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Debt Sustainability in Developing Economies: Evidence from Sub-Sahara Africa

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ABSTRACT

In this study, we assess the debt sustainability of emerging economies in Sub-Saharan Africa. We specify a dynamic panel threshold to estimate the debt threshold for primary surplus and economic growth. The results reveal a non-linear threshold effect. First, with a threshold value of 17.95%, the primary surplus has a strong positive relationship with the debt-to-GDP ratio. Second, economic growth is maintained when the debt-to-GDP ratio is about 52%. The study recommends that governments in SSA should make conscious efforts to restore fiscal discipline that will keep the debt burden at a rate reasonable enough to sustain and avoid debt overhang problems.

1. Introduction

Debate and issues surrounding debts remain important in both academia and policy discourse due to the impacts growing debt has on economic growth and development (Jiménez-Rodríguez and Rodríguez-López 2015; Bökemeier and Stoian 2018; Swamy 2015a, 2015b). The International Monetary Fund (IMF, 2016a) reports that the upward adjustment of debt trajectories particularly in emerging and middle-income countries is triggered by the 2008 financial crisis (Ngan, 2018). Recent statistics reveal about 40% of countries in the SSA region have a debt burden greater than 40% of GDP – some countries (such as Cabo Verde, Mauritania, Togo, and Sudan) recorded fiscal debt above 90% of GDP in 2013 (Battaile, Hernandez, and Norambuena 2015). These liabilities accumulate from one government to the next, growing with each election cycle (Mothibi and Mncayi, 2018). In contrast, government revenue is comparatively lower. Governments in Cabo Verde, Gambia, Ghana, Mauritania, and Togo, for instance, are unable to settle their debts while continuing to borrow money to pay for expenses. Higher debts and interest due payments called for the IMF's warning against debt overhang problems. Since the debt-to-GDP ratio serves as a measure of financial strength, fiscal risks originating from excessive debt accumulation have become a global concern. The Greek crisis and its associated underlying pathologies on consumption, investment, etc is a recent classic example. The issue in sub-Saharan Africa (SSA) is very critical following the fragility of these economies and the macroeconomic instability that characterizes them.

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Debts, both internal and foreign, are essential for supporting governmental spending, but they have also exacerbated macroeconomic instability and negatively impacted economic conditions, particularly in the SSA sub-region (Osei, 1999). The issue is made worse by the fact that money raised by the sale of sovereign bonds and non-concessional loans is used to fund short-term manifesto commitments rather than long-term development initiatives (Osei, 1999). Interest rates rise as borrowing increases without equivalent maturation payments, building up into a debt cycle that has the effect of slowing progress. *Figure 1* depicts how interest payments outweigh capital expenditures in recent this region. A country may experience debt overhang issues and be unable to pay off its debt stock[1] if its debt-to-GDP ratio is high or continues to rise.

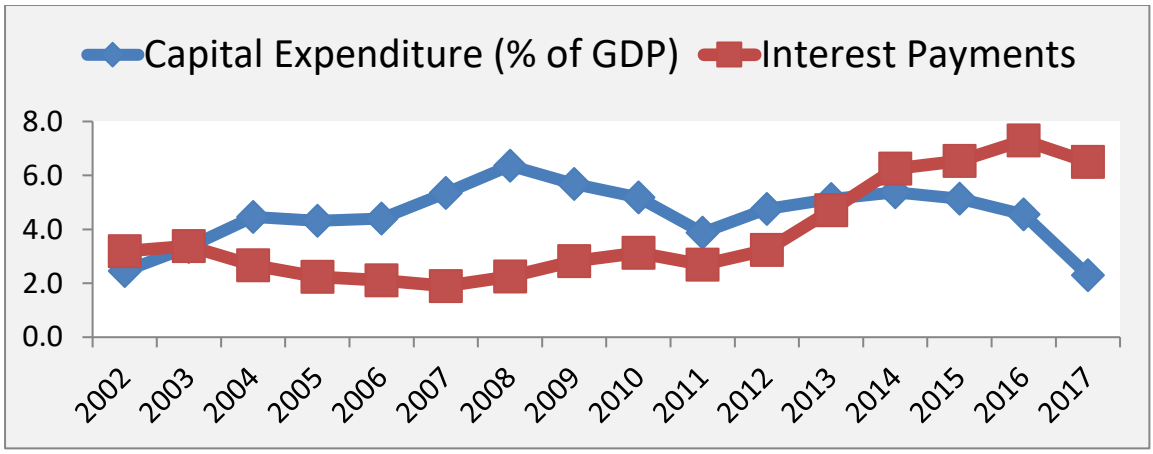

Figure 1: Relationship between Capital Expenditure and Interest Payments
Source: Authors' construct, using data from the World Development Indicators

The foregoing discussion has necessitated various studies to examine the pathology of debt in many economies, particularly, how to sustain debt growth (see Fosu, 1996, 1999; Christensen, 2004; Bua, Pradelli, and Presbitero, 2014; Battaile et al., 2015; Ngan, 2018) yet the focus has predominantly been on external debt sustainability The literature has a few research on domestic borrowing or the blending of sovereign and external borrowing (see, Bua et al., 2014; Battaile et al., 2015). However, these studies could not reveal a unison threshold to signal the risk of defaulting debt to policymakers. To address this issue of debt sustainability, we examine the existence of a fiscal debt threshold that will provide a benchmark for fiscal policymakers vis-à-vis the degree of sustainability. The estimated threshold is identified as the level of fiscal debt-to-GDP ratio beyond which sovereign debt default is statistically possible. Our results will motivate these emerging countries to undertake and maintain stringent fiscal consolidation and debt stabilisation measures.

The rest of the paper is structured as follows: Section 2 is devoted to the review of relevant literature on the subject area; Section 3 deals with the theoretical and empirical models underpinning the study as well as the data source and description. In section 4, the empirical results are discussed with the appropriate diagnostic test conducted to provide meaningful and understandable estimates. The final section summarizes, concludes, and proffers applicable recommendations for policy purposes.

[1]In such a situation, even when the debt-to-GDP ratio begins to fall, the decline will not be enough to ensure sustainability because of the associated risk of default.

2. Literature Review

Numerous empirical studies have been conducted on debt sustainability especially the probability of achieving sovereign intertemporal budget constraint. In his Markov-Switch analysis of fiscal sustainability in emerging market economies, Baharumshah (2016) finds that policymakers lost sight of a sustainable budgetary path because of temporary economic hardship. Therefore, Paret (2017) advises that governments of emerging nations restructure their policies to reduce exposure to currency risk by severe fiscal restraint to improve sustainability anytime debt levels rise. This is because the significant decline in growth is proportional to increases in the debt stock because of crowding out in national savings and huge debt accumulation (Georgiev, 2012). Therefore, governments looking for remedies for the economic slowdown must monitor falling commodity prices, notably oil prices, and ought to settle the recessionary economic effect emanating from China and major European trading partners (Battaile et al., 2015).

Finding a unity threshold value for various economies can lead to contradictions, which is a major source of debate in the research. According to certain studies, the debt ceiling varies between nations and cannot be assessed (see, Kraay and Nehru, 2006; Ghosh et al, 2013). Recent research has shown that the unison threshold is adequate for benchmarking and a robust driver of sovereign default, particularly across nations in the same developmental stage. (Bick, 2010; Kidochukwu, 2015; Ngan, 2018). It's still unclear how these economies' debt sustainability compares to other developed nations. In other words, do the regression estimates hold true for all samples equally, or do they divide into distinct categories? A unison threshold model is a superior method for answering this topic (Hansen, 1999).

IMF’s debt sustainability framework (DSA) provides the foundation for recent empirical studies. The framework suggests that to avoid falling behind on payments, developing economies in the low-, lower-, and middle-income brackets should attempt to maintain or decrease their debt burden below the DSA's proposed threshold (Kidochukwu, 2015). However, these countries are confronted with more severe economic challenges, including high rates of poverty, unemployment, and recession. Studies such as (Nwankwo, 2014; Kidochukwu, 2015) contend that this framework prevents these economies from growing because of two weaknesses: (1) it disregards the ambiguity of macroeconomic projections due to instability surrounding these economies, (2) It presupposes that economies adapt equitably to disturbances in key macroeconomic indicators particularly differences in fiscal reaction to the dynamics of the primary output gap and debt stock ratio (Paret, 2017; Akyüz 2007).

To address this caution, the literature describes a stochastic framework (see Burger et al., 2011; Neaime 2015). One of these is the fan-chart technique, which was first proposed by Celasun et al. in 2006 and later developed by Medeiros in 2012 and Paret in 2017. The two cornerstones of this methodology are fiscal reaction functions to reflect the budgetary response to changes in debt levels and panel VAR estimations to simulate the effect of macroeconomic variables on debt. The nature of the criterion and the benchmark range for measuring sustainability remain unidentified. These inabilities of the fan-chart approach make it inferior to Hansen’s threshold estimator adopted by this study (Bick, 2010; Lee, Seo and Shin, 2011; Ngan, 2018). The dynamic debt threshold model, which Kremer, Bick, and Nautz (2013) suggested as an addition to the Hansen (199) threshold model, provides the basis for our stochastic approach. To take the debt dynamics of developing nations in sub-Saharan Africa into account, we offer two new elements. First, while taking into account the exposure to currency risk, we develop a fiscal response function to explain how changes in the debt ratio and production gap affect the primary surplus. Second, we use the bootstrap crucial values to determine the threshold value and regime parameters using the least squares minimization method.

3. Methodology and Data

3.1. The Fiscal Reaction Function

The calculation of a fiscal reaction function is necessary for the assessments of public debt trajectories. (De-Mello, 2008). The underlying principle assumes that the government adjusts its primary budget balances in response to changes in the debt burden to ensure sustainability over time. Following previous empirical works by Bohn (1998), Gali and Perotti (2003), and De-Mello (2008), the fiscal reaction based on the government's intertemporal budget constraint is specified as follows:

$$Pb_t + (r_t - g_t)d_{t-1} = \Delta d_t + \Delta m_t + (\pi_t + g_t)m_{t-1} \quad (1)$$

Where $Pb_t = \tau_t - \gamma_t$ represents the primary surplus-to-GDP (τ_t indicates fiscal revenue and γ_t aggregate expenditures), $r_t = i_t - \pi_t$ is the real interest rate defined as the difference between the nominal interest rate i_t and the inflation rate π_t. g_t depicts the real GDP growth rate, d_t represents the fiscal debt ratio, and Δm_t defines the change in government's monetary base. We assume for simplicity that there is no monetary financing of budget deficit so that $\Delta m_t = 0$ and $r_t \leq g_t$. Thus, at any given time *t*, we can estimate the proportion of primary surplus that keeps the debt ratio unchanged as:

$$Pb_t = \{(r_t - g_t)/(1 + g_t)\}d_{t-1} \quad (2)$$

Where $d_{t-1} = \sum_{j=0}^{\infty} B_{t+j}/(1+r)^{j+1}\, Y_{t-1}$ is the debt share of GDP in an infinite horizon. Solving (1) forward and imposing the transversality condition of no Ponzi-scheme (i.e. $lim_{T\to\infty}\, d_{t+T+1}/(1+r)^{t+T} = 0$), we define the econometric relation of interest as:

$$pb_{it} = \beta_0 + \beta_1 pb_{it-1} + \beta_2 d_{it-1} + \beta_i X_{it} + f_i + \mu_{it} \quad (3)$$

Where f_i refers to the unobserved country specifics, the subscripts ***i*** and ***t*** represent the country and time indices respectively. X_{it} is a vector of state variables controlling for real exchange rate, real interest rate, output gap, and trade openness; $\mu_{it}$is the random error term.

3.2. The Debt Threshold Estimator

The existence of a threshold to act as a warning signal to policymakers on the degree of sustainability is necessary for the sustainability position of fiscal debts. In line with Kremer et al. (2013), we design the following dynamic panel threshold model to examine how debt affects primary surplus:

$$Pb_{it} = f_i + \delta Pb_{t-1} + \beta'_1 d_{it} I(d_{it} \leq \gamma) + \beta'_2 d_{it} I(d_{it} > \gamma) + \emptyset X_{it} + \mu_{it} \quad (4)$$

Where: $\boldsymbol{Pb_{it}}$ is the respondent variable; f_i measures country *i's* specificities; d_{it} is the debt threshold determinant and regime dependent regressor; $\boldsymbol{\gamma}$ is the threshold; $\boldsymbol{\beta} = (\boldsymbol{\beta_1}, \boldsymbol{\beta_2})'$are the regime parameters[2] and μ_{it} the stochastic component assumed to be independently and identically distributed *(iid)*. We estimate $\boldsymbol{\gamma}$ over a subset of regime boundaries of $\boldsymbol{d_{it}}$ by minimizing the concentrated residual sum of squares (SSR) [3] that is,

[2] Note that the regime parameters and the threshold must be time invariant.

[3]Knowing the threshold value(s) makes it easier to estimate the coefficients, (β_1, β_2) of equation (4) following the ordinary least squares approach. However, if (γ) is unknown, the estimation of (β_1, β_2) becomes nuisance. See Hansen (1999): http://www.ssc.wisc.edu/&bhansen/ for the functional forms.

$$\hat{\gamma} = argmin\, S_i(\gamma) \tag{5}$$

The critical values for determining the confidence interval of the threshold $\hat{\boldsymbol{\gamma}}$ follows the likelihood ratio statistic $LR(\gamma)$ such that the 95% confidence interval of the threshold value is given by

$$CI = \{\gamma: LR(\gamma) \leq C(\alpha)\} \tag{6}$$

Where $C(\alpha)$ is the 95% percentile of the asymptotic distribution of the likelihood ratio statistic $LR(\gamma)$. To account for the number of time periods used for each cross section, the underlying likelihood ratio has been adjusted (see Hansen 1999; Kremer et al., 2013). Once $\hat{\boldsymbol{\gamma}}$ determined, the GMM can estimate the slope coefficients. To investigate instrument validity, we use the Im, Pesaran, and Shin (IPS) (2003) test for stationarity and the Sargan test for over-identification.

3.3. Variables Description

For the purpose of stability, we lag primary balance to account for each economy's reactions to changes in their debt stock over time, as well as the negative impact on fiscal policy (Paret, 2017). The output gap (OG) is defined as the difference between actual and potential GDP expressed as a percentage of potential real GDP. The Hodrick-Prescot (HP) high-pass filter is used to calculate OG (see Razzak, 1997). We define the debt ratio as the aggregate sovereign debts including (fiscal guaranteed debt) expressed as a percentage of GDP. The exchange rate is expressed in terms of the national currency per dollar. It accounts for ongoing depreciation on the fiscal position with respect to paying off foreign debts and the trickle-down effect on primary balances (De Mello, 2008). Finally, we define trade openness as the aggregate export and imports to GDP ratio.

3.4. Data Source

We used a balanced panel data for eleven (11) SSA countries[4]. The annual time series was obtained from the IMF's World Economic Outlook database. This is a comprehensive database that highlights the IMF's global projections of economic development of major country groups, and individual countries. We follow the World Bank's average growth rate per capita grouping index to select the participating countries. Our data spans the years 2000 to 2021. We obtained exchange rate information from the International Financial Statistics (IFS) database.

4. Results Discussion

The empirical relationship between the debt-to-GDP ratio and primary budget surplus based on the threshold are presented in the first column of Table 1. Also, we present the relationship between the debt-to-GD ratio and economic growth based on the benchmark in the second column of Table 1. In column 1, the estimated debt threshold of 17.95% is higher than the 14.5% proposed by Kidochukwu (2015) for developing countries but lower than the 21% suggested for Mongolia and other developing Asian countries by Asian Development Bank (2014; cited by Ferrarini and Ramayandi, 2015). Thus, the 95% confidence interval ([16.34 – 18.07]) of the threshold includes the 14.5% but does not contain the 21%. Also, the regime-dependent coefficient is significant for $\hat{\beta}_1$ This marginal effect shows that there is a strong positive reaction of the primary budget surplus to changes in the debt ratio if the debt-to-GDP-

[4] Participating countries include; Mali, Burkina Faso, Ghana, Ethiopia, Uganda, Tanzania, Zambia, Mozambique, Lesotho, Rwanda, and South Africa

ratio is at most equal to the threshold ($\hat{\beta}_1 = 0.6498$) for these SSA countries. Thus, an increase in net debt by 1% of GDP is associated with an increase in the primary surplus by 64.98% for these SSA countries. This result is also consistent with the findings of De-Mello (2008). In the case of economic growth, we observe a debt-to-GDP threshold of 51.57% for these SSA countries. The regime parameter, $\hat{\beta}_2$ shows that the debt ratio has a strong negative correlation with economic growth if it is greater than the threshold ($\hat{\beta}_2 = -0.1358$). The confidence interval demonstrates that this is possible for a debt-to-GDP ratio greater than 51.04% but less than 52.1%. These threshold results are robust as a parsimonious estimate (see Table 4 in the appendix) obtained by reducing the number of instruments reveals the same benchmarks and confidence interval for the two models. The only notable exception refers to the change in magnitude and direction of the regime parameter $\hat{\beta}_1$ and the significance of $\hat{\beta}_2$ for the model in the first column of Table 1. However, the magnitude and direction of growth remain unchanged. The threshold test presented in Table 2 concludes a non-linear effect of debt ratio on economic growth and primary surplus. Regarding the control variables, the real exchange rate is negatively signed in both models, suggesting that an increase in the real exchange rate decreases primary surplus and retards economic growth. Output gap on the other hand reveals a negatively significant relationship with the primary surplus, suggesting that budget surplus decreases during booms and increases during downs for pro-cyclical fiscal policy.

Table 1:
Debt Threshold Regression Estimates

	Primary Surplus	**Growth**
Threshold estimates		
$\hat{\gamma}$	17.95%	51.57%
95% confidence interval	[16.34 – 18.07]	[51.04 – 52.09]
Impact of debt (regime parameters)		
$\hat{\beta}_1$	0.6498***	0.0208
	(0.1476)	(0.0274)
$\hat{\beta}_2$	-0.131	-0.1358***
	(0.139)	(0.0320)
Impact of covariates		
Pb_{it-1}	-0.0002	
	(0.0007)	
y_{it-1}		0.0676
		(0.0678)
Exchange rate	-3.2998***	-1.7809***
	(1.1128)	(0.5712)
Openness	0.08001	0.0099
	(0.0810)	(0.0354)
Output gap	-0.0097**	-0.0003
	(0.0046)	(0.0023)
Interest rate	-0.03271	0.0496
	(0.6073)	(0.0316)
F test that all u_i =0: F(11, 170) = 2.54	*Prob > F = 0.0053*	

*The standard errors in the parenthesis are bootstrapped and adjusted for outliers. * p < 0.1, ** p < 0.05, *** p < 0.01. Note that each regime has at least 5% of all observation as suggested by Hansen (1998) and Brick (2010).*

Table 2:
Threshold Effect Tests

	RSS	MSE	F-stat	P-value
Growth	1021.53	5.804	4.80	0.443
Primary Surplus	3319.96	18.86	29.91	0.117
Bootstrap = (300 300)				
We fail to reject the null hypothesis of threshold effect.				

Table 3:
Fiscal Reaction Diagnostic Tests

Test Type	Null Hypothesis	Test Score
Wald Test	Explanatory Variables are insignificant	2797.24***
Sargan Test	Over identification restrictions are valid	20.936
Arellano-Bond:	No Autocorrelation	
Order 1		-2.371
Order 2		1.697
According to the Wald test, all explanatory factors have solid statistical validity. All instruments have been validated by the Sargan over-identification test. Furthermore, at the 5% significance level, the Arellano-Bond test reveals no autocorrelation or serial correlation for the lagged variables in both order 1 and order 2.		

Table 4:
Debt threshold estimate with reduced instruments count

	Primary Surplus	Growth
Threshold estimates		
$\widehat{\boldsymbol{\gamma}}$	17.95%	51.57%
95% confidence interval	[16.34 – 18.07]	[51.04 – 52.09]
Impact of debt (regime parameters)		
$\hat{\beta}_1$	-1.1438***	0.0166
	(0.2369)	(0.0272)
$\hat{\beta}_2$	-0.2029**	-0.1325***
	(0.0983)	(0.03199)
Impact of covariates		
Pb_{it-1}	0.0006	
	(0.0007)	
y_{it-1}		0.0623
		(0.0678)
Output gap	0.0036	-0.0004
	(0.0046)	(0.0023)

Source: Bootstrap standard errors in parentheses adjusted for outliers. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Akin to Hansen (1999) and Bick (2010), each regime contains at least 5% of all observations.

5. Conclusion and Recommendation

This paper provided recent evidence on the nonlinear relationship between the debt-to-GDP ratio and the government fiscal budget surplus in emerging SSA. To this aim, we follow a dynamic threshold model proposed and developed by Kremer et al., (2013) to examine the nexus. This model builds on the static model of Hansen (1999) and Caner and Hansen (2004) and allows for endogenous regressors in a panel setup and estimates a unison threshold for measuring debt sustainability. Applying the forward orthogonal deviations transformation suggested by Arellano and Bover (1995) ensured that the original distribution theory of the threshold model is valid in a dynamic context. Our empirical analysis of the debt sustainability threshold framework suggests that the debt ratio distorts the primary surplus and economic growth provided it exceeds a certain benchmark. The estimated debt threshold of 17.95% is higher than the 14.5% proposed by Kidochukwu (2015) but lower than the 21% suggested for

developing countries in Asia. We also observe a strong negative correlation between economic growth and the debt ratio. The empirical setup of the current study controlled for output gap, real exchange rate, openness, and real interest rate. The result of the output gap suggests that budget surplus increases during booms and decreases during recessions. We recommend that emerging governments in SSA make a conscious effort to ensure fiscal discipline, that will keep the debt burden at a rate reasonable enough to be sustained and avoid debt overhang problems. In that sense, they will not be forced to react to debt accumulation by pursuing fiscal contraction. It will be very interesting to compare our findings to those of emerging economies in other regions – future studies can consider this.

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