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External Sector Variables and Macroeconomic Stability in Nigeria: ARDL-Error Correction Approach

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ABSTRACT

This study examines possible causal relationships between external sector variables and macroeconomic stability in Nigeria using the Autoregressive Distributed Lag (ARDL) approach to cointegration and error correction analysis over the period 1981 to 2016. Firstly, the causal effect of external debt stock is positive and insignificant on economic growth and negative and insignificant on inflation in the long-run and short run. The results confirm the weakness of key external sector variable in driving economic activities in Nigeria and highlights the unique case of underutilized fund from abroad. Secondly, the causal effect of exchange rate is found to be positive and significant in the long run and short run. Thirdly, the causal effect of FDI is found to be negative and insignificant on economic growth but exerts positive and significant effect on inflation suggesting the dominant role of FDI in driving macroeconomic stability in Nigeria. Finally, trade openness exerts mixed causal effect on macroeconomic stability. This study concludes that external sector variables exert mixed causal effects on macroeconomic stability in Nigeria. This conclusion is premise on the results identifying real exchange rate and FDI among the underlying factors that determine the amount of economic activities and the rate of inflation passing through the Nigerian economy. The study recommends harmonization of the multiple exchange rate windows into a single window to enhance trade openness.

Keywords: Trade openness, macroeconomic stability, economic growth, inflation, foreign direct investment.

1. INTRODUCTION

Globalization and international trade has made world economies to be interwoven. This has both positive as well as negative implications to economies both developed, developing and/or underdeveloped. It becomes imperative therefore, for the external sector to function optimally to guarantee macroeconomic stability of any economy. The external sector encapsulates a country's economic transactions or activities with other countries of the world (trading partners). It is a measurement of the economic transactions between the residents of an economy and the rest of the world. An economy is seen to be economically stable when it has a fairly constant and/or steady growth in output, combined with low and stable inflation regimes. This is in consonance with Gbosi (2015) who opine that economic stability is usually seen as a desirable state for a developed and developing countries.

In an open economy, economic stability is a function of the interplay of various factors and sectors in an economy, one of which is the external sector. The external sector can be in a state of stability or in instability (in deficit or surplus). A stable and balanced state or equilibrium ensues when receipts (inward payments) from economic activities in the external sector are exactly enough and equal to out-payments. A deficit state represents a situation where receipts are insufficient to billet out-payments, while a surplus position arises when receipts are in excess of out-payments. While a country may desire a surplus, especially in the short-run, an ideal state of the external sector is one that is stable and in equilibrium overtime, as this situation would suggest stability in both inflation and economic growth of the referenced country.

As observed by Mordi et al (2010) Balance of Payments (BOP) accounts, currency Exchange Rate (EXR) and External Debt (EXD) are the chief indicators of external sector performance. Other indicators include Foreign Exchange Earnings, Exports, Imports, Foreign Portfolio Investment (FPI) and Foreign Direct Investment (FDI). Balance of Payment (BOP) as an indicator of the external sector performance is a measure of the value of trade interactions between one country and others. Exchange rate as a performance indicator of external sector is the number of units of a country's currency required to purchase one unit of another country's currency; while External Debt is the profile of a country's debt borrowed from foreign or external lenders, including foreign commercial banks and individuals or organizations, foreign governments or international financial institutions and agencies, to fund expenditure items in an economy.

The structure of the external sector of Nigeria economy has remained relatively unchanged since the 1960's. For instance, the export sector has been characterized by the dominance of one export commodity (Mordi et al 2010). According to them, palm oil was the dominant export commodity, until later on when rubber, timber, cocoa and groundnut made the list of exported goods. Agriculture contributed about 65 per cent to GDP and represented almost 70 per cent of total exports.

Despite the princely position of Agriculture as the mainstay of the external sector in particular and the Nigerian economy in general, the fortunes of the sector changed significantly in the late 1950s and early 1960s to date. Following the discovery of oil in commercial quantity in Oloibiri in Bayelsa State in 1956, Nigeria's agriculturally biased external sector was to change tremendously. Instances are handy to support this assertion. For instance, in 1971, the share of agriculture to GDP stood at 48.23 per cent. By 1977, it had declined to almost 21 per cent. Agricultural exports, as a percentage of total exports, which was 20.7 per cent in 1971, reduced further to 5.71 percent in 1977. The 'misfortune' of the agricultural sector, therefore, was not unconnected to the discovery of oil in commercial quantity in 1956, coupled with the oil-boom resulting from the Arab oil embargo on the USA in 1973. The economy in general and the external sector henceforth, became predominantly dependent on crude oil export. By this time, oil revenue represented almost 90 per cent of foreign exchange earnings and about 85 per cent of total exports. While the boom afforded the government much needed revenue, it also created serious structural problems in the economy. By 1980 however, the external sector was under pressure arising in part from the external debt overhang and from the decline in foreign receipts. This mono product (crude oil) dependent economy has resonated over the years with over 90 percent of total exports and foreign exchange earnings of Nigeria coming from the oil sector; at the expense of the Agricultural sector and other sectors of the economy.

The volatility in oil prices (which are determined externally) and outputs have led to uncertainties and shocks in government revenues. This has also introduced instability in both economic growth and inflation in Nigeria, given that the Nigerian economy is predicated on external sector performances in the form of oils exports and importations (import dependent economy). Therefore, there is no gain saying the fact that the external sector of an economy not only mirrors the relative strength of an economy. This has prompted some Economists and policy makers to advocate for adoption of import-substitution and export-led policies or models to grow economies and mitigate against macroeconomic instability. The Import-substitution model encourages domestic production and development through the use of various protectionist policies, while export-led growth model are chiefly aimed at encouraging and supporting exports to generate sufficient foreign exchange for various consumptions (out-payments). Advocates of import-substitution argue or believe that the benefits from increasing production output with the attendant increase in rate of domestic employment would compensate for losses that may arise from ineffective resource distribution associated with their model. On the other hand, advocates of export-led growth believe that foreign trade drives economic growth, because it facilitates more effective distribution of resources within a single country and between different countries and regions. Thus proponents of the export-led growth model, assert that growth in exports does positively impact on aggregate demand and accumulation of capital.

Some of the major problems that have hindered the attainment of economic stability (increase in economic growth and low inflation rate) have been attributed to external sector aggregates such as balance of payment disequilibrium, exchange rate volatility and excessive reliance by the federal government on external borrowing from the banking system, particularly the World Bank and the International Monetary Fund (IMF) to finance its large and unsustainable fiscal deficits.

With her vast mineral endowment particularly, petroleum and gas resources, and the rich and arable agricultural lands, Nigeria from independence till now, would have attained rapid economic development and national transformation. This however is not the case. The emergence and over dependence on oil had created distortions in the structure of the Nigerian economy. The non-oil (cocoa, groundnuts, rubber, cotton, and palm produce) export sector dropped and this changed the structure of the external trade thus creating unhealthy and undesirable imbalance in the economy. A cursory inspection of data on the pattern and trend of external trade and balance of payment positions further explain or reveal the over dependence of the economy on oil, which has continued to remain often vulnerable to external shocks. The dependence of domestic production and consumption on the availability of foreign exchange was so high that when the price of oil collapsed in the 1980's, a spiral effect was felt on all sectors of the economy. The rate of growth of the economy took a downturn, with the GDP averaging 5.82% within the period; and this was exacerbated by government excessive local and external borrowing. Similarly, Central bank of Nigeria (CBN) report in 2014 revealed that inflation rate averaged 8.7% between 1980 and 1990. It then increased to 9.95 percent between 1991 and 2000. Inflation rate which was 9.9 percent between 1991 and 2000, drastically increased to 15.65 percent between 2001 and 2015. The cumulative effects was a sharp rise in the external debt service burden on an economy that had significant deficit financing of its budget.

In the same vein, fluctuation in Nigeria currency exchange rate, which is a component of the external sector variables, caused economic instability in the country. For instance CBN (2014) statistic revealed that the official

exchange rate moved from a low level of ₦0.54: US \$ 1.00 in 1980 to a high of ₦ 22.05: US \$1.00 in 1994. Furthermore, between the year 2000 and 2014 the exchange rate rose again from ₦102.11: US \$1.00 to ₦ 161.00: US \$1.00. The official exchange rate released by the National Bureau of Statistics (NBS) for the last quarter of 2016 stood at N 365.00: US \$1.00. Conversely, Nigerian export (oil and non-oil) stood at ₦ 14.2m in 1980 increased to N109.9million in 1990, and to 1945.7million in 2000. In fact, it got to a peak of ₦12011.5m in 2010 and then fell to ₦ 10067.300m in 2014. Moreover, Tajudeen (2012) says that Nigerian's debt burden discouraged investments in the economy and created difficulties in accessing additional funds from the international capital market. In the case of external debt, Mordi et al (2010) observed that the debt profile of the country revealed an economy that was largely under borrowed from 1960 to late 1970's, but over-borrowed between 1980 till 2015. According to Ewubare and Obayori (2015) an examination of the Nigerian's external sector profile showed that the pressure on the balance of payments persisted in the first half of 1994. An overall deficit amounting to ₦ 7,275.6 million was recorded in the BOP compared with ₦3, 876.8 million in the deficit, which substantially outweighed the surplus recorded in the current account. However, the situation worsened again in 2008 as a result of the global economic meltdown and falling oil prices. The continual imbalances in the external sector of the Nigerian economy seemingly suggest that government needed to do more to stimulate economic growth and development.

The fluctuations in the external sector caused instability in economic growth rate, and also increased the price level of goods and services in the country. For instance, Obida and Nurudeen (2010) asserted that GDP growth which averaged approximately 6.0% between 1971 and 1980 was not productive output induced growth, rather the growth in GDP was due to the millions of dollars Nigeria made from the oil during this period. This is further highlighted by the GDP growth which averaged -5.82 percent (negative growth) between 1981 and 1985, was chiefly orchestrated by the fall in oil prices which began in 1981.

In recent history, the recession (inefficiency in aggregate demand), high rate of inflation and exchange rate volatility that bedeviled the Nigerian economy since the end of 2014 to date, is chiefly attributable to external sector shocks arising from the fall in the prices of crude oil which subsequently led to the dwindling of government revenues, decline in external reserves, and fall in foreign direct investment (FDI) and foreign portfolio investment (FPI). The combination of these external occurrences culminated into a recessed economy with unstable and negative growth from 6.43 percent in 2014 to -1.54 percent in 2016; an inflation ravaged economy from a manageable rate of 8.04 percent in 2014 to 15.7 percent in 2016 and about 19.1 percent as at January 2017; as well as a nominal exchange rate of N158.5/\$1 (N185/\$1 in the parallel market) in 2014 to N310/\$1 (N510/\$1) as at March, 2017. The macroeconomic instability of the Nigerian economy therefore, could be argued to have an external sector coloration given the import and crude oil dependent nature of the Nigerian economy.

This study therefore investigates the performance of external sector variables and their magnitude impact on macroeconomic stability in Nigeria. This work shall define and restrict macroeconomic stability to mean economic growth (proxied by GDP per capita) and inflation. This study shall cover the period of 1981 to 2016. The study shall limit the external sector variables to foreign direct investment, external debt, exchange rate and trade openness.

2. LITERATURE REVIEW

2.1 Theoretical Literature Reviewed

2.1.1 The Two-Gap Model of Development

The two-gap model was postulated by two theorists, Harrod (1939) and Domar (1946) and their theory is regarded as a post Keynesian growth model for closed economies. The major component of the model states that most countries are underdeveloped either because they are faced with a shortage of domestic savings to augment for investment opportunity or they are faced with foreign exchange constraints to finance the needed capital and international goods. The model therefore, introduces the assumption that an imported commodity not produced domestically is essential for the production of investment goods.

The model is represented thus:

$$Y = C + I + (X - M) \dots\dots\dots (2.1); \text{ where } (X - M) \text{ equals to net export.}$$

$$\text{Equation (2.1) can be rearranged as } Y + M = C + I + X \dots\dots\dots (2.2)$$

Thus, sources of income in the economy = uses of resources in the economy.

$$\text{Equation (2.2) can be broken down further to } S + C + M = C + I + X \dots\dots\dots (2.3)$$

Subtracting C from both sides and defining savings ($S = Y - C$),

$$S + M = I + X \dots\dots\dots (2.4)$$

The two-gap model is then represented by

$$M - X = I - S \dots\dots\dots (2.5)$$

(Foreign exchange gap) = (Savings gap).

In essence therefore, the model states that if the available domestic savings fall short of the level necessary to achieve the target rate of growth, a savings-investment gap is said to exist. And to close this gap requires Foreign Direct Investment (FDI); so also, if the maximum import requirement needed to achieve the growth target are greater than the maximum possible level of export, this is a situation of high importation which will lead to a shortfall in the foreign exchange. This creates the trade gap which can be corrected by foreign aid.

Despite the plausible contribution of this model, however, as observed by Abdullahi et al (2013) the model is not immune to some weaknesses, as it focuses exclusively on the savings-investment gap to achieve growth. By not considering the performance of the external sector of the borrower's economy, the model is silent on this transformation problem being a close economy growth model.

The relevance of this theory to this study is that the model promotes domestic savings as a compulsion to achieving a target rate of growth. It also affirmed that the external sector plays a pivotal role in economic growth and/or development trajectory of any given economy, as it could be used to bridge the domestic savings-investment gap through Foreign Direct Investment, foreign exchange and foreign aid while maintaining external stability.

2.1.2 The Balance of Payment Constrained Growth Model.

Thirlwall's Balance of Payments constrained growth model is another relevant contemporary growth theory of interest to this study. This theory opines that the rate of growth of an individual country is restrained by the Balance of Payments as the economy cannot grow faster than what is consistent with the Balance of Payments equilibrium or at least consistent with a sustainable deficit in the Balance of Payments. To Thirlwall (1979) no country can grow faster than the rate consistent with the Balance of Payments equilibrium on current account unless, it can finance ever-growing deficits, which is generally believed to be overwhelming. Specifically, therefore, the basic idea of the model is that export performance and import behavior determines the rate of economic growth in the long run. Increasing revenue of foreign exchange from exports of goods and services make up the only sustainable means of financing increasing imports caused by the expansion in domestic activity or aggregate demand. One major assumption Thirlwall premised this theory on is its assumption that trade balance equilibrium and imports are related to domestic income only. Ferreira and Canuto (2003), collaborated Thirlwall's position with their elucidation that only export growth and the growth of investment in import substitution are the components of aggregate demand that has the capacity to increase the growth of GDP, as well as to relax foreign constraints and Balance of Payments constriction. Conclusively, therefore, favorable Balance of Payments enhances the capacity of an economy to expand while at the same time maintaining an equilibrated current account.

This theory however, has been criticized for excluding the savings-investment gap, fiscal gap and monetary implication of the Balance of Payments. It also does not show the foreign exchange requirement relating to the maintenance of level of reserves (Darku, 2013). The reason for this theory is that it observed Balance of Payments as an important variable of the external sector. Also, the model is relevant to this study because export performance and import behavior determines the Balance of Payments and exchange rates which has significant impact on rate of economic growth and/or development, as well as macroeconomic stability.

2.2 Empirical Literature

A number of studies and literature exist on the effect of external sector variables on economic stability of Nigeria. This is same for some other countries. For instance, Mukamil and Rizwan (2016) investigated external sector and economic growth of Pakistan. The study used quarterly data that covered the period from 1990:Q1 to 2010:Q4 and applied Vector Auto Regression and Vector Error Correction Model. External sector indices have been developed containing financial integration, net foreign assets and trade integration. The Augmented Ducky fuller test confirmed that all variables in the study were non-stationary at level, but stationary at first difference. The co-integration test suggested one co-integrating vector among the variables. The empirical findings of co-integration analysis showed that financial integration had positive, while trade integration had negative effect on economic growth of Pakistan in the long run. However, the short run dynamics showed that output lag accounts for error correction confirming

Granger representation theorem. The estimated CUSUM and CUSUM-Square stability test showed that the coefficients of the model remained stable in the given sample period. Hua (2011) in his work "economic and social effects of real exchange rate evidence from Chinese provinces" used the one-step Generalized Movement Model (GMM) and panel data, to test variables of GDP, RER, capital intensity, share of employment, education level, export share, coastal provinces etc. His result found that exchange rate appreciated has negative effect on the economic growth higher in coastal than in inland provinces contributing to minimizing of the GAP of GDP per capita between the two provinces. The result also showed that RER appreciation had a negative effect on employment. Kasidi and Said (2013) in their study of "the impact of external debt on economic growth: a case study of Tanzania" used OLS method to test GDP on external debt and debt servicing. Their result revealed that that external debt has a positive effect on GDP while debt service has a negative effect. They also did not find a long run relationship between the external debt and GDP.

Ijeoma (2013) assessed the impact of debt on selected macroeconomic indicators in the Nigerian Economy. Secondary data on External Debt Stock, External Debt service payment, Exchange Rate, Gross Domestic Product and Gross Fixed Capital formation for the period 1980-2010 was drawn from Debt Management Office, CBN, and Statistical Bulletin and analyzed with Linear Regression. The study found that Nigeria's external debt stock has a significant effect on her economic growth. It also revealed that there is a significant relationship between Nigeria's Debt service payment and her Gross Fixed Capital Formation. Alimi and Muse (2013) examined the role of export in the economic growth process in Nigeria using time series data covering 1970 to 2009 and adopting unit root testing, co-integration analysis and VAR Granger causality/Exogeneity Wald test to analyze the time series. The researchers discovered long run relationship amongst the variable and uni-directional causality running from economic growth to export.

Aliyu (2007) examined imports-exports demand functions and BOP stability in Nigeria. He used secondary data on exchange rate, income, and imports capacity, level of foreign reserves on imports and applied co-integration and error correction modeling methods. The result showed that as world income increases, Nigeria's export expands because of very high income elasticity, the Marshall-Lerner condition holds in Nigeria (devaluation impacts positively on economic growth), it also showed that SAP was anti exports. Usman, Ashfaq and Mushtaq (2012) in an attempt to understand the causality between export and economic growth, investigated the impact of export on economic growth in Pakistan using ordinary least square, and discovered a strong positive and significant effect of export on economic growth. Udeh, Ugwu and Onwunka (2016) examined the impact of external debt on economic growth in Nigeria for the period 1980-2013. Model was formulated and data was analyzed using Ordinary Least Square. Diagnostic tests were conducted using Augmented Dickey Fuller Unit Root Test, Co-integration and Error Correction Model. The independent variable was GDP, while the explanatory variables were External Debt Stock, External Debt Service Payment and Exchange Rate. The findings showed that External Debt had a positive relationship with Gross Domestic Product in the short run, but a negative relationship at the long run. Also, while External Debt Service Payment had negative relationship with Gross Domestic Product, Exchange Rate had a positive relationship with it.

Ajayi and Oke (2012) investigated the effect of external debt burden on the economic growth and development of Nigeria. In their work, "the effect of external debt on economic growth and development of Nigeria" using the regression analysis OLS was carried out. They tested national income on debt service payment, external reserves and interest rate. They found that external debt burden had an adverse effect on the National income. Akpan and Atan (2012) examined exchange rate macro-economic aggregates in Nigeria" using a Generalized Moment Method (GMM) and simultaneous equations. They tested rate of inflation, growth rate, real exchange rate, real exports, real government revenue, and real government expenditure. Their results showed that there is no evidence of a strong direct relationship between changes in the exchange rate and inflation growth rate. Rather Nigeria's economic growth was affected by fiscal and monetary policies and other economic variables particularly the growth of export. The factors tend to sustain a pattern of RER overvaluation which has been unfavourable for growth.

Amini, Oushehi, Ahranjani, Amini (2012) examined the effect of trade liberalization on BOP and economic growth in Iran using auto regressive distributed lags and the ECM method. They tested for trade balance, internal income, foreign income, real exchange rate, and trade liberalization. Their results showed that the effects of trade liberalization on the trade balance and economic growth is positive and significant in the long run, but its effects on the current account of BOP are not significant. Imoisi (2012) examined the nexus between BOP and inflation rate in Nigeria using OLS method. He found that there was an insignificant relationship between BOP and inflation, while the relationship between BOP, exchange rate and interest rate was significant. This is in conformity with the economy theory. The empirical works of Wacziarg (2001), and Sinha and Sinha (2000) found that the growth rate of GDP is positively related to the growth rate of trade openness.

3. METHODS OF STUDY

3.1 Research Design

Research design describes the method the investigator aims at adopting in order to prosecute the research task (Robinson, 2007). Thus, the study will adopt and use a quasi- experimental design. This is because the study is interested in cause and effect relationship of variables. Specifically, the study will employ ARDL approach to co-integration and Error Correction Model (ECM) as the main analytical tools.

3.2 Model Specification

The model to be specified is cast in line with Gbosi (2015) and Alimi and Muse (2013). According to Gbosi (2015), an economy with fairly constant output growth as well as low and stable inflation would be considered economically stable. Thus, the Economic growth and Inflation models will be considered. Also, Alimi and Muse (2013) proposed; $GDP = f(EXP)$ (3.1). The current model incorporates more external sector indicators in order to investigate the magnitude influence of external sector variables on inflation and growth of the Nigerian economy.

The functional models to be estimated shall be stated as:

$$GDPP = F (EXR, EXD, TRD, FDI) \quad (3.2)$$

$$INF = F (EXR, EXD, TRD, FDI) \quad (3.3)$$

The linear forms of the models are stated thus;

$$RGDP = \alpha_0 + \alpha_1 EXR + \alpha_2 EXD + \alpha_3 TRD + \alpha_4 FDI + U \quad (3.4)$$

$$INF = \beta_0 + \beta_1 EXR + \beta_2 EXD + \beta_3 TRD + \beta_4 FDI + U \quad (3.5)$$

The natural log of both sides of (3.4 and 3.5) will be taking except for INF that is in rate to have a log-linear form:

$$\ln GDPP_t = \alpha_0 + \alpha_1 \ln EXR + \alpha_2 \ln EXD + \alpha_3 \ln TRD + \alpha_4 \ln FDI + U \quad (3.6)$$

$$INF_t = \beta_0 + \beta_1 \ln EXR + \beta_2 \ln EXD + \beta_3 \ln TRD + \beta_4 \ln FDI + U \quad (3.7)$$

Where;

GDPP = gross domestic product per capita used as proxy for Economic growth

INF= Inflation rate

EXR= Exchange rate

EXD= External debt

TRD= trade openness

FDI= Foreign Direct Investment

U = Error Term

t = Time Frame

α_0 and β_0 = Autonomous components of economic stability (RGDP and Inflation).

α_1 - α_5 and β_1 - β_5 = coefficient of the independent variables

3.3 Brief Explanation of the Variables in the Model

(a) Dependent variables

Gross Domestic Product per Capita (GDPP) is defined as the monetary values of all final goods and services produced within the geographical confines of Nigeria in a given year divided by population of Nigeria. GDP at current market price divided by consumer price index gives us our RGDP variable. **Inflation Rate** is an annualized percentage change in general price index or consumer price index, over time. Inflation is the rapid and persistent rise in general price level of goods and services in an economy over a period of time. Inflation has a negative impact on economic growth in an economy. It also discourages investment and savings as a result of future uncertainty over future.

(b) Independent Variables

Exchange Rate is annual exchange rate (naira/US dollar) valued in rate. It is the number of units of the Naira that can purchase a unit of the US dollars. A decrease in this rate is called nominal appreciation of the Naira, while an increase of this rate is called nominal depreciation. In this study therefore, it is used as an independent variable and is expected to have a positive relationship with economic growth but negative relationship with inflation. **External Debt:** External debt is that part of a country's debt that was borrowed from foreign lenders including commercial banks, governments or international financial institutions. It is captured in the model as independent variable and is expected to have a positive relation with inflation and a negative relationship with economic growth. Thus, an increase in external debt will lead to an increase in inflation and decrease in economic growth. **Foreign Direct Investment** is an investment made by individual or a company from other countries in Nigeria in business interests, in the form of either establishing a business operations or acquiring business assets in Nigeria, such as ownership or controlling interest in a Nigerian company. It is expected to have positive relationship with economic growth and negative relationship with inflation. **Trade Openness** simply represents the outward or inward positioning of a given country's economy. By outward positioning, I refer to economies that take substantial advantage of the opportunities to trade with other countries. Inward positioning on the other hand refers to economies that fails to take advantage of the opportunities to trade with other countries. While some trade policy decisions taken by countries engender outward positioning, others engender inward positioning. Such trade policies include trade barriers, market competitiveness, infrastructure, import-export, exchange rate policies and technologies. International trade openness is a routed through which FDI, capital inputs, goods and services flow to domestic countries. A country with outward positioning in trade openness is expected to have positive impact on economic growth, while the reverse is the case for countries with inward positioning in trade openness.

3.5 Data Collection Method and Sources

The relevant data for the study were sourced from the publications of the Central Bank of Nigeria (CBN) statistical bulletin, CBN statements of account and annual reports, as well as National Bureau of Statistics publications, and also the author's computation for relevant years.

3.6 Technique of Data Analysis

The study will use the ARDL-Error Correction Model methods. The augmented dickey fuller test (ADF) shall be employed to test for the stationarity of the time series. Also, the co-integration shall be used to test for the long run relationship among the variables in the model and the ECM to correct the pitfall of the short run model.

3.6.1 Augmented Dickey-Fuller Unit Root Test

This involves testing the order of integration of the individual series under consideration. Thus, a variable is considered to be integrated of a particular order if the ADF critical value is greater than the variable critical value at 1%, 5% and 10%. Augmented Dickey-Fuller test relies on rejecting a null hypothesis of unit root (the series are non-stationary) in favor of the alternative hypotheses of stationarity. The tests are conducted with and without a deterministic trend (t) for each of the series. The general form of ADF is estimated by the following regression;

$$\Delta YD_t = \theta_0 + \theta_1 YD_{t-1} + \sum \theta_i \Delta YD_i + \alpha_t + U_t \quad (3.8)$$

Where: YD is a time series, t is a linear time trend, Δ is the first difference operator, θ_0 is a constant, n is the optimum number of lags in the independent variables and U is random error term.

3.6.2 ARDL approach to co-integration Test

This study employs the autoregressive distributed lag or Bounds testing approach to co-integration (ARDL) proposed by Pesaran et al. (2001) to investigate the log-linear empirical model specified in equation 1 and 2. Studies have shown that the ARDL approach offers some desirable statistical advantages over other co-integration techniques. While other co-integration techniques require all the variables to be integrated of the same order, ARDL test procedure provides valid results whether the variables are I(0) or I(1) or mutually co-integrated, allows for simultaneous testing of the long and short-run relationships between the variables in a time series model and provides very efficient and consistent test results in small and large sample sizes (see Pesaran et al., 2001). However, in the present study all the variables are integration of the same order (see Table 1) makes ARDL the

preferred approach in this empirical analysis. The implementation of the ARDL test for Eq. (3.6 & 3.7) involves the estimation of the following models:

$$\begin{aligned} \Delta \ln rgdpp_t = & a_0 + \sum_{i=1}^n a_{1i} \Delta \ln gdpp_{t-i} + \sum_{i=0}^n a_{2i} \Delta \ln Ext d_{1t-i} + \sum_{i=0}^n a_{3i} \Delta \ln Extr_{2t-i} + \sum_{i=0}^n a_{4i} \Delta \ln Fdi_{3t-i} \\ & + \sum_{i=0}^n a_{5i} \Delta \ln Trd_{4t-i} + a_6 \ln gdpp_{t-1} + a_7 \ln Ext d_{t-1} + a_8 \ln Extr_{t-1} + a_9 \ln Fdi_{t-1} + a_{10} \ln Trd_{t-1} \\ & + \varepsilon_t \quad (3.9) \\ \Delta \ln infl_t = & a_0 + \sum_{i=1}^n a_{1i} \Delta \ln infl_{t-i} + \sum_{i=0}^n a_{2i} \Delta \ln Ext d_{1t-i} + \sum_{i=0}^n a_{3i} \Delta \ln Extr_{2t-i} + \sum_{i=0}^n a_{4i} \Delta \ln Fdi_{3t-i} + \sum_{i=0}^n a_{5i} \Delta \ln Trd_{4t-i} \\ & + a_6 \ln infl_{t-1} + a_7 \ln Ext d_{t-1} + a_8 \ln Extr_{t-1} + a_9 \ln Fdi_{t-1} + a_{10} \ln Trd_{t-1} \\ & + \varepsilon_t \quad (3.10) \end{aligned}$$

Where Δ is the difference operator while ε_t is white noise error term. Other variables remained as previously defined in Table 1. The following hypotheses are tested to investigate the existence of co-integration among the variables: the null hypothesis of no cointegration among the variables in Eq. (3.9) is ($H_0: a_6 = a_7 = a_8 = a_9 = a_{10} = 0$) against the alternative hypothesis ($H_1: a_6 \neq a_7 \neq a_8 \neq a_9 \neq a_{10} \neq 0$). in in Eq. (3.10) the null hypothesis of no cointegration among the variables is ($H_0: a_6 = a_7 = a_8 = a_9 = a_{10} = 0$) against the alternative hypothesis ($H_1: a_6 \neq a_7 \neq a_8 \neq a_9 \neq a_{10} \neq 0$). The decision to reject or accept H_0 (no co-integration among the variables) is based on the following conditions: if the calculated F-statistics is greater than the upper critical bound, then H_0 is rejected and the variables are co-integrated, if the calculated F-statistics is less than the lower bound, then H_0 is accepted and the variables are not co-integrated, but if the calculated F-statistics remains between the lower and upper critical bounds then the decision is inconclusive (Pesaran et al., 2001).

3.6.3 Error Correction Model

After testing for cointegration among the variables, the long-run coefficients of the variables are then estimated. The existence of cointegration between the variables implies that causality exist in at least one direction. This study uses Akaike Information Criterion (AIC) for selecting the optimal lag length. The error correction model for the estimation of the short run relationships is specified as:

$$\begin{aligned} \Delta \ln rgdpp_t = & a_0 + \sum_{i=1}^n a_{1i} \Delta \ln gdpp_{t-i} + \sum_{i=0}^n a_{2i} \Delta \ln Ext d_{1t-i} + \sum_{i=0}^n a_{3i} \Delta \ln Extr_{2t-i} + \sum_{i=0}^n a_{4i} \Delta \ln Fdi_{3t-i} \\ & + \sum_{i=0}^n a_{5i} \Delta \ln Trd_{4t-i} + \lambda_1 ECM_{t-1} + u_{2t} \quad (3.11) \\ \Delta \ln infl_t = & a_0 + \sum_{i=1}^n a_{1i} \Delta \ln infl_{t-i} + \sum_{i=0}^n a_{2i} \Delta \ln Ext d_{1t-i} + \sum_{i=0}^n a_{3i} \Delta \ln Extr_{2t-i} + \sum_{i=0}^n a_{4i} \Delta \ln Fdi_{3t-i} + \sum_{i=0}^n a_{5i} \Delta \ln Trd_{4t-i} \\ & + \lambda_2 ECM_{t-1} + u_{2t} \quad (3.12) \end{aligned}$$

ECM_{t-1} is the error correction term obtained from the cointegration model. The error correction coefficients (λ_1 and λ_2) indicate the rate at which the cointegration models correct previous period disequilibrium or speed of adjustment to restore the long-run equilibrium relationship. A negative and significant ECM_{t-1} coefficient implies that any short term movement between the dependent and explanatory variables will converge back to the long-run relationship.

3.6.4 Stability and diagnostic test

The following diagnostic tests are conducted to ensure the acceptability of the empirical models: Breusch–Godfrey serial correlation LM test, ARCH test for heteroscedasticity, Jarque-Bera normality test and Ramsey RESET test for functional form. The stability of the long-run coefficients together with the short-run dynamics are tested using the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests. If the plot of CUSUM and CUSUMSQ statistics stays within the 5% range of the significance level, then all the coefficients in the error correction model are assumed to be stable, but if the plot of CUSUM and

CUSUMSQ statistics crossed the 5% range of the significance level, the coefficients in the error correction model are considered unstable (Bekhet and Matar, 2013).

4. EMPIRICAL RESULTS

4.1 Unit root tests

Although the ARDL-bounds cointegration testing approach allows variables to be integrated of different orders $I(1)$, it does not require any of the variables to be integrated of order 2 $I(2)$. Given that the F-statistics calculated by Pesaran et al. (2001) are established on the notion that the variables are $I(1)$, it is essential to examine the stationarity of the variables to ensure that none of the variables is integrated of order 2 $I(2)$. To determine the order of integration of the variables, the ADF and PP test in which the null hypothesis is $H_0 = \beta = 0$ (i.e. β has a unit root) is implemented. The results in Table 1 show that the variables are integrated of different order $I(1)$. However none of the variables is integrated of order two $I(2)$. Therefore, we proceed to conduct bound test to cointegration.

Table 1: ADF and PP unit root tests

variables	Level form $I(0)$	PP	First difference $I(1)$.	PP	Result
	t-Statistic-ADF		t-Statistic-ADF		
lnExtr	-1.9344 [0]	-2.0807 [0]	-5.0204***	-5.0204***	$I(1)$
ln Exd	-1.8792 [0]	-3.0108 [0]	-4.5443***	-4.5443***	$I(1)$
lnRgdpc	-1.5893 [0]	-1.9202 [0]	-3.9164 **	-5.4417***	$I(1)$
ln Fdi	-1.3022 [0]	-1.5731 [0]	-5.5530***	-9.6113***	$I(1)$
lnTrd	-0.6964 [0]	-0.8779 [0]	-4.4188***	-8.1655***	$I(1)$
lnInfl	-2.1972 [0]	-2.7192[0]	-6.9470 ***	-6.2112***	$I(1)$

Note: ADF is the Augmented Dickey Fuller test while PP stands for Phillip Perron unit root test. The lag length in []; level $I(0)$ and first difference $I(1)$. *, **, and *** indicate significance at 10%, 5% and 1%, respectively. All the variables are in the natural logarithm form.

4.2. Results of ARDL Co-integration Test

Given the relative small sample size of 36 observations (1981-2016) used in this study, the critical values for the evaluation of the null hypothesis are taken from Pesaran et al. (2001). Pesaran et al. (2001).computed two sets of critical values: lower bounds $I(0)$ and upper bounds critical $I(1)$ for sample sizes. The results of the co-integration test based on the ARDL-bounds testing method are presented in Table 3. The results indicate that the F-statistic is greater than the upper critical bound from Pesaran et al. (2001).at 1% significance level for model 1 and 2 respectively using restricted intercept and no trend. This study therefore rejects the null hypothesis of no cointegration among the variables. This shows that there is a long-run causal relationship between the real gdp growth rate, external debt stock, real exchange rate, inflation, foreign direct investment and trade openness in Nigeria.

Table 2: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-946.239	NA	8.55E+16	56.01406	56.28342	56.10592
1	-828.848	186.443*	7.38e+14*	51.22638*	53.11188*	51.8693*
2	-794.860	41.98532	1.02E+15	51.34473	54.84638	52.53889

* indicates lag order selected by the criterion; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

Table 3: ARDL bounds cointegration test results

Specifications (Max lag = 1)	ARDL	F-statistic	Result
Fgdpp(gdpp/Exd,Extr,Trd,Fdi)	(1,0, 1,0, 1)	5.8809***	Cointegration
Finfl(infl/Exd,Extr,Trd,Fdi)	(1,0, 0, 1, 0)	3.6080***	Cointegration
Critical Value Bounds	1%	5%	10%
I0 Bounds	3.74	2.86	2.45
I1 Bounds	5.06	4.01	3.52

ARDL Models selected on Akaike information criteria (AIC), $k = 5$

*** indicates significance at 1% level; Restricted intercept and no trend

Source of Asymptotic critical value bounds: Pesaran et al. (2001).

4.3 Long run and short run estimates

Table 4 and 5-(panel A) present the long-run coefficients for Model 1 and 2 estimated using ARDL approach. Each of the four selected indicators of financial intermediary development is used. The two model (specifications) of the macroeconomic stability show that the long-run coefficient of external debt stock is positive and insignificant in model 1 and negative and insignificant in model 2. The coefficient of real exchange rate in the specifications 1 of the growth model is positive and insignificant, contrary to Hua (2011) who found that exchange rate appreciated has negative effect on the economic growth whereas in specification 2 of price stability, the coefficient of exchange rate shows negative and significant at 5% level. This indicates that a decrease in exchange rate in the form of currency appreciation will likely fuel inflation in Nigeria. From the long-run coefficient of specification 2, a unit increase in exchange rate significantly increases inflation by 0.3206%. The coefficient of foreign direct investment in the specifications 1 of the growth model is negative and insignificant whereas in specification 2 of price stability, the coefficient of FDI shows positive and significant at 1% level. Even though the outcome failed to follow economic theory, this indicates that an increase in FDI in the form of net inflows will likely cause inflation in Nigeria. From the long-run coefficient of specification 2, a unit increase in FDI significantly increases inflation by 6.199%. Surprisingly, trade openness in the specifications 1 of the growth model is positive and significant at 5% level this indicates that an increase in trade openness will lead economic growth in Nigeria. From the long-run coefficient, a unit increase in TRD significantly increases economic growth by 0.2593%. The coefficient of TRD is negative and insignificant in model 2.

The short-run error correction estimates are presented in Table 4 and 5-Panel B. The coefficients of the ECM (-1) is negative and significant at 1% level. The coefficients indicate that a deviation from the long-run equilibrium as a result of a short-run shock is adjusted at a speed of over 88% each year. Specifications 1-Panel B suggest that the short-run effect of external debt stock on economic growth is positive, and highly insignificant, exchange rate positive and significant at 10% level while trade openness and FDI show positive and highly insignificant on economic growth. FDI and Exchange rate exerted positive and negative effect on inflation and highly significant in table 5-panel B while, External debt stock and1 trade openness are negative and insignificant.

Table 4: Long-run estimates

Panel A	Specification 1	Panel B	
Variable	Coefficient	Variable	Coefficient
EXTD	0.0001 [0.1669]	D(EXTD)	0.0001 [0.1661]
EXTR	0.00789 [0.0945]	D(EXTR)	0.4384* [1.7554]
FDI	-0.28734 [-0.3941]	D(FDI)	-0.2532 [-0.4009]
TRD	0.2593** [2.3394]	D(TRD)	[-0.0586] -0.5190
C	-12.67** [-2.5604]	Ect (-1)	-0.8813*** [-4.8613]

Diagnostic tests

R-squared	0.4148	
Durbin-Watson Statistic	1.7902	
Breusch–Godfrey serial corr LM test	0.4990	(0.4799)
ARCH test for heteroscedasticity	0.5036	(0.4779)
Jarque-Bera Normality test	3.2388	(0.198)
Ramsey RESET test: F-Statistic	1.6122	(0.2154)

Note: *, **, and *** indicate significance at 10%, 5% and 1% respectively ; t-statistics in [] and p-values in () ; R2 means R-squared; SC means Breusch–Godfrey serial correlation LM test; Het is the ARCH test for heteroscedasticity; RESET is the Ramsey RESET test; JB is the Jarque-Bera Normality test.

Table 5: Long-run estimates

Panel A	Specification 2	Panel B	
Variable	Coefficient	Variable	Coefficient
EXTD	-0.2351 [-0.3603]	D(EXTD1)	-0.21017 [-0.3559]
EXTR	-0.3206** [-2.2164]	D(EXTR)	-0.2865* [-2.0043]
FDI	6.1996*** [3.9476]	D(FDI)	3.7129* [2.6187]
TRD	-0.2506 [-1.3153]	D(TRD)	-0.22403 [-1.2975]
C	19.720** [2.4118]	Ect (-1)	-0.893*** [-4.3472]

Diagnostic tests

R-squared	0.5515	
Durbin-Watson Statistic	1.9332	
Breusch–Godfrey serial corr LM test	0.179	(0.6722)
ARCH test for heteroscedasticity	0.0785	(0.7793)
Jarque-Bera Normality test	7.2448	0.2671
Ramsey RESET test: F-Statistic	0.0021	(0.9636)

Note: *, **, and *** indicate significance at 10%, 5% and 1% respectively ; t-statistics in [] and p-values in () ; R2 means R-squared; SC means Breusch–Godfrey serial correlation LM test; Het is the ARCH test for heteroscedasticity; RESET is the Ramsey RESET test; JB is the Jarque-Bera Normality test.

4.4 Diagnostic and Stability tests

From the diagnostic test results (see results in Table 4 and 5), there is no evidence of serial correlation, heteroscedasticity and functional form misspecification in each of the ARDL models specified. Figures 1 and 2 show the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares (CUSUMSQ) stability test results. The CUSUM and CUSUMSQ are within the critical boundaries for the 5% significance level indicating that the coefficients of the ARDL model in each of the specifications are stable.

Figure 1: CUSUM and CUSUM of Squares for model 1

Figure 2: CUSUM and CUSUM of Squares for model 2

5. CONCLUSION AND POLICY IMPLICATION

Using four indicators of external sector variable, this study examines the possible relationship between external sector variables and macroeconomic stability Nigeria over the period 1981 to 2016 using the ARDL approach to co-integration and error correction model analysis. First, the causal effect of external debt stock is positive and insignificant on economic growth and negative and insignificant on inflation in the long-run and short run. However, the result is in contrast with Udeh, Ugwu and Onwunka (2016) from Nigeria who found that external debt had a positive relationship with Gross Domestic Product in the short run, but a negative relationship at the long run. The results confirm the weakness of key external sector variable in driving economic activities in Nigeria and highlight the unique case of underutilized fund from abroad. Second, the causal effect of exchange rate is found to be positive and significant in the long run and short run contrary to the findings of Akpan and Atan (2012) who examined exchange rate macro-economic aggregates in Nigeria and found no evidence of a strong direct relationship between changes in the exchange rate and inflation growth rate. Third, the causal effect of FDI is found to be negative and insignificant on economic growth but exerts positive and significant effect on inflation suggesting the dominant role of FDI in driving macroeconomic stability in Nigeria. Finally, trade openness exerts mixed causal effect on macroeconomic

stability, therefore, care should be taken in its interpretation even though related studies in the likes of Amini, Oushehi, Ahranjani, Amini (2012) found the effects of trade liberalization (trade openness) on economic growth is positive and significant in the long run.

Given that results identifies real exchange rate and FDI among the underlying factors that determine the amount of economic activities and the rate of inflation passing through the Nigerian economy, the study recommends harmonization of the multiple exchange rate windows into a single window to enhance trade openness.

COMPETING INTEREST

There is no competing interest of whatsoever in respect to this work.

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ENDNOTES

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