
EXCHANGE RATE AND INCOME DISTRIBUTION IN NIGERIA

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Abstract

This work examined the correlation between exchange rate and income distribution in Nigeria between 1990 and 2021, applying Autoregressive Distributed Lag (ARDL) Bound testing technique. In specific terms, the objective of the study is to examine the impact of devaluation or depreciation of the naira on income inequality in Nigeria. The results from the empirical analysis show that devaluation or depreciation of the naira deteriorates income distribution and by extension amplifies income inequality. Evidence from the data analysis also indicates that, in the long-run, increases in per capita income reduced the spread and magnitude of income inequality. However, the short-run outcome is different, because the result shows that for exchange rate depreciation to exacerbate income inequality, it must persist in the long-run, while short-term devaluation or depreciation does not worsen income inequality. In addition, increases in domestic investments, educational attainment and trade openness (globalisation) reduce income inequality in the long run. The recommendation occasioned from the outcome of the work is that the Federal Government of Nigeria should be circumspect with devaluation or depreciation of the naira, because of the adverse impact such policies has on income distribution and the country's Gini coefficient. In addition, the government should pursue sustainable economic growth policies because of the positive effects of such policies on income inequality.

Keywords: Exchange Rate Volatility, Income Distribution, Domestic Investment, Bound Testing analysis.

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Introduction

The exchange rate is among the key macroeconomic variables that monetary authorities attempt to manage because it influences the performance of the aggregate economy and concomitant effect on citizens' welfare. At the basic level, it is the price of a country's currency and its interrelation with the currency of another country. It is a salient macroeconomic variable for policy-making and economic reforms. Governments take interest in it because it is a very important price. The two concepts of exchange rates are; nominal and real exchange rates. Nominal Exchange Rate (NER) refers to the relative price of two currencies, e.g. the US dollar and the Nigerian naira, whereas Real Exchange Rate (RER) represents the relative price of two tradeable commodities (import & export) concerning non-tradable goods and services (i.e. goods & services produced and consumed within a domestic economy). Its volatility or fluctuations represents risks incidental to unforeseen swings in exchange rate dynamics. Exchange rates wield pervasive leverage over germane fundamental macroeconomic indices such as interest rates, inflation rates along with a balance of payments. It provides the fulcrum for international trade. The volatility of exchange rates occasioned by economic or institutional factors has a substantial impact on social welfare. The effect varies in line with subsisting economic cycle, and the state of a country's economy, along with extant welfare

schemes in operation at any time. Also, an unbiased distribution of money is a critical indicator of the welfare of the poor (Ozcelebi, 2018).

Discussions on the exchange rate are topical among policymakers, economists, analysts, academics and other economic agents because of the impact it has on the whole economy. These discussions centre essentially on the adoption of pegged, fixed or floating exchange rates, and contextually of its impact on income distribution. The volatility of the exchange rate redistributes income from wage earners to entrepreneurs, because of short-term wage rigidities. Some of the factors that drive volatility of exchange rates are inflation rate, interest rates, the balance of payments, terms of trade, speculation, economic cycles, government indebtedness, economic health, political stability etc.

Income distribution refers to the modalities for distributing a country's aggregate output amongst its population. Classical economists like Adam Smith, Thomas Malthus, and David Ricardo emphasised factor income distribution amongst the factors of production such as land, labour and capital. However, contemporary economists paid more attention to income distribution to economic agents like individuals, households and firms. Theoretical and policy worries are premised on striking a balance between economic growth and income inequality, and their often negative effect. Income distribution in a society can be represented by the Lorenz curve and is proximately aligned with a gauge of income inequality like the Gini coefficient. Skewed income distribution especially among a large swathe of the population is one of the drags to economic recovery in emerging, frontier and developing countries. Internationally, income inequalities have assumed a pre-eminent position both as a legislative and intellectual issue, more so during the 2007/9 global financial meltdown. Essentially, inequities have stretched beyond an exclusive normative issue that policymakers consider only when social justice is at stake. Increasingly, it is acknowledged as a determinant of economic growth, macroeconomic circumstances, and the other factors that are pertinent for economic policy (Dagdeviren, Der Hoeven & Weeks, 2002; Easterly, 2007).

After Nigeria gained political independence from Great Britain in October 1960; the country's monetary authorities have been working tirelessly to maintain internal and external economic balance in a determined attempt to enhance the living standards of the citizenry, alleviate poverty, and achieve economic/political progress and stability. These were accomplished via administrative adjustment of the domestic currency (naira) foreign exchange rate in response to distinctive and prevalent economic conditions (Lawal, Atunde, Ahmed & Abiola, 2016). Nigeria has seen a significant rate of poverty amongst a large percentage of its population. According to the National Bureau of Statistics, 83 million or 40 per cent of Nigerians live in poverty as of 2020. Due to the considerable disparity associated with even this low level of household income and expenditure, the incidence has a greater impact (Osevwe, 2010). Furthermore, according to OXFAM research (2019), poverty and inequality in Nigeria are not a result of a scarcity of resources, but mismanagement, misallocation, and theft. At the heart of the problem is a corrupt culture paired with a political class that is disconnected from the daily existential challenges faced by ordinary Nigerians.

The effect of continual volatility in the exchange rate of the naira against major convertible currencies is worrisome, especially for the working class whose take-home pay can no longer take them home. Double-digit inflation in the face of wage rigidities has affected their purchasing power negatively (Rewane, 2022). A key solution is wage indexation against inflation, which seems to be a mirage in the near to medium term. This study provided insight into the income distribution's response to the exchange rate in Nigeria; a subject that has gotten little or no attention, more so given the country's recent data. One of the techniques that can be used in throwing light on exchange rate dynamics and its correlation with income distribution is the structural approach.

The structural approach is one method for explaining the equilibrium foreign exchange rate and is taken as the rate at which the internal income distribution is acceptable. This view posits that exchange rate volatility impacts the distribution of income through wages and prices. Currency devaluation increases import prices and decreases exports. Increased demand for exports leads to a rise in the domestic price level (Mishkin, 2000). Domestic currency depreciation also results in to increase in the cost of intermediate inputs sourced

from other countries, resulting in cost-push inflation. While it is true that, basically exchange rates affect prices; usually there is a significant struggle in wages being adjusted to this inflationary effect. As a result, income will be transferred from fixed-income earners to capital owners. Lim (2014) asserts that income inequality corrupts labour in export-led economies. Labour negotiating strength is weak in undeveloped nations. Despite increased worker productivity, salary increases lag behind it, which may result in income redistribution from labour to entrepreneurs. Agénor (2002) proposes double routes via real exchange rates to beggarly wellbeing. To begin, declines in the real exchange rate lower the prices of non-tradable products. It also improves the well-being of poor metropolitan consumers. Secondly, depreciation incentives encourage the allocation of resources to the export of agricultural products, which boosts earnings of foreign exchange and the well-being of the rural poor (Arif & Ünal, 2019).

Coactions between volatilities in exchange rates and income distribution have long been recognised in the literature. Currency devaluation generates concern for an uptick in inflation and improvement in production and distribution of outputs, especially in a mono-product economy like Nigeria, where the import demand function is probably inelastic. The pass-through effect is such that wage earners are negatively affected due to short-term wage rigidities, while owners of factors of production gain. This causes the redistribution of income from wage/salary earners (employees) to owners of productive resources (employers) at least in the short run. Also, positive exchange rate shock (devaluation) may trigger income redistribution from a class of people with a low marginal propensity to save to those with a high marginal propensity to save. This can lead to a reduction in aggregate demand and output (Diaz-Alejandro, 1965; Krugman & Taylor, 1976). Also, frequent changes in exchange rates of a country such as Nigeria which is import dependent contributes to imported inflation and attendant unambiguous increases in the domestic price level. This exacerbates the misery index (currently about 52% in Nigeria as of June 2022). According to Daiz-Alejandro (1965), devaluation and other macroeconomic variables are contractionary on the Gross Domestic Product (GDP) and induce a shift in income distribution towards savers, which in turn depresses consumption and real absorption.

Several authors have examined the impact of volatility in nominal/real exchange rates on income distribution using ordinary least square (OLS), exponential general autoregressive conditional heteroskedastic (EGARCH) and error correction models. However, this study seeks to expand the scope of the subject by looking deeper into how the interface between exchange rate volatilities affects income inequalities between labour and the owners of factors of production. This thus informed the choice of some of the independent variables. The Autoregressive Distributed Lag model (ARDL) was also adopted because of its superiority over some of the models used by other authors found in the literature. This is the gap that this study is meant to fill.

Literature Review

A review of some extant literature on the subject matter of this work encompasses theoretical framework and previous empirical studies by other researchers.

Theoretical framework

This section describes the channels through which fluctuations in the exchange rate affect income distribution, with its concomitant effect on human welfare. An example is the purchasing power theory, which serves a dual purpose as a mechanism to determine exchange rates as well as a means of comparing living standards among different countries. The conventional flow theory of exchange rate determination impacts relative prices and balance of payments. Spiral increases in prices affect income distribution because fixed-income earners do not possess the flexibility to adjust their earnings in the short run to match changes in relative prices, unlike owners of factors of production. Some of the theories that underline the relationship between fluctuations in exchange rates and income distribution in the context of this paper are presented below;

Purchasing Power Parity (PPP) theory of exchange rate

Gustaf Cassel pioneered the adoption of the theory in 1918 as a modern mechanism for the determination of exchange rates. He proposed the theory as a methodology for altering pre-first world war foreign exchange rates or parities for countries planning to revert to the gold standard after the war. The modification was necessitated by the fact that nations that left the gold standard in 1914 encountered significant differences in their pre and post-war inflation rates. Moreover, PPP theory was propounded in response to calls for an alternative mechanism for determining foreign exchange rates due to the collapse of the fixed foreign exchange rates regime. According to the theory; foreign exchange rates between two currencies are completely regulated by market forces of demand and supply. PPP theory assumes that, if a currency pair is fixed at par; the exchange rate differential ought to indicate changes in the buying power of the relevant currency about the base currency (Ibenta, 2012). If for instance, the price of semolina is cheaper in Nigeria; consumers may purchase wheat in Ghana to save money (after taking into account shipping/transportation costs).

PPP theory posits that exchange rates will alternate such that, the price of a specific good or service will be the same irrespective of where it was purchased. The theory is frequently referred to as the law of one price. The theory can be denoted via the equation; $E = P_{dd}/P_{ff}$. Where; E= nominal exchange rate, P_{dd} = domestic prices in domestic currency (P), P_{ff} = foreign prices in foreign currency (P^*). In other words; $E = P/P^*$. It can be inferred from the above equation that; the domestic price level is the primary determinant of the nominal exchange rate (E). This connotes that, the nominal exchange rate (E) is determined endogenously. A commonly used variant expresses the equation in terms of differences depicting the change in the nominal exchange rate to changes in relative prices. This is known as relative PPP, showing; $\% \Delta E = \% \Delta P - \% \Delta P^*$. Where $\Delta\%$ = percentage change (Chamberline & Yaeh, 2006).

The absolute version of the PPP theory is the simplest and strongest form. It is based on an international multi-good variant of the law of one price. Absolute PPP postulates that foreign exchange rates shall adjust to equalise the prices of the national basket of goods and services between countries. This is because, of market forces by arbitrage (Lafrance & Schembri, 2002). From the perspective of absolute Purchasing Power Parity theory; a foreign exchange rate to the ratio of domestic to foreign prices of specified bundles of goods and services. The inference from the aforementioned is such that, the real foreign exchange rate is stationary. Incidentally, the absolute version of PPP theory doesn't hold due to a variety of causes, thus limiting its effectiveness in determining foreign exchange rates. These include i. Arbitrage is forestalled, because of the existence of goods and services that are not traded. ii. Extant substantial operational costs (taxes, tariffs, transport, information costs & other non-tariffs barriers) on traded goods. These make arbitrage to be expensive. Relative PPP (the weaker version) suggests that foreign exchange rates between the currencies of two countries ought to adjust eventually to take care of the dissimilarity in their rates of inflation. In other words, economies that pursue monetary policies experiencing differing inflation rate goals must anticipate the manifestation of this difference in the exchange rate movement.

The monetary theory of exchange rate

The theory postulates that the actions of domestic monetary authorities determine exchange rates. It represents an extension of the simple quantity theory of money, viz: $Mv = Py$, Where; M= monetary stock, v = velocity of money in circulation, P= price level, y= level of output at full employment, with v & y being constant, the equation becomes: $P = 1/v (M/y)$, hence $\% \Delta M = \% \Delta P$. If relative prices are determined by different monetary regimes, then it becomes easy to take the attendant step; using the relative PPP equation, such that, the change in domestic prices can then feed directly and proportionally into the exchange rate; i.e. $\% \Delta M = \% \Delta P = \% \Delta E$. This makes the exchange rate to be exogenously determined and its changes have an effect on economic growth through changes in monetary stock (Chamberline & Yaeh, 2006).

Balance of payment (BOP) theory

The balance of payment theory of exchange rate determination states that, under free exchange rates, the exchange rate of a country's currency is a function of its balance of payment. Favourable BOP impacts positively on the exchange rate, while an unfavourable BOP position has the converse effect. The theory implies that exchange rates are determined by the market forces of demand and supply, which depends on the export and import of goods, services, international loans, capital flows etc. (Jhingan, 2003).

Theories of income distribution

Income distribution refers to the pattern of apportioning output to the various factors of production (land, labour, capital and entrepreneur). The earliest theory of income distribution is the classical version. Since (labour, capital, and land) may be independently appropriated, the industrial zone can perhaps be considered divided into productive labourers, capitalists, and owners of the land. Each of these classes, as such, obtains a share of the produce. No other class obtains anything except by concession from them (Mill, 1871). For about 200 years, the classical theory of income distribution was dominant. It was broadly adopted and very well accepted even in its long period of gestation. For classical political economy, the delineation of a value unit suitable to the analysis of distribution needed a detachment of the determinants of distribution from the size of the net product. This separation allowed the classical economists to isolate the forces which determine income from those which determine the concept of the value of output.

Marx treats the determinants of income distribution within the framework laid out by his classical predecessors, especially Smith and Ricardo. The classical framework did not, however, provide Marx with a single, logically consistent argument upon which he could base his analysis. Instead, it merged segments of diverse well-defined theories. Marx carried on alongside the divergent approaches first cleared by Smith and Ricardo, following one, at some point another. For Marx, the concept of value signifies a sum of labour time needed by society to produce a given commodity. Marx's cost of production is identical to the "long-period" or "natural" price of modern versions of the classical theory (Mainwaring, 1984). In the context of this research, the key issue is how volatilities in exchange rates affect the share of labour in output. Factor incomes that appear in post-Keynesian theories of the income distribution are profits (i.e. interest, rent, dividends and retained earnings) and wages (i.e. salaries, except possibly the salaries of higher business executives that may be considered part of profits).

Empirical review

Empirical studies that examined the effects of fluctuations in foreign exchange rates on income distribution are not many. A few are summarised hereunder.

Ehigiamusoe and Lean (2019) examined the stabilising potency of real foreign exchange rates and their volatilities on per capita GDP in West Africa. Additionally, it measures the marginal outcomes of financial sector development on economic growth at different levels of real foreign exchange rate and volatility. While financial sector development has a long-term beneficial effect on the growth of the economy, this effect is mitigated by the foreign real exchange rate and its volatility. The marginal impact of financial sector development on economic growth differs, depending on the actual exchange rate's level and volatility. The more volatile the actual exchange rate is; the less financing encourages growth. The research indicates that financial sector development will not produce the intended economic benefits unless it is followed by a cutback in the stabilisation of real exchange rates. This demonstrates that the foreign exchange rate has a negative influence on the growth of per capita GDP growth via the banking sector.

Goodness and Laurence (2019) examined how volatilities in real foreign exchange rates influence the apportionment of earnings amongst human and non-human capital in South Africa. They considered the unsymmetrical along with symmetric impacts. Results from their work indicate the existence of instantaneous response in respect of labour's share of income which represents one negative standard

deviation shock in exchange rate volatility. Also, elevated volatility in exchange rates harms the portion of income accruing to labour, whereas, low exchange volatility has a positive influence on income due to labour. Eneji, Nanwul, Eneji, Anga and Dickson (2018) studied the reaction of foreign exchange rate policies and volatilities on Nigeria's economic growth. The result shows a negative correlation between foreign exchange rate volatilities and economic growth in Nigeria. Given this outcome, the researchers recommended that; Nigeria should fast track the evolution of indigenous technological innovation across the broad spectrum of the nation's economy premised on import substitution. The consequential effect will be a reduction in external dependency, currency manipulations, and income inequality amongst other positive derivatives.

Moshen and Amid (2018) adopted asymmetry analysis in exploring the relationship between changes in foreign exchange rates and income distribution in forty-one countries. Income possibly will be shifted away from labour to producers, because of the slow adjustment of salaries and wages to inflationary impacts of depreciation in currencies. It can be asked if appreciation of a currency can yield a contrasting result. The authors investigated asymmetric consequences of exchange rate volatilities on income distribution in each of the forty-one countries for which a Gini coefficient was accessible. By employing recent asymmetry error-correction modelling and asymmetry cointegration of Pesaran, Shin and Smith. (2001); support was provided for short-run asymmetric effects in thirty-four countries, and long-run asymmetric effects in twenty-two countries. This represents a unique discovery that was masked by previous research. Asymmetric impacts revealed that, while depreciation showed variable effects in ten countries, they had equalising effects in only five countries.

Diala, Kalu and Igwe-Kalu (2017) studied the impact of volatilities in exchange rates on the distribution of incomes from real estate in Nigeria using the EGARCH model. Between 2000 and 2010, this study analysed time series data of 10 years. The data revealed that exchange rate volatilities had a significant favourable influence on returns from investments in low-income residential real estate in Nigeria. Okeme (2017) analysed Nigeria's currency deregulation and human capital growth from 1986 to 2015 using the error correction model (ECM). This analysis took into account the currency rate, government expenditure on education and health, interest rate, inflation rate, GDP (a proxy for national income), and crude oil price. According to the study's findings, there is a direct association between human capital development, and a one-year lagged exchange rate, national income, and crude oil price in Nigeria.

Paul and Muazu (2016) examined the variables that drive foreign exchange rate volatilities and the impacts of disproportionate movements in foreign exchange rates on the growth of the Ghanaian economy. The kernel of their enquiry was centred on the above thematic questions. Results from the work indicated that whilst exchange rate shocks revert to the mean, corrections of misalignments were very sluggish. This comes with painful short-term consequences because economic agents modify their investment and consumption preferences. Approximately seventy-five per cent of the disturbance in real foreign exchange rates are self-directed. On the other hand, the balance of twenty-five per cent is attributable to variables like government expenditures, growth in money supply, terms of trade, and shocks in GDP. Unrestrained volatilities were discovered to be inimical to the growth of the economy. However, this can only occur to a certain extent, because growth-inducing impacts can evolve from enhanced efficient resource allocation and innovation.

Flavia (2015) investigated the correlation between income inequality and different foreign exchange rate regimes. The paper discussed optimality between foreign exchange regimes along with income inequality. The fundamental question is; whether a relationship exists between a country's foreign exchange rate regime, and income distribution within that country, and whether one type of foreign exchange rate regime exhibits superior performance with income inequality.

Adeniran and Adeyemi (2014) evaluated the impact of fluctuations in foreign exchange rates on human capital development in Nigeria. They discovered that exchange rates have a beneficial, albeit slight, effect on human capital development. Owolabi and Adegbite (2013) investigated the effect of exchange volatilities on Nigeria's economy between 1991 and 2010. After testing 27 years' time series data, they discovered that foreign exchange had a significant impact on the Nigerian economy. The outcome of the work showed a reduction in GDP by N0.02 as the rate of export rises. In addition, extant foreign exchange rate policies did not affect the development of oil and non-oil exports. Therefore, there is a need for appropriate management of Nigeria's foreign exchange policies.

Oyovwi (2012) investigated the linkage between volatilities in the foreign exchange rate, and the growth rate of the Nigerian economy between 1970 and 2009. Findings from the work showed that the correlation between economic growth and foreign exchange rate volatility is positive in the short-run, while their long-run relationship is negative. Also, empirical results from the research revealed that, in the long run, increases in oil prices depress economic growth in Nigeria. Therefore, the expected positive impacts on the country's revenues from rising oil prices are neutral. In addition, the output effect is evidenced in factory closures and re-location to neighbouring countries. The study recommends import restrictions, control of both public and private expenditures, and greater economic diversification via investments in key productive sectors of the economy to mitigate the negative impacts of exchange rate volatilities. Furthermore, they recommended domestic refining of crude oil to obviate the current unbridled importation of the same in the short run, as well as the legalisation of refining activities in the creeks of the Niger Delta to complement the existing four refineries in the country.

Ping (2011) studied the socio-economic impacts of real foreign exchange rates using data from 29 Chinese Provinces between 1987 and 2008. Findings from the work showed that the real foreign exchange rate yields divergent social and economic outcomes. For instance, if there is an uptick that exerts a positive influence on economic growth via efficiency improvements, and technological progress through the motivation of workers via education and capital intensity; conversely it applies detrimental effects by declining international competitiveness in the tradable sector thereby eradicating employment. In addition, the results indicate that appreciation of the real foreign exchange rate harmed economic growth. This was more prevalent in the coastal provinces as compared to the inland provinces, thus contributing to a reduction in the gap between the GDP per capita between the coastal and inland Provinces. Greg (2000) worked on foreign exchange rate stability and poverty reduction in Nigeria. The study established that exchange rate instability may affect the poor through; inefficient allocation of resources between foreign and domestic goods, price distortion due to misalignments, reduced investment and competitiveness of the tradeable sector, increased cost to the poor by the extent of financial integration in the international capital markets and distorting and inhibiting growth.

Methodology

The methodology utilised in this investigation is the *ex-post facto* framework, which is designed as a systematic empirical research method in which the researcher has no direct control over the independent variables. The independent variables are a domestic investment, real GDP per capita, percentage change in dollar value, level of educational attainment and the extent of trade openness (globalisation). The dependent variable is income distribution as measured by the Gini coefficient. The number of observations/scopes is 31 years (1990 to 2021).

Model specification

The methodology used by Arif Eser Güzel and Ünal Arslan (2021) was adopted by domesticating, expanding and modifying it in line with the peculiarities of the Nigerian environment. The mathematical model applied here is as stated hereunder:

$$\text{Gini} = f(\text{DI}, \text{DV}, \text{EDU}, \text{RGDP}, \text{TOP}) \tag{1}$$

Where:

Gini = Gini Coefficient

DI=Domestic Investment(US\$)

RGDP = Real GDP per Capita (US\$)

DV= Percentage change in dollar value

EDU= Level of educational attainment in percentage

TOP= Extent of trade openness in percentage.

The adopted control variables were used, because of their direct and indirect influence on some elements of the Sustainable Development Goals (SDGs), and their impact on inequality, poverty, hunger and climate change. Their adoption is also strengthened by the fact that there is a pass-through effect from fluctuations in foreign exchange rates, income distribution and human development index. Equation (1) can be transformed into an econometric model, such as;

$$\text{Gini}_t = \beta_0 + \beta_1 \text{DI} + \beta_2 \text{DV} + \beta_3 \text{EDU} + \beta_4 \text{RGDP}_t + \beta_5 \text{TOP}_t + \varepsilon_t \tag{2}$$

Given that the Autoregressive Distributed Lag Model (ARDL) is used, equation (2) can then be written in the long and short-run forms as follows:

$$\begin{aligned} \Delta \text{Gini}_t &= \alpha_0 + \alpha_1 \text{InGini}_t + \alpha_2 \text{InDI}_t + \alpha_3 \text{InDV}_t + \alpha_4 \text{InEDU}_t + \alpha_5 \text{InRGDP}_t + \alpha_6 \text{InTOP}_t \\ &+ \alpha_7 \sum_{i=1}^{\rho} \Delta \text{Gini}_{t-i} + \alpha_8 \sum_{i=1}^{\rho} \Delta \text{DI}_{t-i} + \alpha_9 \sum_{i=1}^{\rho} \Delta \text{DV}_{t-i} + \alpha_{10} \sum_{i=1}^{\rho} \Delta \text{EDU}_{t-i} + \alpha_{11} \sum_{i=1}^{\rho} \Delta \text{RGDP}_{t-i} \\ &+ \alpha_{12} \sum_{i=1}^{\rho} \Delta \text{TOP}_{t-i} + \text{ECT}_{t-i} + \varepsilon_t \end{aligned} \tag{3}$$

All the variables in equation (2) are in logarithmic form and the datasets are annual for Nigeria for thirty (31) years (1990-2021). In line with the stipulation of the cointegration methodology of Engle & Granger (1987) along with that of Johansen and Juselius (1990), time series datasets are expected to be integrated in the first order (i.e. I_1). Nevertheless, whenever this is not the case and the time series datasets are integrated into dissimilar orders. These two models may not be a fitting framework to adopt. Therefore, the appropriate methods that can be used to analyze cointegrating relationships are the ARDL of Pesaran and Shin (1998), and Pesaran, Shin and Smith (2001). Autoregressive Distributed Lag (ARDL) model is;

$$\begin{aligned} \Delta Gini_t = & \psi + \eta_0 \ln Gini_t + \eta_1 \ln DI_t + \eta_2 \ln DV_t + \eta_3 \ln EDU_t + \eta_4 \ln RGDP_t + \eta_5 \ln TOP_t \\ & + \beta_1 \sum_{j=0}^q \Delta Gini_{t-j} + \beta_2 \sum_{j=0}^q \Delta DI_{t-i} + \beta_3 \sum_{j=0}^q \Delta DV_{t-i} + \beta_4 \sum_{j=0}^q \Delta EDU_{t-i} + \beta_5 \sum_{j=0}^p \Delta RGDP_{t-i} \\ & + \beta_6 \sum_{j=0}^q \Delta TOP_{t-i} + ECT_{t-i} + \varepsilon_t \end{aligned} \tag{4}$$

It is noteworthy to highlight some relative advantages of the ARDL bound testing model over that of Engle and Granger (1987) and Johansen and Juselius (1990). These include: (i) Autoregressive Distributed Lag can be used to ascertain cointegration for a time series dataset with small sample size, unlike Engle and Granger and Johansen and Juselius' methods that require large time series sample size; (ii) all the covariate variables in Engle and Granger and Johansen and Juselius' techniques must of necessity be integrated in congruent order before cointegration will be tested, while on the contrary, ARDL can be applied in testing cointegration irrespective of the magnitude of aforementioned control variables. In other words, predictor variables could be either I(0) or I(1). It can also be an amalgam of the two (Pesaran, Shin & Smith, 2001); and (iii) Autoregressive Distributed Lag methodology creates room for wider options while choosing stimulus variables to be used. ARDL bound testing model makes allowance for error correction model (ECM), which makes it possible to find out the number of periods the variables will be in equilibrium. The ECM is captured in equation (5) below;

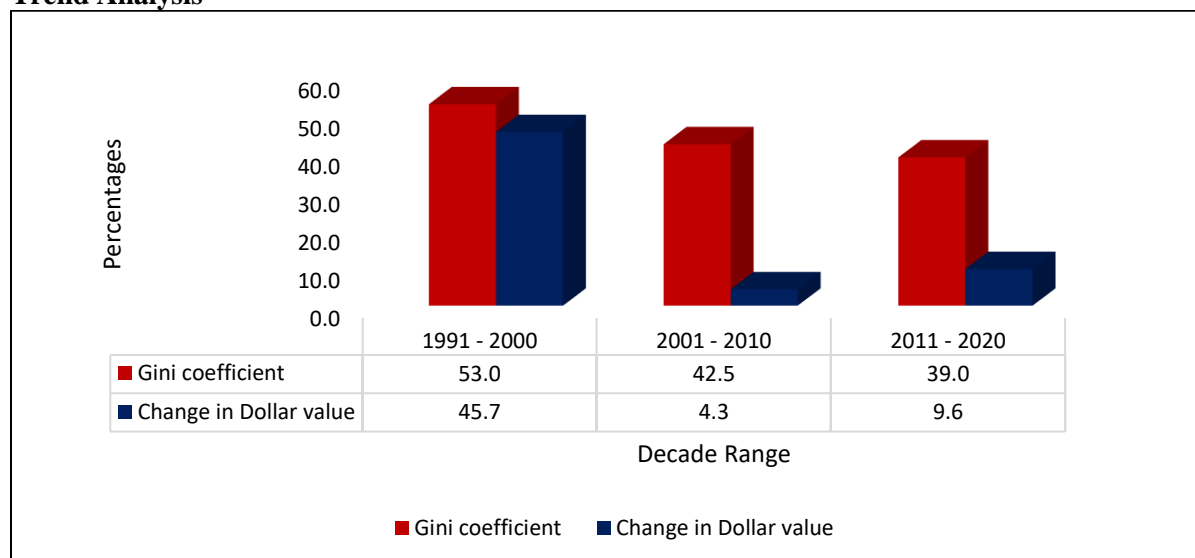
$$ECT_t = Gini_t - \beta_0 - \beta_1 DI_t - \beta_2 DV_t - \beta_3 EDU_t - \beta_4 RGDP_t - \beta_5 TOP_t \tag{5}$$

$$\begin{aligned} \Delta Gini_t = & \gamma_0 + \gamma_1 \sum_{i=0}^q \Delta Gini_{t-j} + \gamma_2 \sum_{i=0}^q \Delta DI_{t-i} + \gamma_3 \sum_{i=0}^q \Delta DV_{t-i} + \gamma_4 \sum_{i=0}^q \Delta EDU_{t-i} + \gamma_5 \sum_{i=0}^p \Delta RGDP_{t-i} \\ & + \gamma_6 \sum_{i=0}^q \Delta TOP_{t-i} + ECT_{t-i} + \varepsilon_t \end{aligned} \tag{6}$$

Analysis of Results and Discussion

The results obtained from the estimated model are analysed to achieve the research objective that is stated in the introductory section of the study; which is to investigate the nexus between foreign exchange rate volatilities, and income distribution in Nigeria. The presentation of the section starts with a trend analysis between income distribution measured by the Gini coefficient and the exchange rate value for the periods under consideration. The next analysis is the conduct of descriptive statistics which presents descriptive statistics of the various variables employed in the work. Subsequently, unit root and cointegration test results of variables used were presented, before the final regression result.

Trend Analysis



Source: Author’s computation using data from World Bank (2021) and World Inequality Database (2020)

Figure 1: Graph of Gini coefficient and Change in Dollar Value (1991 – 2020)

From Figure 1, it can be seen that the Gini coefficient value for the period 1991–2000 averaged 53 per cent (0.53) which is the highest and in the subsequent decade, it declined to 42.5 per cent (0.425). The Gini coefficient further declined to 39 per cent (0.39) in the last decade under consideration (2011–2020). This shows that there is a significant improvement in income distribution for the past 3 decades. The result of the improvement in income distribution was accompanied by a moderated and improved percentage change in the exchange rate. It can be seen from Figure 1 that the percentage change in dollar value declined from 45.7 per cent in the period 1991–2000 to 4.3 per cent during the 2001–2010 decade. It however slightly increased in the last decade to 9.6 per cent.

Table 1: Descriptive Statistics of Employed Variables

Statistics Measures	DI	DV	EDU	GINI	RGDP	TOP
Mean	8.92 trillion	19.52601	91.80604	45.31407	1983.594	36.89020
Median	8.60 trillion	2.371962	92.09114	42.67150	1948.048	37.02160
Maximum	11.9 trillion	321.9049	102.1081	57.15000	2688.267	53.27796
Minimum	6.96 trillion	-5.755942	78.66348	35.54100	1414.101	20.72252
Skewness	0.476984	4.733650	-0.056555	0.461074	0.129855	0.005043
Kurtosis	1.963635	24.96782	2.189598	1.861767	1.372818	2.398221
Jarque-Bera	2.562802	739.1107	0.697442	2.682415	3.507097	0.467892
Probability	0.277648	0.000000	0.705590	0.261530	0.173158	0.791404
Sum	277 trillion	605.3062	2295.151	1359.422	61491.41	1143.596
Observations	31	31	25	30	31	31

Source: Author’s computation using data from World Bank (2021) and World Inequality Database (2020)

Table 1 presents the results of descriptive statistics of the variables employed. These variables are a domestic investment, percentage change in dollar value, level of educational attainment, the Gini coefficient, per capita income and the extent of trade openness. The result shows that the average domestic investment value for the period is 8.92 trillion Naira and this however reached a peak of 11.9 trillion Naira. The least domestic investment of a particular year within the period of consideration was 6.96 trillion Naira. The percentage change in dollar value reached a peak of 321.9 per cent, while it maintained an average of 19.5 per cent, its least was -5.8 per cent. It’s noticeable that increases in the value of the dollar weigh too much higher than the decline in dollar value.

From the result presented in Table 1, it can be seen that on average, about 91.8 per cent of the populace were enrolled in the minimum primary school level, while it was as high as 102.1 per cent. For a particular year, the least primary school enrollment rate was 78.7 per cent. The extent of income inequality averaged 45.3 per cent throughout the study and this slightly improved to 35.5 per cent, while it worsened for as far as 57.2 per cent. The extent of per capita income of citizens between 1990 and 2020 averaged US\$1,983.6 per individual, while for a particular year, it was as high as US\$2,688.3 and the least of income per share was US\$1,414.1. Trade openness showed a momentum increase from an average of 36.9 per cent to a peak of 53.3 per cent, while it worsened up to 20.7 per cent. On average, 36.9 per cent of the nation’s GDP were traded in the international market as export and imports.

The distribution of the variable data can be defined using the skewness, kurtosis value or the Jarque-Bera statistics. From the findings, we refuse to reject the null hypothesis which states that, the independent variables - domestic investment, educational attainment, Gini coefficient, per capita income, and trade openness are normally distributed. Thus, we conclude that domestic investment, educational attainment, Gini coefficient, per capita income and trade openness are normally distributed because their probability values are greater than 5 per cent. The result however showed that the percentage change in dollar value is not normally distributed, because its probability value is less than the 5 per cent benchmark.

Table 2: Correlation Coefficient Result

	DI	DV	EDU	GINI	RGDP	TOP
DI	1.00					
DV	-0.09	1.00				
EDU	-0.01	0.03	1.00			
GINI	-0.71	0.20	-0.23	1.00		
RGDP	0.77	-0.29	-0.18	-0.78	1.00	
TOP	-0.09	-0.12	0.19	-0.06	-0.12	1.00

Source: Author’s computation using data from World Bank (2021) and World Inequality Database (2020)

Table 2 reveals the result of the correlation analysis conducted. The purpose of conducting this statistic is to ensure that, there is no perfect multicollinearity that is associated with the regression analysis; otherwise it will make the model spurious. The result of correlation statistics among the explanatory variables shows an averagely weak degree of relationship amongst them, except for the one between per capita income and investment. Together the highest mark is 0.77. This is however expected. There will always be a correlation, but the degree is our concern, and since none is very high or perfectly correlated; we can then conclude that there is no perfect multicollinearity correlated with the regression result.

Table 3: Unit Root Test

S/N	Variable	At Level			At First Difference			Conclusion
		ADF stat.	ADF 5% crit. val.	Prob.	ADF stat.	ADF 5% crit. val.	Prob.	
1	DI	0.093	-2.972	0.9594	-9.670***	-3.689	0.000	I(1)
2	DV	-5.448***	-2.964	0.0001	-	-	-	I(0)
3	EDU	-1.850	-3.030	0.3470	-2.318**	-1.960	0.0233	I(1)
4	GINI	-1.802	-2.972	0.3718	-7.499***	-3.052	0.000	I(1)
5	RGDP	-3.179**	-2.981	0.0329	-	-	-	I(0)
6	TOP	-2.959*	-2.964	0.0506	-5.175***	-2.972	0.0002	I(1)

Source: Author’s computation using data from World Bank (2021) and World Inequality Database (2020)

Conducting unit root test of the variables employed is very important. This is to ensure that, the variables employed are stable in the long run (stationary). To perform this test, the study employed the Augmented

Dickey-Fuller unit root test in probing stationarity of the variables considering the model to have intercepted. The result of the unit root test is presented in Table 3. For us to conclude that a variable is stationary at a 5 per cent level of significance; the ADF statistical value exceeds the critical value or the probability is below 5 per cent (0.05). Unit root test was conducted at the level and by differencing the variable for those variables that were not stationary at level. The result from the study shows that at level, the only percentage change in dollar value and per capita incomes are stationary. This is owing to the reality that; their probabilities were less than 5 per cent. Other variables were tested at the first difference, and the result showed that domestic investment, educational attainment, the Gini coefficient and trade openness are stationary at the first difference. This is owing to the point that; their probabilities were less than 5 per cent at first difference.

Table 4: ARDL Bounds Cointegration Test

F-Bounds Test		Null Hypothesis: No levels of relationship		
Test Statistic	Value	Significant	I(0)	I(1)
F-statistic	36.29381	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Source: Author’s computation using data from World Bank (2021) and World Inequality Database (2020)

Given that, unit root test as in Table 3 have varying levels of stationarity with some stationary at level, while others at first difference; it then becomes important that we find a statistical measure which can help to find that since all are not stable in the long run when they are combined, can the model be cointegrated in the long-run? To do this, Pesaran, Shin and Smith (2001) recommended a bound testing approach that ensures that cointegration exists. According to them, the bounds test examines the condition that there is cointegration by checking that, F-statistic is greater than I (1) at a 5 per cent critical value. The results in Table 4 show that the F-statistic of 36.29 is greater than I(I) upper bound of 3.38. Thus, we conclude that there is cointegration related to the regression result.

Table 5: ARDL Regression Result

Dependent Variable:				ΔGini			
Long Run				Short Run			
Variable	Coefficient	t-Stat.	Prob.	Variable	Coefficient	t-Stat.	Prob.
Constant	311.57**	7.105	0.0192	D(GINI(-1))	2.030***	43.097	0.0005
GINI	-0.236*	-3.805	0.0627	D(RGDP)	0.001	2.206	0.1582
RGDP	-0.004**	-6.128	0.0256	D(RGDP(-1))	0.008***	16.413	0.0037
DV	0.094**	4.761	0.0414	D(DV)	-0.008**	-5.212	0.0349
LOG(DI)	-9.066**	-5.863	0.0279	D(DV(-1))	-0.003**	-8.583	0.0133
EDU	-0.218**	-8.563	0.0134	DLOG(DI)	-3.280***	-18.884	0.0028
TOP	-0.0730*	-4.175	0.0529	D(EDU)	-0.150***	-26.249	0.0014
				D(EDU(-1))	0.402***	29.805	0.0011
				D(TOP)	-0.122***	-27.294	0.0013
				D(TOP(-1))	-0.066***	-27.304	0.0013
				CointEq(-1)	-0.236***	-31.878	0.0010
R-Squared	0.998			Ramsey RESET Stat.	4.143		
Adj. R-Squared	0.994			Ramsey RESET Prob.	0.0964		
D.W.	2.322			BPG Stat.	2.636		
AIC	-2.112			BPG Prob.	0.3097		
F-Stat	1959.9***			BG Stat.	3.723		
				BG Prob.	0.7469		
				JarqueBera Prob.	0.660		

Source: Author’s computation using data from World Bank (2021) and World Inequality Database (2020)

Table 5 shows the regression analysis from the model specified for the study. The result reveals that, in the long run, there is a negative effect of per capita income on the Gini coefficient. This implies that an uptick in income per capita will cause the Gini coefficient to decline. The result conforms to a-priori expectations and the implication of this is that an increase in the income level of individuals will improve the income distribution across different income groups (decline in income inequality). The result however is different in the short run. The implication of this is that, when per capita income increases momentarily in a short while, it doesn't cause an improvement in income distribution; for the increase in income per head to cause improvement in the extent of the income distribution, the increase must take a longer period.

The result reveals that in the long run, foreign exchange rates exhibit a positive significant impact on the Gini coefficient. Therefore, an increase in percentage change in the exchange rate (devaluation or depreciation depending on the policy), the higher the level of the Gini coefficient (the more worsening and unequal, income will be distributed). The implication of this is that the result conforms to a-priori expectation and this implies that exchange rate depreciation increases the extent of income inequality. The result is however different in the short run. In other words, for exchange rate depreciation to aggravate income inequality; it must persist in the long run, while short-term devaluation or depreciation does not worsen income inequality.

The result also shows that increases in domestic investment reduce the extent of income inequality, this is justified by the negative impact of domestic investment on income inequality as revealed in Table 5. Also, the result shows that increases in educational attainment reduce the extent of income inequality. This is justified by the negative impact of educational attainment (EDU) on income inequality as revealed in Table 5. Trade openness (increase in globalisation) reduces the extent of income inequality as revealed by the negative significant long-run impact of trade openness on income inequality.

Examining the statistical property of the model; the result shows that about 99.4 per cent of the changes in the dependent variable are accounted for by variation in independent variables put together. The implication of this is that variation in the dependent variable is well accounted for. Durbin-Watson statistics that examines if the error term exhibits a serial correlation of order one, indicates that there is no serial correlation of order one associated with the regression result because it is approximately 2. Also, testing the model at higher order, the Breusch Godfrey test for serial correlation of higher order shows that, the model is not serially correlated or higher order. The Breusch-Pagan-Godfrey (BPG) test indicate that the variance of the error term is homoscedastic. The result shows that we should accept the null hypothesis that the variance of the error term is homoscedastic. Thus, we conclude that our regression analysis has no associated heteroscedasticity. The Akaike Information Criterion (AIC) amongst other alternative models shows that its value is least and thus, the model is the most robust. The f-statistics show that there is harmony in the regression result, while the Ramsey RESET result shows the model is stable. Overall, the error term is normally distributed as shown by the Karque-Bera probability.

Some of the findings of this work, to the extent that short-run fluctuations in exchange rates exacerbate income inequality are in sync with some previous studies as seen in the literature. Arif and Ünal (2019) in their study found that an increase in the value of the US dollar leads to higher income inequality in Turkey. There is also a correlation between some findings of the work with that of Moshen and Amid (2018). An aspect of the findings of the latter shows that earnings may be transferred from labour to employers, because of sluggish adjustment of salaries and wages to inflationary impacts of depreciation in currencies.

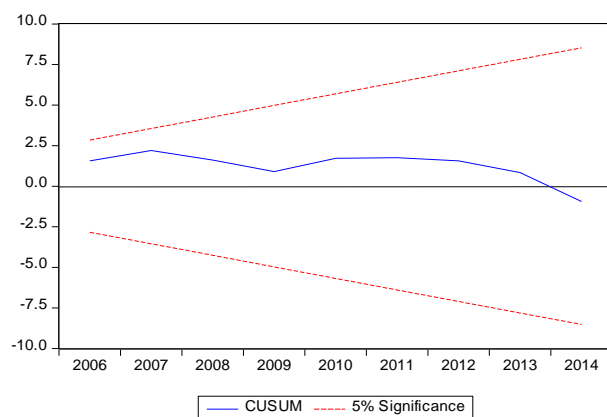


Figure 2: Graph of the CUSUM

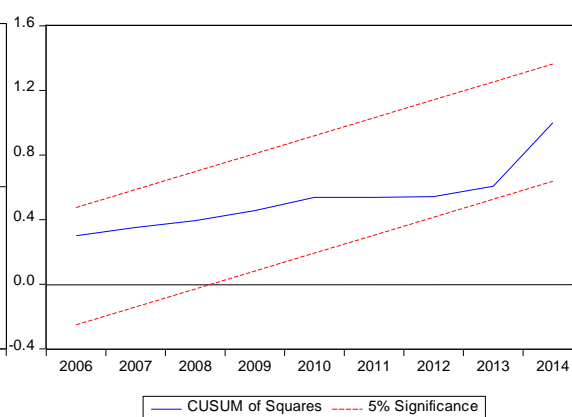


Figure 3: Graph of the CUSUM of squares

Source: Author's computation

The cumulative sum (CUSUM) and CUSUM squares test are also alternative stability test instead of the Ramsey RESET test that is conducted earlier. The CUSUM test examines the stability of the model over the time frame and is deemed to be stable if the regression line does not cross the 5 per cent critical bounds level. Using the CUSUM and the CUSUM square test result reported in figures 2 and 3, it can be revealed that the regression line did not cross the 5 per cent critical bound line for the CUSUM and the CUSUM square values. It can thus be concluded that the regression equation is stable in the long run and credible predictions can be drawn from it.

Conclusion

This study hypothesizes that exchange rates could impact the extent of distribution of income across residents of an economy, using Nigeria as a case study. The extent of income imbalance is measured by the Gini coefficient, while foreign exchange rate changes are measured by percentage changes in dollar value in naira. Extensive theoretical and empirical literature was conducted to situate our analysis. The model was carefully designed and adapted from previous literature reviews. Before estimating the model, trend analyses were conducted and the result shows that fall in the percentage change in the exchange rate is accompanied by a fall in the Gini coefficient. Thereafter, we conducted a descriptive statistic and the result shows no perfect multicollinearity.

Unit root and co-integration tests were conducted on the variables. The result of the stationarity test shows that some variables were stationary at levels, while others attained that at first difference. The study further conducted the ARDL bound co-integration test and the result shows that there is co-integration associated with the regression result. The ARDL regression model was estimated. It can be concluded from the study that exchange rate devaluation/depreciation worsens income distribution and thus, the depreciation or devaluation of the exchange rate increases income inequality. The study also concludes that in the long run, increases in per capita income reduced the spread and extent of income inequality.

This study recommends that the Nigerian government should take caution in depreciating or devaluing the naira exchange rate since depreciation widens income inequality. Again, the government must consistently design policies to ensure long-term growth in income as this can reduce income inequality. Specifically, the government should implement the following policies to mitigate the impact of fluctuations in foreign exchange rates on income distribution: Periodic indexation of wages/salaries to cushion the impact of upticks in inflation rates. Sustained implementation of the social investment scheme for vulnerable members of society. Exert the political will to diversify the economy from a mono-product structure. Implement strategic export promotion incentives for non-oil exports to enhance & diversify the country's foreign exchange earnings.

The primary limitation encountered in undertaking this study is reliance on secondary data; hence any error therein can filter into the work. Data used for empirical analysis was obtained from the Central Bank of Nigeria's statistical bulletins. This study employed the Autoregressive model, which is but one of the available models. It is recommended that future research on the subject can equally adopt other models like simultaneous equation techniques and vector autoregressive models. This will allow for a comparison of obtained results.

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