Asymmetric Impact of Exchange Rate on Inflation in Nigeria: A Non-linear ARDL approach

Chukwuemeka Valentine Okolo[*], Stephen Obinozie Ogwu[**], Afamefuna A. Eze[***], Stella Nonye Agubata (Ph.D.)[****], Joshua Chukwu Onwe[*****], Obehi Destiny Obozua[***]

[*]School of Economics and Finance, Xi'an Jiaotong University, China

[**] Department of Economics, Kingsley Ozumba Mbadiwe University, Ideato, Imo State, Nigeria.

[***] Department of Economics, University of Nigeria, Nsukka, Nigeria.

[****]Department of Accountancy, Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State, Nigeria.

[*****]Department of Economics and Development Studies, Alex Ekwueme Federal University Ndufu Alike, Ikwo Ebonyi State, Nigeria.

Abstract- *PURPOSE: The purpose of this study is to unravel if there is an asymmetric impact between rising price (i.e., inflation) and exchange rate in Nigeria. The study also checked if price racketeering exists in the Nigerian pricing system.*

METHODOLOGY: Quarterly time series data from 1981; Q1-2020; Q4 was used and the Non-linear Autoregressive Distributed-Lag (NARDL) Model was employed.

APPROACH: The short-run and long-run analyses were performed to know the nature of asymmetric relationship that exist between inflation and exchange rate in Nigeria.

FINDINGS: The short-run results show that positive exchange rate (EXCHR[+]) and negative exchange rate (EXCHR[-]), negative local interest rate (LLINTR[-]), negative import (LIMPORT[-]), positive gross domestic product (GDPGR[+]) and negative gross domestic product (GDPGR[-]), positive foreign direct investment (FDI[+]), and negative foreign direct investment (FDI[-]) significantly impact on inflation (LINFL) in Nigeria. The long-run results show that EXCHR[+] and EXCHR[-], LLINTR[-], positive Real interest rate (RINTR[+]), GDPGR[+], and FDI[+], significantly impacts negatively on inflation whereas LLINTR[+], and FDI[-] impact positively on inflation. Furthermore, the Wald short-run restrictive additive test of symmetry shows that, with the exception of RINTR and LLINTR, the rest of the regressors significantly contribute to price racketeering in the Nigerian market.

Keywords: Exchange Rate, Price level, Covid-19, Nonlinear ARDL, Wald test, Price Racketeering.

I. INTRODUCTION

The outbreak of coronavirus disease in early 2020 left the economies of countries around the world in a mess as economic activities came to a halt due to measures put in place to prevent the spread of the virus. One of the measures put in place restricted the movement of people as well as goods from one country to another. However, the moment the ban on inter-country movement was lifted, many importers and exporters, especially those in countries that are import dependent, intensified their efforts to exchange local currencies for foreign currencies in order to import goods. This development led to increased demand for foreign currencies. As Adesoji and Simplice (2020) noted, the coronavirus pandemic represents both a public health and an economic crisis. They added that "while the public health crisis addresses disease containment measures, treatment and development of vaccines, the economic crisis is reflected in supply and demand shocks as well as oil price shocks, consequent upon disruptions in economic activities caused by the global lockdown. Post-pandemic economic recovery is the major concern of both developed and developing countries in 2021. Like other developing countries, Nigeria's economic recovery plans will not only focus on resuscitating domestic economic activities, but they will, to a large extent, include plans that will make international trade favorable. According to Ogundipe and Egbetokun (2013), the Nigerian economy is external sector driven and shocks from the global commodity market have several implications for consumers. They further explain that an increase in the price of foreign raw materials or scarcity of key foreign imports into the production sector will immediately reflect on the exchange rate pass-through to the manufacturer. They concluded that the "distortions in the supply of consumer goods, particularly stable food items or household

items, in the foreign market are a signal of high exchange rate pass-through to the country's consumers.

As the preceding paragraph suggests, a country such as Nigeria that is import dependent is likely to witness rising prices that are induced by exchange rate volatility in a post-pandemic period. An increased general price level adversely affects the purchasing power of members of the public. Jian (2008) observed that during periods of high exchange rates, the value of a country's currency drops, adding that the increased exchange rate is often passed onto consumers. He concluded that "the rate of exchange passed through to consumers depends, among other things, on the quality of the imported goods, price elasticity of demand, openness, and the monetary policy of the central bank. Ogundipe and Egbetokun (2013) noted that consumer purchasing power largely depends upon wealth and the prices of goods and services. They added that domestic purchasing power is mainly affected by the inflation rate of individual countries.

First, the rising general price level poses a serious challenge to social planners in the sense that policies, more often than not, target certain categories of economic agents. For example, a policy of increased wages due to inflation will only benefit public servants and a few other people who are privileged to work in standard organizations. However, traders, artisans, farmers, etc. don't benefit from the minimum wage directly. Some categories of people earn the same amount from the economic activities they are involved in regardless of the rate of inflation. In these circumstances, policies will likely not lead to inclusive growth as the rising price level tends to weaken the investment demand of members of the public. Apparently, the bulk of members of the public will spend their earnings on basic needs, thereby leading to low savings, which are used for investment. Second, countries that are import dependent arguably consume more than they produce. This means, in post-war and post-pandemic periods, such countries will likely witness high prices for domestic and foreign goods. This is mainly due to exchange rate changes between local and foreign currencies in post-pandemic periods, as there is a surge in the demand for foreign currencies in order to buy goods that are produced in other countries. Adetiloye (2010) noted that the understanding of the degree and timing of exchange rate changes that are passed on to the prices of imported goods is very important in accessing its effect on different economies, adding that pass-through, that is, its effect on consumer prices, could be complete where import prices respond absolutely to exchange rate movements. Conversely, a partial induced response of the exchange rate on consumer prices is termed an incomplete pass-through.

According to Adesoji and Simplice (2020), the rise in government spending driven by the need to combat the effects of Covid-19 has increased the country's fiscal deficit and its susceptibility to high public debt vulnerabilities. They argue that there is likely to be depressed global capital flows which will put serious pressure on Nigeria's foreign exchange reserves and exchange rates, adding that it will affect the conduct of public monetary policies in Nigeria. They concluded that the likely development will lead to macroeconomic consequences for variables such as economic growth, inflation, unemployment, and exchange rates. In the preceding paragraphs, the likely challenges of rising prices and the exchange rate on post pandemic economic recovery are disused. In the following section, data on these variables is collected from published sources and analyzed in order to determine the current state of the economy.

1.1 Graphical Analysis on Covid-19 Pandemic Cases, Exchange Rate And Inflation Rate

This study is a post-pandemic study; it is important to know the degree of damage coronavirus disease had on the health and lives of Nigerians before analyzing the variables that will likely determine post-pandemic recovery. To this end, consider the graph below which shows the five most affected states in Nigeria.

Figure (i): **Analysis of Covid-19 Cases in Nigeria**
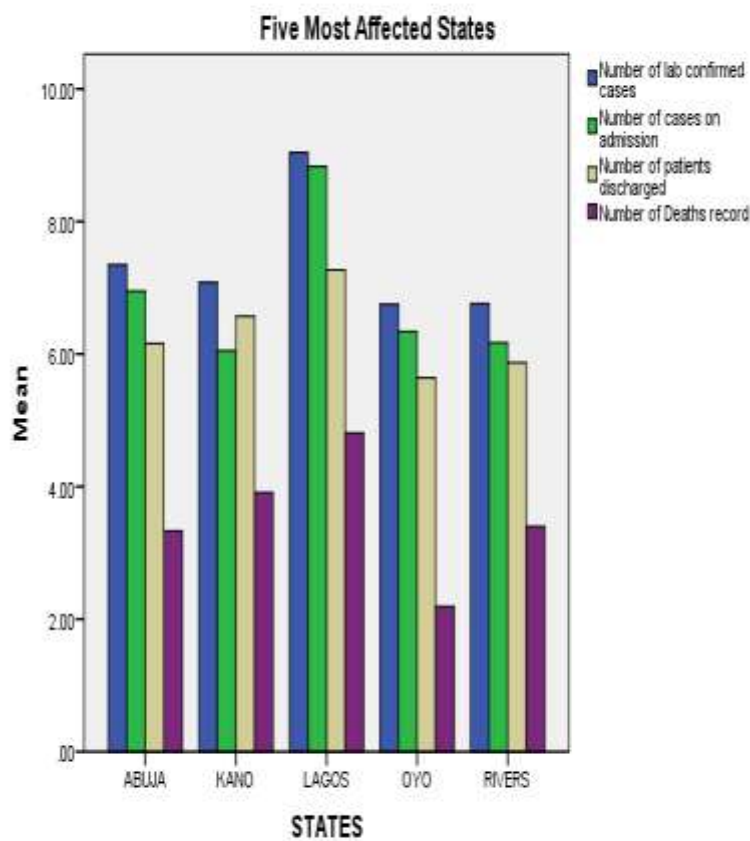
Data Source: Nigeria Centre for Disease Control (NCDC)

As the preceding graph in figure (i) shows, so many key states, including the Federal Capital Territory (FCT), were affected by coronavirus disease in 2020. The clustered bars for each state, including Abuja, represent the number of people that tested positive for coronavirus, the number of people that were admitted, the number of people that survived and were discharged from the hospital and, lastly, the number of people that died from the virus. The most affected state, Lagos, is the economic hub of Nigeria. Economic activities attract people from around the world to Lagos.

It is not a surprise that it is the most affected. The second most affected, Abuja, is the administrative capital of Nigeria. It is well known that the capital territory of a country attracts all kinds of people. Rivers State is an oil producing state in Nigeria. It attracts people from far and near. Kano State is the most populous state in the northern part of Nigeria. It is the commercial hub of the northern part of Nigeria. The capital of Oyo, Ibadan, is one of the largest cities in West Africa. The preceding explanation is an indication that Nigeria was badly affected in 2020 as the outbreak of coronavirus affected places where major economic activities are undertaken. Even though there were restrictions on the movement of people and goods around the world, economic activities were undertaken in some states that were not badly affected. However, the provision of economic activities in some states was not adequate as economic activities in the most affected came to a complete halt. Almost all the states in Nigeria depend on Lagos for some vital goods. During this period, all the firms in Lagos were shut as both the Federal and Lagos State governments ensured strict adherence to Covid-19 safety measures in the state due to the high possibility of the spread of the virus in the state. Moreover, Nigeria could not import goods from abroad as international movement was restricted globally. The Nigeria situation was quite critical because of the economic role the most affected states play in the economic well-being of Nigerians. It is not out of place to assume that a country that is import dependent as well as dependent on key states for the availability of vital goods will go through economic hardship during and after a pandemic.
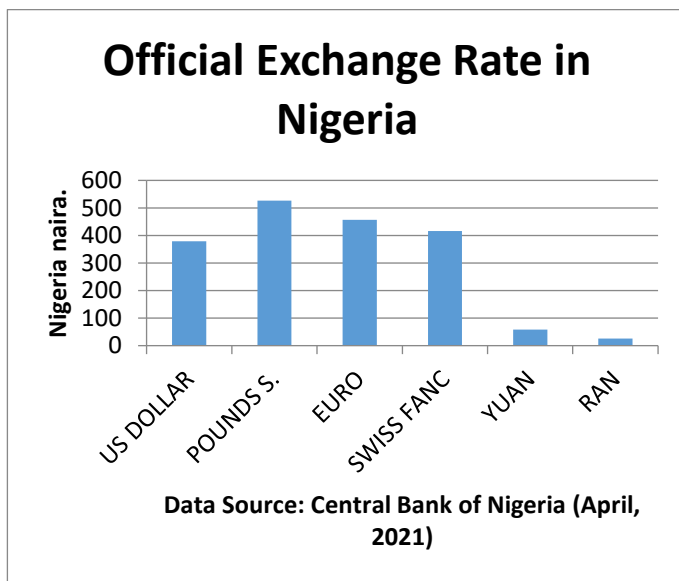
First, there is likely to be a rise in the general price level as demand will likely outweigh the supply of goods needed by members of the public. As noted in the preceding paragraph, Lagos and other major states, including FCT, were badly affected in Nigeria. Even though the firms have begun operations, at the initial stage of the lifting of the ban on economic activities, there is a high chance that the price of goods being produced will be high. Second, there is likely to be a surge in the demand for foreign currency in order to import goods from other countries. It is well known that Nigeria is import dependent. When more of a local currency exchanges for a few foreign currencies, the value of the local currency will depreciate in value. And if the country relies more on foreign goods than locally produced goods, the high cost of importation will increase the general price level of the local economy. This is apparent as importers will shift the burden to final consumers by increasing the price at which the imported goods are sold to local consumers. To ascertain whether this is what is happening in Nigeria, consider the figure below:

Figure (ii): Surge in Food Prices in Nigeria

Surge in Food Prices in Nigeria

Data Source: Nigeria Bureau of Statistics.
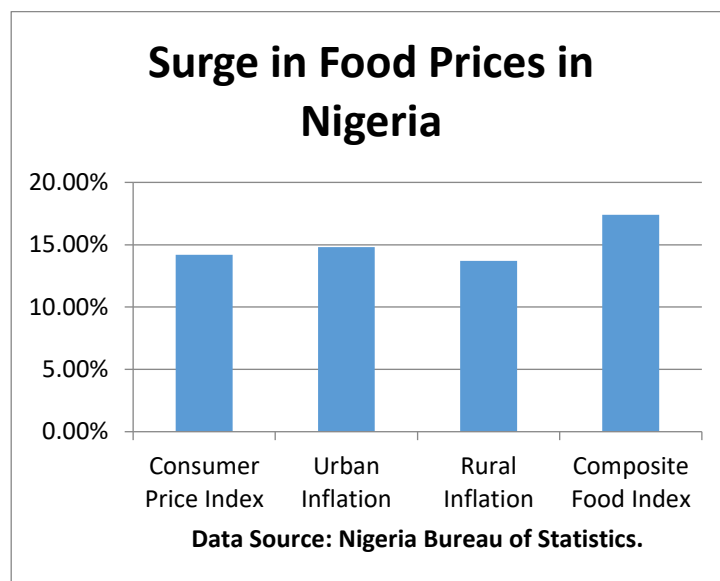
As in the preceding graph in figure ii above, the consumer price index, as at December 2020, increased by 14% in Nigeria. This is worrisome as the public will hardly make investment demand, which leads to economic growth. The bulk of the public are low-income earners. Their meager income will barely be enough to meet basic needs given the surge in food prices. Urban inflation has increased by 14.8%, as shown in the graph. It is well known that, in developing countries like Nigeria, people migrate to urban areas in order to make ends meet. The high rate of inflation in urban cities could lead to a recession. There can't be adequate savings in an environment with a high inflation rate. Without savings, there would be no investment demand. Without investment, there would be no employment. And if people are not employed, economic activity will drop and the economy will slide into recession. The surge in food prices has extended to rural areas, as rural inflation has increased by 13.7% as at December 2020, as shown in the preceding graph. As a consequence, the composite food price index has increased by 17.4%. The rising price level in Nigeria poses a challenge to post-pandemic recovery in Nigeria. Like the rising price levels, the exchange rate, which is the rate at which a country's currency exchanges for foreign currencies, is critical to post-pandemic economic recovery, especially for countries that are import dependent. Below is a graph of the exchange rate in Nigeria in recent times.

Figure (iii): Official Exchange Rate in Nigeria

Official Exchange Rate in Nigeria

Data Source: Central Bank of Nigeria (April, 2021)

The introductory section of this study is followed by a literature review. Section three and four discloses the theoretical framework and methodology, section five contains the analysis of the results. Finally, section six discusses the findings as well as recommendations of the study.

II.   EMPIRICAL REVIEW

Many studies have been done in this area and their findings documented. While some findings have certain areas of agreement, others disagree. For instance, (Adetiloye, 2010, and Nwosa and Oseni, 2012; Babatunde and Olufemi, 2014) found the existence of a two-way causality between the exchange rate and consumer price level, (Gidigbi, Babarinde, and Lawan, 2018) had a contradictory finding. Similarly, (Adetiloye, 2010; and Onuoha, 2014) agreed that the import ratio and consumer price index have a stronger positive significant coefficient than other variables. Furthermore, (Nwosa and Oseni, 2012; Gidigbi, Babarinde, and Lawan, 2018; and Musa, 2021) were among those who employed the VECM methods of analysis and found that long-run relationships existed between consumer price level (inflation) and the other variables of interest, including exchange rate. Similarly, while (Onuoha, 2014 and Bakare, 2014) adopted the Ordinary Least Square (OLS) techniques, (Nwachukwu, 2017) employed the Two Stage Least Square for data analysis. The majority of studies such as (Adetiloye, 2010; Nkoro and Uko, 2016; Charles and Chilaka, 2019; Eze and Markjackson, 2020; Bakare, 2014; and Musa, 2021) recorded that the exchange rate or exchange rate volatility has a statistically significant impact on consumers' price level (inflation) in Nigeria. But for (Eze and Markjackson, 2020), the impact assumed a negative nature. Other studies, like (Nwachukwu, 2017), had a contrary finding.

This study will be different in the following ways. Firstly, the study will utilize quarterly data instead of annual data. This is ideal because the exchange rate and price levels, amongst others, change daily, and even at times, more than once per day. Hence, applying the quarterly data will best capture these changes. Secondly, the study will adopt the Non-linear Autoregressive Distributed Lag-Model (ARDL) in examining the impact of the independent variables on the dependent variable. Finally, the study will further utilize the Wald restrictive asymmetric test to check if the price level is affected by price racketeering caused by the independent variables.

The above graph in figure iii shows the rate at which the Nigerian naira exchanges for the currencies of notable countries around the world. Nigeria exchanges almost four hundred naira for a dollar, as shown in the above graph. This is the official exchange rate. The parallel market exchange rate information is hardly accurate and that is why it is not reported in this study. However, experience has shown that the parallel market exchange rate is always higher than the official exchange rate. The Pounds Sterling, Euro and Swiss Franc official exchange rates are even higher than the US Dollar, as shown in the above graph. Even though the Chinese Yuan and South African Ran exchange rates are not so high, it can be seen that Nigeria exchanges more than a naira to get a unit of all the currencies considered in the above graph. For a country that is import dependent, this is worrisome. The outrageous exchange rate contributed to the rising price level in Nigeria due to the unfavorable international trade balance occasioned by the depreciation of the Nigeria naira.

To address the problems discussed in the preceding paragraphs, there is a need to conduct research studies on exchange rates and inflation rates in the post-pandemic period in order to put efficient policies in place that will stabilize the Nigerian naira. This is important for a country that is import dependent, as the stabilization of the local currency will lead to a favorable international trade balance. External sector stabilization will lead to a quick recovery of other sectors of an economy that is import dependent. Hence, this study is important. It departs from previous works on exchange rates and inflation rates as it is based on the economic challenges brought upon economies by the novel corona virus pandemic, a recent unfortunate development.

III.   THEORETICAL FRAMEWORK

Four theories of inflation were conceptualized by economists and monetary experts which can also be described as schools of thoughts. The Demand-Pull Inflation proponents hold the thought that increase in purchasing power transcends to increased aggregate demand with aggregate supply remaining constant while the Cost-Push Inflation is occasioned by increase in the cost

of production which is then transferred to the consumers in the form of increased prices. Similarly, when monetary policy measures put in place to control the existing inflation fails to achieve its goal the Hyper-inflation or galloping inflation surfaces. Many factors according to the schools of thoughts are responsible for these inflationary occurrences and they include war, natural

disasters like flood and earthquakes, pandemics like Corona-virus, population explosion, increased disposable income, budget deficit and etc. These factors directly impact on the macroeconomic variables and indicators which in turn bring about fluctuations in the general price levels. Hence this study seeks to unravel the asymmetric relationships between these macroeconomic variables and the general price level (Inflation).

In line with the exchange equation of Fisher we can state that:

$$MV = PT$$
(1)

Where M is used to denote money supply, V is the velocity of money in circulation, P represents the price of goods and services and T is the transaction or output in the economy.

IV. METHODOLOGY

This study adopts the non-linear autoregressive distributed lag (NARDL) modeling approach which was popularized by Pesaran, Yu, and Green-Wood (2013) used for modeling asymmetric long-run relationships and dynamic multipliers. This method is an extension of the linear ARDL framework proposed by Pesaran, Shin, and Smith (2001) for estimating equilibrium relationships. The NARDL, which has been widely used in literature, uses the positive and negative partial sums of the explanatory variables to account for the short-run and long-run linearity in the model. The method is still consistent where the dataset is mutually integrated of either I(0) or I(1), and a combination of both I(0) and I(1) in the same model estimation. The Augmented Dickey Fuller (ADF), Philip Perron (PP) and Breakpoint unit root tests will be used in this study. The application of the Breakpoint unit root test is meant to account for structural break in the time series. The ARDL modeling approach have been proven to be potent and very effective in handling spurious regression, this is because the method can easily make up for the missing or omitted variables by its lags Engle and Granger (1987). This is ideal as studies have shown that omitted variables are the main causes of spurious regression Yule (1926) and Simon (1954) contrary to Granger and Newbold (1974). The method is also potent in testing the null hypothesis of no equilibrium relationship between the positive and negative levels of regressors and the dependent variable. In testing for this equilibrium relationship, this study shall apply the Bound F-statistics test (Fpss). The study used quarterly time series data that was originally in annual form but was converted to its quarterly form using Eviews. The data covers the following variables: actual Inflation rate, real exchange rate at purchasing power parity, local Interest rate, real Interest rate, total Import, total Export and Foreign Direct Investment. The span of this dataset ranges from 1981(Q1) to 2020(Q4), and were sourced from the World Bank Development Indicators (WDI) and can be accessed at https://wdi.worldbank.org. Accordingly, this study hypothesized a positive relationship between inflation and Exchange rate for the naira, Import and Export. While a negative relationship is hypothesized between the actual Inflation rate and the local Interest rate, real Interest rate and FDI.

The NARDL method assumes an asymmetric co-integration relationship which is stated below:

$$Y_t = \pi^+ X_t^+ + \pi^- X_t^- + \mu_t$$
(1)

Where Y_t, is the general price level (INFL), and $\sum X_{jt}$ is a 7×1 vector of explanatory variables which include exchange rate (EXCHR); Local interest rate (LINTR); Real interest rate (RINTR); Import (IMPORT); Export (EXPORT); Gross Domestic Product Growth Rate ((GDPGR); and Foreign Direct Investment (FDI), which is further decomposed into positive and negative partial sum processes. This is indicated by j which takes the values 1, 2, 3,…,7. This will allow this study to relate with positive changes (or increases) and negative changes (or decreases) in the explanatory variables. This is stated below as:

$$X_t = X_0 + X_t^+ + X_t^-$$
(2)

Where $X_t^+ = \sum_{j=1}^{t} \max(\Delta X_j, 0)$ and $X_t^- = \sum_{j=1}^{t} \min(\Delta X_j, 0)$ are the partial sum processes of the positive and negative movement (changes) in X_t. In line with Green-Nimmo and Shin (2013) and Ogbuabor, Orji and Anthony-Orji (2020), this study assumes X_0 to be the initial threshold value and thus, equal to zero. Δ is the first difference estimator while π^+ and π^- are the long-run asymmetric parameters. Also, notice that in equation (1) that the intercept is suppressed.

We transform equation (1) into a (p,q) NARDL model in the level form, in line with Green-Nimmo and Shin (2013) and Ogbuabor, Orji and Anthony-Orji (2020):

$$Y_t = \sum_{j=1}^{m} \delta_j Y_{i=j} + \sum_{j=0}^{n} (\pi_j^+ X_{i=j}^+ + \pi_j^- X_{i=j}^-) + \varepsilon_t \text{ (3)}$$

Where δ_j is used to capture the lag of the dependent variable; π_j^+ and π_j^- are the long-run asymmetric parameters of the independent variables and ε_t is taken to be an identically and independently distributed error term. Following Green-Nimmo and Shin (2013) and Ogbuabor, Orji and Anthony-Orji (2020), this study will make use of the general-to-specific lag selection approach for the purpose of model estimation. Furthermore, because the model equation (3) above can only account for the long-run equilibrium relationship, there is need to extent the modeling to both the short-run dynamic and long-run relationship as it is fitting for every good model. Thus, we state the long-run and short-run asymmetric of the NARDL which is expressed in error correction form as follows:

$$\Delta Y_t = \sigma Y_{t-1} \theta^+ X_{t-1}^+ + \theta^- X_{t-1}^- + \sum_{j=1}^{m-1} \delta_j \Delta Y_{i=j} + \sum_{j=0}^{n-1} (\varphi_j^+ \Delta X_{i=j}^+ + \varphi_j^- \Delta X_{i=j}^-) + \varepsilon_t \dots (4)$$

Where σ is the speed of adjustment; $\beta^+ = -\frac{\theta^+}{\sigma}$ and $\beta^- = -\frac{\theta^-}{\sigma}$; represent the asymmetric long-run parameters; φ_j^+ and φ_j^- represents the short-run parameters. The model equation (4) will be used to achieve the objective of this study. Furthermore, the standard wald restrictive test will be applied to check for null hypothesis of long-run symmetry i.e, $H_0: \beta^+ = \beta^-$ and the short-run additive symmetry i.e, $H_0: \sum_{j=0}^{m-1} \varphi_j^+ = \sum_{j=0}^{m-1} \varphi_j^-$. This study will further assess the existence of racketeering as well as rent-seeking behavior in the pricing system in Nigeria. The common principle for achieving this according to Ogbuabor, Orji and Anthony-Orji (2020) is to check if the positive short-run additive parameter is greater than the negative short-run additive

parameter, and if this difference is statistically significant and greater than zero. A statistically significant result is an indication of the prevalence of racketeering as well as rocket and feathers effect. This suggests that general price level (INFL) quickly responds to positive changes in exchange rate than negative changes in exchange rate (EXCHR). The same measure shall be applied for interest rates (LINTR and RINTR). In line with Ogbuabor, Orji and Anthony-Orji (2020), this study will check if there is an existence of market failure in Nigeria, which may assume the form of hoarding of foreign currencies thereby creating black market activities; smuggling activities; etc.

The study also exploited the dynamic multiplier graph to illustrate the nature of short-run and long-run asymmetry in the general pricing system in Nigeria. In essence it describes the rate of change (dynamic multiplier effects) on the general price level (INFL) brought about by ΔX_t^+ and ΔX_t^-. This relationship shall be achieved by the equations expressed below:

$$p_v^+ = \sum_{j=0}^{v} \frac{\partial Y_{i+j}}{\partial X_t^+} = \sum_{j=0}^{v} \frac{\partial Y_{i+j}}{\partial X_t^-}, \quad V = 0,1,2,...(5)$$

By implication, as $V \to \infty$, $p_v^+ \to \beta^+$ and $p_v^- \to \beta^-$.

V. ANALYSIS AND DISCUSSION OF FINDINGS

Table (i): Descriptive Statistics

	INFL	EXCHR	LINTR	RINTR	IMPORT	EXPORT	GDPGR	FDI
Mean	19.01083	102.4711	17.80362	0.738300	19.83487	28.33368	3.528562	2.790491
Median	12.90347	106.4643	17.40189	3.686666	19.50057	30.76862	3.444667	2.534126
Maximum	72.83550	382.6110	31.65000	25.28227	36.48173	51.73036	33.73578	10.83256
Minimum	5.382224	0.617708	8.916667	-43.5727	7.903450	9.218110	-13.1279	0.652160
Std. Dev.	15.82319	104.2895	4.482524	13.17951	7.557038	10.58804	6.205715	2.032448
Skewness	1.801573	1.077091	0.037514	-0.01381	0.403607	-0.115080	1.165621	1.640234
Kurtosis	5.025854	3.548496	3.452987	4.099299	2.180267	1.876101	8.663542	6.190364
Jarque-Bera	111.7758	32.32462	1.379154	34.79994	8.658263	8.609637	245.3805	136.9818
Probability	0.000000	0.000000	0.501788	0.000000	0.013179	0.013503	0.000000	0.000000
Sum	2984.700	16087.97	2795.169	115.9131	3114.075	4448.387	553.9843	438.1070
Sum Sq. Dev.	39058.22	1696704	3134.511	27097.12	8908.977	17488.64	6007.701	644.4117
Observations	157	157	157	157	157	157	157	157

The descriptive statistics from the original data for this study show that the average inflation rate (INFL) between 1981 and 2020 was 19.01, and the maximum and minimum inflation rates (INFL) are 72.83 and 5.38, respectively. The average exchange rate (EXCHR) between these periods is 102.47, with a maximum and minimum of 382.61 and 0.62, respectively. The implication of this outcome for the exchange rate (EXCHR) is that there were periods when the naira exchanged for as low as 0.62 for the dollar. Secondly, the huge gap between the maximum and minimum values of the exchange rate (EXCHR) indicates the volatile nature of the EXCHR in Nigeria. The average local interest rate (LINTR) for these periods is 17.80, while the maximum and minimum LINTR are 31.65 and 8.92, respectively. The real interest rate (RINTR) averaged 0.74 with a

he descriptive statistics from the original data for this study show that the average inflation rate (INFL) between 1981 and 2020 was 19.01, and the maximum and minimum inflation rates (INFL) are 72.83 and 5.38, respectively. The average exchange rate (EXCHR) between these periods is 102.47, with a maximum and minimum of 382.61 and 0.62, respectively. The implication of this outcome for the exchange rate (EXCHR) is that there were periods when the naira exchanged for as low as 0.62 for the dollar. Secondly, the huge gap between the maximum and minimum values of the exchange rate (EXCHR) indicates the volatile nature of the EXCHR in Nigeria. The average local interest rate (LINTR) for these periods is 17.80, while the maximum and minimum LINTR

are 31.65 and 8.92, respectively. The real interest rate (RINTR) averaged 0.74 with a maximum of 25.28 and a negative minimum (-43.57), implying that the incidence of inflation had often engendered losses for lenders. That is, there were periods when lending was not viable in Nigeria due to rising inflation. The average import (IMPORT) for the period is 19.83, while the maximum and minimum are 36.48 and 7.90, respectively. This implies that there has been remarkable growth in importation levels in Nigeria despite the fact that many of these importation activities are not accounted for due to smuggling. Furthermore, the value of export (EXPORT) indicates that the country's exports have been on the decline. This is evident as the average import shows 28.33 while the maximum and minimum values are 51.71 and 9.21, respectively. Similarly, the Gross Domestic Product Growth Rate (GDPGR) and Foreign Direct Investment (FDI) have been on the decline. This is as shown by the huge difference between their maximum and minimum values, whereas their average values are single digits. For GDPGR, the minimum value is negative, implying that Nigeria's GDP had during the periods under consideration witnessed negative growth.

Generally, the data for the study looks good with most of the variables having a positive skew except for RINTR and EXPORT that are negatively skewed.

Table (ii): Result of the Unit Root Tests

	ADF		PP		BREAKPOINT	
	Level	**First Difference**	**Level**	**First Difference**	**Level**	**First Difference**
INFL	-3.678***	-6.100***	-2.900**	-6.165***	-4.5870**	-7.3324***
EXCHR	0.499	-2.719*	2.349	-3.534***	-1.9582	-4.2282
LLINTR	-2.964**	-2.404	-2.424	-4.191***	-4.9038**	-3.6306
RINTR	-3.319**	-4.181***	-3.725***	-5.049***	-5.7285***	-4.5220**
LIMPORT	-2.178	-4.107***	-1.839	-4.302***	-2.9400	-4.2887
LEXPORT	-1.496	-4.679***	-1.041	-4.628***	-3.4609	-5.2556***
GDPGR	-3.049**	-4.125***	-3.411**	-4.484***	-3.9933	-5.2221***
FDI	-1.857	-3.602***	-1.704	-4.129***	-3.0713	-5.0532***

Note:* **, ** , * ** imply significance at the 1%, 5% and 10% level of significance. The lag length selection for the ADF and Breakpoint was based on the Schwarz Information Criterion (SIC) with maximum lag of 13, while the PP Bandwidth was based on Newey-West automatic using Bartlett Kernel.

The results of the unit root test indicate that with the ADF test, all the variables are integrated into I (1) at the 1% level of significance, with the exception of EXCHR and LLINTR. Although LLINTR is integrated of I (1) at the 5% level of

significance, the EXCHR is not. However, with the PP test, all the variables are integrated of I (1) at the 1% level of significance, with few, like INFL and RINTR, and GDPGR, showing integration of I (0) at 1% and 5% respectively. The Breakpoint test shows mixed stationary among the variables with the exception of EXCHR and LIMPORT which are not stationary at both I(0) and I(1). A further check showed that they are stationary at the I(2), giving us the notion that the ARDL can resolve any spurious regression at lag 2 or beyond. This result, however, shows that data for the variables has met the necessary unit root requirement for

the use of the NARDL model for estimating the objectives of this study.

Table (iii): Result of the LARDL Regression

Estimated parameters	EXCHR	LLINTR	RINTR	LIMPORT	LEXPORT	GDPGR	FDI
σ	-0.16***						
β^+	-0.01**	10.27***	-0.03**	-0.46	0.69	-0.06**	-0.66***
β^-	-0.10***	-6.10**	-0.02	1.06	-1.88***	-0.03	0.50***
$\sum_{j=0}^{m-1}\varphi_j^+$	-0.002***	-0.58	-0.005*	0.70*	0.11	-0.01**	-0.21***
$\sum_{j=0}^{m-1}\varphi_j^-$	-0.02***	2.02**	-0.004	-0.71***	0.14	-0.03***	0.25**
Symmetry Tests							
$H_0:\beta^+=\beta^-$	2.83***	4.90***	-0.41	-0.95	2.37**	-2.01**	-4.81***
$H_0:\sum_{j=0}^{m-1}\varphi_j^+ = \sum_{j=0}^{m-1}\varphi_j^-$	-2.69***	-1.32	0.45	2.63***	-1.95*	-6.37***	-2.81***
Diagnostic Tests							
$Fpss$	4.92 (14)						
BG$_{SC}$(NR^2)	3.88**						
$ARCH_H$	14.26***						
Rff	2.09 (0.151)						
$JBnorm$	110.07***						
$ADJ.R^2$	60						

Note: *, **, *** indicates statistical significance at the 10%, 5% and 1% levels. F_{pss} is the result of the Bound F test of cointegration proposed by Pesaran, Smith and Shin,; BG$_{SC}$(NR^2) is the Breusch-Geofrey test of serial correlation estimated with a lag of 2; $ARCH_H$ denotes the ARCH test of Heterescedasticity; R_{ff} is used to denote the Ramsey test for functional form (omitted variable test); JB_{norm} is the JB normality test and the ADJ. R^2 denotes the result of the Adjusted R^2 of the LARDL regression when expressed in testable form.
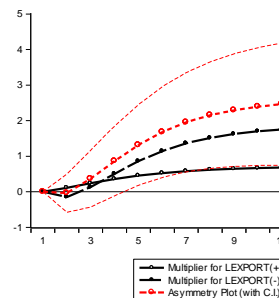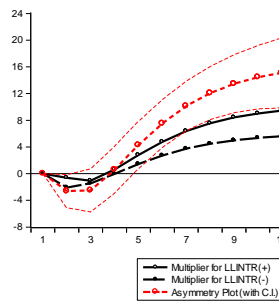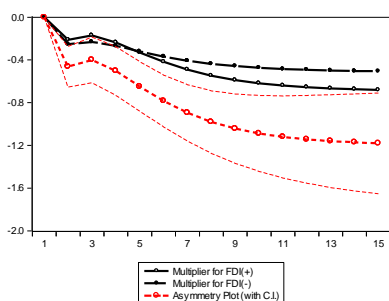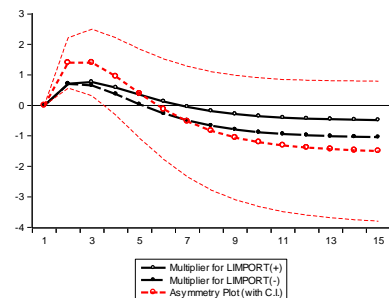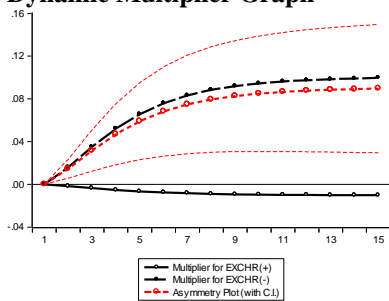
The result of the bound test (F_{pss}) indicates that there is a long-run relationship between the dependent variable and the independent variables at all levels of the critical upper bounds. The number in brackets indicates the number of independent variables used to estimate the bound F-statistics, which consist of the positive and negative of the various variables summed up to 14. With this outcome, we shall proceed to the estimation of the co-integrating equation for this study.

The result of the diagnostic test indicates the presence of serial correlation and heteroskedasticity as shown by the Breusch-Godfrey (BGSC (NR^2)) and (ARCH$_H$) tests, respectively. The Ramsey functional form (Rff) test result shows that there is no

omitted variable in the data generating process. Furthermore, the JB normality (JB$_{norm}$) test result indicates that the data generating process is normally stated. As a result of the presence of serial correlation and heteroskedasticity in the model, the White's heteroskedasticity-consistent standard error and covariance were applied to eliminate the effects of the same, thus leaving us with a consistent regression result that is suitable for policy purposes.

Dynamic Multiplier Graph

Note: That the two black thick lines represents the changes (dynamic multipliers) in the independent variables: while the broken thick line represent the negative changes, the unbroken line represent the positive changes. Similarly, the two thin red lines measure the standard error confidence intervals for the two thick black lines. Furthermore, the thick red line measures the difference between the two thick black lines.

The multiplier graph indicates that price levels (INFL) in Nigeria respond more to positive changes in EXCHR, thereby validating the existence of an asymmetric relationship both in the short-run and long-run. The local interest rate (LLINTR) shows a symmetric relationship in the short-run and an asymmetric relationship in the long-run. Thus, a rising interest rate will push up the general price level. The real interest rate (RINTR) showed a symmetric relationship in both the short-run and the long-run. While imports (LIMPORT) are asymmetric only in the short-run, exports (LEXPORT) are asymmetric only in the long-run. However, price levels (INFL) respond more to positive changes in LEXPORT. GDP growth rate (GDPGR) and Foreign Direct Investment (FDI) show asymmetry in both the short-run and the long-run. The presence of an asymmetric relationship between the multiplier effect of the positive and negative changes in the independent variable on the general price level (INFL) in Nigeria suggests the existence of price racketeering as well as possible rockets and effects on the country's pricing system, and this could be the result

of ineffective price regulation and lack of proper management of the macroeconomic variables, which are the basic tools for the stabilization of the economy. If these are checked, post-pandemic recovery will be a mirage for the country.

4.1 SHORT-RUN RESULT

The short-run result shows that both positive and negative exchange rates ($EXCHR^+$ and $EXCHR^-$) have a statistically significantly decreasing impact on price level (LINFL) as indicated by their respective coefficient values of -0.0016 and -0.0160, and t-values of -2.615 and -3.158. This implies that a unit increase in the exchange rate will reduce the general price level by less than 1%, whereas a unit decrease in the exchange rate will reduce the general price level by approximately 2%. The positive local interest rate ($LLINTR^+$) has no statistically significant impact on LINFL, while the negative local interest rate ($LLINTR^-$) has a positive and statistically significant impact on LINFL, as shown by their respective coefficient values; 0.5829 and 2.0112, and t-values of -0.406 and 2.202. Implying that a decreasing local interest rate has the potential to increase the general price level (LINFL) by 201%. At the 5% significance level, both the $RINTR^+$ and $RINTR^-$ have no statistically significant impact on the general price level (LINFL). $LIMPORT^+$ has no statistically significant impact on LINFL at the 5% percent significant level, whereas $LIMPORT^-$ has a negative significant impact on LINFL. This is as revealed by their respective coefficient values of 0.7001 and -0.7085, and t-values of 1.883 and -2.720. This result for $LIMPORT^-$ implies that a unit decrease in imports will bring about a 71% reduction in the general price level (LINFL) in Nigeria. This outcome conforms to the stipulations of economic theory. This is true as demand for foreign exchange is expected to fall as imports fall, thus reducing the price level. It is worthy of note that many of these imported commodities have local substitutes. Hence, the reduction in their imports will not automatically lead to a hike in prices. The results for both $EXPORT^+$ and $EXPORT^-$ show no statistically significant impact on LINFL in Nigeria. This seems to suggest that the country's exports do not have a significant influence on the general price level; this is validated by the fact that the Nigerian economy is a mono-economy which depends on crude oil exports alone as a source of foreign earnings. Furthermore, both $GDPGR^+$ and $GDPGR^-$ strongly impact on the general price level (LINFL) in Nigeria, just as their respective coefficient values of -0.010 and -0.029, and t-values of -2.519 and -3.262 show. This implies that any one unit change in GDP growth rate will reduce the general price level (LINFL) by 1%, and a unit decrease in GDP growth rate will equally reduce the general price level (LINFL) by about 3%. While the result of the positive change in GDP growth rate ($GDPGR^+$) conformed to a priori, that of the negative change in GDP growth rate ($GDPGR^+$) does not. This result could suggest that GDPGR does not directly influence the general price level (LINFL) in Nigeria. Both FDI^+ and FDI^- have a strongly significant impact on the general price level (LINFL) in Nigeria. While the FDI^+ impacts negatively on the (LINFL), the FDI^- impacts positively on LINFL. This is as revealed by their respective coefficient values of -0.2108 and 0.2543, and t-values of -2.960 and 2.360. This implies that an increasing FDI could bring about a 21% reduction in LINFL, while a decreasing FDI

could result in a 25% fall in LINFL. Both results are in tune with a priori expectation.

4.2 LONG-RUN RESULT

The results of the long-run equation show that both the positive and negative exchange rates (EXCHR$^+$ and EXCHR$^-$) have a statistically significantly decreasing impact on the price level (LINFL) as indicated by their respective coefficient values of-0.0099 and-0.0987, and t-values of-2.359 and-2.645. Similarly, both the positive local interest rate (LLINTR$^+$) and the negative local interest rate (LLINTR$^-$) have a statistically significant impact on LINFL. While the LLINTR$^+$ increases LINFL by about 1026, the LLINTR$^-$ decreases LINFL by 609% as revealed by the respective coefficient values of 10.2660 and-6.0976. This is highly significant as the t-values of 4.385 and-2.534 also show. The outcome of the local interest rate conforms to a priori. This is because a lower interest rate encourages local investment, which will further revitalize local industries and boost local output. When this happens, there will be a cut in importation, especially when the outputs are those that were being imported. This could also attract foreign direct investment and stimulate the production of export commodities.

The positive real interest rate (RINTR$^+$) has a negative significant impact on LINFL while the negative real interest rate (RINTR$^-$) has no statistically significant impact on LINFL at 5% significance. Both IMPORT$^+$ and IMPORT$^-$are statistically insignificant. Although this result for imports is far from expectations, the possible reason is racketeering, which takes the form of smuggling through the borders of the country. Thus, many products being imported are not accounted for. Another reason for insignificant import results may be the activities of importers and their clearing agents who make false or under declaration of container contents. Finally, these results may also suggest that the activities of the government in revitalizing the agricultural and industrial sectors are yielding positive outcomes. Similarly, EXPORT$^+$ is not statistically significant, but EXPORT-impacts significantly on LINFL in a negative fashion. This outcome is in line with expectations; this is because Nigeria has a mono-economy with oil as the main export commodity. Thus, the economy is import-driven. The only way the results of the import and export will be possible is if, in the long-run, the self-sufficiency efforts of the economy in terms of revitalizing the industrial sector become fruitful. At this point, the economy may not export much and imports will be drastically reduced. GDPGR$^+$ will significantly reduce the general price level in the long-run by about 6%, as indicated by the coefficient value of -0.0620, whereas GDPGR$^-$ is statistically insignificant in the long-run. This result is in conformity with a priori. The long-run result for foreign direct investment shows that both FDI$^+$ and FDI$^-$ significantly impact on the general price level (LINFL). While FDI$^+$ leads to a reduction in the general price level in Nigeria by 65%, FDI$^-$ raises the general price level by 50%. FDI is a potential economic tool to remedy the country's worsening inflation and, thus, a viable instrument for the post-pandemic recovery in Nigeria.

The error correction parameter (σ), shows that the speed of adjustment to the long-run equilibrium is 16%. This is a demonstration of sluggishness in convergence, hence, portraying the existence of market failure in Nigeria. R^2 falls between 67% and 97%, which is quite good because it falls within the acceptable region. The rest of the measures of goodness of fit of the model for this study and the data used all indicate that they are all normal.

VI.   SUMMARY, CONCLUSION AND RECOMMENDATIONS

In seeking to unravel the role of the increasing price level and exchange rate in the post-pandemic recovery in Nigeria, this study was undertaken to examine the impact of the exchange rate on the general price level (inflation), and to check if price racketeering exists in the Nigerian pricing system. Quarterly time series data was applied to estimate the Non-linear Autoregressive Distributed-Lag (NARDL) Model using Eviews 9.0. The result of the Bond co-integration test shows that there is a long-run relationship between general price level (LINFL) and the regressors. The long-run results show that, with the exception of RINTR$^-$, LIMPORT$^+$ and LIMPORT$^-$, EXPORT$^+$, and GDPGR$^-$, which are statistically insignificant, the rest of the variables are statistically significant and impact on the general price level (LINFL) in varying ways, at the 0.05 level of significance. The short-run results show that EXCHR$^+$ and EXCHR$^-$, LLINTR$^-$, LIMPORT$^-$, GDPGR$^+$ and GDPGR$^-$, and FDI$^+$, and FDI$^-$ significantly impact on the general price level (LINFL) in Nigeria, at the 0.05 level of significance. The Wald short-run restrictive additive test of symmetry shows that, with the exception of RINTR and LLINTR, the rest of the regressors significantly contribute to price racketeering in the Nigerian market. Similarly, the long-run result shows that LLINTR, EXPORT and FDI create occasions for price racketeering in Nigeria's domestic market. This finding from the Wald restriction test portents that even with the return to full economic activity in the post-pandemic period, the general price level will not immediately return to the pre-pandemic level, and this will likely hinder the speedy post-pandemic recovery of the economy. Supporting this Wald restrictive additive test of symmetry result is the result error correction parameter, which shows that the speed of adjustment is sluggish, being less than 50%, suggesting the existence of market failure in Nigeria. Thus, suggesting the need for an effective price control system in Nigeria.

the study thus, recommend for effective price regulation in the country with strict measures to ensure compliance. furthermore, the incidence of smuggling should be checked while improving local production through the revival of the various industries as this will cut down importation and improve export capacity. finally, measures should be put in place to restore investors' confidence as this will encourage fdi in nigeria.

REFERENCES

Achouak, B., Ousama, B., & Mourad, Z. (2018). Exchange rate volatility and economic growth. *Journal of Economic Integration, 33*(2), 1302-1336. https://www.jstor.org/stable/26431809

Adesoji, O. F., Simplice, A. A. (2020). The economic consequences of the Covid-19 pandemic in Nigeria. *SSRN Electronic Journal.* Available at: https:// www.researchgate.net/publication/342518936

Adetiloye, K. A. (2010). Exchange rates and the consumer price index in Nigeria: a causality approach. *Journal of Emerging Trends in Economics and Management Sciences,* 1(2), 114-120.

Adetiloye, K. A. (2010). Exchange Rates and the Consumer Price Index in Nigeria.: A Causality Approach. Journal of Emerging Trends in Economics and Management Sciences (JETEMS), 1(2): 114-120. https://hdl.handle.net/10520/EJC133837

Babatunde, W.A., & Olufemi, M.S. (2014). Monetary Policy Shocks and Exchange Rate Volatility in Nigeria. Asian Economic and Financial Review, 4(4): 544-562.

Dickson, O. O., & Andrew, U. (2013). Exchange rate volatility effect on trade variations in Nigeria. *Mediterranean Journal of Social Sciences, 4*(6), 401-415. https://doi.org/10.5901/mjss.2013.v4n6p401.

Engle, R. F. & Granger, C. W. J. (1987). Co-integration and Error Correction: representation, Estimation and Testing, *Econometrica*, 55: 251-276. http://dx.doi.org/10.2307/1913236.

Eze, G. P., & Markjackson, D. (2020). Foreign Exchange Rate and Consumer Price Changes in the Nigerian Economy. Saudi Journal of Economics and Finance, 4(2): 64-71. https://doi.org/10.36348/sjef.2020.v04i02.001

Gidigbi, M.O., Babarinde, G.F., & Lawan, M.W. (2018). Inflation and Exchange Rate Volatility Pass-Through in Nigeria. Journal of Management, Economics, and Industrial Organization, 2(3): 18-40. http://doi.org/10.31039/jomeino.2018.2.3.2

Granger, C.W.J. & Newbold, P. (1974). Spurious regressions in Econometrics. *Journal of Econometrics*, 2(1), 111-120.

Greenwood-Nimmo, M. and Y. Shin (2013) taxation and the Asymmetric Adjustment of Selected Retail Energy Prices in the UK, Economics Letters, 121(3): 411-416. https://doi.org/10.1016/j.ecolet.2013.09.026

Jian, Z (2008). Effect of exchange rate, inflation and wages on the purchasing power of consumers in different economics. *The Global Conference on Bureau & Economics,* USA. Available at: https:// www.gcbe.us›Jian Zhang

Musa, N. (2021). Impact of Exchange Rate Volatility on Inflation in Nigeria. Journal of Contemporary Research in Business, Economics and Finance, 3(1): 26-38. https://doi.org/10.33094/26410265.2021.31.26.38.

Njoku, C. O., & Nwaimo, C.E. (2019). The Impact of Exchange Rates on Inflation in Nigeria. Journal of Management studies and Economic Systems, 4(3): 171-195.

Nkoro, E., & Uko, A. K. (2016). Exchange rate, inflation and stock price stability. Evidence from Nigeria (1986-2012). *Journal of Applied Finance and Banking, 6*(6), 57-70.

Nwachukwu, T., (2017). The Impact of Variations in Exchange Rate on Price Stability in Nigeria. Journal of Business and African Economy, 3(1): 37-60.

Nwosa, I.P., & Oseni, O.I. (2012). Monetary Policy, Exchange Rate and Inflation Rate in Nigeria: A Co-integration and Multi-Variate Vector Error Correction Model Approach. Research Journal of Finance & Accounting. 3(3): 62-70.

Obiekwe, E., & Osabunhien, E. (2016). *Exchange rate pass-through, exchange rate volatility and inflation rate in Nigeria.* Paper presented at the Proceedings of the 3rd International conference on African Development Issues. Covenant University, Nigeria.

Ogbuabor, J. E, A., Orji and O. I., Anthony-Orji (2020) Are anticompetitive behaviours rampant in global retail energy markets? A study of price elasticity, asymmetric price adjustment and rent-seeking. *Energy Research & Social Science,* 70.https://doi:10.1016/j.erss.2020.101783

Ogundipe, A. A., Egbetokun, S. (2013). Exchange rate pass-through to consumer prices in Nigeria. *European Scientific Journal,* 9(25), 1857-7431. http://www.scientificpapers.org

Okere, K.I., Muoneke, O.B., & Onuoha, F.C. (2021). Symmetric and asymmetric effects of crude oil price and exchange rate on stock market performance in Nigeria: Evidence from multiple structural break and NARDL analysis, *The Journal of International Trade & Economic Development*, 30(6), 930-956. https://doi.org/10.1080/09638199.2021.1918223.

Pesaran, M. H, Y. Shin and R. J, Smith (2001) Bound Testing Approach to the Analysis of level Relationships, Journal of Applied Econometrics, 16(13): 289-326. https://doi.org/10.1002/jae.616

Shin, Y, B. Yu and M. J. Greenwood-Nimmo (2013) Modelling ASSymmetric Cointegration and Dynamic Multipliers in a Nonlinear ARDL framework, in: W.C Horrace, R.C.

sickles (Eds.) Festschrift in Honour of Peter Schmidt: Econometric Methods and Applications, Springer Science and Business Media, New York. Pp 281-318. https://doi.org/10.1007/979-1-4899-8008-3_9

Simon, H.A. (1954). Spurious Correlation: A Causal Interpretation, *Journal of the American Statistical Association*, 49(267), 467-479. https://doi.org/10.1080/09638199.2021.1918223.

Viola, A. P., Klotzle, M. C., Pinto, A. C., & Gaglianone, W. P. (2017). Predicting exchange rate volatility in Brazil. Brasilia Working Paper Series No 466,1-40.

Yakub, M. U., Sani, Z., Obiezue, T. O., & Aliyu, V. O. (2021). Empirical investigation of exchange rate volatility and trade flows in Nigeria. *Central Bank of Nigeria Economic and Financial Review, 57*(1), 25-46. https://doi.org/10.33094/26410265.2021.31.26.38

Yule, G. (1926). Why do we Sometimes get Nonsense-Correlations between Time-Series? A Study in Sampling and the Nature of Time-Series. *Journal of the Royal Statistical Society, 89*(1),1-63. https://doi.org/10.2307/2341482

Zidek, L., & Suterova, M. (2017). Did the exchange rate intervention enhance inflation in Switzerland? *Journal of Economic Studies, 43*(4), 203-221.

AUTHORS

First Author – **Chukwuemeka Valentine Okolo (MSc),** School of Economics and Finance, Xi'an Jiaotong University, China, Email address: okolojunior@outlook.com

Second Author – **Stephen Obinozie Ogwu (MSc),** Department of Economics, Kingsley Ozumba Mbadiwe University, Ideato, Imo State, Nigeria. Email: stephenobinozie1@gmail.com.

Third Author – **Afamefuna A. Eze (MSc),** Department of Economics, University of Nigeria, Nsukka, Nigeria. Email: angus.eze@unn.edu.ng

Fourth Author – Stella Nonye Agubata (Ph.D.), Department of Accountancy, Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State, Nigeria. Email: **sn.agubata@coou.edu.ng**

Fifth Author – Joshua Chukwuma Onwe (MSc), Department of Economics and Development Studies, Alex Ekwueme Federal University Ndufu Alike, Ikwo Ebonyi State, Nigeria. Email: onwejosua@gmail.com

Correspondence Author – Afamefuna A. Eze, Department of Economics, University of Nigeria, Nsukka, Nigeria. Email: angus.eze@unn.edu.ng. Phone contact: +234(0)7068021915. https://orcid.org/0000-0003-1163-372X