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The Effect of External Debt on Economic Growth in Sub-Saharan Africa

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ABSTRACT

Purpose
This paper examines the effect of external debt on economic growth in Sub-Saharan Africa (SSA) in view of an upsurge in the level of external debt in many countries on the continent.
Design/methodology/approach:
The paper uses annual data for 39 SSA countries from 1990 to 2013 and employs the System Generalised Methods of Moments (GMM) estimation technique.
Findings:
The paper finds that external debt negatively affects economic growth in SSA. Categorization of countries based on per capita income however does not affect the external debt-growth nexus, neither does there exist a non-linear relationship between external debt and economic growth.
Research limitations/implications:
The finding of a negative relationship between external debt and growth does not necessarily imply that SSA countries should cut back on foreign borrowing in other to boost growth. Rather, given the huge savings gaps in some of the countries, what governments in SSA must do is to ensure that the foreign loans are invested in projects that would eventually generate enough returns to amortize the debt.
Originality/value:
Not only does the present paper extend to more recent data but we also apply one of the frontier econometric techniques - the system GMM approach - to unravel the external debt-economic growth dynamics in SSA.

1. Introduction

Economic growth and development is a major goal of most developing countries; hence resources are mobilized from various sources including external borrowing for investment into viable projects for growth acceleration. Sustainable economic growth is a predominant concern for all countries, especially developing economies that frequently face burgeoning fiscal deficits mainly driven by higher levels of debt service, particularly external debt servicing and widening current account deficits (Reinhart et al., 2012). According to Atique and Malik (2012), external debt constitutes a greater share of the public debt structure in developing countries. Reliance on external borrowing is not only rationalized on the grounds that excessive domestic borrowing can lead to financial instability and crowd out the private sector (Panizza et al., 2010) but also, as argued by Todaro and Smith (2006), developing countries in their early stages of development need to borrow externally because of inadequate domestic capital for investment.

The Harrod-Domar growth model[1] has been the traditional inspiration for development economists in explaining the importance of external borrowing in closing the savings-investment gap in developing countries. Krugman (1988), asserts that debt servicing obligations cause distortions in an economy and hence discourages investment and economic growth. Eaton (1993), on the other hand, argues that external debt is a complement to domestic savings and investment, and thus promotes growth. Several hypotheses have been put forward on the adverse effects of external debt on developing countries' growth. They are the Debt Overhang Hypothesis, the Crowding-Out Effect, the Liquidity Constraint Hypothesis, and the Debt Laffer Curve Theory. Empirical evidence on the debt- growth nexus is mixed. While some studies (Reinhart and Rogoff, 2010; Butts, 2009; Hameed and Chaudhary,

[1] The Harrod-Domar model assumes that economic growth occurs through capital accumulation in form of savings.

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2008; Were, 2001; Iyoha, 1999; Fosu, 1999; Deshpaned, 1997; Elbadawi et al., 1996) have established a negative relationship between external debt and economic growth, others have confirmed a positive relationship (Jayaraman et al., 2008; and Warner, 1992). Yet others find no correlation between debt and growth (Frimpong and Oteng-Abaye, 2003; Afxentiou and Serletis, 1996; Chowdhury, 1994; Cohen, 1993). The balance, however, appears to tilt in the negative direction.

The external debt levels of SSA countries have been on the rise in the past two decades, generating concerns among analysts and policy-makers about a looming debt distress threatening the region. While Africa's current external debt ratios appear manageable, the rapid growth in several countries is of concern (UNCTAD, 2016).[2] From a level of US$176.36 billion in 1990, the total external debt stock for SSA rose to US$235.94 billion in 1995, representing an increase from 58.2 per cent of the regional GDP to 72.0 per cent. For the years under study (1990-2013), the highest external debt-to-GDP ratio of 78.2 per cent was recorded in 1994. Standing at US$213.44 in 2010, the total external debt stock rose by US$55.63 billion to reach US$269.08 billion at the end of 2010. External debt witnessed a rapid build-up in the 3 years following, to reach US$367.51 billion in 2013 (World Bank, 2015).

Despite recent tightening of concessionary terms associated with bilateral and multilateral loans, Sub-Saharan Africa countries still continue to rely heavily on external borrowing for fiscal sustainability in order to accelerate economic growth. The impacts of the global economic downturn in the 1980s on developing economies, including the debt crisis, was such that the 1980s is often referred to as the "lost decade" for Africa (Iyoha, 1999). Even though many countries in the developing regions have managed to restore growth fortunes after the global economic distress of the 1980s, stagnation persisted in SSA into the first half of the 1990s as the burden of external debt lingered. Thus, the regional growth rate averaged 0.8 per cent per annum between 1990 and 1995, with many countries in the region experiencing negative growth. Growth improved in the years that followed, and stood at 3.4 per cent in 2000, rising further to 5.3 per cent by the end of 2010 (World Bank, 2015). UNCTAD (1998) attributes the protracted low growth of the region to the negative impact of external and internal developments, external debt burden, and structural and institutional setbacks and policy slippages.

Although generally exhibiting a rising trend, figure 1 shows us that the average growth rate for SSA was much lower between 1990 and 2000 compared to the decade following. The lower average growth between 1990 and 2000 was associated with much higher external debt-to-GDP ratios. Economic growth appears to have peaked for SSA in the last decade as the debt-to-GDP ratio decreased over time. Admittedly, the drastic decline in the debt-to-GDP ratio starting from 2001 was on account of many SSA countries subscribing to debt relief under the highly indebted poor countries (HIPC) initiative. The improved growth performance witnessed following the declining debt burden could be read as indicating the freeing up of additional resources through reduced external debt service obligations to propel growth.

That said, is the observed inverse correlation between external debt and economic growth a mere statistical fluke or is there a causal relationship between them?

This work investigates the effect of external debt on economic growth in SSA. A plethora of cross-country studies on external debt and economic growth exist in the literature, but the focus has predominantly been on developed countries (Geiger 1990; Reinhart and Rogoff, 2010). Studies covering developing economies are concentrated largely on Latin American countries and/or selected countries in Africa (Cohen, 1993; Warner, 1992; Afxentiou and Serletis, 1996; Desphane, 1997; and Butts, 2009). Empirical literature on SSA as a whole is scant, with the most recent studies being Fosu (1996; 1999) and Iyoha (1999). Fosu (1999), employing Ordinary Least Squares, estimated an augmented production function and found a negative relationship between external debt and growth in SSA. Similarly, Iyoha (1999) also found a negative effect of external debt on economic growth. While the above cited studies on SSA appear quite dated, not only does the present paper extend to more recent data but we also apply one of the frontier econometric techniques - the system GMM approach - to unravel the external debt-economic growth dynamics in SSA. Another value-added to our paper, which earlier studies on SSA failed to capture is to control for country-groupings based on per capita income. The rest of the paper is organized as follows: the next section provides a survey of the existing literature, followed by a discussion of the methodology in Section 3. The results are presented in Section 4, whilst Section 5 concludes with policy recommendations.

2. Literature Review

There is no unified theoretical and/or empirical explanation for the debt-growth nexus. The majority of theoretical propositions and empirical findings, however, reveal a negative relationship. The Harrod-Domar growth model provides the most basic direct relationship between savings and the rate of economic growth. According to the model, capital accumulation in the form of savings is essential for growth. External borrowing is, therefore, seen as capital helping to fill the financing gap in developing countries to promote growth (Eaton, 1993). In contrast, the literature has identified five channels through which external debt could affect growth negatively. First is the debt overhang hypothesis (DOH); Krugman (1988) defined debt overhang as "a situation in which the expected repayment on foreign debt falls short of the contractual value of the debt", whiles Borensztein (1990) asserts that debt overhang is "a situation in which the debtor country benefits very little from the return to any additional investment because of the debt service obligations." The DOH has two versions, namely, the narrow (traditional) and broader versions. The narrow perspective posits that

[2] In 2012, the World Bank observed that the eight African countries to have borrowed fastest since receiving debt relief - Ghana, Uganda, Senegal, Niger, Malawi, Benin, Mozambique, and São Tomé and Príncipe - could within a decade be back to pre-debt relief debt stock levels (UNCTAD, 2016).

debt overhang effect exists when investors expect an increase in the tax rate on returns to capital to service the debt, and consequently reduce their investment levels to avoid higher future taxes (Krugman, 1988; Sachs, 1989; Anyanwu, 1994). Neoclassical models posit that imposition of taxes for interest payment on external debt reduces individuals' disposable income and hence curtails savings of the taxpayer. The broader version of debt overhang argues that there is disincentive to invest when investors expect inflation, devaluation and other economic distortionary measures as means to service the debt. Debt rescheduling negotiations discourage investment since it raises uncertainty within the business environment (Claessens et al., 1996).

Second, there is a crowding-out effect of external debt. Debt service burden on government reduces public spending, including spending on social investments such as education and health which are crucial for economic growth. Moreover, heavy debt burden implies that government short term revenue must be used to service the debt, thereby crowding out public investment into the economy (Serieux and Yiagadeesen, 2001). Reduction in public investment can lead to a decrease in private investment since some private investments and public investments are complementary (Diaz-Alejandro, 1981; Taylor, 1983). Third, the growth effect of very high debt burden through the balance of payments account is referred to as liquidity constraint hypothesis (LCH) or import compression effect. Countries with high debt burden require enough inflow of foreign exchange so as to service the debt, especially when the nation's currency is not tradable in the international market. A situation where a country has low exports and capital inflows as well as inadequate reserves, debt servicing becomes problematic. The country may therefore resort to devaluation/depreciation and/or import restriction to attract foreign exchange inflow (Serieux and Yiagadeseen, 2001). Serieux and Yiagadeesen (2001), Ndulu et al., (1997) and Taylor (1983) have argued that import compression may lead to a situation where imported commodities, including inputs and capital goods, become expensive which can result in low growth.

Fourth, the debt-growth channel can be traced to the Direct Effect of Debt Hypothesis (DEDH) as hypothesized by Fosu (1996). Thus, Debt overhang, the crowding out effect and liquidity constraint hypotheses, suggest an indirect negative effect of external debt on economic growth through reductions in investment levels. However, Fosu (1996) argues that even if external debt is inconsequential in the savings and investment function, it can still influence output growth through its effects on factor productivity and investment mix. While a drag on investment could reduce growth, external debt may also stifle the productivity of the factors production and hence growth (Fosu 1999). Pattillo et al. (2004) argue that high debt burden creates uncertainty and thus biases investment towards short-term instruments to the detriment of long-term investments. Investors would therefore be reluctant to invest in projects with longer gestation periods because of higher uncertainty that characterizes the long-term. Lastly, the Debt Laffer Curve theory postulates a nonlinear relationship between debt and growth on the assumption that there is an optimal level of debt that promotes growth. Beyond that threshold further debt accumulation impedes growth. Cohen (1993) observes that the Debt Laffer Curve can be used to show the relationship between the face value of debt and investment, since the curve explains that as the outstanding debt increases beyond a certain threshold, repayment capacity begins to fall. In other words, when a country borrows to finance its budget deficit, it makes resources available for capital investment which could help promote growth objectives. However, borrowing beyond a certain level creates debt overhang and debt service challenges, and may retard growth (Pattillo et al., 2002).

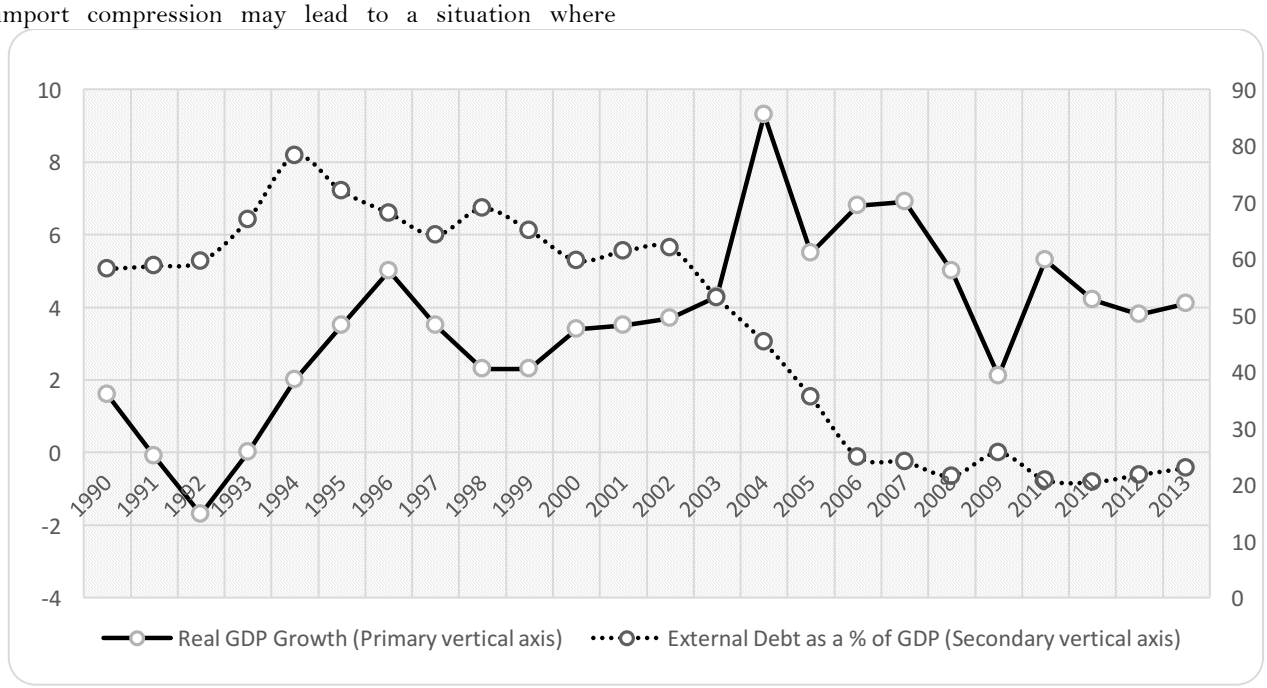

Figure 1. External Debt (% GDP) and GDP Growth Rate in Sub-Saharan Africa, 1990-2013, based on World Bank's World Development Indicators 2015

The empirical literature on the debt-growth relationship proffers mixed conclusions. The works of Warner (1992) and Jayaraman et al. (2008) found a positive impact of debt to growth. However, Geiger (1990), Gerald (1994) and Deshpaned (1997) found that debt retards growth. Using an augmented aggregate production function, Fosu (1996) establishes a nonlinear relationship between debt and growth in SSA, thus confirming the Debt Laffer curve hypothesis. Fosu (1999) again also established a negative effect of external debt on growth in SSA, a finding also confirmed by Iyoha (1999). Were (2001), and Hameed and Chaudhary (2008) conducted time series analysis on Kenya and Pakistan, respectively, and found external debt to be negatively correlated with growth. Reinhart and Rogoff (2010) employed panel regression analysis on a sample of 20 developed countries and found that for GDP to Debt ratios below 90 per cent, the relationship between debt and growth was insignificant whilst for ratios above 90 per cent external debt worsened the median growth by 1 per cent and considerably more for mean growth. This finding is consistent with Kumar and Woo (2010) who also found that external debt is deleterious to economic growth in developed countries. Musebu (2012) found that external debt does not promote economic growth in HIPC Southern Africa Development Community (SADC) counties. A few studies, including Chowdhury (1994), Afxentiou and Serletis (1996), Cohen (1993), Frimpong and Oteng-Abaye (2003), have found no clear relationship between external debt and growth. Clearly, empirical investigations have divergent findings regarding the relationship that exists between external debt and economic growth, even though the balance tilts in the negative direction. In the context of Sub-Saharan Africa, save studies by Fosu (1996; 1999) and Iyoha (1999), there is a dearth of research on the effect of external debt on economic growth. The present paper adds to the external debt-growth literature using data for 39 SSA countries from 1990 to 2013. Unlike previous studies on SSA, the paper controls for per capita income levels of countries in the sample and uses the system GMM estimation technique.

3. Methodology and Data

We adopt the augmented production function specified by Fosu (1996), which expresses economic growth as a function of labour, capital and exports. The importance of labour and capital in the growth function derives from neoclassical theory whilst the robustness of exports in the growth model is attributed to its generally avowed significant contribution to growth (Fosu, 1990). The augmented production function is specified as:

$$q_i = b_1 + b_2 l_i + b_3 k_i + b_4 x_i + e_i \qquad (1)$$

where q is growth rate of output; l denotes labour force growth rate; k represents growth rate of capital, x is growth rate of exports; and e is the error term.

We employ the dynamic panel regression model in estimating the effect of external debt on economic growth in SSA. The predetermined variables in the model comprises lagged dependent variable and lagged independent variables aimed at incorporating the persistence of those variables in the estimation. Furthermore, the use of a dynamic panel model would help account for temporal serial correlation, and minimize the likelihood of estimating a spurious regression model. The dynamic panel regression model is generally specified as:

$$q_{it} = \alpha q_{it-1} + \beta x_{it} + \gamma x_{it-1} + \mu_i + v_{it} \qquad (2)$$

where $\mathbf{q}_{it}$ represents output growth, $\mathbf{q}_{it-1}$ represents the lagged output growth, $\mathbf{x}$ is the matrix of all independent variables, $\mathbf{x}_{it-1}$ is the matrix of lagged independent variables, $\boldsymbol{\mu}$ denotes unobserved country-specific time-invariant effect, $\mathbf{v}$ represents the stochastic error term, $\boldsymbol{\alpha}$, $\boldsymbol{\beta}$, $\boldsymbol{\gamma}$ are vectors of parameters to be estimated, $\mathbf{i}$ indexes the countries under study, and $\mathbf{t}$ denotes time (or year).

The debt overhang (DOH) and liquidity constraint (LCH) hypotheses emphasize investment as the main channel of the debt-growth nexus. The DOH posits that when a country accumulates huge debts, it beacons an eroding fiscal space, creating uncertainty in investors' minds thereby discouraging investment. A liquidity constraint, on the other hand, binds on a country when external debt service requirement reduces the financial resources available for investment into the economy. Otherwise, a fall in current debt service obligations should result in a rise in current investment for a given level of future loan (Cohen, 1993).

While many empirical studies have traced the effect of debt on growth through investment and savings (see Fry, 1989; Faini and DeMelo, 1990; Hoffman and Reisen, 1991; and Savvides, 1992), a few have attempted ascertaining the direct impact of debt on economic growth (Fosu, 1996, 1999; and Iyoha, 1999). This paper adopts the latter approach to investigate the effect of external debt on economic growth in Sub-Saharan Africa. As noted by Fosu (1996), the effect of external debt on growth need not necessarily be traced through investment. He argues that this indirect effect may be less important than the direct approach for Sub-Saharan African countries. Hence in analysing the debt-growth nexus, the traditional research emphasis on the effect of debt on investment is not completely advisable (Fosu, 1996). The direct effect is tested for SSA by directly incorporating the debt variable into the augmented production function, as specified in equation (3)

$$\begin{aligned} grgdp_{it} = {} & b_0 + b_1 grgdp_{it-j} + b_2 labor_{it} + \\ & b_3 kgdp_{it} + b_4 gxports_{it} + b_5 debt_{it-k} + \\ & b_6 sqdebt_{it} + b_7 midinc_{it} + b_8 debtinc_{it} + u_{it} \end{aligned} \qquad (3)$$

where *grgdp* denotes real GDP growth, *labor* is natural log of labour force, *kgdp* is total investment as percent of GDP (proxy for capital), *gxports* is growth rate of exports, *debt* stands for external debt as percent of GDP (proxy for debt burden), *sqdebt* is the square of external debt as percent of GDP (captures nonlinearity in the debt-growth relationship), *midinc* is a dummy (assumes 1 for middle-income country and 0 for low-income

country), *debtinc* is interaction of debt and income dummy, *b's* are coefficients to be estimated, *u* is the error term, *t* is time, and *i* represents country. The variable of interest is external debt to GDP ratio used as a measure of debt burden. Data on all the variables are obtained from The World Bank (World Development Indicators) and the International Monetary Fund (IMF) online database thus, World Bank (2015) and IMF (2015), respectively. We estimate equation (3) by the system Generalized Moments of Methods (GMM). The system GMM is a superior technique among all the dynamic model estimators since it has an inbuilt mechanism to resolve issues of endogeneity arising from omitted variables, endogeneity of explanatory variables, and the presence of measurement error, amongst others (Caselli et al., 1996; Roodman, 2006; and Hesse, 2008).

4. Results

Table 1 presents descriptive statistics of the variables employed. Real GDP growth rate for the 39 SSA countries in the study averaged 3.8 per cent for the period 1990-2013 with a standard deviation of 7.3. The standard deviation of real GDP growth portrays the extent of variability in the growth rates among the selected countries for the period under study. The level of external debt in the region remains high, averaging 83.9 per cent of GDP over the period. With a standard deviation of 134.5, this also reflects the high variability in the debt-GDP ratio among the sampled countries over the period of study. The Fisher Test for stationarity shows no presence of unit roots in panels (see Appendix). Hence, the variables are stationary and there is no tendency for any possible spurious regressions. Furthermore, the Hausman test results confirms that the fixed-effects is the preferred model, a pre-requisite for employing the system GMM technique (see Appendix).

Table 2 presents the dynamic panel estimates of the system GMM model. The random and fixed effects estimates are also reported to ascertain the consistency of the parameter estimates. The Wald Chi–squared statistic for the system GMM model indicates joint significance of the explanatory variables.

Table 1. Descriptive Statistics of Variables, 1990-2013

Variable	Mean	Standard Deviation
Real GDP Growth Rate (%)	3.77	7.26
Investment as % of GDP	20.40	9.54
Labour Force (millions)	6.31	8.76
Export Growth Rate (%)	7.74	22.47
External Debt as a % of GDP	83.90	134.53

Table 2 Results of the Estimated Dynamic Model

	System GMM			
	Model 1	Model 2	Random Effects	Fixed Effects
First lag of GDP growth	0.0653**	0.0665**	0.0681**	0.0202
	(0.0330)	(0.0337)	(0.0345)	(0.0354)
Second lag of GDP growth	0.0958*	0.0973*	0.0981*	0.0622***
	(0.0324)	(0.0325)	(0.0332)	(0.0341)
Debt to GDP ratio	-0.0148*	-0.0464*	-0.0468*	-0.0548*
	(0.0034)	(0.0146)	(0.0149)	(0.0165)
First lag of Debt to GDP ratio		0.0395*	0.0396*	0.0380*
		(0.0121)	(0.0124)	(0.0123)
Second lag of Debt to GDP ratio		-0.0032	-0.0036	-0.0037
		(0.0091)	(0.0093)	(0.0096)
Square of Debt to GDP ratio		-0.00001	-0.00002	7.68e-06
		(0.00004)	(0.00005)	(0.00005)
Middle income country	-0.0664	-0.0276	0.0098	*Dropped due to*
	(0.3617)	(0.5601)	(0.5686)	*multicollinearity*
Debt*Middle income country		0.0008	0.0016	-0.0010
		(0.0067)	(0.0068)	(0.0085)
Growth rate of exports	0.0677*	0.0660*	0.0678*	0.0659*
	(0.0076)	(0.0076)	(0.0078)	(0.0079)
Log of Labour force	0.3876*	0.3880*	0.3785*	-0.9637
	(0.1376)	(0.0076)	(0.1433)	(0.8751)
Investment to GDP ration	0.0513*	0.0579*	0.0487**	0.0621**
	(0.0194)	(0.0195)	(0.0196)	(0.0256)
Constant	-2.8928	-3.3399	-3.0219	17.7413
	(2.1401)	(2.2264)	(2.3701)	(13.3202)

Wald chi2(11)			188.80	
F (10, 706)				13.72
Prob>F			0.0000	0.0000
Wald chi-squared (prob>chi2)	0.0000	0.0000		
Arellano-Bond AR2 (prob>chi2)	0.5660	0.6440		
Sargan Test (Prob>chi2)	0.8060	0.4350		
Number of observations	757	754	754	754

Note: Standard errors are in parentheses; *, ** and *** denote statistical significance at 1%, 5% and 10% respectively.

The Arellano–Bond test AR (2) in first differences fails to reject the null hypothesis of no two–period serial correlation in the residuals. Besides, the Sargan test for over-identifying restrictions shows that the over-identifying restrictions are valid in the model implying that the model does not suffer the weakness of too many instruments. The system GMM results (model 2) reveals that external debt negatively affects growth in SSA. A one percentage point increase in external debt to GDP ratio reduces GDP growth by 0.05 percentage points. This result is consistent with the random and fixed effects model results. According to Fosu (1999), the negative contemporaneous effect of external debt on growth suggests a reverse causality between external debt and growth. Thus, low growth performance elicits the need for more debt acquisition in the current period. The result is in agreement with the findings of Fosu (1996, 1999), and Iyoha (1999).

The results also indicate that the coefficient of first lag of debt is positive and significant at 1 per cent whilst the second lag is insignificant. Thus, the first lag of debt to GDP ratio stimulates GDP growth by 0.04 percentage points. We extrapolate that greater debt acquisition in the previous period makes resources available for higher growth in the next period. However, the magnitude of the positive effect is lower than the negative contemporaneous effect of debt. The Square of external debt as a percentage of GDP is statistically insignificant, suggesting the non-existence of a nonlinear relationship between external debt and GDP growth, contrary to the findings of Fosu (1996), who found that external debt and growth are positively correlated at low levels of investment but the relationship turns negative after the investment to GDI/GDP ratio reaches a threshold of 16 per cent. The coefficient of the interaction of debt and middle-income is positive but statistically insignificant, indicating that being a middle-income country does not make external debt less detrimental to growth than in low-income countries.

In order to ascertain the independent effect of external debt on growth, a restricted form of the dynamic model in equation (3) is estimated. The restricted model excludes the lags of debt to GDP ratio, debt to GDP ratio squared, and debt-middle-income dummy from the dynamic model. The results are reported as model 1 in Table 2. The restricted model estimates are similar to those of the complete model (model 2) in spite of a reduction in the coefficient of the debt variable. The results indicate that an increase in external debt to GDP ratio by 1 percentage point impedes economic growth by 0.02 percentage points at 1 percent level of significance. Thus, the coefficient of debt remains negative and significant, implying that the adverse effect of external debt on growth is independent of the inclusion of first and second lags of external debt to GDP ratio, external debt to GDP ratio squared, and debt-dummy interacted variable in the model, thereby providing further support for the robustness of the debt coefficient. The results from both Model 1 and Model 2 shows that capital, labour, and exports are positively significant at 1 percent, lending further empirical evidence as key determinants of growth.

5. Conclusion

This paper sought to examine the effect of external debt on economic growth in SSA for the period 1990-2013. Results indicate that external debt directly impedes economic growth in SSA. Classification of the countries in the sample into low-income and middle-income economies had no significant effect on the debt-growth relationship. In other words, being a middle-income country does not enhance the effect of debt on growth compared to low-income countries in the sample. The paper did not confirm a non-linear relationship between external debt and growth. Does the finding of a negative relationship between external debt and growth imply that SSA countries should cut back on foreign borrowing in other to boost growth? This would be a difficult policy decision for most governments in the region. Given the huge savings gap in most of the SSA countries, these economies would continue to rely on foreign financing of development programmes in the short- to medium-term. Rather what governments in SSA must do is to ensure that the foreign loans are invested in projects that would eventually generate enough returns to amortize the debt. Enhancing domestic revenue mobilization will also go a long way to reduce the over reliance on external financing. In this regard, there is the need to embark on efficient revenue mobilization drives through the broadening of tax bases, devising various strategies to capture untaxed informal sectors into the tax net and check revenue leakages so as to increase domestic revenue mobilization.

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Appendix

Table A1. List of the 39 Sub–Saharan Africa countries in the study

Low-Income Countries	**Lower-Middle Income Countries**
Benin	Cameroon
Burkina Faso	Congo Republic
Burundi	Côte d'Ivoire
Central Africa Rep	Ghana
Chad	Kenya
Comoros	Lesotho
DR Congo	Mauritania
Eritrea	Nigeria
Gambia, The	Senegal
Guinea	Sudan
Liberia	Swaziland
Lesotho	Zambia
Madagascar	
Malawi	**Upper-Middle Income Countries**
Mali	Angola
Mozambique	Botswana
Niger	Gabon
Rwanda	Mauritius
Sierra Leone	South Africa
Tanzania	
Uganda	
Zimbabwe	

Note: Country groupings based on United Nation's classification of countries.

Table A2: Results of Fisher Unit Root Test of Stationarity

Variables	Inverse chi-squared	Inverse normal	Inverse logit	Modified inverse chi-squared

	Statistic	Prob	Statistic	Prob	Statistic	Prob	Statistic	Prob
GDP growth rate	210.5609	0.0000	-7.1303	0.0000	-7.8768	0.0000	10.6134	0.0000
Ln of labour force	555.8800	0.0000	11.1950	0.0000	-21.7506	0.0000	38.2610	0.0000
Investment % of GDP	139.8574	0.0002	-4.6836	0.0000	-4.7345	0.0000	5.1795	0.0000
Export growth	225.3758	0.0000	-8.4528	0.0000	-9.1508	0.0000	11.7995	0.0000
Debt as a % of GDP	197.8712	0.0000	-5.6376	0.0000	-6.5721	0.0000	9.5974	0.0000
Debt as a % of GDP2	641.9709	0.0000	-20.8838	0.0000	-28.3261	0.0000	45,1538	0.0000
(Debt*middle income)	196.6536	0.0000	-6.6885	0.0000	-7.3703	0.0000	9.4999	0.0000

Source: Authors' computation using STATA 13

Table A3: Hausman Test for Fixed Effects and Random Effects

Ho: Difference in coefficients not systematic (Random effect)
Chi2 (4) = (b-B)'[(V_b-V_B) ^ (-1)] (b-B) = 35.63
Prob>chi2 = 0.0000

Source: Authors' computation using STATA 13