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Assessment of exchange rate determination in a mono-resource economy: A case of Nigeria

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ABSTRACT

This study examined the determinants of the exchange rate in a mono-resource economy, during the period of currency and oil price fall in Nigeria. The aim of the study is to ascertain the potentiality of economic diversification (non-oil export) in saving the falling value of the domestic currency, as well as, its stability. The study employed the use of monthly data from the Central Bank of Nigeria and Nigeria National Petroleum Corporation from January 2008 to December 2020 using the ARDL and NARDL models to achieve the stated objectives. In the literature, several empirical studies analyzed the relationship between exchange rates, oil price, and oil export and came to the logical conclusion that a rise in the price of oil would bring about a rise in the exchange rate, all things being equal while the reverse is the case. To add to the existing body of knowledge this study did not only look at the relationship between the variables but also examined the determinants of the exchange rate in a mono-resource economy and ascertained the potentiality of economic diversification in bringing succor to the falling exchange rate in the midst of falling oil price. The NARDL result corroborates the findings of previous studies on the relationship between exchange rate, oil price, and the performance of non-oil export. It maintains that positive changes in oil prices would lead to the appreciation of domestic currency while negative changes in oil prices would lead to the depreciation of the domestic currency. With this analysis, the study recommends the diversification of the economy and revitalization of the non-oil sector. Since import proves to have a negative impact on the exchange rate, the revitalization of the non-oil sector stimulates domestic consumption and thus reduces import bills which raise the demand for the dollar and weakens the naira.

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1. Introduction

Among the macroeconomic indicators in an economy, the exchange rate is found to be one of the most influential variables that exert widespread impacts on an economy. The exchange rate in an economy exerts influence on the current account via the balance of payment, international transactions, external competitiveness, and also the general price level. In this case, an exchange rate is a major tool that the monetary authorities need to wield in their routine macroeconomic management duties. The behaviour of this macroeconomic variable to a very large extent determines how other numerous macroeconomic variables behave in an economy. In view of this, the subject of the exchange rate has become an interesting topic of debate among academicians and policymakers who aim at finding the real function and determination of this all-influential macroeconomic variable, especially in a mono-resource economy with challenges of the twin fall of resource (Oil) price and domestic currency (naira) (Alley, 2018; Oaikhenan and Aigheyisi, 2015). The keen interest in the exchange rate as an influential macroeconomic variable has led policymakers and academicians to conduct several kinds of research on its determination and how it affects the overall economy.

In international finance, the interactions between the agents in the global foreign exchange market meet to determine the exchange rate as what needs to be paid for international currency by the local currency. In Nigeria, the exchange rate between the naira and the dollar is determined by the interaction of the demand and supply for the US dollar in the foreign exchange (FOREX) market. When there is a need for imports, it results in a demand for US dollars to purchase foreign goods. On the other hand, the US dollar proceeds from exports serve as the source of supply for US dollars in the foreign exchange market. (Alley, 2018).

Nigeria's economy, being a monocultural or mono-resource economy depends solely on oil. Oil dominated the country's export, earnings from FOREX, as well as revenues for the government by about 80.0 per cent. As a result, the determination of exchange in Nigeria cannot be possible without the major role played by oil prices and exports. Several studies on oil price-exchange rates and macroeconomic variables were investigated within the country-specific and multi-country frameworks. Other studies concentrated on oil-exporting countries. Among the country-specific studies are Adeniyi et al (2012); Dregera et al. (2016); Alley (2018); Babatunde (2013). Those that concentrated on the multi-nation context include: (Bal and Rath (2015); Benbouziane and Benamar (2007); Muhammad et al (2011); Basher et al (2016); Egert and Morales (2005); Aimer (2016)). While studies that dwelt on oil-exporting countries include: (Buetzer et al., 2012; Akram and Holter, 1996) who analyzed the exchange rate determination via oil price and discovered mixed results.

Despite the findings of some of these studies (Akram and Holter, 1996; Buetzer et al., 2012), which show that oil price fluctuations have no effect on exchange rates, others (such as the ones mentioned above) reach the opposite conclusion. Babatunde (2013), Adeniyi et al. (2012), Basher et al. (2016), Chen and Chen (2007), and Olomola and Adejumo (2006) are among those who draw conclusions about the impact of oil price fluctuations on the exchange rate. They contend that the exchange rate increases when there is a positive shock to the price of oil, particularly in oil-exporting nations. In another development, Muhammad et al. (2011); Huang and Guo (2007); Ghosh (2011); Akram (2004) argue that the exchange rate depreciates when there is a positive shock to oil prices in oil-importing countries. Hasanov and Samadova (2010) conducted a thorough investigation into how exchange rates affect non-oil sectors in oil-rich economies, and the results indicate that export performance suffers when the exchange rate increases. In addition, the studies show that non-oil export particularly and total export generally have been affected negatively when the rate of exchange adds value in Azerbaijan (Majidli and Guliyev 2020), Indonesia (Heru et al., 2023) Cameroun (Amin, 1996), Iran (Masoud and Rastegari, 2008; Sabuhi and Piri, 2008), Algeria (Sorsa, 1999), Mexico (Ros, 1993) and Nigeria (Oyejide, 1986; Ogun, 1998; Osuji, 2015; Abolagba et al., 2010; Alalade, Adekunle, and Joseph, 2014).

Although several research has investigated the correlation between exchange rates and oil prices as well as

between exchange rates and the performance of non-oil sector exports, very few, including Alley (2018), have examined the relationships between oil prices, exchange rates, and economic performance through diversification. In fact, the analysis of Alley (2018) concentrated on aggregating current accounts which may suffer from aggregation bias. The analysis of this linkage in the context of the Nigerian economy is scarce. The importance of economic diversification in aiding the domestic currency on the global foreign exchange market, particularly in the period of the falling price of crude oil cannot be overemphasised. Analyzing the relationship between these three key macroeconomic variables (exchange rate, oil price, and diversification) has a lot of policy implications ranging from stabilising the exchange rate, enhancing competitiveness, and improvement on the economic performance of the economy. In addition, the study uses a non-ARDL which derives asymmetric cumulative dynamic multipliers that allow the possibility of tracing-out the asymmetric adjustment trends of the dependent variable in the event of positive and negative shocks to the independent variables.

This has huge appeal in terms of theoretical underpinning as it guarantees the chance to depict in an intuitive manner the traverse to a new equilibrium following a perturbation to the system. The overall combinations of long-run and short-run asymmetry can easily be accommodated because of the flexibility of the NARDL framework. These are the areas this paper is trying to address and contribute to the extant body of knowledge both theoretical and empirical. This research makes significant contributions to understanding the relationship between exchange rates, oil prices, and non-oil export performance in the context of economic diversification's impact on preventing domestic currency depreciation. The main contributions of this paper are as follows: (i) The study rigorously investigates the correlation between exchange rates, oil prices, and non-oil export performance. By doing so, it sheds light on how economic diversification measures can influence and potentially safeguard the value of the domestic currency from falling. (ii) Building upon the work of Alley (2018), the study modifies and adapts the model for the current account. The revised equation captures the functional influence of the price of oil, real oil export, non-oil export, import, and net trade balance (current account) on the exchange rate. Notably, the study disaggregates current accounts into external reserves, foreign direct investment (FDI) capital flows, and other components to gain a comprehensive understanding of the underlying dynamics. (iii) The study employs a rich dataset comprising monthly variables from January 2008 to December 2020. This timeframe coincides with the period marked by the twin decline in oil prices and the domestic currency, enabling a comprehensive assessment of the effects under consideration. By combining these contributions, this research contributes to the body of knowledge on how economic diversification efforts can influence exchange rates, non-oil exports, and ultimately impact the stability of the domestic currency during times of volatile oil prices. The findings will provide valuable insights for policymakers and economists aiming to develop effective strategies for economic diversification and currency value protection.

In order to obtain robust estimates for policy implications, the paper investigates the long-run relationship between exchange rate and its determinants which underscores the significance of the results. The questions underpinning this study include: (i) what determines the exchange rate in a mono-resourceful economy during the period of falling oil prices and domestic currency? (ii) Can economic performance via diversification save the situation in terms of reducing the fall in the value of the domestic currency? (iii) Is the NARDL a better estimation technique than the ARDL in nonlinear macroeconomic variables? The major objectives of the study are to (i) Examine the determinants of the exchange rate in a mono-resourceful economy during the period of falling oil prices and domestic currency (ii) To examine whether economic performance via diversification can save the situation and reduce the adverse fall in the value of the domestic currency. (iii) To investigate whether the NARDL is a better estimation technique than the ARDL in non-linear macroeconomic variables. The arrangement of the paper is as follows: following the introduction in section one is the theoretical and empirical review in the section which occupies section two. The methodology of the paper is situated in section three whereas section four takes data

analysis, results, and interpretation of findings. The section takes the conclusion with the policy implications of the paper.

2. Theoretical and Empirical Frameworks

2.1. Conceptual, theoretical, and empirical frameworks

One of the important macroeconomic factors that bear on the utility function of almost all agents of economics is the exchange rate between currencies, of which the consumption basket includes traded international commodities with regards to local currency against international currencies, exchange rates tend to impact the prices of export, prices of import, trade terms amongst other local macroeconomic variables. The significance of this variable for trade and capital flows is that it has encouraged the creation of numerous models of its behaviour, causes, and effects. Among the models in which exchange rate influences are exchange rate determination models of monetary theory, the models of portfolio theory, the models that have to do with currency substitution as well as the models of the current account. MacDoal (2000) posited that the model of monetary theory consists of two variants. One is the flexible price approach's monetary modelling, and the other is the sticky price approach's monetary modelling. While the flexible monetary approach forecasts that the differential between countries' outputs, money supplies, and nominal interest rates determine exchange rates between two currencies, the sticky price monetary approach on the other hand sees the differences in domestic and foreign interest rates, relative money balances, outputs, commodity and bond prices, and relative marginal costs of consuming domestic and foreign goods as the primary influences on exchange rates.

MacDonald (2000) further stressed that currency pricing dynamics are majorly determined by foreign financial assets based on the portfolio balance and currency substitution models. According to this theory, changes in relative returns on financial assets held and exchange rate fluctuations are a result of the foreign currencies and their fluctuations that economic agents own. Such capital flows that exist between countries are a result of the adjustments made by the economic agents. Therefore, capital flows have a crucial impact on the determination of currency exchange rates.

The current account model therefore theoretically shows the linkage between the exchange rate, the balance of current account, and the import and export. According to Pilbea's (2006) model, the current account refers to the balance between the amount of money a country receives from exporting goods and services and the amount it spends on importing goods and services, both in foreign currency. In this situation, the spot exchange rate market acts as a platform where domestic currency can be exchanged for foreign currency, enabling the payment of import bills (MacDonald, 2000). The current account and capital account are symmetrical in absolute terms at the equilibrium point of the balance of payments (Obstfeld and Rogoff, 1996). In an economy that is under the regime of fixed exchange rate, foreign exchange reserves come into the relationship since exchange rate is being managed by the adjustments in foreign exchange reserves (Tang and Fausten, 2006). In this case, Alley and Poloamina (2015) concluded that the current account and changes in foreign exchange reserves determine the capital account.

The determination of exchange rates and their macroeconomic effects have been empirically investigated in a number of studies. Some of these studies are those that examined changes in exchange due to changes in oil prices for both countries that export and those that import oil. These studies indicate that the impact of oil prices on the exchange rate varies significantly between countries that export oil and countries that import it. While Alley (2018); Alley et al. (2014); Aliyu (2009) posits that economic growth is positively driven by positive changes in oil price in an oil exporter and brings about the appreciation of the domestic currency, Jimenez-Rodriquez and Sanchez (2005); Barsky and Kilian (2004); Sauter and Awerbuch (2002); Mordi and Adebiyi (2010) on the other hand emphasized that economic growth is negatively influenced by positive changes in the price of oil and, as a result, causes exchange

rates to weaken and the inflation conditions of oil-importing nations to worsen. (Riti and Kamah, 2015; Balcilar et al., 2018).

Numerous studies have been conducted by various researchers to explore the impact of the exchange rate on the economy and trade. In oil-exporting economies, non-oil response to changes in the exchange rate has been given a lot of consideration. Some of the researchers that focus on the effects of exchange on the economy particularly trade agree that external competitiveness and non-oil revenue reduce when the exchange rate appreciates (Anning et al, 2016; Riti, 2013). On the other hand, trade is enhanced, and export is encouraged in the presence of exchange rate depreciation (Riti, 2013). While Mouna and Reza (2001) in their studies of some selected African economies discovered that exports of manufactured goods are affected positively due to the depreciation of their currency, Abeysinghe and Yeok (1998) on the other hand, discovered that Singaporean exports did not fall when its domestic currency appreciated. This kind of mixed findings is due to the reliance of export on imported inputs, and the exchange rate appreciation positively determines the import of the inputs.

Other researchers such as Broda and Romails (2004) discovered that trade is being affected in a negative way by changes in exchange rate because the generated ambiguity stimulates trade to exchange rate risks. Several other studies such as Doyle (2001); Bredin and Murphy (2003) are of the view that volatility in exchange rate affects trade positively. Inflation, investment both foreign and domestic investment, employment, and economic growth are some of the macroeconomic variables that exchange rate influences. Still, volatility in the exchange rate can lead to a fall in the foreign direct investment inflow, domestic investment, employment, productivity growth, and economic growth in general (Feldmann, 2011; Ogunleye, 2009; Schnabl, 2009; Bleaney and Greenaway, 2001; Aghion et al., 2009; Bagella et al., 2006; Ghura and Greene, 1993).

The connections between oil prices and exchange rates become essential to understand the impact of crude oil markets on the real economy (Huang et al., 2020). Specifically, unravelling the interactions between oil prices and exchange rates in different economies, such as oil exporters and importers, can aid in formulating appropriate macroeconomic policies. However, these interactions are complex to observe due to the influence of multiple factors on oil prices (e.g., supply and demand, economic growth, geopolitics) and exchange rates (e.g., international trade, inflation, and government debt). Additionally, common factors like GDP, interest rate, commodity markets, stock markets, and unforeseen events further complicate the understanding of how exchange rates respond to oil prices and vice versa (Wesseh and Lin, 2018; Beckmann et al., 2020; Jain and Biswal, 2016; Husaini and Lean, 2021; Wang et al., 2022). Consequently, the relationship between oil prices and exchange rates remains ambiguous.

The strength and flexibility of revenue from export and bill from imports are critical in the exchange rate volatility. This arises because of the meaning of exchange rate being the price rate of currency given another currency and the role played by the interplay of demand for foreign exchange (import) as well as the supply of foreign exchange (export). This analysis shows that the level of diversification of the base of an economy serves as a basis on which these interactions lean.

The more an economy is diversified the more the inter-sectoral nexus gains and alliances and less when an economy is less diversified. According to Siegel et al. (1994), an economy that is diversified does not only promote a stable economy but can in addition promote growth sustainability. In the words of Papageorgiou and Spatafora (2012), when an economy is less diversified, the resultant effect is minimal sustainability in growth. While Imbs and Wacziarg (2003) on the other hand asserted that a higher level of per capita income when there is a rise in economic diversification. In addition to the higher income that results from the processes of stable economic growth that come from diversification, diversification also leads to more employment opportunities (Hvidt, 2013; GSDP, 2011). Economic diversification can enhance long term economic growth and a stable economy by generating higher levels of sectoral development and causing growth through experiential learning gains, wider information symmetry access as well as increased perspective for discovering one's individuality (Leiderman and William, 2007;

Hesse, 2008; Alley, 2018; Gelb, 2013).

According to Papageorgiou and Spatafora (2012), economic diversification is a comprehensive concept that involves diversifying across multiple sectors of the economy. This includes diversification in production, consumption, as well as trade structures and patterns. Although these concepts are individually different from each other, however, they are economically interwoven in practice. In the words of Esanov (2013), economic diversification is perceived in two aspects: one, diversification in the area of products, and two, in terms of export. He further stressed that diversification in products has to do with domestic diversification that is, diversification in production and consumption while export diversification is related to trade diversification. His fundamental argument is that although trade diversification is driven by product diversification, trade diversification is very important because of its visibility and direct link to exchange rate dynamics and hence, attracts attention. In this regard, a lot of research on diversification dwells on export diversification because indications have shown clearly that the real sectors of the economy have been diversified.

Several ways and techniques have been applied by different researchers to measure diversification. However, the method adopted in empirical research depends on the objective of the research in question. Some of the measures are based on indices, but others are not. The majority of index-based measures are used in industrial organisation research. This is due to the fact that they are frequently used when a study's main focus is on the analysis of competition and market power concentration. Among the index-based measures include the Ogive Index (Jackson, 1984; Grossberg, 1982; Rodgers, 1957; Tress, 1938; McLaughlin, 1930), the Entropy Index (Smith and Gibson, 1988) and the Herfindahl Index (Scherer, 1980).

The Location Quotient and Hachman Index of the Economic Base Theory, the National Average Index of Regional Business Cycle Theory, the National Growth Effects for the ith sector (NGEi), the Industrial Mix Effects for the ith sector (IMEi), and the Competitive Share Effects (CSE) of the Trade Theory are additional measures also referred to as the originating theories that diverge from the industrial organization theory (DBEDT, 2011). The Portfolio Theory, the Location Theory, the Economic Development Theory, and the Input-Output Model are some other theories that underlie other diversification measures in addition to the originating theories. In mono-resource economies, the desire for trade or diversification of export has always been a cause for concern, particularly when the price of commodities is being driven by unfavourable shocks from the dependent resource. This is because the effects of such shocks in an economy is overblown when very few commodities detect the pace of foreign exchange and fiscal revenues in such an economy. Therefore, to capture the process of diversification, such countries look at the extent to which production and exportation of products in the non-dominant sectors are employed. Therefore, the rate of growth of the non-oil sector in absolute and relative terms as well as its level of international competitiveness determine the degree of diversification in an economy like Nigeria that is solely dependent on oil. In this regard, DBEDT (2011) argues that the absolute and relative growth of the non-dependent sector and its measure of export performance may be helpful because using index-based measures like the Ogive Index, Entropy Index, and Herfindahl Index to analyze the diversification process on the growth of the economy and price stability may not produce consistent results.

3. Methodology

3.1. Source and description of data

This study uses monthly data from the Central Bank of Nigeria (CBN) Statistical Bulletin, and the Nigeria National Petroleum Corporation (NNPC) Statistical Bulletin, with a time span from January 2008 to December 2020. The study obtains data on Exchange Rate (ER), Current Account (CU), Oil Price (OP), Non-Oil Export (NOX), Oil Export (OX), Total Import (IM), Foreign Reserve (FR), Equity-FDI (EQ) and Capital-FDI (KA). All the selected data

are transformed into natural logarithms to be interpreted as elasticities. Therefore, the choice of these variables is based on their relevance in understanding the dynamics of exchange rate determination in a mono-resource economy like Nigeria. Each variable is selected for its potential impact on the exchange rate and its connection to the economic context of Nigeria as a mono-resource-dependent nation.

3.2. The empirical model

The study adopts and modifies the model of the current account equation used by Alley (2018). This model offers the theoretical framework for investigating the relationship between the exchange rate, the price of oil, and diversification as measured by non-oil exports. In a mono-resource economy like Nigeria, the current account, which is the difference between exports and imports, becomes an appropriate equation to trace the effects of the underlying determinants of the exchange rate. This is made possible by breaking down export into oil export (and then further into real oil export and oil price) and non-oil export equation.

$$CU_t = EX_t - ER_t IM_t \tag{1}$$

Where:

CU = Current account

EX = Export in US dollars

ER = Exchange rate ($/#)

IM = Import in US dollars

To find the determinants of the exchange rate, equation (1) is rearranged in such a way that exchange is a function of the current account, export and import. This yield:

$$ER_t = \frac{EX_t - CU_t}{IM_t} \tag{2}$$

This functional relationship can be expressed as:

$$ER_t = f(CU_t, IM_t, EX_t) \tag{3}$$

To capture the influence of economic diversification, export is further divided into oil and non-oil export, thus:

$$EX_t = OX_t + NOX_t \tag{4}$$

To further capture the impacts of oil prices, oil export is divided into:

$$OX_t = OP_t, ROX_t \tag{5}$$

ROX_t = Real oil export

Putting equations (4) and (5) into (3) yields:

$$ER_t = (CU_t, IM_t, NOX_t, ROX_t, OP_t) \tag{6}$$

To obtain the modified version of Alley (2018), the current account is replaced, and equation (6) becomes:

$$ER_t = (FR_t, KA, EQ, IM_t, NOX_t, ROX_t, OP_t) \tag{7}$$

where

FR = Foreign reserve

KA = Capital-FDI

EQ = Equity-FDI

The current account variable accounts for how capital flows affect foreign reserves. The capital account may have contributed to this, but the current account may also have played a role in the corresponding change in foreign reserves. Therefore, the current account variable has consistently captured the effects of capital flow components like FDI, portfolio equity, debt, etc. as well as those of changes in foreign reserves. Furthermore, since the official rate is managed by changes in foreign reserves, any effects of the official rate (whether on the nexus or the black-market rate) have been absorbed in changes in foreign reserves, which are then reflected in the current account. Therefore, the variables are supported by the literature.

3.3. Method of analysis

In this section, the Nonlinear Autoregressive Distributed Lag Model (NARDL) is presented and discussed. For robustness, Auto Regressive Distributed Lag Model (ARDL) is also discussed and applied.

3.3.1. Autoregressive-Distributed Lag Model (ARDL)

The Autoregressive-Distributed Lag model (ARDL) developed by Pesaran et al. (2001) allows the analysis of both short- and long-run effects using linear and symmetric bases. The use of variables with various orders of integration is also permitted, in addition to variables that are stationary only in second differences.

$$\Delta Y_t = \alpha_t + \sum_{n=0}^{k} \beta_{12t} \Delta X_{t-n} + \delta_{21t} Y_{t-1} + \delta_{22t} X_{t-1} + \varepsilon_{1t} \tag{8}$$

Equation (8) represents the ARDL equation. The operator "Δ" indicates the first differences. The symbol α_t indicates the constant, β_{ket}, $k = 1, 2$ and $e = 1,.., m$ indicates the short-run coefficients, δ_{ket}, $k= 1, 2$ and $e =1,.., m$; indicates the long-run coefficients.

3.3.2. Asymmetries and Nonlinearity – The Nonlinear Autoregressive Distributed Lag (NARDL) model

Asymmetry refers to both positive and negative changes in the variables. This fundamental idea served as the foundation for Schorderet and Yann's definition and organization of the nonlinearity concept in 2001. In order to uncover relationships between variables that were "hidden" in the linear version, nonlinearity emerged as a novel and significant method of analysis. In light of this, it can be concluded that variations in explanatory variables have an impact on dependent variables in various ways. Schorderet and Yann (2001) used the idea of nonlinearity in the following ways:

$$x_t = \alpha + y_t^{+} + y_t^{-} + y_0 + \varepsilon_t \tag{9}$$

In equation (9), y_t is decomposed into: $y_t = y_t^{+} + y_t^{-} + y_0$ where y_t^{+} and y_t^{-} are partial sums of processes of positive and negative changes in y_t respectively. The sum process is described by the following equation:

$$y_t^{+} = \sum_{n=1}^{t} \Delta y_n^{+} = \sum_{n=1}^{t} max[\Delta y_n, 0] \tag{10}$$

$$y_t^{-} = \sum_{n=1}^{t} \Delta y_n^{-} = \sum_{n=1}^{t} min[\Delta y_n, 0] \tag{11}$$

The co-integration between the ascending and descending variables was discovered by Granger and Yoon in

2002, who also developed this concept. With the long-run equation shown below, Schorderet (2003) generalized the "hidden co-integration":

$$z_t = \alpha_0{}^+ x_t{}^+ + \alpha_0{}^- x_t{}^- + \alpha_1{}^+ y_t{}^+ + \alpha_1{}^- y_t{}^- \tag{12}$$

Please note that y_t is considered asymmetric co-integrated if z_t is stationary. Short-run symmetric can also be analyzed with the constringent of $\alpha^+ = \alpha^-$, where δ indicates the short-run coefficient. Long-run multipliers (elasticities) are calculated using the following equations:

$$\partial^+ = -\frac{\alpha^+}{\rho} \tag{13}$$

$$\partial^- = -\frac{\alpha^-}{\rho} \tag{14}$$

The Wald test is used to determine whether long-run symmetry exists $\partial^+ = \partial^-$. The null hypothesis is a symmetric relationship, indicating that the decomposition of the variable is inappropriate (Chattopadhyay et al., 2015), obtaining the χ^2, and indicating the signification level.

Shin et al. (2014) proposed the nonlinear ARDL model. This technique combines the ARDL linear standard method with the hidden co-integration idea. Considering that all the previously mentioned properties of the ARDL can also be used in the NARDL, the ARDL model satisfies the requirements to merge the hidden co-integration analyzes.

The NARDL enables four different analyzes of the independent variable. At various points during the analysis, the various signs could be obtained in the short- and long-run as well as simultaneously in the variable's ascending and descending movement. For example, Chattopadhyay et al. (2015); Kumar (2017); Tang and Bethencourt (2017) are recent works that demonstrate the application of this new methodology. Long-run symmetry tests are put into place to validate the model's correct properties and the existence of "hidden co-integration".

$$\Delta Y_t = \alpha_t \sum_{n=0}^{k} \beta_{12t} \Delta X^+{}_{t-n} + \sum_{n=0}^{k} \beta_{13t} \Delta X^-{}_{t-n} + \delta_{14t} Y_{t-1} + \delta_{15t} X^+{}_{t-1} + \delta_{16t} X^-{}_{t-1} + \varepsilon_t \tag{15}$$

Equation (15) represents the standard NARDL equation. The operator "Δ" denotes the first differences. The α_t indicates the constant, , $k=$ 1, 2 and e =1,.., m indicates the short-run coefficients, , k = 1, 2 and e =1,.., m; indicate the long-run coefficients. The symbols "+" and "-" indicate the positive and negative changes respectively.

The linear ARDL allows for the inclusion of dummy variables, short- and long-run analyzes, co-integration identification, and the incorporation of variables with various orders of integration. Additionally, the model's (ECM) adjustment speed can also be obtained. The inability of linear ARDL to analyze series volatility is one of its limitations. For instance, the ARDL is unable to differentiate between the expansionary and contractionary effects of a trend on a variable such as investment. The limitation can be circumvented by the NARDL, making it possible to differentiate between the changes. Thereby making policymakers create more targeted policies by analyzing ascending and descending moments. Also, the co-integration hidden in the ascending and descending moments can be uncovered.

4. Data Analysis

The data analysis section begins by analyzing the data results of descriptive statistics and correlation matrix of all the variables in order to ascertain the relationships. This is to give the study a clear understanding of the data

patterns and the types of estimations and diagnostics that are made. Below are the results of the descriptive and correlation matrix.

4.1. Descriptive analysis

A preliminary analysis of the data in the form of descriptive statistics was performed to provide an overview of the study's data (or to provide a more precise understanding of the distribution of the variables). The monthly data for the period (January 2008 - December 2020) is used to calculate all the statistics using the observations in the study sample. The study looked at mean, maximum, minimum values, standard deviation, and Jarque-Bera statistics as descriptive statistics.

The descriptive statistics results presented indicate that the minimum and maximum values of the current account (CU) in Nigeria during the period were -4749.63 and 5998.98 billion naira respectively. The current account has an average value of 1725.96 billion Naira over the period, with a standard deviation of 2014.47, indicating that the data deviate from the mean on both sides. Given that the standard deviation is higher than the mean value, it can be inferred that the current account balance was widely dispersed during the study period. The descriptive normality result shows that the current account balance is normally distributed as captured by the Jarque-Bera probability value of 0.6000, greater than 0.05 significant values.

Table 1. Descriptive statistics.

Variable	Mean	Maximum	Minimum	Std. Dev.	J-Bera (P-value)
CU	1725.96	5996.98	-4749.63	2014.47	1.0216 (0.6000)
NOX	408.26	2034.08	117.41	341.78	581.0364 (0.0000)
OP	87.29	141.26	31.21	28.75	8.5856 (0.0136)
IM	4613.41	8443.46	2611.43	1236.59	7.7044 (0.0212)
ROX	5964.50	10098.96	2235.39	2063.35	6.4484 (0.0397)
EQ	1.83E+08	2.00E+09	256464.9	2.44E+08	3646.13 (0.0000)
KA	4940393	92668387	0	11798511	4029.673 (0.0000)
FR	39016.66	62081.86	23689.87	9485.00	8.301247 (0.0157)
ER	165.53	309.7304	117.7243	40.3046	221.7776 (0.0000)

Source: Authors' Computation.

Table 1 further shows that non-oil export (NOX) has minimum and maximum values of 117.41 and 2034.08 billion naira, respectively. During the period, non-oil exports had an average value of 408.26 billion Naira with a standard deviation of 341.78 billion Naira. This suggests that the data from the non-oil export is not widely dispersed from the mean during the sampled period, as the standard deviation is lower than the mean value. Furthermore, the Jarque-Bera p-value of 0.0000 indicates that the 0.05 significant level of the Gaussian distribution assumption of normal data is not satisfied.

Also, as can be observed from Table 1 the descriptive results for oil price (OP) shows that it has a minimum and maximum values of 31.21 and 141.26 US dollars respectively. The average value of the oil price during the period is 87.29 UD dollars with a standard deviation of 28.78 US dollars. This suggests that oil price is not widely dispersed during the period under study as the standard deviation is less than the mean value. The probability value of Jarque-Bera captured by 0.0136 also implies that the Gaussian distribution assumption of the normal data on the oil price is not met.

Furthermore, the total import (IM) for the period ranged from 2611.43 billion Naira to 8443.46 billion Naira, with the minimum and maximum values being those amounts. The data on total imports during the sampled period have an average value of 4613.41 and a standard deviation of 1236.59 billion Naira. As the standard deviation is less than the mean value, this suggests that the data on total imports are not widely dispersed during the sampled

period. The Gaussian distribution assumption of normality is not upheld for total import, according to the p-value of 0.0212 for Jarque-Bera.

With regards to oil export (ROX), it could be observed from the descriptive results that oil export has minimum and maximum values of 2235.39 and 10098.96 billion Naira respectively. The mean value of oil export during the period is 5964.50 with a standard deviation of 2063.35 billion Naira. This suggests that the data for oil export does not widely deviate from the mean of the sample. More so, the p-value of 0.0397 for Jarque-Bera which is less than the 0.05 significant levels suggests that the data is not normally distributed.

In addition, equity-FDI (EQ) from the descriptive statistics shows that the minimum and maximum values are 25644.9 and 2.00E+09 billion Naira respectively. The average value of equity during the period is 1.83E+08 with a standard deviation of 2.44E+08 billion Naira, implying that the data on equity is widely dispersed during the sampled period, as the standard deviation is relatively greater than the mean value. The p-value of 0.0000 for Jarque-Bera which is less than the 0.05 significant levels suggests that the normality distribution assumption is not met.

Capital-FDI (KA) on the other hand shows that the minimum and maximum values are 0 and 92668387 billion Naira respectively. The mean value of debt during the period stands at 4940393 with a standard deviation of 11798511 billion dollars, an indication of large variances of the data around the average value. This further shows that debt is widely dispersed during the sampled period. The p-value of the Jarque-Bera (0.000) which is less than the 0.05 significant levels implies that the data is not normally distributed.

Foreign reserve (FR) from Table 2 also shows minimum and maximum values of 23689.87 and 62081 billion naira respectively. The mean value of foreign reserve during the period stands at 39016.66 with a standard deviation of 9485.00 billion Naira, implying that the data on the foreign reserve is not widely dispersed around the mean value, as the standard deviation is less than the mean value. The p-value 0f 0.0157 for Jarque-Bera which is less than the 0.05 significant levels indicates that the data is not normally distributed.

Lastly, with regard to the exchange rate (ER), it could be observed from the descriptive results that the exchange rate ($/#) has minimum and maximum values of 117.72 and 309.73 Naira per dollar respectively. The mean value of the exchange rate during the period is 165.53 with a standard deviation of 40.30 Naira per dollar, implying that the data for exchange rates is not widely dispersed from the mean of the sample. The p-value of 0.0000 for Jarque-Bera implies that the normal distribution assumption is not met for the exchange rate.

4.2. Correlation matrix results

A correlation matrix of the variables is conducted in order to identify the relationships between the variables. The direction and strength of an association are indicated by the sign and magnitude of the correlation coefficient, respectively. The correlation is stronger and weaker depending on how close the correlation coefficient value is to one (± 0.50 to ± 0.99) and how close it is to zero (± 0.01 to ± 0.49). Thus, Table 2 presents the correlation analysis between the exchange rate and its factors in a mono-resource economy in Nigeria.

The correlational results in Table 2 indicate that negative relationships exist between exchange rates and some of the determinants. However, the relationship between current account, equity-FDI, capital-FDI (KA), non-oil export, and total import and the dependent variable (exchange rate) are weak and stand at -0.485, -0.202, -0.165, 0.178, and -0.250 respectively. The relationship between foreign reserve, oil price, and oil export are, however, strong though in the negative, positive, positive direction and stand at -0.712, 0.541, and 0.588 respectively. Therefore, among the eight correlations of interest, the correlation between foreign reserve and exchange rate is the strongest, followed by oil export and exchange rate then oil price and exchange rate in that order.

4.3. Stationarity (Unit Root) test results

Table 2. Correlation matrix result.

Variable	ER	CU	EQ	FR	KA	NOX	OP	ROX	IM
ER	1								
CU	-0.485	1							
EQ	-0.202	0.114	1						
FR	-0.712	0.555	0.368	1					
KA	-0.165	0.118	-0.031	-0.030	1				
NOX	0.178	0.338	-0.069	0.114	-0.040	1			
OP	0.541	0.708	0.091	0.392	0.282	0.334	1		
ROX	0.588	0.796	0.052	0.411	0.273	0.301	0.938	1	
IM	-0.250	-0.087	-0.116	-0.156	0.267	0.224	0.541	0.488	1

Source: Authors' Computation.

The unit root test is used in the study to determine the order of integration of individual time series in order to check for stochastic non-stationary behavior in the series. All of the model's variables were put through a stationary test as part of the study. According to Granger and Newbold (1974) and Granger (1986), all regression results with non-stationary time series deviate from the accepted theory of regression with stationary series. In other words, regression coefficients for non-stationary variables will be spurious and misleading.

Therefore, the Perron (2006) unit root technique is used to pre-test the data's time series properties. In comparison to the standard Augmented Dickey Fuller (ADF) test, the Perron unit root test technique offers a more reliable result and takes structural breaks into account. The Perron test offers two break dynamics: (1) the additive outliers (AO) model, which captures a sudden change in the mean of a series (or assumes the breaks occur immediately); and (2) an innovational outliers (IO) model, which allows for a gradual shift in the mean of the series (that is, it assumes that the break occurs gradually, with the breaks following the same dynamic path as the innovations). The Perron unit root test result is presented in Table 3:

Table 3 shows that the null hypothesis of a unit root is rejected for the levels of the lnCU, lnNOX, lnEQ, and lnKA variables for both the innovational outlier model and the additive outlier model. The break dates of these variables under innovational outlier model are 2018/4, 2018/6, 2009/9 and 2011/8 for lnCU, lnNOX, lnEQ and lnKA respectively. The break dates for these same variables under the additive outlier model are 2014/12, 2018/4, 2009/9 and 2010/6 respectively. However, lnFR, lnROX and lnOP, tend to be stationary at first difference for both innovational outlier model and additive outlier model. The break dates for lnFR, lnROX and lnOP under the innovational outlier model are 2016/5, 2009/5 and 2016/1 respectively. The break dates of these same variables under the additive outlier model are 2016/5, 2009/5 and 2009/9. In addition, while lnER is stationary at levels under the innovational outlier model with break date of 2019/5, it is stationary at first difference under the additional outlier model with a break date of 2018/2.

More so, while lnIM is stationary at levels under the additive outlier model with a break date of 2018/8, it is stationary at the first difference under the innovational outlier with a break date of 2015/3.

4.4. Co-integration test results and estimation of coefficients using ARDL and NARDL

The ARDL-bound testing approach, which demands that each variable in the equation be static either at level or at modification, was satisfied by the fact that each variable is integrated in a different order. Testing for the stationarity properties of the variables in the bounds approach to co-integration serves this purpose because ARDL-bounds testing only becomes applicable in the presence of I(0) and I(1) variables or a combination of both. It is important to stress that it is helpful to establish the existence of co-integration among the variables of interest. If co-integration exists among the variables, establishing an ARDL error correction model is appropriate. Table 4 summarises the results of the ARDL-bounds testing co-integration.

Table 3. Perron (2006) unit root test result with structural breaks.

Innovational Outlier				Additive Outlier			
Variable	t-stat	Break date	I(d)	Variable	t-stat	Break date	I(d)
lnER	-4.972*	2019/5	I(0)	lnER	-3.184	2018/9	I(1)
-	-	-	I(1)	ΔlnER	-7.919*	2018/2	I(1)
lnFR	-4.175	2015/7	I(0)	lnFR	-3.644	2015/5	I(0)
ΔlnFR	-7.927*	2016/5	I(1)	ΔlnFR	-8.047*	2016/5	I(1)
lnCU	-7.284*	2018/4	I(0)	lnCU	-7.701*	2017/12	I(0)
lnIM	-4.027	2018/8	I(0)	lnIM	-5.818*	2018/8	I(0)
ΔlnIM	-16.057*	2015/3	I(1)	-	-	-	-
lnNOX	-12.811*	2018/6	I(0)	lnNOX	-13/004*	2018/4	I(0)
lnROX	-3.407	2017/9	I(0)	lnROX	-3.360	2017/8	I(0)
ΔlnROX	-12.855*	2009/5	I(1)	ΔlnROX	-13.023*	2009/5	I(1)
lnOP	-3.328	2010/9	I(0)	lnOP	-3.941	2014/12	I(0)
ΔlnOP	-6.911*	2016/1	I(1)	Δ lnOP	-6.895*	2009/6	I(1)
lnEQ	-9.920*	2009/9	I(0)	lnEQ	-10.111*	2009/9	I(0)
lnKA	-8.365*	2011/8	I(0)	lnKA	-9.234*	2010/6	I(0)

Source: Authors' Computation.

Table 4. ARDL and NARDL-Bounds tests for Co-Integration.

ARDL-bounds tests for co-integration					
Model	F-stat	K	5% sig Level I(0) I(1)		Decision
ER, lnCU, lnOP, lnROX, NOX, lnIM	4.101**	5	2.62	3.79	CE exists
ER, lnFR, lnOP, lnROX, NOX, lnIM	3.146	5	2.62	3.79	No CE
ER, lnFR, lnEQ, lnOP, lnROX, NOX, lnIM	2.658	6	2.45	3.61	No CE
ER, lnFR, lnEQ, lnKA, lnOP, lnROX, NOX, lnIM	0.835	7	2.32	3.50	No CE
ER, lnCU, lnFR, lnEQ, lnKA, lnOP, lnROX, ENOX, lnIM	1.098	8	2.02	3.39	No CE
NARDL-bounds test for co-integration					
ER, lnCU+, lnCU-, lnOP+, lnOP-, lnIM+, lnIM- lnNOX+, lnNOX-, lnOP+, lnOP-, lnROX+, lnROX-	4.787*	12	1.63	2.79	CE exists

*Source: Authors' Computation Note: ** denotes significance at 5 % level.*

From Table 5 the co-integration test result demonstrates that in all the six ARDL models, only the first model (ER, lnCU, lnOP, lnROX, NOX, lnIM) indicates that the null hypothesis of no co-integration is rejected, whereas the other five ARDL models indicate that the null hypothesis of no co-integration cannot be rejected at 5% significance level. The findings show that the F-statistic values of 4.101 and 4.787 for the first model's ARDL and NARDL, respectively, are higher than the upper bound, or I(1) critical value, at even a 1% significance level. The null hypothesis that there is no long-term relationship is thus rejected. Therefore, it can be assumed that the variables are co-integrated and that between January 2008 and December 2020, the exchange rate and its determinants (current account, oil price, oil exports, non-oil exports, and total imports) have a long-run equilibrium relationship.

Given the co-integrating relationship between the exchange rate and its determinants (current account, oil price, oil exports, non-oil exports and total imports), the study goes to estimate the error correction and the long run model using both ARDL and NARDL to also ascertain which of the approach produces more convincing and robust estimates. The ARDL-ECM and the NARDL-ECM results investigate how the models change to the long-run equilibrium. Hendry's (2005) general-to-specific modeling approach is used to derive a satisfactory parsimonious result for the exchange rate-oil-diversification nexus. Table 5 displays the result of the short-run and long-run dynamic policy modeling that was reduced. For comparison, Table 5 shows the relationship between the exchange rate, oil price, non-oil export, a measure of economic performance through diversification, and oil export and import,

which are examined within the ARDL and NARDL models. While the ARDL model reveals information about the nexus in both the short and long terms, the NARDL model also reveals information about the nexus's asymmetry—that is, the effects of independent variables' positive and negative changes on the dependent variable. The short-run effects of the oil price, oil exports, non-oil exports, current account, and import on the exchange rate are shown in Table 5 for both the ARDL and NARDL models. The findings demonstrate that the exchange rate is influenced not only by macroeconomic fundamentals but also by recent values (trend) in addition to these. This suggests that some explanatory factors had an impact on both the trend and the exchange rate.

Table 5. Short run and long run estimates of both ARDL and NARDL.

ARDL SR-coefficients			ARDL LR-coefficients		
Variable	Coefficient	P-value	Variable	coefficient	P-value
$\Delta ER(-1)$	0.442*	0.0000	C	-0.0362**	0.050
$\Delta ER(-2)$	-0.300*	0.0013	lnCU	0.0009	0.132
$\Delta lnIM$	-0.0007	0.3561	lnIM	-0.0014	0.3434
$\Delta lnNOX$	0.0002	0.4910	lnNOX	0.0004	0.4986
$\Delta lnOP$	-0.0002***	0.0730	lnOP	-0.0005	0.1152
$\Delta lnROX$	0.0004*	0.0083	lnOX	0.0076**	0.0211
$\Delta lnCU$	-0.0004	0.8433			
ECM(-1)	-0.048*	0.0031			
NARDL SR Coefficients			NARDL LR Coefficients		
Variable	Coefficient	P-value	Variable	coefficient	P-value
$\Delta ER(-1)$	0.6671*	0.0000	C	0.029*	0.0000
$\Delta lnOP+(-4)$	0.0008**	0.0468	lnCU+	0.005**	0.0364
$\Delta lnCU-(-2)$	0.0007*	0.0080	lnCU-	0.003	0.1254
$\Delta ER(-3)$	0.3177*	0.0044	inIM+	0.007	0.5331
$\Delta ER(-2)$	-0.1888***	0.0666	lnIM-	0.003	0.7175
$\Delta lnROX+(-3)$	-0.0006*	0.0012	lnNOX+	0.002**	0.0246
$\Delta lnIM+(-3)$	-0.0002**	0.0362	lnNOX-	-0.006*	0.0162
$\Delta lnROX-(-1)$	-0.0008*	0.0037	lnOP+	0.009*	0.0003
$\Delta lnCU-(-4)$	0.0008.*	0.0056	lnOP-	-0.001**	0.0199
$\Delta lnROX+(-2)$	-0.0006*	0.0012	lnROX+	0.005*	0.0100
$\Delta lnOP-(-2)$	0.0009*	0.0092	lnROX-	-0.006**	0.0148
$\Delta lnROX-(-4)$	-0.0008*	0.0005			
$\Delta lnROX+(-1)$	-0.0005**	0.0146			
$\Delta lnCU+(-3)$	0.0007***	0.0556			
$\Delta lnOP-$	-0.0005***	0.0714			
$\Delta lnOP-(-1)$	0.0011*	0.0016			
$\Delta lnROX-(-2)$	-0.0007**	0.0115			
$\Delta lnROX-(-3)$	-0.0007*	0.0016			
ECM(-1)	-0.343*	0.0000			

*Source: Authors' Computation - Note: *, ** denotes significance at 1% and 5 % level respectively.*

From the short-run analysis and under the ARDL model, results indicate that the exchange rate is rather influenced more by trend (its immediate past values) than macroeconomic fundamentals. A 100% rise in the first and second past value of the exchange rate would lead to an appreciation and depreciation of the naira by 40% and 30% respectively at the 0.01 significance level. On the other explanatory variables, only the price of oil and oil export are significantly influencing the exchange rate. A 100% rise in oil price and real oil export would lead to a 0.02% and 0.04% depreciation and appreciation of the naira respectively. This result on the negative impacts of oil price on exchange rate agrees with earlier research by Mordi and Adebiyi (2010), Barsky and Kilian (2004), Sauter and Awerbuch (2002), and Jimenez-Rodriquez and Sanchez (2005), which found that increases in oil prices have been shown to have a negative impact on economic growth and lead to exchange rate depreciation. The outcome, however,

conflicts with studies by Alley (2018), Babatunde (2013), Adeniyi et al. (2012), Basher et al. (2012), Chen and Chen (2007), and Olomola and Adejumo (2006), which contend that positive oil price shocks result in an appreciation of the domestic currencies of oil exporting countries. Real oil export has positive effects on the exchange rate. Real oil exports would increase by 100%, which would result in a 0.04%-point increase in the exchange rate. This suggests that an increase in real oil exports boosts export revenues and the supply of dollars, which lowers the price of dollars in naira and invariably appreciates the exchange rate. The result further shows that the exchange rate is not significantly influenced by non-oil export, current account balance, or import in the short analysis of the ARDL model. As expected, the ARDL-ECM is negative, less than unity, and statistically significant at 1%. The coefficient (-0.048) shows that once the system is in disequilibrium, the long-run relationship between the exchange rate and its determinants (oil price, real oil export, current account balance, import, and non-oil export) must be restored at an average (monthly) speed of 4.8%.

In other words, when the relationship between the exchange rate and its determinants is above or below the equilibrium level, the system adjusts itself by approximately 4.8% within the first month to ensure full convergence to its equilibrium level. This finding agrees with the fact that a highly significant ECM proves the existence of long-run relationship between the dependent variable and independent variables; its ability to adjust from disequilibrium state towards equilibrium (Bannerjee, Dolado and Mestre, 1998).

The short-run analysis of the NARDL model in Table 5 shows some interesting results as well. Apart from the exchange rate inertia which shows appreciation and depreciation of the naira at the first and second lagged values (0.667 and -0.188) respectively, other macroeconomic fundamentals (oil price, real oil export, non-oil export, current account balance and import) also exert impacts on exchange rate both positive and negative (asymmetry). A 100% rise in oil price lagged 4 indicates an increase in the supply of dollar, hence, appreciation of the naira by 0.80% points while a decrease in oil price lagged 1 and 2 shows that exchange rate appreciates by 0.10% and 0.091% points respectively. However, lagged 3 of a 100% fall in oil price would lead to naira depreciation by 0.50% point. Table 5 further reveals that a positive change in real oil export lagged 1 to 3 would lead to a fall in the value of the naira. In a similar manner, a negative change in real oil export would lead to the depreciation of the naira. The implication is that a fall in real oil export cannot generate the needed revenue to attract the rise in the supply of dollars. Positive change in import shows that exchange rate depreciates by 0.02% point. Both positive and negative rise in current account balance indicate that the naira appreciates. Non-oil export (economic diversification) does not exert influence on exchange rate in the short run using the NARDL model, just like the ARDL model. The NARDL-ECM model displays more adjustment mechanism than the ARDL-ECM model. The value stands at -0.343, indicating that it takes the model 34.3% (monthly) speed to adjust towards equilibrium when there is disequilibrium.

The long-run coefficients of the ARDL with respect to the linkage between exchange rate and its determinants are also presented in Table 5. The oil price has negative, albeit insignificant effects on the exchange rate in contrast to its short-run coefficient. The negative and insignificant results of oil price effects on exchange is contrary to the findings of Alley (2018); Alley et al. (2014); Aliyu (2009) who assert that it has been demonstrated that positive oil changes have a positive impact on economic growth in oil-exporting countries. Real Oil export significantly contributes to exchange rate appreciation; with a 100% rise in real oil export, the exchange rate would appreciate by approximately 0.76% points. Total import has negative albeit insignificant effects on exchange in line with economic theory. The negative effects of total import on the exchange rate imply that an increase in import raises more demand for dollars thus leading to the fall in the value of the naira, all things being equal. Non-oil export and current account balance have insignificant positive effects on exchange rates in the long run under the ARDL model, in line with their short-run effects.

The long-run coefficients of the NARDL model in Table 5 show that both positive and negative changes in oil price have significant effects on exchange rate. The asymmetry result of the NARDL shows that a 100% positive

change in oil price would lead to a 9.0% increase in the value of the naira while a 100% negative change in the price of oil would bring about a fall in the value of the naira. With these findings, exchange rate has proven to be driven by oil price in a mono-resourceful economy like Nigeria. When oil price rises/falls, more/less supply of dollar is obtained, and the naira appreciates/depreciates as a result. In the same vein, Real oil export effect on exchange is significant. A 100% positive change in real oil export would lead to a 0.50% increase in the value of the domestic currency while the symmetry of the result shows that a 10% negative change in real oil export would bring about a 0.70% fall in the value of the domestic currency. The significant effect of real oi export on exchange rate is an indication that oil export revenue is driven by oil price. Increase in economic diversification proxied by non-oil export by 100% would lead to the appreciation of the naira by 0.20% points while a 100% negative shock on non-oil export would bring about a fall in the naira by 0.60% points. This analysis outcome suggests that non-oil export as a proxy for economic diversification provides the necessary shock absorber for the exchange rate in the event of a fall in the price of oil. It also reduces the rate of currency instability. When oil price crashes, economic diversification has the potential of saving the domestic currency due to its ability to attract more dollar supply. On the other hand, the import coefficient under the NARDL appreciates the naira which is contrary to the ARDL results and also contrary to economic theory.

Overall, the first research question/objective of the study is met where the major determinants of the exchange rate in a mono-resourceful economy such as Nigeria are the oil price, real oil export, and non-oil export. The findings also answered the second research question/objective of the study where economic diversification is found to save the situation in terms of providing save landing to the exchange rate during the period of fall in the price of oil. The third research question/objective is also answered by the findings of the analysis where the NARDL through its asymmetry analysis provides better coefficients than the ARDL

5. Conclusion and Policy Implications

In this study, we examined the determinants of the exchange rate in Nigeria, a mono-resource economy, during a period of falling oil prices. The primary objective was to assess the potential of economic diversification, particularly non-oil exports, in mitigating the depreciation and instability of the domestic currency. Monthly data from the Central Bank of Nigeria and Nigeria National Petroleum Corporation spanning from January 2008 to December 2020 were used, and both ARDL and NARDL models were employed to achieve the research objectives.

The existing literature has explored the relationship between exchange rates, oil prices, and oil exports, indicating that a rise in oil prices generally leads to an appreciation of the exchange rate, while a decline in oil prices has the opposite effect. Building on the existing knowledge, our study delved deeper by investigating the determinants of the exchange rate in a mono-resource economy and assessing the potential role of economic diversification in counteracting the falling exchange rate during periods of declining oil prices. This aspect of the research is critical as the role of economic diversification in the existing relationship between these variables had not received sufficient attention.

The utilization of both ARDL and NARDL models allowed us to analyze short- and long-run effects and establish relationships between variables, uncovering hidden patterns not evident in the linear version. The findings from the NARDL analysis were consistent with previous studies, reaffirming that positive changes in oil prices tend to appreciate the domestic currency, while negative changes lead to currency depreciation.

Based on the research findings, we propose the following policy recommendations to address the challenges posed by falling oil prices on the exchange rate and enhance the stability of the domestic currency:

- The government should prioritize and invest in diversifying the Nigerian economy beyond oil. This can be achieved by supporting and incentivizing non-oil sectors, such as agriculture, manufacturing, technology, and

services. A diversified economy is more resilient to external shocks and reduces dependency on oil revenues, thereby mitigating exchange rate fluctuations.

- Policymakers should develop strategies to boost non-oil exports. This may include offering export incentives, improving export infrastructure, and exploring new markets for Nigerian products. Strengthening the non-oil export sector can lead to increased foreign exchange earnings, supporting a more stable exchange rate.

- Encouraging import substitution industries can help reduce the demand for foreign currency and, in turn, lessen the pressure on the domestic currency's value. By supporting local production and consumption, Nigeria can decrease its reliance on imports and enhance its balance of trade.

- The Central Bank of Nigeria should maintain a consistent and transparent monetary policy to manage exchange rate fluctuations. Effective coordination of monetary policies, including interest rates and foreign exchange interventions, can contribute to exchange rate stability.

- Structural reforms aimed at improving the business environment, infrastructure development, and ease of doing business can attract foreign direct investment and foster economic diversification. These reforms can lead to increased productivity and competitiveness across various sectors of the economy.

- While diversifying the economy, attention should also be given to diversifying the range of non-oil exports. Relying on a broad range of export products can provide resilience against fluctuations in global commodity prices and strengthen Nigeria's position in the international market.

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Declaration of Competing Interest

All the authors claim that the manuscript is completely original. The authors also declare no conflict of interest.

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