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Impact of External Debt on Economic Growth: A Markov Regime- Switching Approach

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Abstract: The study examines the relationship between external debt and economic growth in Nigeria for the period 1970-2016 using the Markov Regime Switching approach. This approach is adopted because of its various advantages. Firstly, it is more flexible compared with other models. Secondly, it allows the examination of unobservable variables in an observable model. The study analyzes the relationship between economic growth and external debt in terms of public and private external debts. The results show that the relationship between external debt and economic growth is nonlinear. Also, public external debt and private external debt have a significant negative effect on economic growth in both the contractionary and recessionary phases. However, public external debt harms economic growth more than private external debt. The result confirms the existence of the debt-overhang hypothesis in the case of Nigeria.

***Keywords*:** External debt, Economic growth, Markov-Switching model, Nigeria.

***Jel Classification*:** F43; E62; H68; O40

INTRODUCTION

In countries faced with low domestic savings and limited export earnings, borrowing may be inevitable. Governments need to borrow from external economies to grow their capital and develop their infrastructure and thereby raise the economic growth rate. Moreover, governments borrow in periods of economic and financial crises to pump-prime their economies and enhance economic growth rate (Spilioti & Vamvoukas, 2015). However, as argued in the literature, financing economic growth

with substantial public debt could increase the government debt ratio, which may be harmful to long-run fiscal sustainability. The high and increasing level of external debt, especially in developing countries like Nigeria and its possible impact on economic growth, has been of considerable concern to policymakers and academics alike.

Theoretically, there are four perspectives on the relationship between debt and economic growth: no impact, negative impact, positive impact, and nonlinear impact. The neutrality impact theory argues that public indebtedness has no effect on economic growth, while the negative impact hypothesis asserts that debt negatively impacts economic growth. This conjecture is popularly referred to as the debt-overhang hypothesis. The positive impact theory states that debt has a positive impact on economic growth. It works through various channels, including improved productive government spending and injection of new financial resources. The nonlinear hypothesis simply says that the effect of debt on economic growth is positive at lower levels and harmful at higher levels of external debt.

Empirically, several studies have been conducted to validate these theoretical perspectives. However, empirical results have yielded conclusive evidence. Some studies confirmed the negative impact of debt on economic growth (Gomez-Puig & Sosvilla, 2015, 2017; Ahlborn & Schweickert 2016). In contrast, some studies reported the positive effect of debt on economic growth (Owusu-Nantwi & Erickson 2016, and Uzu, Kabadayi & Emsen 2012). Yet, a few studies said that public debt had no significant impact on economic growth (Koutellos, Strengos & Tan 2013; Parizza & Presbitero 2012 and Schclarek 2004). Finally, several studies supported the nonlinear effect of public debt on economic growth (Baum et al. 2012; Minea & Parent 2012; Reinhart & Rogoff 2010 and Cecchetti, Mohanty & Zampolli 2011).

For the Nigerian economy, the total external debt increased over the period 1970-2005. The debt stock rose from US$19. 2billion in 1986 to US$30billion in 2004 until 60 per cent of the total external debt of the country was cancelled by International creditors in 2005. However, Nigeria's external indebtedness increased to US$31.15billion in 2016. The rising indebtedness of the country following the global economic and financial crisis in 2008-2009 and the sharp decline in oil price has brought to the front burner the impact of external debt on economic growth in Nigeria. Specifically, it has raised three main questions: (i) what is the impact of external debt on economic growth in Nigeria? (ii) Does the nonlinear relationship between external debt and economic growth hold in the case of Nigeria? (iii) Does the impact of external debt on economic growth change depending on public

borrowing and private sector borrowing? The need to answer these questions constitutes the main focus of this work.

The remainder of the paper is organized as follows. Section 2 provides a brief overview of Nigeria's debt. Section 3 provides a summary of the empirical literature. Section 4 discusses the methodology. Section 5 discusses the results and section 6 contains the conclusion.

OVERVIEW OF NIGERIA'S EXTERNAL DEBT: 1970-2016

Sequel to the oil boom of the 1970s, the Nigerian economy had an impressive growth. Indeed, the vast revenues from oil assisted the country in an ambitious public spending programme designed to develop infrastructural facilities destroyed during the civil war without much recourse to foreign borrowing. The foreign debt profile of the country changed significantly after 1978 following the world oil glut. Much pressure was exerted on government finances, and became imperative to borrow for the balance of payment support and financing of the development projects.

The first major federal government borrowing of US$1 billion from the International Capital Market (ICM) referred to as 'Jumbo-loan', was secured in 1987. This loan increased the total external debt of the country to $ 22 billion. Following the collapse in world oil prices in early 1980, the economic condition deteriorated between 1981 and 1982. Consequently, various agencies and state governments resorted to deficit budgeting partly financed through external loans secured from private sources under stringent requirements (CBN, 1989). The sharp drop in oil export revenues in the 1980s led to increased external debt in Nigeria. The government borrowed massively, and large trade arrears accumulated over the period 1982-1983. The fall in oil prices at the international market seriously pressured the government. The country could not meet her external obligations. Consequently, government embarked on programmes to reconcile and reschedule her debts.

Specifically, in 1986, when creditors refused to open new lines of imports to Nigeria, the government approached the creditors for debt relief. This effort led to the debt restructuring arrangements with the Paris Club in 1986, 1989, 1999, and 2000. Although the various agreements with creditors (Paris and London Clubs) helped in reducing aggregate debt stock, the burden was still enormous in the country.

In 1986, the government introduced the Structural Adjustment Programme (SAP) to promote economic efficiency and private sector development as a basis for improving the prospect for long-term growth. SAP combined exchange rate and

trade policy reforms with stabilization policies. The programme incorporated public sector downsizing and an improved management of publicly owned assets. Unfortunately, the programme had no significant positive impact on the Nigerian debt stock. For example, over the period 1985-1992, Nigeria's stock of public and guaranteed long-term external debt increased from US$19.2 billion in 1985 to US$ 29.3 billion in 1992. The debt restructuring arrangements with the creditors in 1986, 1989, 1991, and 2000 provided no succor for the government in significant debt reduction. The debt crisis continued under the Obasanjo's civilian regime that started in 1999. The administration embarked on a relentless campaign for debt relief, which paid off in 2005. The Paris Club group of creditors agreed to cancel 60% ($18 billion) of the US$30 billion owed by Nigeria. The debt relief freed the nation from the yearly US$2.3 billion debt service.

The sharp drop in oil prices in 2015 and the decline of the country into recession forced the government to borrow both domestically and externally. Consequently, the stocks of Nigeria's external debt increased from US$21.14 billion in 2013 to US$31.15billion in 2016. However, a positive development that should be maintained in this new borrowing arrangement is that a large chunk of borrowed funds comes from multilateral organizations. Besides, the borrowed funds are used on upgrading infrastructural facilities such as roads, railways, hospitals, and airports to create an enabling environment for private sector development.

All the same, the government should exercise great caution on the amount to be borrowed externally. Huge debt stock and rising debt re-payments may negatively impact investment and growth of the economy. Specifically, debt re-payments reduce the volume of available resources for economic activity. Also, high external debt could adversely affect the country's credit rating, which may precipitate macroeconomic uncertainty with an adverse effect on the macroeconomy. Therefore, the government must ensure that the country's debt level is sustainable to foster macroeconomic stability and long term economic growth.

LITERATURE REVIEW

The relationship between external debt and economic growth has been widely debated both theoretically and empirically (for a comprehensive review of the literature, see Saungweme & Odhiambo, 2019). Theoretically, both neoclassical and endogenous growth models suggest that high public debt will always hurt the rate of economic growth (Modigliani, 1961; Saint-Paul, 1992 and Aizenman *et al.* 2007). Other identified channels through which debt might adversely affect economic growth include (i) the

debt overhang hypothesis (Sachs, 1989), (ii) the crowding-out effect (Hansen, 2004); (iii) liquidity constraint channel (Moss & Chiang 2003), and the uncertainty channel (Cochrane, 2011).

However, another school of thought opined that external debt could have a positive effect on economic growth. Theoretically, the argument is that debt capital could augment or add to capital formation, which may positively impact economic growth. This assertion is particularly relevant to less developed countries (LDCs) that usually face resource constraints in development (Baker & Hassan, 2008; Cohen, 1991, 1997). According to Abbas & Christensen (2010), a moderate level of non-inflationary domestic debt as a share of gross domestic product (GDP) has an overall positive impact on economic growth. The low non-inflationary domestic debt to GDP ratio positively impacts economic growth through improved monetary policy, strengthened institutions/accountability, and increased private savings and financial intermediation. De Long & Summer (2012) argued that under certain conditions, if expansionary fiscal policies generate public debt accumulation without creating a persistent recession; it could positively impact economic growth in the short and long run.

The empirical findings are also inconclusive. The study by Jayaraman & Hall (2009) found evidence of the positive impact of external debt on economic growth in the long run. Bal & Rath (2014) found that increased public debt had a positive effect on economic growth in the short run but harmed economic growth in the long run in India. Teles & Mussolini (2014) found that debt had no significant impact on economic growth. However, when debt was interacted with productive expenditure, the effect on economic growth was significant. This finding implies that an increase in debt for productive expenditure will lead to a rise in economic growth. Spiloti & Vamvoukas (2015) found a positive effect of government debt on economic growth for Greece.

Apart from the studies reviewed above and many others that are linear dependence, some others have investigated the nonlinear relationship between public debt and economic growth (Reinhart & Rogoff, 2010; Checherita-Westphal & Rother, 2012; Dogan & Bilgli, 2014; Mitze & Malt, 2015; Elberhardt & Presbitero, 2015; Chiu & Lee, 2017; and Karadan 2018). Pattillo et al. (2002, 2004) found that at low levels of total external debt in developing countries, the impact of debt on the rate of GDP is positive. However, this relation turns negative at high levels of debt. The study by Schclarek (2004) on the debt-growth nexus showed that low total debt level has a positive impact on growth, but provided no evidence supporting inverted-U

shaped association. Presbitero (2005, 2010) found that high total debt harm economic growth, particularly in low-income countries and highly-indebted low-income countries. He, however, did not find evidence in support of a U-shaped curve.

Checherita-Westphal & Rother (2012) found a nonlinear impact of public debt on per capita GDP growth rate, with the debt turning at about 90-100% of GDP. Similarly, Mitze & Matz (2015) provided evidence of an inverted U-shaped debt-growth with the threshold value for a 46% debt-to-GDP ratio in the long run, and further showed evidence of a U-shaped relationship between the 5-year lagged debt and economic growth.

The empirical work of Eberhardt and Presbitero (2015), based on 118 countries, found that public debt had a significant positive impact on economic growth in the long run. The study equally showed evidence of an inverted U-shaped debt-growth nexus in most of the countries studied. Dogan & Bilgli (2014), using the Markov-switching approach, found evidence of negative and nonlinear effects of both private and public debts on economic growth. The results showed that the negative impact mainly comes from public debt. Chiu & Lee (2017) showed that high public debt had an adverse effect on economic growth in a high-risk environment. However, the negative effect public debt has on economic growth decreases under low political and financial-risk environments.

Concerning Nigeria, many studies have been conducted on the effect of public debt on economic growth (Ezike & Mojekum, 2011; Adesola, 2009; Ezeabasili et al. 2011; Obademi, 2013; Okoli, 2014; Udoka & Ogege, 2016; Hassan et al. 2015; Ibi & Aganyi, 2015; Matthew & Mordecai, 2016; and Ndubuisi, 2017). Most empirical studies have reported that high debt and debt service harmed economic growth. However, a few studies found a positive debt-growth relationship. For example, Ezike & Mojekwu (2011) found a positive effect of external debt on economic growth. Osinubi et al. (2010) found evidence of a nonlinear relationship between external debt and economic growth, with a turning point of 60% debt to GDP ratio.

The major weaknesses of most existing studies in Nigeria are: (i) the assumption of linear dependence on the relationship between external debt and economic growth; (ii) failure to distinguish the differential effect of public and private debt; and (iii) failure to determine the impact of external debt (public and private) changes on economic growth in the two phases of growth (expansionary and contractionary). Essentially, there is a need to correct these identified weaknesses on the subject matter in Nigeria. Failure to control for nonlinearities in the debt-economic growth

relation will lead to wrong specification between the two variables, which may lead to erroneous inferences.

METHODOLOGY

Data

The data used to estimate the model are annual observations for Nigeria over the period 1970-2016. The data are obtained from the Central Bank of Nigeria (CBN) Statistical Bulletin, and the variables are in logarithmic form except for variables that are in rate form, namely, exchange rate, inflation, and interest rate. The real GDP is calculated as the nominal GDP deflated by the consumer price index (1990=100). The exchange rate is the real exchange rate expressed as the domestic currency per unit of U. S. dollar, the discount rate is the Central Bank of Nigeria minimum rediscount rate, and the inflation rate is the consumer price index (1990=100).

The Model

In this study, a simple growth regression to analyze the debt-growth relationship is given as:

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$$RGDP_t = Af(Lab, Extdebt_t^{total}, Z_t, \mu \quad (1)$$

where RDGP, the dependent variable, is the real GDP measured as the annual growth rate of the real gross domestic product (a proxy for economic growth), $Extdebt_t^{total}$ total is the total external debt; Lab, is the labour force, and Z represents other variables that may help to explain output growth. Among these variables are exchange rate, inflation, and interest rate.

However, since the main focus of the paper is on the differential impact private and public external debt; total external debt is broken into two components, thus:

$$Extdebt_t^{total} = Extdebt_t^{public} + Extdebt_t^{private} \quad (2)$$

where $Extdebt_t^{public}$ public represents public external debt, and $Extdebt_t^{private}$ private is private external debt. Substituting equation (2) into equation (1), we obtain:

$$RGDP_t = Af(Lab, Extdebt_t^{public}, Extdebt_t^{private}, Z_t, \mu \quad (3)$$

Explicitly specifying equation 3, we obtain:

$$RGDP_t = \beta_0 + \beta_1 Lab_t + \beta_2 Extdebt_t^{public} + \beta_3 Extdebt_t^{private} + \beta_4 Z_t + \mu_t \quad (4)$$

Where β_0 measures productivity growth, μ is the error term with normal distribution, β_1 is the elasticity of output with respect to labour, β_2 and β_3 capture the marginal productivity of public and private debt, respectively, and β_4 is the elasticity of output with respect to other factors.

Markov-Regime Switching Model

The paper uses the Markov-Regime Switching model (MS) developed by Hamilton (1989, 1990, 1996). This model is particularly appropriate to examine the economic growth in different regimes. More specifically, economic growth is allowed to shift in the mean and variance, that is, for periods of expansion and contraction and high volatility and low volatility. Several studies, including Arin & Spagnolo (2011), Saltoglu *et al.* (2003), Anas *et al.* (2004), and Akinlo 2017), have shown the various advantages associated with the use of the Markov-Switching approach. The model allows not only unobserved variables within an observed model but also uses a robust algorithm to reach strong optimization (convergence) through iteration in a dynamic system in the estimation procedure. It possesses features such as the persistence of extreme observations and the nonlinearity and can take into account the asymmetry of time series (Anas *et al.* 2004). These advantages explain the wide application of MSM in the analysis of economic and financial time series as exemplified in the works of Hamilton (1988, 1996); Engel and Hamilton (1990); Engel (1994); Kim and Nelson (1998), among others.

Specifically, concerning our study, this approach is appealing because it fits the fact that economic growth can perform differently in different sub-periods. Moreover, MSM permits two or more processes to exist with a series of shifts between the states occurring in a probabilistic manner, so that shifts occur exogenously. Another motivation for using the approach is the patterns of economic growth, which historically have switched in response to many political and macroeconomic shocks. Finally, with the smoothed probabilities graph, MSM allows us to have a probabilistic approach of appurtenance of each regime, while explaining economic growth by debt and other factors, conditionally with all information of the sample. Through the stochastic process, switches in volatility from the low level (contraction) to the high level (expansion) are captured in a probabilistic procedure as shown by MSM equation 5.

$$P\left(y_t / Y_{t-1}, X_{t,S_t} = \begin{matrix} \{f\{y_t / Y_{t-1}, X_t; \theta_1 & s_t = 1\} \\ \{f\{y_t / Y_{t-1}, X_t; \theta_m\} & s_t = M\} \end{matrix} \right) \tag{5}$$

where $Y_{t-i}\{y_{t-j}\}_j^{\infty} = 0$ shows the history of y_t which depends on unobservable state variables $s_t \in \{1, 2, \ldots\ldots, M\}$, which represents the probability of being in a particular state of the data. X_t and θ_m with $m = 1, 2, 3, \ldots, M$ are exogenous variables and parameter vector, respectively (Bilgili *et al.* 2012, and Krolzig, 2000).

For a two-state Markov chain, the four transition probabilities are given as:

$$\begin{aligned} P\{s_t = 1 / s_{t-1} = 1\} &= \rho_{11} \\ P\{s_t = 0 / s_{t-1} = 1\} &= 1 - \rho_{11} \\ P\{s_t = 0 / s_{t-1} = 0\} &= \rho_{00} \\ P\{s_t = 1 / s_{t-1} = 0\} &= 1 - \rho_{00} \end{aligned} \tag{6}$$

where $s_t = 0$ or 1 represents the unobserved state of equation (Hamilton, 1989). The transition probability takes the range of $0 < \rho_{ij} \leq 1$, and the transition probabilities summed up to one.

As well, the transition probabilities measure persistence in the regime. Then, the expected duration of a typical recession is written as a reverse function of the probability remaining in recession.

$$\sum_{k=0}^{\infty} K_{\rho 00}{}^{k-1}(1 - \rho_{00})^{-1} \tag{7}$$

and the expected duration of a typical expansion is given as:

$$\sum_{k=0}^{\infty} K_{\rho 11}{}^{k-1}(1 - p_{11}) = (1 - \rho_{11})^{-1} \tag{8}$$

Assuming Δy_t denotes growth rate of y_t while μ represents the mean growth of y_t. The general form of Makov-Switching model takes the form:

$$\Delta y_t - \mu(s_t) = A_1(\Delta y_{t-1} - \mu(s_{t-1})) + \cdots\ldots + A_p\left(\Delta y_{t-\rho} - \mu(s_{t-\rho})\right) + u_t \tag{9}$$

where u_t is normally and independently distributed.

The low (repression) phase ($s_t = 0$) and high (expansion) phase regimes are related with different conditional distributions of Δy_t. μ, however, depends on regimes

(Bilgili *et al.* 2012, Krolzig 2001). As noted in the literature, the Markov Switching model given as equation (9) can be extended into a multivariate MSM (see Simon, 1996; Raymond and Rich 1997, Frommel et al. 2005, Ribeiro and Pereira, 2010; Liu and Mumtaz, 2010), which is adopted in this paper to analyze the relationship between economic growth and external debt in Nigeria. The model is formally expressed as:

$$GDP = \beta_0(s_t) + \beta_{1t}(s_t) + \sum_{i=2}^{n} B_i X_{1t}(s_t) + u_t \quad (10)$$

where GDP is economic growth, s is the state (regime), t is the trend, X_i is external debt (public and private) and other variables, u_t is the residual time, and t is the time subscript. The state term in the equation (10) is a vector of states; state (regime 0) and state (regime 1) or equivalently corresponds to a vector of regimes. Hence, the parameters of B_0, B_1, …, B_n denote time-varying parameters.

The maximum likelihood estimation of this model is performed with annual data 1970-2016. The estimation is done to investigate the possible structural changes (regime shifts) in level, and, or trends as well as possible changes in parameters of vector b in FDI-MSM equations through the transition probabilities as explained in Hamilton (1989, 1990) by conducting analytical derivatives of Feasible Sequential Quadratic Programming explicitly detailed in the work of Lawrence and Tits (2001).

EMPIRICAL RESULTS

The results of three alternatives Markov-Switching models 1-3 denoted by MSM1, MSM2, and MSM3, respectively, are reported in Table 1. In the three models, the growth of gross domestic product is the dependent variable. However, as shown in column 2 of table 1, MSM1 uses, in addition to constant and trend, the independent variables human capital, openness, and external debts divided into public external debt and private external debt. Compared to MSM1, MSM2 incorporates inflation as an additional explanatory variable.

The third model MSM3 employs besides constant and trend, the independent variables human capital, inflation, exchange rate, oil price, interest rate, and external debt broken into public external debt and private external debt. In the three models (MSM1-MSM3), constant and trend are positive and significant in both regimes except in regime 0 of MSM1, where the constant is insignificant. Human capital is found negative and significant in regime 0 of MSM1 and MSM2. Though the human capital variable is negative in the expansionary phase of MSM1-MSM3, the coefficient is not significant. Openness is positive in both models except in the period of

contraction in MSM2 with an insignificant coefficient. This result seems consistent with the findings of Nourzad and Powell (2003), Bhala and Lau (1991), and Frankel and Romer (1996).

Table 1: Markov Regime Switching Models for Debt-Growth Nexus 1970-2016

Variable/Regimes	*MSM1*	*MSM2*	*MSM3*
Constant			
Regime 0	1.809(0.000)	2.185(0.000)	0.886(0.758)
Regime 1	1.411(0.000)	1.316(0.000)	1.742(0.000)
Trend			
Regime 0	0.208(0.000)	0.223(0.000)	0.188(0.000)
Regime 1	0.218(0.000)	0.206(0.000)	0.155(0.000)
Human Capital			
Regime 0	-0.214(0.002)	-0.149(0.036)	0.320(0.679)
Regime 1	-0.052(0.359)	-0.074(0.106)	-0.035(0.757)
Private External Debt			
Regime 0	-0.094(0.003)	‘-0.077(0.000)	0.058(0.358)
Regime 1	-0.090(0.000)	-0.084(0.002)	-0.062(0.185)
Public External Debt			
Regime 0	-0.107(0.051)	-0.082(0.004)	0.046(0.436)
Regime 1	-0.103(0.000)	-0.117(0.002)	-0.085(0.076)
Openness			
Regime 0	0.679(0.000)	-0.038(0.885)	
Regime 1	0.016(0.95)	0.683(0.000)	
Inflation			
Regime 0		-0.0009(0.605)	0.004(0.453)
Regime 1		0.0007(0.532)	0.008(0.005)
Exchange Rate			
Regime 0			0.002(0.523)
Regime 1			0.069(0.000)
Oil Price			
Regime 0			0.316(0.310)
Regime 1			0.263(0.000)
Interest Rate			
Regime 0			-0.023(0.085)
Regime 1			-0.034(0.075)

Note: The value in parenthesis is the p-value

Inflation in MSM2 and MSM3 is positive except in the contraction period in model MSM2. However, the coefficient is only significant in the period of expansion in MSM3. The coefficient of the exchange rate is positive in both regimes but significant only in the expansion period. This finding suggests that the appreciation of the exchange rate is associated with increased economic growth. As argued in the literature, exchange rate appreciation could positively impact economic growth through increased foreign direct investment it generates (Campa, 1993; Boateng *et al.* 2015). The oil price has a positive and significant effect in the period of expansion. The result is consistent with *apriori* expectation. An increase in the oil price means higher foreign exchange earnings for the country and increased economic activity.

The interest rate variable has a negative and statistically significant effect at 5 per cent level in both periods of economic contraction and expansion. The finding conforms to *a priori* expectation. An increase in the rate of interest will lead to a reduction in economic growth. An increase in interest rate tends to reduce domestic activity working through the cost of production channel. This finding should not come as a surprise in Nigeria because the interest rate was consistently double-digit over the study period.

Concerning the target variable, namely external debt (public external debt and private external debt), the effects of both variables on economic growth are adverse in both regimes except in MSM3, where public debt and private debt are positive but not significant in the contraction periods. The coefficient of the private external debt is -0.094 in the contraction period (Regime 0) and 0.090 in the expansion period (Regime 1). In MSM2, the coefficient of the private external debt is -0.077 in Regime 0 and -0.84 in Regime 1. Here, the result confirms a negative effect of private external debt on economic growth. However, the negative impact of external debt on economic growth is greater in the contraction period than the expansion period in MSM1. The reverse is the case in MSM2.

In terms of public external debt, the same pattern of results holds: Public external debt hurts economic growth in MSM1-MSM3 in both regimes except in the period of contraction in MSM3 where it has an insignificant positive effect. In the MSM1, the negative effect of public debt in the period of contraction is higher than the negative impact in the period of expansion. However, in MSM2, the negative effect in the period of expansion is higher than the negative effect in contraction phase.

One clear fact that emerges from this result is that the public external debt hurts economic growth more than private external debt. The results show that the main source of the negative relationship between external debt and economic growth is the

public debt component of the aggregate debt in Nigeria. This finding suggests that public external debt seems to harm economic growth more than private external debt. This result is consistent with earlier findings by Dogan and Bilgili (2014) for Turkey.

As shown in Table 2, the three models seem to perform well. However, model MSM2 appears to fit the data best as it gives the lowest AIC value of -1.319425 and the highest log-likelihood value of 49.00650. As shown in Table 2, the linearity test shows that the null of nonlinearity of the three MSMs is rejected at 1 %. This result suggests that for the three MSMs, conducting nonlinear estimates are more desirable than their linear counterparts. This result confirms the fact the relationship between external debts and economic growth is not linear. The finding is consistent with the findings of Cordella et al. (2005); Adam and Bevan (2005); Kutivadze (2001); and Dogan and Bilgili (2014) that established a nonlinear relationship between external debt and economic growth.

Table 2: Switching variances, transition probabilities and test statistics of Markov Regime-Switching Models: 1970-2016

	MSM1	*MSM2*	*MSM3*
Sigma 0	-2.91690	-2.574306	-1.571664
Sigma 1	-2.50349	-2.921074	-3.253175
P[0/1]	0.102558	0.106829	0.135760
P[1/1]	0.897442	0.893171	0.864240
P[1/0]	0.113825	0.068253	0.268087
P[0/0]	0.886175	0.931747	0.731913
Log likelihood	46.37602	49.00650	14.11992
AIC	-1.292597	-1.319425	0.335322
Linearity Test (χ^2)	53.84818	31.55688	56.32157
	(0.0000)	(0.0000)	(0.0000)

Note: Below the linearity test values are the *p*-values

Each of MSM1-MSM3 shows that when the current state of the relationship of economic growth and external debt in time (t) is regime 1, the probability of the jump of the economic growth and external debt relationship from regime 1 at the time (t+1) to regime 0 is 0.345147 on average.

It may be necessary to observe overtime (between regimes), smoothed probabilities during the transition period. Figures 1-3 reveal the smoothed probabilities of contraction (regime 0) and expansion (regime 1) for the three

alternative models. Figures 1a-b to Figures 3a-b (with Fig.a below Fig. b in all cases) shows the smoothed probabilities of regime 0 and regime 1 of the three alternative models MSM1-MSM3 respectively. Regime 0-ime points, as shown in Figure 1a, are 1974-1976, 1981-1991, and 2006-2016. Regime 1 points cover the periods of 1970-1973, 1977-1979, and 1991-2005 (Figure 1b). In Figures 2a and 2b, the regime 0 points for MSM2, the best model in this paper, cover the periods 1976-1980 and 1991-2006. The regime 1 points for MSM2 cover the period 1970-1974,1981-1991 and 2006-2016 (Fig 2b). With respect to MSM3, Regime 0 point covers the periods 1975, 1981, 1983-1984, 1988, 1991, 1992-1994 and 1999-2016. However, regime 1 points correspond to 1970-1974, 1976-1980, 1982, 1986-1987, 1989, 1991, and 1996-1998.

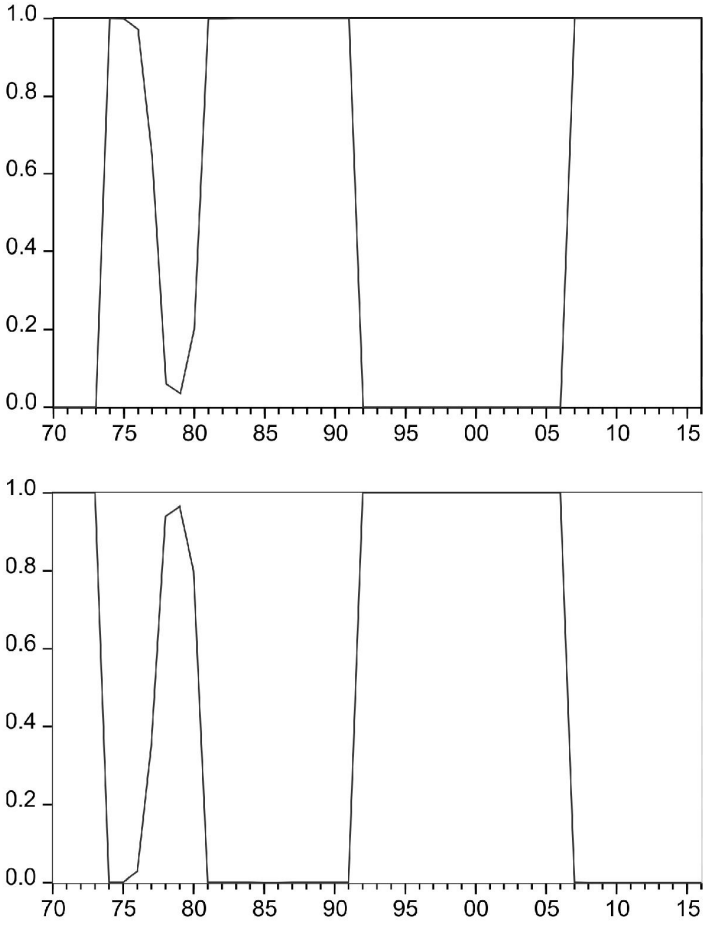


Figure 1a&b: Probabilities of Regime 0 and 1 smoothed MDM SM 1

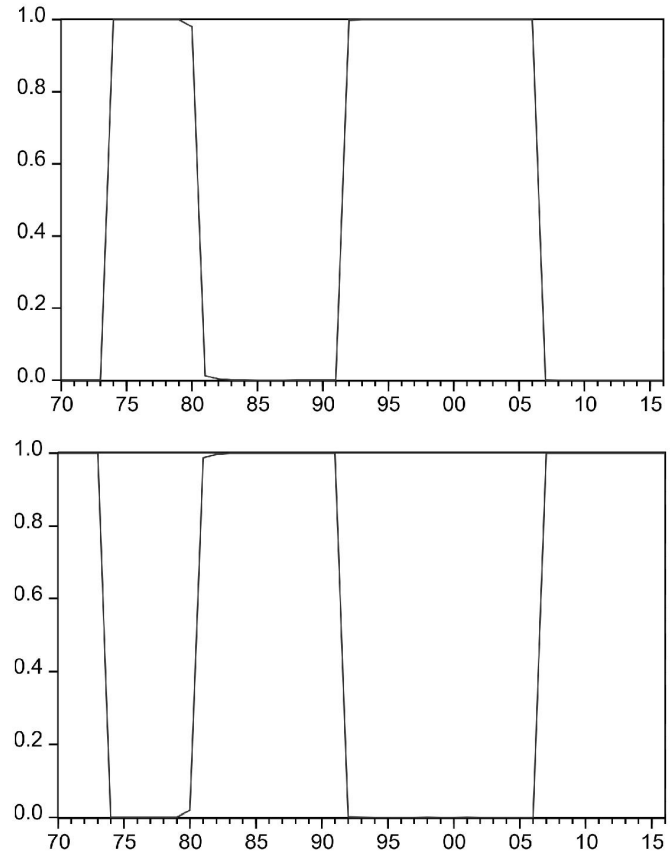
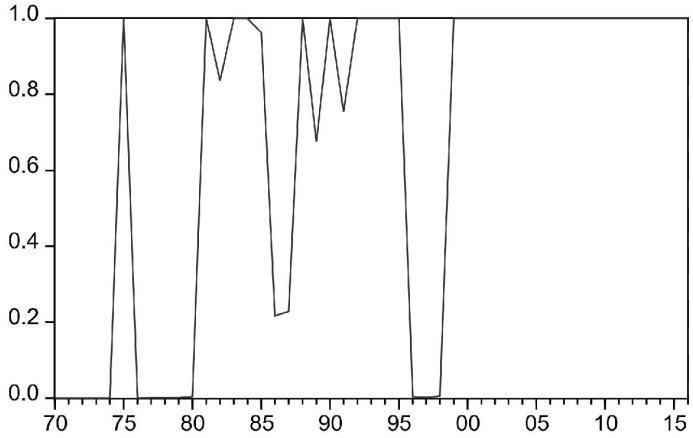


Figure 2a&b: Probabilities of Regime 0 and 1 smoothed MDM SM 2



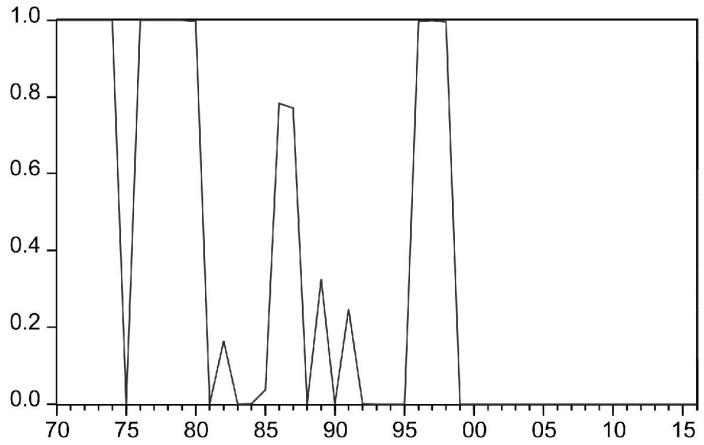


Figure 3a&b: Probabilities of Regime 0 and 1 smoothed MDM SM 3

CONCLUSION

In this paper, we re-examined the effect of external debt on economic growth in Nigeria using annual data for the period 1970-2016. Unlike all the previous studies on the subject matter in Nigeria, we use the Markov-Switching model based on the argument that the debt-economic growth relationship is not linear. Moreover, this approach permits us to investigate the impact of foreign debt (private and public) on growth in two states of growth (expansion and contraction) by allowing the data themselves to identify these states.

The results show that the relationship between external debt and economic growth is nonlinear. Moreover, both public and private external debts have a significant negative impact on economic growth. However, public external debt harms economic growth more than private external debt. This finding suggests that public external debt is inefficiently used in the country. In Nigeria, public external debt is more susceptible to corruption, and the public sector often resorts to external debt to finance current expenditures. Since the results validate the debt-burden hypothesis, policymakers should ensure that the debt burden is curtailed through effective debt management policy in Nigeria. The government should resort to external borrowing only when necessary, and the borrowed funds must be invested in productive areas and projects such as infrastructural facilities. Also, money borrowed from external sources should be used to finance capital expenditures only.

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