Maliye Çalışmaları Dergisi
Journal of Public Finance Studies

Research Article

Macroeconomic Volatility and its Significance to the Rising External Indebtedness of Nigeria

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ABSTRACT

The motivation of this study has been to identify the effects of the multidimensional perspectives of macroeconomic volatility on the growth of external debt in Nigeria from 1970 to 2018. Methodologically, the Auto-Regressive Distributed Lag (ARDL) model and the Toda-Yamamoto causality approach were adopted. For the purpose of understanding the multidimensional perspective of macroeconomic volatility, macroeconomic volatility was disaggregated into three different perspectives which are: volatility from macroeconomic outcomes, domestic sources, and external sources. Findings from the study suggest that while volatility from macroeconomic outcomes exclusively affects external debt in the long-term, effects from the three sources were very substantial in the short-term. Furthermore, the causality result indicates bidirectional nexus between volatility from macroeconomic outcomes and external debt. Also, the irregular variations in the Nigerian political space, unanticipated disease outbreaks, and the effects of the 1986 recession in the country all significantly worsened the country's external debt situation. Thus, the study recommended amongst others that since developing countries such as Nigeria cannot do away with the demand for external debt to finance its economic growth, it is also important to count the cost such financing provides even if faster growth is actually realise.

Keywords: Macroeconomic volatility, External debt, Domestic source, External source

JEL Classification: E3, E63, H6

1. Introduction

Nigeria's external indebtedness can be traced back to the 1920s, when the country began to accumulate a significant amount of debt from the United Kingdom capital market and the International Bank for Reconstruction and Development (IBRD). The loans were secured for the purpose of infrastructural development, such as railway line expansions, building of port harbours, etc. Total external debt then stood at about 10 million pounds while total revenue accruable to the country was barely 6 million pounds (Ogunyemi, 2011). After the lunch of the Colonial Development and Welfare Plan (CDW) in 1946, Nigeria secured another set of loans from the United Kingdom for infrastructure and budget expenditure support up until 1960 when independence was attained. External debt during the 1959/1960 fiscal year stood at about 17 million pounds (Ogunyemi, 2011).

After independence, specifically in 1964, the scope of the nation's bilateral external borrowing was expanded with a loan of about $13.1 million from the Paris Club of Creditor Nations (DMO, 2005). The loan served as part funding for the building of the Niger Dam. By 1970, Nigeria had begun the commercial exploration of her vast oil resources. Gradually, the economy became heavily reliant on oil revenue while agriculture, which had been the prior mainstay of the economy, also continued to diminish substantially in value. Worthy of note, the country had just emerged from a civil war that lasted between 1968 and 1970. Thus, the government embarked on a massive reconstruction of infrastructure damaged during the war. This was why, despite the new-found wealth (crude oil) and the boom in its price in the early 1970s, external borrowings were still undertaken. However, Nigeria's external borrowings incurred before the 1978 period were relatively minute and primarily long-termed, sourced from multilateral and official organizations such as the World Bank and Nigeria's major trading partners. These loans were mainly secured on soft terms and, thus, were perceived to be of no detriment to the economy. Nevertheless, Nigeria in the 1977/78 fiscal period initiated her first US$1.0 billion jumbo loan, sourced from the international capital market (Essien, Agboegbulem, Mba, and Onumonu, 2016). The loan was further deployed in funding various medium to long-term infrastructural projects in the country.

The period between 1981-1990 witnessed tremendous decline in the average annual growth rate of oil price to -1.44 percent against a growth rate of 40.04 percent between 1970-1980 (BP statistical review of world energy, 2019). This massive decline was attributed to the oil glut experienced in the international oil market at the commencement of the decade. Hence, Nigeria suffered a huge shortfall in oil revenues needed to fund the fiscal budgets and debt repayment obligations. For instance, by 1984 when the $13.1 million Paris Club loan was due for repayment, Nigeria was already battling with a huge balance of payment problems. On the other hand, accrued interests on the loan had continued to remain unremitted for several years before the due repayment date of the principal. This resulted in enormous penalties imposed on the country, which further compounded her debt burden. Specifically, the amount owed the Paris Club of Creditors alone had climbed to a staggering $6.36 billion by 1984, from less than $30 million in the 1960s, and constituted about 42.6% of the total external debt burden of about $14.81 billion (Central Bank of Nigeria annual statistical bulletin, 2018).

By mid-1986, the country slipped into a recession, and as a policy measure, the government introduced the Structural Adjustment Programme (SAP) which saw deficit financing grow significantly within the recession period (1986-1990). To fund the deficits, the government escalated the use of external borrowing. For instance, while Nigeria's external debt-to-GDP ratio was just 13.9% in 1980, during 1986, 1987, 1988, 1989, and 1990, the ratios jumped to 40.5%, 55.1%,

59.7%, 68.5%, and 61.9%, respectively (WDI, 2019). To further exacerbate the matter, the country's external debt-to-export of goods and services ratios suddenly peaked at 772.2% in 1986 from 47.4% in 1980 (WDI, 2019). This signifies that by the year 1986 alone, Nigeria needed more than seven times what she received in earnings from exports for debt repayment. Thus, this made the 1980-1990 period a most challenging time in Nigeria's debt management history.

The high external indebtedness of Nigeria continued all through the 1990s to the mid-2000s when it attained unsustainable heights. Consequently, by the year 2005, the country had become one of the most highly indebted nations of the world. This motivated the federal government under the leadership of President Olusegun Obasanjo to seek a 'debt buy back' agreement in 2005 from Nigeria's major creditors—the London and Paris Clubs of creditors. The deal was later agreed upon and implemented in 2006. Thus, Nigeria was afforded the privilege of 'buying back' some $30 billion of her $32.6 billion external debt on the payment of $12.4 billion (DMO, 2005).

Despite the 2006 debt relief granted to Nigeria by the London and Paris Club of Creditors, Nigeria's external debt has once again begun climbing to worrisome heights. Responsible factors for such growth vary in the literature, ranging from issues of governance and capital flight (Lawanson, 2007; and Ndikumana and Boyce, 2011) to macroeconomic factors (Ajayi, 1991; Ajayi and Khan, 2000; and Iyoha, 2000). Hence, it is important to stress that the core focus of this study is on the macroeconomic factors and the impact their volatile nature exerts on external debt in Nigeria. Furthermore, the possibility of a reverse impact from external debt to macroeconomic volatility was also evaluated and justified on the grounds that in the event of a reverse causation from external debt to macroeconomic variables, ineffectiveness of economic policies could ensue. Nevertheless, the role of instability in governance, unanticipated disease outbreaks, and the effects of the 1986 recession on external debt accumulation were captured with the inclusion of a time trend and dummy variable. Methodologically, the Auto-Regressive Distributed Lag (ARDL) model and the Toda-Yamamoto causality approach were adopted for deriving the study's empirical findings.

To aid the understanding of the multidimensional interaction of macroeconomic volatility with external debt, this study disaggregated macroeconomic volatility into three different perspectives. The first stems from the fact that volatility can be the result of macroeconomic outcome. For instance, it is expected that macroeconomic objectives of controlling inflation, achieving growth in output, and reducing unemployment of factors of production, initiated in an economy, should help to guarantee a sustainable external debt profile for the country. On the contrary, attaining such macroeconomic goals in developing countries has been known to exaggerate economic instability in these countries (Loayza, Ranciere, Serven, and Ventura, 2007), which could leave a dire negative effect on their external debt.

Secondly, macroeconomic volatility can arise from self-inflicted domestic shocks, triggered by the very nature of the instability associated with a country's development process and self-inflicted policy mistakes (Loayza, Ranciere, Serven, and Ventura, 2007). This intrinsic instability can be traced to the development of the country's financial system. For example, the Nigerian financial market, like most developing nations, is characterized by weak instruments of credits and poor volume of savings. This has made the lending rates in the country to constantly remain high due to the scarcity of loanable funds. Such a phenomenon has been known to have encouraged government external borrowing. Thirdly, macroeconomic volatility can arise from external sources, which could arise from the effects of an inadequate trade policy and resource price shocks. For example, in an oil-dependent country such as Nigeria, where oil export and revenue

constitutes about 96 and 75 percent of the total government's export and receipts, respectively (Aladejare 2018), this makes the economy susceptible to bigger exogenous shocks from volatile oil price than a well-diversified economy. This is due to the weak "shock absorbing" feature of an oil-driven economy in the presence of volatile oil prices. To add to this, the Nigerian financial market is still developing towards possessing sufficient market instruments to neutralize the effects from such external shocks (World Bank 2000). The result of which was the growth in external indebtedness to unsustainable heights as experienced from the mid-1980s to the mid-2000s.

Hence, this study pinpoints specific macroeconomic policies required to curtail the unnecessary growth in external debt and its rewarding ills on the growth and development of the economy. Noteworthy, there is a dearth of studies that have particularly x-rayed the interaction between the multidimensional aspect of macroeconomic volatility and external debt in Nigeria. Rather, a vast majority of external debt literature on Nigeria has delved into a one-way effect of macroeconomic volatility on external debt or external debt on macroeconomic volatility or the economy without further assessing the plausibility of a feedback relationship.

The rest of this study is structured as follows: Section 2 covers the study's literature review. Section 3 contains the study's data description and methodology. Section 4 covers the study's empirical findings while the concluding remarks of the study are found in section 5.

2. Literature Review
2.1. Theoretical Review
Common knowledge about government debt dictates that they are often demanded to smooth a consumption path inter-temporally when there is volatility in the source of income. Models attributed to Eaton and Gersovitz (1981) and Chari and Kehoe (1993) state that consumption smoothing is realised when government demand for credit is based on the available generated revenues. Precisely, the government seeks additional borrowing whenever its revenue level is low or volatile and will most likely choose to repay debts whenever there is an increase in revenues. Debt servicing in these models is fundamentally based on the amount of debt formation and the interest rate but is not a function of generated income. Hence, in a steady state, the government always ensures that its debts are fully serviced.

In another model proposed by Grossman and Van Huyck (1988), consumption smoothing is realised when debt servicing is made to depend on the generated revenue. Specifically, the government demands a quantum of debt depending, among other things, on the probability distribution of revenue and the interest rate but not on the generated revenue due to its volatility. For the purpose of consumption smoothing, debt servicing by the government is done in full only when there is a high amount of revenue generated. However, in a situation whereby income generated is very low, the government has the incentive to default in debt repayment either partially or in total. Regardless of the decision path chosen, if the government fails to make a strict commitment to service its debt and chooses not to collateralise its debt, it is anticipated that even in periods of highly generated government revenues, there will be incentive for the government to still default on its debt repayment.

Also, the government debt hypothesis is often based on the premise that creditors are usually caught in the dilemma of two adoptable approaches, necessary to discourage the government from defaulting. The first is the imposition of a credit ceiling accessible to the government while the second entails the denial to future credit in the event of a repayment default. However, there are three theorised options available to a government that chooses to default in spite of any of the

two measures adopted by creditors against defaulters. Bulow and Rogoff (1989) premised that a government can still borrow to smooth its consumption path despite credit denial by its creditors. This will involve purchasing a standard insurance policy in the event of low generated revenues. Under this premise, irrespective of whether credit demand or servicing by the government is dependent on revenue, the ability to borrow for consumption smoothing would be valueless for the government while the imposed penalty of no further lending by creditors would not discourage default. As a result, the government will not demand for uncollateralised credit. Limitations to this model stems from the fact that standard insurance policies with respect to low or volatility in revenue generation do not actually exist. In addition, governments are in the habit of demanding an enormous quantum of uncollateralised loans.

Another assumption is linked to where, in the absence of savings by the government, the penalty of no future access to credit will result in the government's future consumption path, being exactly equal to its generated future income stream (Eaton and Gersovitz, 1981; Grossman and Van Huyck, 1988; Worrall, 1990; and Eaton, 1993). Under this premise, irrespective of whether credit demand or servicing is dependent on revenue, the penalty of no future access to borrowing would be a significant discouragement to default, thereby making creditors to permit a positive credit ceiling.

2.2. Empirical Review

There are three categories of reviewed literature related to this study. First are those that examined the effect of macroeconomic volatility on external debt. Second are those that evaluated the role of external debt in creating macroeconomic volatility while the third are those who assessed the impact of external debt on economic growth. These three categories are briefly reviewed as follows.

2.2.1. Macroeconomic Volatility and External Debt

Empirical evidence abounds on the effect of macroeconomic variables volatility on the growth of external debt in developing countries. For instance, Ajayi (1991) was able to trace Nigeria's external indebtedness to both domestic and external sources. Identified domestic sources were high fiscal irresponsibility, poor economic management, and overvaluation of the exchange rate. For the external sources, diminishing terms of trade and escalating real interest rates were identified. Ajayi and Khan (2000) opined that the accumulation of external debt in Sub-Saharan African countries could be linked to excessive government spending. However, the study by Iyoha (2000) indicated that the deteriorating terms of trade, rising interest rates, and volatile export revenue were the cause of the post-1982 rise in external debt in Nigeria. By adopting a logit model in a panel study for 25 emerging economies, Catao and Sutton (2002) showed that external and domestic sources of volatility are likely to create higher external debt and also higher default in repayments especially if these volatilities are partly policy-induced. Similarly, Catao and Kapur (2004), using a logit model for a study on OECD countries, observed that macroeconomic external sources of volatility have the tendency of aggravating external debt for the purpose of domestic consumption smoothing. However, the ability to borrow is limited by the significant default potential that usually accompanies such volatility.

Edo (2002) concluded that fiscal spending, balance of payment problems, and global interest ratessubstantially explain growth in external debt in Nigeria and Morocco. Genberg and Sulstarova (2004) adopted a Monte-Carlo simulation approach to arrive at the conclusion that volatility in the real growth rate, real lending rate, and the primary fiscal deficit as well as the possible interaction

between them are the underlying determinants of external debt in emerging economies. Through the aid of the Dynamic Ordinary Least Square (DOLS) approach, Greenidge et al. (2010) concluded that the output gap, exports, the real effective exchange rate, and the real interest rate were negatively associated with the level of external indebtedness while deviations in government spending from its trend value was positively related to growth in external debt in Caribbean countries. Abdullahi, Abu Bakar, and Hassan, (2015) adopted an ARDL model and found that high interest rates, poor savings, poor naira exchange rate value, and constant fiscal deficits were the accumulating determining factors of external debt in Nigeria. Adamu and Rasiah (2016), also using the ARDL approach, found that changes in oil price, debt service, the exchange rate, budget deficit, and gross domestic saving have the tendency to aggravate the external debt profile of Nigeria.

2.2.2. External Debt and Macroeconomic Volatility

There are also studies that have focused on the role of debt in creating macroeconomic volatility in the literature. For instance, Leung (2003) found that developing countries, especially those in Africa, have experienced growing economic instability due to increasing external debts since the 1970s. Korinek (2011) observed that in small open emerging economies, the level of external debt can distort the macro economy by creating volatility in aggregate demand and exchange rate. Merola (2012) identified the main factors that give rise to debt in OECD countries. Noting that while debt aids the smoothing of real economic activities, Merola found that debt also has the potential threat of initiating instability and poor macroeconomic performance. In a related study for OECD countries, Sutherland, Hoeller, Merola, and Ziemann (2012) used a probit model to conclude that high indebtedness has the tendency of exposing an economy to asset price volatility, which can also aid macroeconomic instability. Furthermore, the study noted that public debts follow an upward trajectory during economic recessions. Using a Panel Vector Auto-Regression (PVAR) model, the study by Goyal, Sengupta, and Verma (2019) found that emerging economies with enormous external debt financing are usually prone to larger macroeconomic volatility. Particularly, the study observed that economies of emerging countries responded more to shocks from external debt financing in periods prior to and after the 2008 world financial crisis.

2.2.3. External Debt and Economic Growth

External debt has also been observed in the literature to affect the growth of a developing economy. In the study by Essien, Agboegbulem, Mba, and Onumonu (2016), through the use of a VAR and Granger causality approach, it was revealed that neither external nor domestic debt substantially impacted the growth of the Nigerian economy. Okoye, Modebe, Erin, and Evbuomwan (2017) employed the use of the OLS approach to derive the conclusion that external debt has a significant positive effect on the Nigerian economy. Adopting the Vector Error Correction Method (VECM), Elom-Obed, Odo, Elom-Obed, and Charity (2017) submitted that external debt has significantly impacted the Nigerian economy negatively. Also, by using the ARDL approach, Jibir, Abdullahi, Abdu, Buba, and Ibrahim (2017), Festus and Saibu (2019) and Ogbonna, Ibenta, Chris-Ejiogu, and Atsanan. (2019), for Nigeria, and Sami and Mbah (2018), for Oman, concluded that external debt adversely impacted economic growth in both the short and long-run periods.

3. Data and Methodology
3.1. Data Description

This study made use of annual time series data sourced for Nigeria from 1970 to 2018. To measure for external debt, data on external debt-to-GDP (EDGDP) was used. The EDGDP is used to proxy for

external debt since it gives a picture of the size of external debt to the economy. Furthermore, as previously stated, this study disaggregates macroeconomic instability into three perspectives. The first, which is instability as a macroeconomic outcome, is being measured using the growth rates of the Consumer Price Index (denoted as GCPI) used to proxy for the effect of changes in the price of non-tradable goods and export (denoted as GX) and import (denoted as GM), both used to gauge the effect of the revenue generating capacity and consumption levels of the economy, respectively. To gauge macroeconomic instability as a domestic source, deficit financing-to-GDP (DEFGDP) was used to proxy for fiscal policy effect while the growth rates of the nominal lending rate (denoted as GLR) and nominal deposit rate (denoted as GDR) were used to proxy for monetary policy effect. For the third source of macroeconomic instability (i.e., external sources), the degree of openness (DOP) was used to proxy for the trade policy/liberalisation effect; the growth rate of the Nigerian international price of oil, known as "Forcados" (denoted as GOP), was used to proxy for the speculative effect of resource price in the international market, and the growth rate of the external reserves (denoted as GXRE) was used to proxy for creditworthiness. These variables were all sourced from the World Bank WDI, with the exception of DEFGDP, which was sourced from the Central Bank of Nigeria (CBN) annual statistical bulletin. The choice of these variables stems from the empirical literature review, particularly from studies related to Nigeria.

Furthermore, a time trend component and a time dummy variable were added to the model. The time trend captures, first, irregular variations in the Nigerian political space, believed to have had significant effect on external debt management. For example, from 1970-2000, there had been 7 different coups (1975, 1976, 1983, August 1985, December 1985, 1990, and 1993), an interim President in August 1993, and a de facto military President from 1998-1999. Second, it captures the effects from different unanticipated outbreaks of diseases for which the federal government had to curb by making available supplementary funds, sometimes sourced through external borrowing. Some of this emergency health borrowing was noticed during the AIDS, bird flu, Ebola, and Lassa fever outbreaks and currently the coronavirus outbreak. Also, the inclusion of a time dummy variable was to capture the effects of the 1986-1990 recession. This period constitutes a significant turning point in external debt management in Nigeria.

3.2. Model Specification

Both the ARDL and Toda-Yamamoto causality approach were adopted for this study. Pesaran, Shin, and Smith (2001) proposed the ARDL bounds testing approach, which estimates short-term and long-term cointegration values. Obviously, the adoption of this technique is vast in empirical analysis especially when measuring long and short-term effects as well as measuring the time it takes for long-term equilibrium restoration. In addition, its numerous advantages in comparison with other conventional cointegration testing procedures includes its valid application whether the variables under observation are level, first difference stationary, or both. However, a pre-condition for using the ARDL model states that the dependent variable must be first difference stationary while the regressors can either be level or first difference stationary or a combination of both.

In addition, the bounds cointegration test technique requires that the F-test be conducted in accordance with the ARDL model chosen with the appropriate lag length selected. Table 2 offers the best four ARDL models, with 2 lags as optimum and used through-out this study. The preferred model selected was based on the Akaike Information Criterion (AIC) since it had the lowest ratio.

This study's functional form is as specified as follows:

$$edgdp_t = f(gcpi_t, gx_t, gm_t, defgdp_t, glr_t, gdr_t, dop_t, gop_t, gxre_t) \qquad \text{(Equ.1)}$$

Rewriting Equation 1 in an ARDL format yields:

$$\Delta edgdp_t = \propto_0 + b_1 edgdp_{t-1} + b_2 gcpi_{t-1} + b_3 gx_{t-1} + b_4 gm_{t-1} + b_5 defgdp_{t-1} + b_6 glr_{t-1} + b_7 gdr_{t-1}$$

$$+ b_8 dop_{t-1} + + b_9 gop_{t-1} + b_{10} gxre_{t-1} + b_{11} recession + \sum_{j=1}^{p} \varphi_i \Delta edgdp_{t-j}$$

$$+ \sum_{j=1}^{p} \pi_i \Delta gcpi_{t-j} + \sum_{j=0}^{p} \rho_i \Delta gx_{t-j} + \sum_{j=0}^{p} \sigma_i \Delta gm_{t-j} + \sum_{j=0}^{p} \theta_i \Delta defgdp_{t-j} + \sum_{j=0}^{p} \vartheta_i \Delta glr_{t-j}$$

$$+ \sum_{j=0}^{p} \tau_i \Delta gdr_{t-j} + \sum_{j=0}^{p} \delta_i \Delta dop_t + \sum_{j=0}^{p} \aleph_i \Delta gop_t + \sum_{j=0}^{p} \omega_i \Delta gxre_t + \forall_i trend_t$$

$$+ \mu_t \qquad\qquad (Equ. 2)$$

$$Note \quad i = 1, 2, \dots, N; \qquad\qquad t = 1, 2, \dots, T.$$

Re-specifying equation 2 to capture the error-correcting term yields:

$$\Delta edgdp_t = \emptyset_i ecm_{t-1} + \sum_{j=1}^{p} \varphi_i \Delta edgdp_{t-j} + \sum_{j=1}^{p} \pi_i \Delta gcpi_{t-j} + \sum_{j=0}^{p} \rho_i \Delta gx_{t-j} + \sum_{j=0}^{p} \sigma_i \Delta gm_{t-j}$$

$$+ \sum_{j=0}^{p} \theta_i \Delta defgdp_{t-j} + \sum_{j=0}^{p} \vartheta_i \Delta glr_{t-j} + \sum_{j=0}^{p} \tau_i \Delta gdr_{t-j} + \sum_{j=0}^{p} \delta_i \Delta dop_t + \sum_{j=0}^{p} \aleph_i \Delta gop_t$$

$$+ \sum_{j=0}^{p} \omega_i \Delta gxre_t + \mu_t \qquad\qquad (Equ. 3)$$

Hence:

$$ecm_{t-1} = edgdp_{t-1} - \pi_0 - \pi_1 gcpi_{t-1} - \pi_2 gx_{t-1} - \pi_3 gm_{t-1} - \pi_4 defgdp_{t-1} - \pi_5 glr_{t-1} - \pi_6 gdr_{t-1} -$$

$$\pi_7 dop_{t-1} - \pi_8 gop_{t-1} - \pi_9 gxre_{t-1} \qquad\qquad (Equ. 4)$$

where "*ecm*" as shown in Equations 3 and 4 denote Error Correction Mechanism. The parameter $\emptyset_i$ serves as the short-term error-correcting speed of adjustment to the long-term equilibrium path. Put differently, it captures how long it will take for the system to correct itself back to its long-run equilibrium path, supposing a shock is introduced into the relationship. Hence, the long-term parameters given as $\pi_0, \pi_1, \pi_2, \pi_3, \pi_4, \pi_5, \pi_6, \pi_7, \pi_8,$ and π_9 in Equation 4 are computed as $-\frac{\propto_0}{b_1}, -\frac{b_2}{b_1}, -\frac{b_3}{b_1}, -\frac{b_4}{b_1}, -\frac{b_5}{b_1}, -\frac{b_6}{b_1}, -\frac{b_7}{b_1}, -\frac{b_8}{b_1}, and -\frac{b_9}{b_1}$ respectively.

3.2.1. The Toda-Yamamoto causality approach

The Toda and Yamamoto (1995) causality approach is preferred to the ordinary Granger causality test due to its compatibility with incorporating variables in a standard vector autoregressive model in their level form (Aladejare, 2019). This negates the fitting in first difference as common

with the Granger causality approach, thereby lowering the margin for error that is likely to occur in terms of erroneously identifying the nature of integration of the variables. The primary argument behind this method is to manipulate the correct VAR order (k) by simply introducing a maximal order of integration, denoted as dmax. Once this is done, a $(k+d_{max})$th order of VAR is evaluated, and the coefficients of the last lagged dmax vector disregarded.

Thus, to estimate the Toda-Yamamoto causality test, we denote the regressor variables in the following VAR system. However, for the sake of brevity, we only present the hypothetical model applicable to this study as shown below:

$$y_t = \propto_0 + \sum_{i=1}^{k} \propto_1 y_{t-i} + \sum_{j=k+1}^{d_{max}} \propto_{2j} y_{t-j} + \sum_{i=1}^{k} \aleph_1 x_{t-i} + \sum_{j=k+1}^{d_{max}} \aleph_{2j} x_{t-j} + \varepsilon_1 \qquad (Equ.5)$$

$$x_t = \gamma_0 + \sum_{i=1}^{k} \gamma_1 x_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} x_{t-j} + \sum_{i=1}^{k} \tau_1 y_{t-i} + \sum_{j=k+1}^{d_{max}} \tau_{2j} y_{t-j} + \varepsilon_2 \qquad (Equ.6)$$

where is the regressor(s) and denotes the response variable.

4. Results and Discussion of Findings
4.1. Unit Root Test

As prior noted, the precondition for adopting the ARDL method requires the dependent variable to be first difference stationary (I.e., I(1)); while the regressor variables can be a combination of both level and first difference variables, but definitely not second-order stationary. Thus, to ensure conformity with this condition, the Augmented Dickey-Fuller (1976) (ADF) and the Phillips-Perron (*1988*) (PP) unit root tests were conducted on the variables, and their result as shown in Table 1.

Output in Table 1 indicates that (i.e., the response variable) conforms with being stationary at the first difference level as required, for both the ADF and the PP test. Furthermore, the regressor variables are revealed to be generally level stationary. Thus, having a mix of level and first difference variables conforms with the ARDL procedure, thus, justifying the ARDL model adopted for this study.

Table 1: Unit Root Tests

	ADF Test			PP Test		
	With Constant	**With Constant & Trend**	**Without Constant & Trend**	**With Constant**	**With Constant & Trend**	**Without Constant & Trend**
edgdp	-6.4470***[b]	-6.5162***[b]	-6.5187**[b]	-6.4549***[b]	-6.5091***[b]	-6.5254***[b]
gcpi	-3.4147**[a]	-3.9792**[a]	-2.0987**[a]	-3.2491***[a]	-3.2352***[a]	-1.9373***[a]
gx	-8.2840***[a]	-8.3840***[a]	-3.1817***[a]	-8.2718***[a]	-8.3840***[a]	-6.4324***[a]
gm	-6.4291***[a]	-6.4037***[a]	-2.7376***[a]	-6.4291***[a]	-6.4037***[a]	-4.7611***[a]
defgdp	-5.6146***[a]	-5.5650***[a]	-4.2937***[a]	-5.7309***[a]	-5.6861***[a]	-4.5076***[a]
glr	-6.4661***[a]	-6.5341***[a]	-6.2907***[a]	-6.4941***[a]	-6.5419***[a]	-6.3559***[a]
gdr	-6.3270***[a]	-6.3562***[a]	-6.2830***[a]	-6.4271***[a]	-6.4347***[a]	-6.3969***[a]
dop	-2.7402*[a]	-7.8523***[b]	-7.9786***[b]	-2.8378*[a]	-7.8523***[b]	-7.9786***[b]
gop	-5.7710***[a]	-5.9594***[a]	-5.3294***[a]	-5.7710***[a]	-5.9293***[a]	-5.3295***[a]
gxre	-7.1223***[a]	-7.4815***[a]	-6.6181***[a]	-7.1438***[a]	-7.9518***[a]	-6.6180***[a]

Note: Where a and b indicates stationarity at level and first difference respectively, and *, **, *** indicates significance at 10%, 5%, and 1% respectively.
Source: Author's estimated output.

4.2. Bounds Cointegration Test

Table 2 shows the bounds cointegration test result for the chosen ARDL model. Judging by the F-statistic value of 9.6438, the model's F-statistic value exceeds the critical upper bound (i.e., I(1)) at the 1 percent significance level. Thus, we conclude that the variables co-move in the long-term. Hence, the magnitude of the long-term impact of the regressors on the response variable can be evaluated. Likewise, their short-term dynamic impact on the response variable as well as the adjustment to the long-run equilibrium path can be determined.

Table 2: Model Selection Criteria and Bounds Cointegration Test

LogL	AIC*	BIC	HQ	Adj. R-sq.	Specification
-112.019	6.2675*	7.4318	6.7016	0.9699	ARDL(2, 2, 2, 0, 2, 2, 2, 2, 2, 1)
-111.708	6.2981	7.5026	6.7471	0.9684	ARDL(2, 2, 2, 0, 2, 2, 2, 2, 2, 2)
-111.849	6.3044	7.5088	6.7534	0.9682	ARDL(2, 2, 2, 1, 2, 2, 2, 2, 2, 1)
-111.290	6.3240	7.5686	6.7880	0.9667	ARDL(2, 2, 2, 1, 2, 2, 2, 2, 2, 2)
Bounds test					
Test Statistic	Value	Significance	I(0)	I(1)	
F-statistic	9.6438***	10%	2.16	3.24	
K	9	5%	2.43	3.56	
		2.5%	2.67	3.87	
		1%	2.97	4.24	

Note: * indicates the preferred selected information criterion with the lowest ratio. *** denotes significance at the 1% level.
LogL is the Log-Likelihood ratio, BIC is the Bayesian Information Criterion, and HQ is the Hannan Quinn information criterion.
Source: Author's estimated output.

4.3. Estimated Long-run ARDL Result

Results in Table 3 capture the long-run effects of the three measures of volatility on external debt. For volatility as a macroeconomic outcome, only the growth rates of export and import substantially affect the growth of external debt. Specifically, the growth in export, which is a measure of the revenue-generating capacity of the economy, exhibits a very high inverse effect on the growth of external debt. This suggests that when there is a decline in export revenues, external debt should be expected to rise more than double in proportion to the decline. This is plausible owing to the fact that increased volatility in revenue aggravates the incentive to borrow. Furthermore, the ability to service prior debts and pay the principal lies on revenue generated. Nigeria's main source of revenue is from crude oil sales, constituting about 96 percent of her total foreign exchange earnings (Aladejare, 2020). Tax revenues have not been adequate due to the weak tax system in the country. Thus, a sudden decline in oil revenue is usually followed with a significant increase in external borrowing with the tendency for external indebtedness to pile in the long-run in principle and in service cost. The growth rate of imports, on the other hand, has a high significant positive effect on external debt. While the growth rate of imports indicates that the consumption level in the economy grows, external debt also rises more than the proportional increase in consumption. This also is plausible since the Nigerian economy is more biased towards imported goods. Factors such as a weak technological base, an inadequate highly skilled workforce required to service the manufacturing sector, and high production cost have continued to encourage the growth of imports for which the government has had to borrow at different intervals to maintain. For instance, Nigeria's yearly food import bill, which was about N50 million in 1970 and

grew to almost N100 million before 1973, had skyrocketed to about N1.106 billion by 1979, and by 1981, it was estimated to have reached about N1.5 billion (Eyiuche, 2000).

Measures used for the domestic source of volatility turned out to have insignificant long-run effects. However, the external sources show a weak long-run effect as only the growth rate of oil prices was revealed to substantially affect external debt inversely. Antecedence has shown that when there is a decline in oil price, which normally translates to a reduction in oil revenue, the government's budget as well as other sectors of the economy is susceptible to react negatively. Hence, to augment for the oil revenue short-fall, external borrowing is used.

Table 3: ARDL Long-run Estimates

Dependent Variable: $\Delta edgdp$			
	Coefficient	**Std. Error**	**Prob.**
gcpi	1.475962	0.906222	0.1229
gx	-2.127684	1.078622	0.0661*
gm	1.128205	0.503073	0.0394**
defgdp	3.707885	4.664656	0.4383
glr	0.814446	1.207289	0.5096
gdr	-0.166750	0.564673	0.7716
dop	-0.351790	0.870880	0.6916
gop	-1.333730	0.702074	0.0757*
gxre	-0.058804	0.104443	0.5812

Note: *, and ** indicates significance levels at 10% and 5% respectively.
Source: Author's estimated output.

4.4. Estimated Short-run ARDL Result

Results in Table 4 show that the three sources of macroeconomic volatility significantly affect external debt in the short-run. For volatility as a source of macroeconomic outcome, the growth rate of the consumer price index significantly and positively affects external debt. While this growth rate indicates that in the short-run, an increase in the price of non-tradable goods significantly aggravates external debt. For example, domestic prices of goods such as staple foods, local transportation, electricity, water supply, etc., have always enjoyed subsidies from the government. These subsidies are in the form of reduced fertilizer cost to farmers of staple foods, the reduction in electricity tariffs, and subsidized pump prices of petrol for all use in the economy. For instance, the government through the Nigerian National Petroleum Corporation (NNPC) paid over N10 trillion in subsidizing refined petroleum products from 2006 to 2018 (BudgIT, 2019a). Also, a Price-Waterhouse-Coppers' (PWC) report in 2019 noted that from 2015 to 2018, the government expended about N1.12 trillion as electricity subsidies. Such huge expenditures are mostly sourced through external borrowing for the purpose of short-run price stabilization of non-tradable goods. Volatility from the revenue-generating capacity of the government (GX) is revealed to significantly and negatively affect external debt as was found in the long-run result. However, the short-run magnitude is much less compared to the long-run effect. An indication that the consequences of the declining growth of exports could be more severe on external debt in the long-term than in the short-term.

The estimated output for domestic sources of volatility shows that the fiscal policy (i.e.,) positively and substantially affects external borrowing in the short-run. The Nigerian government has consistently operated budget deficits since 1970 to date. Often, such deficits have been hinged on various government policy directions, aimed at providing critical infrastructure required for the development of the economy. Consequently, the use of external debt financing grew, and so too did

the principle and repayment cost, evident by the high coefficient of the lagged from 1970 to 1990 (CBN annual statistical bulletin, 2018). Similarly, the two measures of monetary policy were found to positively and significantly affect external debt in the short-run. A double-digit inflation rate and high monetary policy rates have helped to keep lending rates high in the short-term. These rates, usually ranging between 25 to 30 percent depending on the sector, have led to the government opting for foreign borrowing with lower rates in recent times. The positive effect of the growth of deposit rate on external indebtedness suggests that growth in the domestic savings rate still falls below the interest rate required to service specifically short-term external debts.

 For the third category of volatility, which deals with the external sources, the coefficient of trade policy/liberalisation () shows a significant positive effect on external indebtedness in the short-term. This stems from the import dependent nature of the economy, which substantially has a larger effect than export on trade liberalisation for Nigeria. Similar to its long-run effect, short-run growth in oil prices has a significant inverse effect on external borrowing, thus indicating that external indebtedness is also used in the short-term to counter the negative effects of a decline in oil revenue. For instance, it is not unlikely that Nigeria's external debt will rise due to the 2020 crash in oil prices from the effects of the COVID-19 pandemic and the oil price war that has lasted between Saudi Arabia and Russia. However, the lagged growth in oil price has a positive substantial effect on external debt. This result relates to the effect that despite Nigeria being the largest producer of crude oil in Africa and 10th in the world, it is also a huge importer of refined petroleum products. Although the country has a total installed oil refining capacity of 445,000 barrels per day, her refining plants in the past 15-20 years have been operating within the range of 15 to 20 percent annually (Ogbuigwe, 2018). Consequently, the country currently imports about 70 to 80 percent of its needed refined petroleum products, for which the country has had to use external indebtedness to also pay for. For the substantial positive effect of the creditworthiness variable (), the result suggests that creditors may be optimistic of Nigeria's potential to service, especially short-term foreign indebtedness, predicated on the rich oil and gas resources of the country. Hence, there is bound to be an increase in short-term external borrowing.

The significant adverse effect of the trend coefficient attests to the fact that poor management of the economy, especially by the military, led to the accumulation of external debt as the non-oil sector was further neglected due to the 'cheap' accruing oil revenues. For example, the economic policy that characterized the military regime between the 1980s to the 1990s saw about 45 percent of the country's foreign exchange earnings being used for debt servicing with minimal economic growth (Ogunyemi, 2011). Also, with deteriorating public health comes increasing external borrowing to sustain the economy from transmitted health shocks. Similarly, the recession dummy has a very high significant inverse coefficient. Suggesting that the SAP policy as introduced by General Babangida (the Military Head of State) in 1986 to control the recession only helped to further exacerbate the growth of external debt. For instance, the introduction of the second-tier foreign exchange market (SFEM) under the SAP led to the naira being officially devalued for the first time against the dollar. The goal was to make Nigerian exports cheaper in the international market. However, the exercise only triggered the problem of hyperinflation in the economy, coupled with the instability in oil revenue at the time. To sustain government spending, external borrowing was highly demanded. As noted prior, Nigeria's external debt-to-GDP ratio, which was just 13.9% in 1980, rose during 1986, 1987, 1988, 1989, and 1990 to 40.5%, 55.1%, 59.7%, 68.5%, and 61.9%, respectively (WDI, 2019).

Lastly, the cointegrating term (*ecm*) of the model is significant and negatively signed as expected. Its approximate value of -0.16 suggests that long-term equilibrium distortion will take approximately 75 months to correct.

Table 4: ARDL Short-run Estimates

Dependent Variable: Δ*edgdp*			
	Coefficient	**Std. Error**	**Prob.**
Constant	17.9674	1.9454	0.0000***
Δ*edgdp$_{t-1}$*	-0.556857	0.092223	0.0000***
Δ*gcpi*	0.323241	0.049980	0.0000***
Δ*gcpi$_{t-1}$*	0.305086	0.050300	0.0000***
Δ*gx*	-0.134010	0.020386	0.0000***
Δ*gx$_{t-1}$*	-0.038304	0.012906	0.0091***
Δ*defgdp*	0.890357	0.317781	0.0128**
Δ*defgdp$_{t-1}$*	1.332862	0.320054	0.0007***
Δ*glr*	-0.044660	0.052507	0.4076
Δ*glr$_{t-1}$*	0.174167	0.045995	0.0016***
Δ*gdr*	0.161040	0.033821	0.0002***
Δ*gdr$_{t-1}$*	0.166197	0.037828	0.0005***
Δ*dop*	-0.010077	0.114730	0.9311
Δ*dop$_{t-1}$*	0.960514	0.117897	0.0000***
Δ*gop*	-0.083630	0.027839	0.0084***
Δ*gop$_{t-1}$*	0.297779	0.031058	0.0000***
Δ*gxre*	0.015079	0.003472	0.0005***
trend	-0.363044	0.052728	0.0000***
recession	9.009199	2.365107	0.0015***
ecm	-0.161595	0.013164	0.0000***
Adj.R^2	0.862555		
J-B	1.324395		0.5157
LM(1)	0.059592		0.8071
LM(2)	3.650687		0.1612
ARCH(1)	0.132912		0.7154
ARCH(2)	0.387794		0.8237

Note: ** and *** indicates significance levels at 5% and 1% respectively. J-B is the Jarque-Bera test for error normality, LM(.) is the Breusch-Godfrey serial correlation Lagrange Multiplier test up to the lag order given in the parenthesis, and ARCH(.) is the Autoregressive Conditional Heteroskedasticity test up to the lag order given in the parenthesis. J-B, LM, and ARCH accepts Ho: normally distributed, no serial correlation, and no heteroscedasticity problem respectively.

4.5. The Toda Yamamoto Causality Result

Contained in the first three columns of Table 5 are the Toda-Yamamoto causality test findings for the three measures of volatility on external debt. There appears to be a significant similarity with the ARDL long-run result as volatility from macroeconomic outcome seems to be the main causal effect of external indebtedness. Specifically, the revenue-generating capacity and the consumption level of the economy are the major causes of external debt in Nigeria. Causalities were also partially found from domestic and external sources through monetary policy () and trade liberalisation ( ), respectively. However, the aggregate of both sources of volatility were revealed to have weakly caused external debt.

Furthermore, a reverse causal effect was found from external debt to the three measures of volatility as a macroeconomic outcome, suggesting that causality runs both ways. Just as the government uses external debt to stabilize price of non-tradable goods, external debt can also cause this price to rise. The reason is that when the level of external debt piles to an unsustainable level due to high servicing cost, it limits the ability of the country to borrow for technological development of the tradable sector. Such effect limits the transfer of technology from the tradable sector to the non-tradable sector, which could cause higher prices in the latter.

The causal effect of external debt on the revenue-generating capacity of the economy occurs through the effect of debt repayment on capital formation, which could either increase or diminish

future revenue. Also, the significance of the causal effect of external debt on consumption levels in the economy shows that external indebtedness is usually deployed to smoothing the consumption path.

Partial causality was also found from external debt to domestic and external sources. Specifically, external debt was found to cause domestic volatility through fiscal policy. This causal effect stems from principal repayment and debt service cost, which contributes annually to the growth of fiscal deficit in the country. For instance, Nigeria's debt service to revenue ratio is over 60 percent, which exceeds the World Bank's ceiling of 22.5 percent (BudgIT, 2019b). Lastly, external debt was found to cause trade liberalisation, which can be related to the provision of needed credit to finance imports. On the whole, external debt weakly causes domestic and external volatilities.

**Table 5: Toda-Yamamoto Causality Test Results**

Hypothesis	Chi-sq.	Causality	Hypothesis	Chi-sq.	Causality
gcpi→edgdp	4.372930	No	edgdp→gcpi	13.35974***	Yes
gx→edgdp	4.625631*	Yes	edgdp→gx	7.590974**	Yes
gm→edgdp	10.90915***	Yes	edgdp→gm	5.840117*	Yes
defgdp→edgdp	0.887505	No	edgdp→defgdp	4.652938*	Yes
glr→edgdp	9.348502***	Yes	edgdp→glr	2.704318	No
gdr→edgdp	2.176271	No	edgdp→gdr	2.652194	No
dop→edgdp	9.722442***	Yes	edgdp→dop	5.552364*	Yes
gop→edgdp	3.958934	No	edgdp→gop	2.049470	No
gxre→edgdp	1.657980	No	edgdp→gxre	1.047359	No

Note: *, **, and *** denote significance at 10% and 5% respectively. denotes direction of causality.

4.6. Residual Stability Test Result

In this study, both the cumulative sum of recursive residuals (CUSUM) and the CUSUM of squares (CUSUMSQ) test for assessing residual's stability were applied. Plots of both the CUSUM and CUSUMSQ test are presented in Figure 1. A statistic that dwells within the 5 percent significant critical bounds for the model is regarded stable. However, any divergence outside the critical bounds is indicative of instability in the residuals. Thus, output in Figure 1 indicates that in general, the model has a stable residual at the 5 percent significance level. Consequently, we end that the inferences drawn from our estimated coefficients are not spurious but valid for policy decision-making.

Figure 1: A graphical plot of CUSUM and CUSUMSQ of recursive residuals
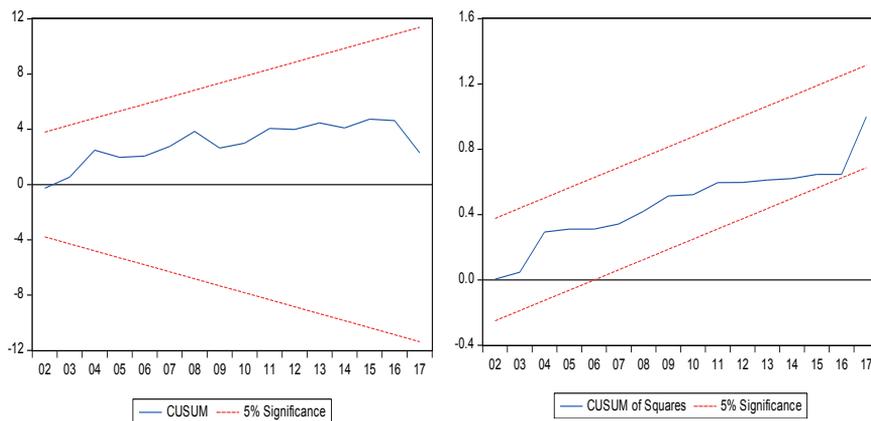
5. Concluding Remarks

The motivation of this study has been to identify the effects of the multidimensional perspectives of macroeconomic volatility on the growth of external debt in Nigeria from 1970 to 2018. Methodologically, the ARDL model and the Toda-Yamamoto causality approach were adopted. For the purpose of understanding the multidimensional perspective of macroeconomic volatility, macroeconomic volatility was disaggregated into three different perspectives, which are volatility from: macroeconomic outcomes, domestic sources, and external sources. Findings from the study suggest that while volatility from macroeconomic outcomes exclusively affects external debt in the long-term, effects from the three sources were very substantial in the short-term. Furthermore, the causality result indicates bidirectional nexus between volatility from macroeconomic outcomes and external debt. Also, the irregular variations in the Nigerian political space, unanticipated disease outbreaks, and effects of the 1986 recession in the country all significantly worsened the country's external debt situation.

To curtail effects of volatility from macroeconomic outcomes, it is recommended that, since greater volatility from the revenue generating capacity of the economy, indicates a higher probability of enormous inverse revenue shocks that could result to default due to an undermined capacity-to-pay; emphasis should be placed on the urgent need to diversify export. Such measure will increase the foreign exchange earnings, and free-up budget resources that would have been deployed to debt servicing for capital investment. Simultaneously, external shocks from trade liberalisation, and volatile oil price will be drastically reduced. To curb the overwhelming demand for imports, the development of the tradable sector to produce internationally competitive goods is required. A developed tradable sector will also aid the development of the non-tradable sector through the transfer of domestic technological know-how.

In order to curtail short-term domestic sources of volatility, specifically fiscal policy-induced macroeconomic volatility, there is the need to limit government spending from rising above 3 percent of the country's GDP as stipulated in the fiscal responsibility act of 2007. Also, the CBN should exercise its autonomy by declining to fund any government deficit which is above 5 percent of the previous year's actual revenue as stated in the CBN act of 2007. Such moves will ensure that government's budget planners only require external debt to fund productive ventures capable of growing capital formation and ensuring a repayment of the borrowed funds. For monetary policy-induced macroeconomic volatility, policies that will encourage saving habits and eliminate barriers to investment are required. Having a savings rate that lies above the rate of debt servicing will guarantee savings accumulation and availability of loanable funds.

Since developing countries such as Nigeria cannot do away with demanding for external debt to finance their economic growth, it is also important to count the cost such financing provides even if faster growth is actually realised. External debt financing will surely lead to higher debt servicing, more macroeconomic volatility, and wider economic growth divergence through economic recolonization. Thus, issues of debt rescheduling, reduction, forgiveness, and interest rate reduction are to be given urgent serious attention. Otherwise, the palpable uncertainty surrounding the government's revenue due to effects of the COVID-19 pandemic will leave the economy vulnerable to external interference since paying off present debt and servicing old ones are essential. Hence, external debt financing options are to be best utilised as growth stimulus rather than being seen as the crux for economic growth and development. It will also be important for the country to continue on the path of stability in governance. This would involve ensuring a continuum of existing government projects by successive administrations and promoting strong governance institutions anchored on transparency and accountability at all levels of government.

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