responses (red lines) from the impulse (blue line) shows that this impact is statistically significant in all periods.

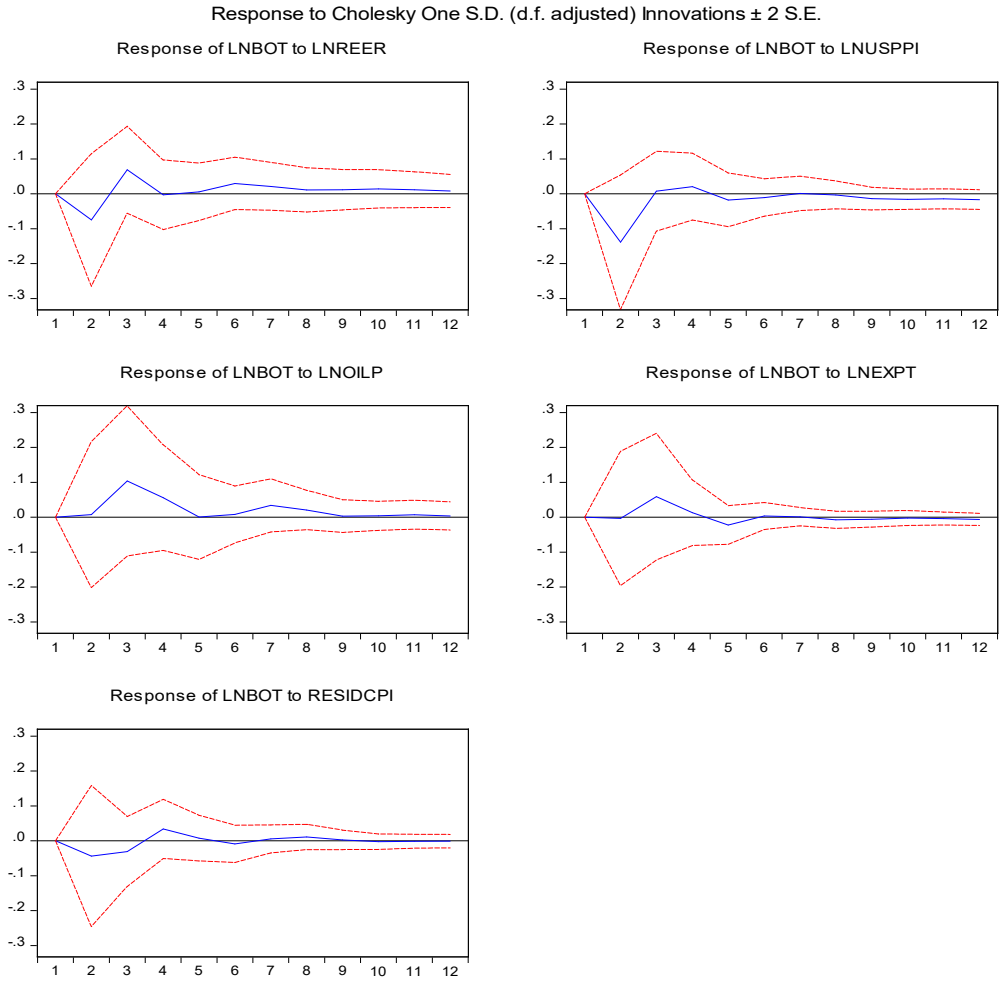

Figure 1. Impulse response test for the responses of balance of trade in Nigeria to the impulses of selected variables from 2011–2022.

Similarly, when USPPI goes up by 1 unit of measurement, BOT falls by over 100% immediately to negative values of −1. The distance of the responses (red lines) from the impulse (blue line) between 0 and −1 shows that this impact is statistically significant in all periods. This is also consistent with our variance decomposition result, as USPPI maintained a wide influence from the first time period till the last. Although witnessing an upward movement in balance of trade response to USPPI shocks within the second to third period, the negative shock on balance of trade to changes in USPPI is steady towards the line till the last period. These changes within

the 2nd–4th periods are consistent with our variance decomposition result breakdown. More so, the negative result is consistent with our regression result, and this explains that the impact of a shock of USPPI today on future BOT remains negative successively in the future time periods with over 100% magnitude.

For the response of BOT to EXPT, when EXPT goes up by 1 unit or there is a unit shock in EXPT, BOT is impacted with little response to this shock. Evidently, successive shocks in the future time period witnessed no significant magnitude or response of BOT to these changes. This is also evident in our variance decomposition result, as EXPT has influence on BOT around 0 to 2. Whereas the influence increased a little over 1% on our variance decomposition table at the third period, it is not strong enough and still maintained such stance till the end of the time period under investigation.

Evidence from the impulse response function also indicates the response of balance of trade (BOT) to RESIDCPI. Thus, a one S.D. shock, or impulse, given to domestic factors that cause inflation will result in a negative impact on the balance of trade (BOT) within the first three months, followed by a sharp increase from the third month, which was steady and remained so till the last period. The distance of the responses (red lines) from the impulse (blue line) shows that this impact is statistically significant in all periods. It is worthy to note that whereas there is a positive response to the shock of RESIDCPI, the magnitude is not too large in successive time periods and remained within the 0 point. This is consistent with our variance decomposition and regression results.

4.7. Variance decomposition

The variance decomposition is useful to us as it demonstrates how significant a shock is in explaining the variations of the variables in the model. It also shows how that shock changes over time. It is relevant in our work because the table plots the composition of the error variance of the variables concerned across shocks at each time period.

Observing **Table 7**, the variance decomposition shows how important each random innovation is to the balance of trade in Nigeria. From the results, 100% of BOT is accounted for in its own variance, but decreases to 58.1% at the 140th month. More so, oil prices and exports are shown to explain about 28% and 21%, respectively, of its historical variations in the 40th month, and declining only to about 0.9% and 0.34% at the 140th month. The massive decline in EXPT and OILP is witnessed after the RESCPI and USPPI took a larger portion of impact at the 60th month for values of 11.1% and 30.2%, respectively, and maintained through till the 140th month at 12.8% and 28% each. However, the real effective exchange rate maintained a small portion of variation in balance of trade during the 144 months. This result, thus, implies that Nigeria's balance of trade is being significantly influenced by import prices and domestic prices, which empirically and historically have been important in explaining Nigeria's balance of trade positions. This result affirms the assertion that the effect of exchange rate changes (exchange rate pass-through) on foreign trade (BOT) in Nigeria is significantly dependent on the country's level of inflation and import.

Table 7. Summary of the variance decomposition of the main model.

Period	S.E.	LNBOT	LNREER	LNUSPPI	LNOILP	EXPT	RESCPI
1	0.713403	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
20	2.357643	51.11635	2.635512	35.44163	1.247321	4.820524	4.738663
40	1.449805	41.80129	2.197307	6.000695	28.26297	21.26608	0.471659
60	5.692852	56.25890	0.556299	30.15001	0.987103	0.998627	11.04905
80	6.946883	57.11729	0.393609	28.97965	0.957815	0.675892	11.87574
100	8.023124	57.58971	0.309236	28.32194	0.941892	0.509283	12.32794
120	8.975201	57.88120	0.258224	27.91327	0.932104	0.408752	12.60646
140	9.836560	58.07700	0.224191	27.63810	0.925537	0.341730	12.79344

Source: Researchers' compilation, 2024.

4.8. Discussion of findings

4.8.1. For exchange rate pass-through to domestic prices

Results from the base model indicate that the exchange rate pass-through elasticity to Nigeria's inflation is found to be incomplete at lags 1 and 2, where the pass-through elasticity is 0.006 at both lags. This supports the results of Bada et al. [6], where the pass-through elasticities in the long run in Nigeria were found to be incomplete at values of 0.24 for the baseline. This result supports Krugman's explanation that "firms do not change prices immediately when exchange rate changes, resulting in lower CPI pass-through". More so, the substitution effect can also explain it in part, whereby there will be an increase in import prices, which leads consumers to import substitute goods. The costs of these substitute goods are lower than their imported counterparts, which explains the lower pass-through to inflation (CPI) from the regression analysis. Therefore, exchange rate pass-through relates positively and has statistical significance with domestic prices in Nigeria.

4.8.2. For ResidCpi To BOT

The results from the main model show that domestic prices (proxied by residual CPI) have a negative impact on the balance of trade at lag 1 and lag 2, as they decrease it by 0.16% and 0.04%, respectively. It can also be deduced from the estimates that a unit increase in RESIDCPI as a result of depreciation in Nigeria's exchange rate, on average, brings about a decrease of about 0.016% in balance of trade. More so, lag 2 shows a negative impact of 0.04% on the balance of trade in Nigeria. This is in line with economic theory. Also, we explained that RESCPI is the portion of domestic inflation contributed by exchange rate depreciation, affecting domestic factors (such as RGDP, money supply, wage rate, marginal propensity to save, consumption, amongst others) in Nigeria; therefore, the negative impact could imply that the exchange rate depreciation affected the GDP during the period investigated, leading to a reduction in productivity for export and consequently a negative balance of trade. Furthermore, increases in money supply resulting in an increase in importation (Marginal propensity to import), ceteris paribus, offset other efforts to increase exports and instead cause an unfavorable balance of trade.

4.8.3. For real effective exchange rate to BOT

The result from the main model finds the coefficient of the real effective

exchange rate on the balance of trade to be negative but statistically insignificant at 5% and 10% for lags 1 and 2, respectively. The negative result is consistent with economic theory evidencing an unfavorable balance of trade as a result of real exchange rate depreciation for an import-dependent country like Nigeria. This means that when there is an increase in the value of currency (exchange rate) by one unit, there will be a decrease in balance of trade on average by 4% and 5% at lags 1 and 2, respectively, thus making exports expensive and imports of production resources expensive, thus leading to an unfavorable balance of trade. This will discourage domestic production since import substitution industries rely on imported machinery for production, and efforts towards export promotion will be hampered as the cost of domestic goods will become expensive at the international market. The elasticity is high with values greater than one, implying that the magnitude of changes in the real effective exchange rate on the balance of trade in Nigeria is high. However, in the long run, there is a positive relationship between the real effective exchange rate and the balance of trade.

4.8.4. For OILP to BOT

The findings of the study also showed that there is a positive and statistically insignificant relationship between world oil prices and balance of trade in Nigeria at lag 1 but a negative relationship at lag 2 during the period investigated. Thus, since crude oil constitutes the majority of Nigeria's exports, when the prices of oil increase, the receipts will increase through increased values of exports, thereby improving our balance of trade by 1.1% on average. However, since we import refined oil, the increase in value of oil prices will lead to a decrease in balance of trade by 10% on average. This is consistent with economic reality and theory. However, there is a negative long-run relationship that exists between balance of trade and oil prices.

4.8.5. For import and export to BOT

The findings of the study also showed that import and export prices have a negative and statistically insignificant impact on the balance of trade in Nigeria at lag 1, however, at lag 2, there is a negative relationship with the balance of trade and a statistically significant effect at 10% for import prices, and that of exports is statistically insignificant during the period investigated. The negative relationship between imports and balance of trade in Nigeria is consistent with literature. An import-dependent country will have negative trade balances since the value of imports is greater than the value of exports. Evidence from **Table 5** shows that balance of trade decreased by about 3.4% on average relative to export, which was about 0.27 units at lag 1. The difference will have a negative balance, thus reducing the balance of trade. More so at lag 2, with imports having a negative relationship with the balance of trade with a value of 104%. We also observe a negative relationship between exports and balance of trade with a value of 0.76%. This reinforces the balance of trade position for an import-dependent country like Nigeria. This is consistent with the findings of Emehelu and Christopher [22]. However, there is a positive long-run relationship between balance of trade and import and export prices, with both statistically significant at 5% and 10%, respectively. The implication of this finding is that when there is an increase in exports by 1 unit, the appreciation of the currency makes export goods more competitive at the international market, and as such, it becomes cheaper

to import than export, and this subsequently leads to an unfavorable balance of trade. This calls for Nigeria to adopt a fixed exchange rate regime (system) that was dropped in 2014 or a modified/managed floating system in order for exchange rate fluctuations to be controlled and reduce the impact of appreciation on our trade balances using a pegged exchange rate.

From the above findings, we observe that the external sector has a significant impact on our trade balances, and this explains why efforts made by the central authority to control exchange rate volatility in the domestic economy through domestic variables have not yield good results. This calls for appropriate attention on the external sector and the implementation of measures to manoeuvre external fluctuations that significantly impact our trade balances.

4.8.6. Marshal-Lerner elasticity result

In this work, import and export demand elasticities are governed by the demand side of the economy. The response of aggregate imports to changes in relative prices depends on consumers' willingness to substitute domestic goods with foreign goods. For firms, they use these substitutes to produce goods for export (export demand elasticity). With the above justification, we use the import elasticity of the base model and the export elasticity of the main model to justify our Marshal-Lerner condition of BOP in Nigeria to ascertain if depreciation is relevant for an import-elastic country like Nigeria. The absolute values of the import demand elasticities from the base model for lags one and two are 0.039943 and 0.039419, respectively, while those of export demand for lags one and two are 0.271338 and 0.756618, respectively.

BOP = IMP (USPPI) elasticity + EXPT elasticity

Thus,

The sum of elasticity for lag one is 0.0399 + 0.2713 = 0.3112.

The sum of elasticity for lag two is 0.0394 + 0.7566 = 0.7960.

The results of the sum of the elasticities for the two lags shown above are less than 1, which implies that depreciation is not recommended for an import-dependent country like Nigeria. This result is in line with the findings of Ihuoma et al. [23]. Thus, economic conditions that would encourage the depreciation of the naira should be avoided, such as government devaluation of the naira in the fixed exchange rate regime or implementing a flexible exchange rate regime that would encourage depreciation through speculation.

5. Conclusion

This study investigated the impact of exchange rate pass-through to inflation on the balance of trade in Nigeria. As observed, real exchange rate depreciation leading to higher domestic prices could have impacted other sectors of an economy and increased the overall cost of domestic production, causing a rise in inflationary pressures and a subsequent impact on trade balances. This made this work empirically relevant to examine the spillover effect of the pass-through of the exchange rate to inflation on the balance of trade in Nigeria. We first looked at the elasticity and impact of exchange rate pass-through to inflation in the base model and subsequently the impact of this exchange rate pass-through on the balance of trade in Nigeria. We employed a dual model utilizing the VAR and VECM estimation techniques for our

base and main models, anchoring our work on the Marshal-Lerner elasticity approach. With the theoretical framework of the Marshal-Lerner condition, the addition of elasticity of our import and elasticity of our export demand was not up to 1, implying that exchange rate depreciation is not the right policy for Nigeria as it worsens Nigeria's trade balance. More so, while the pass-through of the exchange rate to domestic prices (inflation) was not complete, the study found that exports had a negative impact on the balance of trade in Nigeria. This is theoretically unusual and suggests that the flexible exchange rate is not favorable to exports in Nigeria.

Therefore, it is suggested that Nigeria should adopt a fixed exchange rate that was dropped in 2014 since it will be more favorable for improving the Nigerian economy. This policy should be complemented with an import substitution policy for better results. This will be a good measure because Nigeria is an import-dependent country, and while export promotions are very important, a short-run policy to implement will be import substitution. With time, the demand for foreign currencies will decline and exports will improve, leading to the strengthening of the naira against other currencies. Thus, our findings simply justify that the Nigerian government should fix the exchange rate or peg it at a particular value. The government should not also implement austerity measures as an import-dependent country because it will be detrimental to the economy. It is better to implement austerity measures in the long run when import substitution industries would have improved. This is the steady road to diversification.

Policy recommendations

Based on the findings of this study, our recommendations are as follows:

Although the exchange rate pass-through to domestic prices was not complete (based on Krugman's explanation of price inflexibility and import substitution goods), we recommend a short-run policy of investing more in promoting import substitution industries, which will produce import substitution goods for the domestic economy and reduce the dependence on imported goods.

We also recommend that the borders should not be shut for the importation of various necessary goods, as austerity measures should not be an option for an import-dependent country like Nigeria. This is because instead of improving domestic production and exports, it could lead to policy conflict and cripple the economy since our domestic industries use relevant commodities through joint demand for production and other imported commodities for production, where we have the least comparative and competitive advantage.

In line with the negative relationship between exports and balance of trade in Nigeria, we recommend that the Nigerian policymakers should adopt a fixed exchange rate regime in order to control fluctuations and tackle the spill-over effect of exchange rate pass-through to the domestic economy. This is because Nigeria is import inelastic, and the Marshal-Lenner elasticity condition has given us evidence that the depreciation (flexible exchange rate regime) of the naira is not sufficient in improving our balance of trade. This implies that for an import-dependent country like Nigeria, the exchange rate value is better off pegged to reduce uncertainties/speculations. More so, pegging the exchange rate will mitigate the impact of depreciation and appreciation

of the currency because appreciation will not be favorable as it would discourage exportation, as seen in our result. Thus, a fixed exchange rate will help keep the country's exchange rate value in a favorable position to promote trade and boost the comparative advantage of Nigeria at the international market against the rest of the world while protecting the domestic economy from external fluctuations.

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