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ECONOMIC GROWTH AND PUBLIC DEBT THRESHOLD: NEW EVIDENCE FROM AN EMERGING ECONOMY

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The threshold beyond which debt accumulation hinders economic growth in Kenya has not been established. This paper sought to investigate whether a threshold exists in the country's debt level and its influence on economic growth beyond the threshold. Using annual data from 1980 to 2018, threshold regression technique and statistical loss functions, we found out that there exists a debt-to-GDP threshold of 55.5%. Beyond the threshold, a 10% increase in debt leads to a 1.4% decline in growth. As such, during periods of high debt, policymakers may have to rely on robust economic growth to ensure debt sustainability.

Keywords: Public Debt, Economic Growth, Threshold Regression, Statistical Loss Functions
JEL Classification: F34; H63; C24

1. INTRODUCTION

The issue of whether there is a particular public debt threshold beyond which medium-term growth is hampered remains a subject of heated academic and political debate. In the aftermath of the 2007-2009 global financial crisis and subsequent sovereign debt crisis in the euro area, the debt-growth nexus has received a lot of interest. This is partly because debt accumulation persists for years following financial crises (Reinhart and Rogoff, 2010). It is against this background that this paper sought to establish whether there exists a debt-GDP threshold point for Kenya, beyond which economic growth slows significantly, and the influence of debt on growth beyond the established tipping point.

Proponents of debt dispute the existence of debt-GDP threshold. They assert that debt enhances growth by smoothing distortionary taxation over time (DeLong and Summers, 2012; Pattillo, et al 2004; Cohen, 1993). Such borrowing compensates for reduced tax revenues and boosts economic growth via infrastructural financing and other social programs (Checheita-Wesphal and Rother, 2012). These studies allude that weak

growth is the main cause of high levels of debt and therefore an endogeneity problem. Thus, the priority should be boosting growth rather than reducing debt. On the contrary, the debt overhang hypothesis associates high debt levels with large negative effects on growth (Sichulla, 2012; Clements et al., 2003). Time horizon may also play a role on the determination of the impact of debt on output. Although debt can stimulate aggregate demand and output in the short run, it crowds out investments and reduces output in the long run (Salotti and Trecroci, 2016; Fayed, 2013; Akram, 2011). Investors may also lower their expectations of returns in anticipation of future higher taxation, higher long-term interest rate and inflation.

Along the spectrum, there are also studies that have documented possible non-linear effects in the debt-growth nexus where debt accumulation could harm growth, especially when the level of debt exceeds a certain threshold. Existing literature on this topic however remains scarce. There are few studies that have employed non-linear analysis and therefore are of particular interest for our paper. The seminal work by Reinhart and Rogoff (2010) shows that output expands with debt accumulation up to 90% of GDP after which it declines from 3% to -0.1%. They also observed a lower debt threshold for emerging markets at 60%. Their study, however, relied on simple descriptive statistics which cannot be relied in establishing a debt threshold. Specifically, the use of histograms can only be indicative and must be interpreted with caution. Two years later, their subsequent work on advanced economies (Reinhart et al., 2012) suffers from the same methodological weaknesses.

Several studies have contested Reinhart and Rogoff (2010) findings. Ndoricimpa (2020) examined the threshold effects of public debt on economic growth in Africa and found a debt threshold in the range of 62-66%. Mensah et al. (2019) finds a debt threshold in the range of 20%-50% in Africa. Although these two studies utilized data from Africa, they present contradicting results perhaps due to different estimation techniques. Using dynamic panel threshold model, Zaghdoudi (2020) investigated the relationship between external debt and economic growth for the middle- and low-income countries and found a statistically significant debt threshold level of 15.28%. Using data on a sample of 40 advanced and developing economies, Chudik et al. (2017) do not find any evidence for a threshold effect in the relationship between public debt and output. Similarly, Ash et al. (2017), do not find any evidence on threshold. On Nigeria, Omotosho et al. (2016) finds debt thresholds of 30.88%, 49.4% and 73.7% on internal, external and total debt-to-GDP respectively. Woo and Kumar (2015) found a significant debt threshold of above 90%. Égert (2015) finds non-linear effects ranging from 20% to 60% of debt to GDP ratio. Herndon et al. (2014) finds no evidence of non-linear effects at the 90% threshold. Pattillo et al. (2011) found a threshold in the range of 35-40% for developing countries. Caner et al. (2010) arrived at a much lower threshold level of 77% on advanced economies and 64% for emerging markets. Checherita and Rother (2010) found a debt threshold of 90-100%. Most of these studies have focused on a combination of developing and developed economies and not on a particular country and the findings remain inconclusive. Our study findings should provide a more cantered analysis at the

country level.

These initial findings suggest that there is no single universally applicable debt threshold. Some economies have been able to sustain high debt levels for prolonged periods and grow strongly without fiscal distress. Consistent with Eberhardt and Presbitero (2015), it may be the case that the debt threshold level depends on country-specific characteristics including the political system, production technology and debt composition (foreign versus domestic currency denominated, domestic versus external, long-term versus short term). While debt threshold has been investigated in both developed and emerging economies, to date few studies have examined this link in the context of Kenya. Previous studies on Kenya have focused on the relationship between debt and growth and primarily on the causality (Matiti, 2013; Putunoi and Mutuku, 2013; Were, 2001). These studies confirm that there is a closer link between public debt accumulation and economic growth, whether this linkage is positive or negative.

Kenya is an interesting laboratory for investigation for the following reasons. As a developing country the debt-to-GDP ratio is high and worrying. The country has witnessed significant development in infrastructure mainly using borrowed funds. This has led to higher government expenditures and debt accumulation. The country is facing a debt crisis and has recently obtained a debt-servicing suspension from the Paris Club of international creditors and China (which is the major bilateral creditor) from January to 30th June 2021. The sharp increase in public debt over the last eight years has triggered serious concerns regarding fiscal sustainability. Both the IMF and World Bank have raised red flag over the relatively high debt level and the high cost at which the country is borrowing commercial loans, warning of future repayment difficulties (Onyekwena and Ekeruche, 2019). While the country continues to record sluggish economic growth, there has been significant net outflow of resources to meet the debt obligations which may crowd out social programs and infrastructure development.

Although IMF recommends a debt-GDP ratio of less than 40% for developing countries, Kenya's debt-to-GDP ratio stood at 67 % as at December, 2020, up from 42.8% in 2008. This level of debt is comparable to South Africa with a debt to GDP ratio of 69.4% in 2020 up from 27.8% in 2008 (Mothibi and Mncayi, 2020). Nevertheless, South Africa's economy is several times larger than Kenya's. In 2019, the Kenyan parliament amended the law that previously capped public debt at 50% of the GDP and raised the debt level to $90 billion. Public debt has been on upward trajectory, piling up quickly from $58 billion in June 2019 to $67 billion in June 2020. This is projected to hit the $90 billion ceiling in 2022. Therefore, determining the optimum debt-to-GDP ratio that is consistent with Kenya's economic transformation agenda can prevent the adverse effects of debt overhang by providing signals to policymakers in managing debt accumulation. These stylized facts raise serious concerns regarding the debt threshold value at which economic growth can be sustained. This paper therefore seeks to address the following research questions: What is the debt-GDP threshold for Kenya? What happens if debt stays above this threshold for an extended period of time?

This paper makes at least three main contributions to the emerging literature on debt-GDP threshold. First, it is timely since the Kenyan government has made public debt one of its top priorities with an aim of reducing the debt levels and improve productivity. The focus on Kenya data provides the opportunity to make specific policy inference, adding to the current discussion on the sustainability of debt. Second, we present new empirical evidence based on a different methodology and a sizeable dataset over longer periods of time which circumvents the concerns of reverse causality from growth to debt. Third, while previous studies have identified the debt-to-GDP threshold values for some advanced economies (for example 90% by Reinhart and Rogoff for OECD) and Sub-Sahara Africa (Ndoricimpa, 2020; Mensah et al., 2019), Kenya may have a different debt-to-GDP ratio threshold value due to structural, institutional, and economic differences. To the best of our knowledge, the optimal debt-threshold for Kenya has not been investigated.

The remainder of this paper is structured as follows. The next section presents econometric methodology and data employed. Section 3 reports the estimated results and interprets the findings while the final section concludes the discussion.

2. METHODOLOGY AND DATA

2.1. Empirical Strategy

Consistent with theory, we specify a basic debt-growth model based on Elbadawi et al. (1999) and Pattilo et al. (2002, 2004) as follows:

$$GDP_t = \alpha\left(d_t^i\right) + \beta X_t + \varepsilon_t, \tag{1}$$

where d_t^i is debt-to-GDP ratio, X_t is a vector of control variables and GDP_t is real GDP growth. Equation (1) is used in the literature to conduct unconditional correlation analysis between debt and economic growth. This study lays more emphasis on the nonlinearity in the debt-growth relationship by employing threshold estimation techniques to establish the debt threshold. However, Equation (1) does not take into account this nonlinearity. Using threshold regression techniques, Equation (1) is transformed as follows:

$$GDP_t = \alpha\left(d_t^i, d_t^{i*}\right) + \beta X_t + \varepsilon_t, \tag{2}$$

where d_t^{i*} is the debt threshold.

Equation (2) incorporates the debt threshold thus takes care of the non-linearity in the debt-growth nexus. From Equation (2), it is expected that low debt levels enhance growth while high debt levels hinder growth.

The most feasible way to model the non-linearity in the debt-growth relationship

entails creating interaction terms "high" and "low" dummy variables and then using them in the growth regression. These interaction terms capture the possibility that debt may have a different effect above and below the threshold. In order to determine the value of threshold in this model, we choose an arbitrary debt level (d_t^{i*}) such that if $d_t > d^{i*}$, then this is a high debt regime, otherwise it is a low debt regime. We then use a dummy variable k defined as

$$k = \begin{cases} 1, if\ d_t^i < d^{i*} \\ 0, otherwise \end{cases}.$$

By using variable k, we create interaction debt dummy variables and the debt term in Equation (2) then becomes

$$\begin{aligned} \phi\left(d_t^i, d_t^{i*}\right) &= \gamma_1 d_t^i I\left(d_t^i \le d^{i*}\right) + \gamma_2 d_t^i I\left(d_t^i > d^{i*}\right) \\ &= \gamma_1 d_t^i (k_t > 0) + \gamma_2 d_t^i (k_t \le 0) \\ &= \gamma_1 d_t^{iL} + \gamma_2 d_t^{iH}, \end{aligned} \tag{3}$$

where $I(\cdot)$ is a function notation, d^L is "low" debt regime while d^H is "high" debt regime. This shows existence of a debt threshold.

We adopt the Khan and Senhadji (2001) approach, which has been widely used in the analysis of inflation-growth nexus to determine public debt-to-GDP threshold. However, since their original model was mainly used for panel set-ups, we employ the version modified by Doguwa (2012) to determine a single country debt threshold for Kenya. The debt threshold model is thus specified as:

$$GDP_t = \alpha_{td} + \beta_1 d_t^{td}(td_t - td^*) + \beta_2\left(1 - d_t^{td}\right)(td_t - td^*) + \phi_{td} X_t + \varepsilon_t. \tag{4}$$

GDP is real GDP growth and td is public debt-to-GDP ratio. X_t represents control variables, that are chosen based on traditional growth theory and ϕ represents their respective coefficients. td^* is the value used in the iteration process in search of the public debt-to-GDP. $\beta_1$captures the effect of public debt on real GDP growth for periods when debt-to-GDP ratio is greater than the optimal threshold (high debt regime) while β_2 captures the effect when debt-to-GDP ratio is lower than the threshold value (low debt regime).

The variable d_t^{td} is categorical for public debt and is defined as:

$$d_t^{td} = \begin{cases} 1, if\ td_t > td^* \\ 0, elsewhere \end{cases}.$$

The study controls for various macro-economic factors known to influence economic growth and which are clearly established in the literature. From growth theory

perspective, investment is an important driver of economic growth. Since economies tend to grow due to increases in the production of goods and services, we control for this using total investment as a ratio of GDP. Literature on trade and growth shows that trade openness has favourable effects on growth. Baldwin and Rober-Nicoud (2008) contend that trade openness has pro-growth effects due to the impact it has on the marginal cost of innovating. Since Kenya is an open economy, we use trade openness to capture the country's degree of openness. Further, we use debt service as it may affect the amount of resources available for spending on infrastructure and human capital. Finally, we control for inflation[1]. The estimable equation is therefore specified as follows:

$$GDP_t = \alpha_{td} + \beta_1 d_t^{td}(td_t - td^*) + \beta_2\left(1 - d_t^{td}\right)(td_t - td^*) + \varphi_1 INV_t + \varphi_2 INF_t + \varphi_3 TO_t + \varphi_4 DS_t + \varepsilon_t, \quad (5)$$

where GDP is real GDP growth, td is public debt-to-GDP ratio, INV is total investment as a ratio of GDP, INF is inflation rate, TO is trade openness and DS is public debt servicing.

2.2. Estimation and Testing

We iterate Equation (5) using different arbitrary values of debt-to-GDP to establish public debt threshold. The threshold is established at the point where the two statistical loss functions: residual sum of squares (RSS) and root mean squared error (RMSE) of the iterated regression equation are minimized.

The total effect of public debt on economic growth is given by the sum of the coefficients β_1 (high debt regime) and β_2 (low debt regime). At the threshold, it is expected that the sum of these coefficients is negative. Further, for the established threshold to hold, β_1 and β_2 should be statistically different from each other. This is tested using the hypothesis: $H_0: \beta_1 - \beta_2 = 0$

2.3. Data Description and Sources

The study used annual data for real GDP growth, public debt (total debt-GDP ratio), total investment as a ratio of GDP, inflation, public debt service and trade openness for the period 1980 to 2018, for which data for all the variables was available. The data is compiled from World Development Indicators and Central Bank of Kenya. Table 1 shows definition and measurement of the variables of interest.

Table 2 presents summary statistics. The highest real GDP growth rate the country has ever recorded was 8.4% in 2010 while the lowest was -1.1% in 1992. The average

[1] From a theoretical perspective, inflation has a negative effect on growth, though Tobin (1965) finds a positive effect.

real GDP growth for the period 1980 to 2018 is 3.9%, which is above its standard deviation of 2.3% and significantly below the revised target of 7.0% annual growth enshrined in the country's Vision 2030.

Table 1. Variables Definition and Measurement

Variable	Notation	Description and measurement	Predicted effect
Real GDP Growth	GDP	Annual change in the level of production of goods and services. Measured by growth in GDP at constant prices based on constant local currency	-
Public Debt	TD	Indicator of the country's level of total indebtedness. It's given by the sum of public and publicly guaranteed debt expressed as percentage of the country's nominal GDP.	Indeterminate
Total Investment	INV	Sum of private and public investments expressed as a ratio of GDP	Positive
Inflation	INF	Annual change in the cost to the average consumer of acquiring basket of goods and services. Measured by changes in consumer price index.	Negative
Trade Openness	TOT	Indicator of the country's level of trade openness. It's measured by the sum of imports and exports of goods and services normalized by the country's GDP.	Positive
Debt Service	TDS	Measure of public debt repayment. Given by the sum of principal repayments and interest actually paid by the government on long-term obligations expressed as percentage of exports of goods and services and primary income.	Indeterminate

Table 2. Descriptive Statistics

Statistic	GDP Growth	Debt-to-GDP	Debt Service	Investments	Inflation	Trade Openness
Mean	3.9	41.5	19.6	20.4	11.0	55.0
Median	4.3	44.3	16.4	19.6	8.6	55.2
Maximum	8.4	68.1	39.8	28.6	46.0	72.9
Minimum	-1.1	13.5	4.3	13.6	1.6	36.2
Std. Dev.	2.3	14.6	11.7	4.0	8.5	8.2
Skewness	-0.5	-0.2	0.3	0.3	2.2	-0.1
Kurtosis	2.4	2.1	1.8	2.2	9.0	3.7
Jarque-Bera	2.0	1.7	3.1	1.8	89.4	0.8
Probability	0.3631	0.4277	0.2160	0.4141	0.0000	0.6555
N	39					

There has been consistent growth in the country's debt stock as shown by the growing trend of debt-to-GDP ratio, the highest being 68.1% in 1993. This was perhaps as a result of the country's recovery from a deficit growth in the previous year which was balanced by high levels of borrowing and the lowest being 13.5% in 1980. Cumulatively, as at December 2018, the country's public debt as a ratio of GDP stood at 59.3%, which is below the 70% threshold jointly established by IMF and the World Bank. Debt service, investments and inflation are positively skewed while real GDP growth, debt-to-GDP and trade openness are negatively skewed, indicating that they may contain outliers.

3. EMPIRICAL FINDINGS AND DISCUSSIONS

3.1. Preliminary Results

The Jarque-Bera statistics indicate that all the variables except trade openness follow a normal distribution. However, a linear combination of the variables is normally distributed (Table 3). Therefore, non-normality in trade openness is not a big problem.

Table 3. Jarque-Bera Test for Normality of OLS residuals

Model	Statistic
Skewness	0.1413
Kurtosis	0.5571
Adjusted Chi-Square	2.6900
Probability	0.2606
Observations	39

A correlation matrix and the variance inflation factor (VIF) indicate that there was no multi-collinearity among the variables (Table 4 and Table 5) since none of the pairs of independent variables gave a correlation of at least 0.8. This is confirmed by the VIF test, which was based on a linear combination of the variables. The correlation matrix further indicates that public debt is negatively correlated with total investments and GDP growth thus supporting the hypothesis that high debt accumulation reduces investment through crowding out and debt overhang effects. Debt service as a ratio of exports and primary income is negatively correlated with debt accumulation implying that a highly indebted Kenyan economy may not be able to generate enough export revenues and primary income to service the debt.

Table 4. Correlation Matrix

Variable	GDP Growth	Debt-to-GDP	Investments	Inflation	Trade Openness	Debt Service
GDP Growth	1.0000					
Debt-to-GDP	-0.1616	1.000				
Investment	0.3221	-0.6705	1.000			
Inflation	-0.4752	-0.0487	0.1149	1.000		
Trade Openness	-0.2204	-0.1639	0.1275	0.4548	1.000	
Debt Service	-0.1614	-0.5769	0.5209	0.2289	0.0529	1.000

Table 5. Variance Inflation Factor

Variable	VIF	1/VIF
Debt-to-GDP	2.20	0.453605
Investment	1.92	0.521596
Debt Service	1.72	0.580357
Inflation	1.39	0.718169
Trade Openness	1.34	0.745367

Both the Augmented-Dickey Fuller and the Phillips-Perron tests in Table 6 reveal the presence of a unit root in the debt-to-GDP, investments, trade openness and debt service variables. GDP growth and inflation are stationary at levels. All $I(1)$ variables were differenced once to ensure stationarity.

Table 6. Unit Root Test Results

Variable	ADF Statistic	PP Statistic	Order of Integration
Debt-to-GDP	-5.7592***	-5.7730*	1
Investments	-8.4263***	-8.6129***	1
GDP Growth	-3.6326**	-3.6707**	0
Inflation	-3.0587**	-3.1529**	0
Trade Openness	-6.0299**	-6.0993**	1
Debt Service	-5.8321**	-5.8261***	1

Notes: *** Significant at 1% ** significant at 5% * significant at 10%.

3.2. Threshold Estimation Results

Table 7 reports threshold estimation results. The Table shows the debt level at which the two statistical loss functions (RSS and RMSE) for Equation 5 are minimized. From Table 2, the maximum and minimum levels of debt-GDP are 68.1% and 13.5% respectively. Therefore, the threshold search began from 14.9% to 66.7% with an interval of 1.4%. The iteration process reveals that RSS and RMSE are minimized at a debt-GDP ratio of 55.5%. The impact of debt on economic growth is the sum of the coefficients of the high debt regime (β_1) and low debt regime (β_2). At the 55.5% debt-GDP ratio, the sum of these coefficients ($\beta_1 + \beta_2$) is negative as anticipated (-0.14). This is the debt threshold for Kenya. Relative to Reinhart and Rogoff (2010), a much lower threshold was found for Kenya perhaps due to the size of the economy and lack of physical resources.

Further, the estimation results show that the coefficients of high debt regime and low debt regime are statistically different from each other at 5%. This was achieved by testing the null hypothesis $H_0: \beta_1 - \beta_2 = 0$ hence confirming that the 55.5% debt threshold is statistically significant. The debt to GDP ratio of 67% as at the end of 2020 therefore exceeds this threshold. There is some evidence of nonlinearity with higher debt levels having a proportionately larger negative effect on subsequent growth. Specifically, a debt-GDP ratio that is higher than 23.3% but lower than 40%, is associated with faster economic growth. However, as the ratio rises beyond 40%, the effect on growth diminishes rapidly and at 55.5%, the impact of debt on growth switch from positive to negative depressing growth. The marginal contribution to economic growth from each additional debt between 40% and 55.5% of GDP decreases up to the established threshold, and then turns negative. At this point, the economy may begin to suffer from debt overhang. Beyond the 55.5% debt threshold, a 10% increase in debt accumulation leads to a 1.4% decline in economic growth.

These results are consistent with Woo and Kumar (2015). Therefore, at moderate debt level, credit constraints are relaxed, and the economy has more resources for investment. This finding has important policy implications. During periods of high debt, policymakers may have to rely on robust economic growth to ensure debt sustainability. As with previous studies, our empirical results should be interpreted with caution. The fact that there is a clear debt threshold that impairs medium term growth should not be interpreted as a conclusion that debt is harmful in the long run. It might as well be the case that the Keynesian fiscal deficit spending to boost growth may not necessarily affect growth negatively in the long run, if it is backed by credible fiscal policy plan of reducing debt burden to sustainable levels.

Turning to the control variables, our threshold estimation results reveal that as from 23% debt-GDP ratio public investments significantly promote economic growth, but the effect becomes insignificant beyond the 55.5% threshold (See Tables 1-3 in the appendix). This finding is consistent with Woo and Kumar (2015) who concludes that investment has a positive impact on growth when debt level is low. Inflation negatively

influences growth both in high and low debt regimes which is consistent with Chudik et al. (2017).

Table 7. Threshold Estimation Results

Debt/GDP	β_1	β_2	$\beta_1 + \beta_2$	RMSE	RSS	R^2	F (6, 32)	Probability
14.9	-0.0045	-0.04623	-0.0508	1.8252	106.6017	0.4608	4.56	0.0019
16.3	-0.0071	-0.0168	-0.0240	1.8280	106.9251	0.4592	4.53	0.0020
17.7	-0.0080	0.0201	0.0121	1.8279	106.9132	0.4593	4.53	0.0020
19.1	-0.0062	-0.0328	-0.0389	1.8278	106.9042	0.4593	4.53	0.0020
20.5	-0.0051	-0.0446	-0.0497	1.8273	106.8439	0.4596	4.54	0.0020
21.9	-0.0068	-0.0129	-0.01972	1.8279	106.9228	0.4592	4.53	0.0020
23.3	-0.00982	0.0192	0.0093	1.8272	106.8344	0.4597	4.54	0.0020
24.7	-0.0122	0.03467	0.0224	1.8252	106.6070	0.4608	4.56	0.0019
26.1	-0.0149	0.0466	0.0318	1.8220	106.2347	0.4627	4.59	0.0018
27.5	-0.0167	0.0502	0.0335	1.8193	105.9156	0.4643	4.62	0.0017
28.9	-0.0189	0.0506	0.0317	1.8171	105.6608	0.4656	4.65	0.0017
30.3	-0.02109	0.04950	0.0284	1.8150	105.4173	0.4668	4.67	0.0016
31.7	-0.0226	0.0468	0.0243	1.8145	105.3628	0.4671	4.67	0.0016
33.1	-0.0237	0.0434	0.0197	1.8143	105.3355	0.4672	4.68	0.0016
34.5	-0.0239	0.0374	0.0135	1.8156	105.4800	0.4665	4.66	0.0016
35.9	-0.0247	0.0330	0.0082	1.8166	105.6007	0.4659	4.65	0.0016
37.3	-0.0259	0.0301	0.0042	1.8169	105.6304	0.4658	4.65	0.0017
38.7	-0.0268	0.0270	0.0002	1.8172	105.6721	0.4655	4.65	0.0017
40.1	-0.0273	0.0237	-0.0036	1.8178	105.7440	0.4652	4.64	0.0017
41.5	-0.0275	0.0199	-0.0076	1.8189	105.8675	0.4646	4.63	0.0017
42.9	-0.0275	0.01600	-0.01149	1.8203	106.0273	0.4637	4.61	0.0018
44.3	-0.0296	0.0146	-0.0150	1.8201	106.0140	0.4638	4.61	0.0018
45.7	-0.0314	0.0127	-0.0187	1.8207	106.0751	0.4635	4.61	0.0018
47.1	-0.0387	0.0146	-0.0240	1.8185	105.8266	0.4648	4.63	0.0017
48.5	-0.05008	0.0177	-0.0323	1.8143	105.3336	0.4673	4.68	0.0016
49.9	-0.0605	0.0186	-0.04194	1.8118	105.0444	0.4687	4.71	0.0015
51.3	-0.0796	0.0217	-0.0579	1.8066	104.4415	0.4718	4.76	0.0014
52.7	-0.1052	0.0247	-0.08048	1.8000	103.6783	0.4756	4.84	0.0013
54.1	-0.1347	0.0263	-0.1084	1.7954	103.1539	0.4783	4.89	0.0012
55.5	-0.16704	0.0257	-0.14139	1.7936	102.9456	0.4793	4.91	0.0012
56.9	-0.19522	0.0218	-0.1734	1.7969	103.3206	0.4793	4.87	0.0012
58.3	-0.2074	0.0147	-0.1927	1.8058	104.3465	0.4722	4.77	0.0014
59.7	-0.14896	0.0030	-0.1459	1.8213	106.1436	0.4632	4.60	0.0018
61.1	0.1071	-0.0126	0.0945	1.8255	106.6334	0.4607	4.56	0.0019
62.5	0.3269	-0.0172	0.3097	1.8154	105.4673	0.4666	4.66	0.0016
63.9	0.4612	-0.0172	0.4434	1.8143	105.3305	0.4673	4.68	0.0016
65.3	0.70008	-0.0172	0.6829	1.8143	105.3305	0.4673	4.68	0.0016
66.7	1.4158	-0.0172	1.3986	1.8143	105.3305	0.4673	4.68	0.0016

4. CONCLUSION

This study contributes to a growing literature on debt-growth nexus by identifying the impacts of debt on economic growth. The analysis was based on historical data spanning over almost four decades and controls for a broad range of determinants of growth. The study adopted threshold estimation approach first used by Khan and Senhadji (2001). The estimated threshold for Kenya is lower than that established by Reinhart and Rogoff (2010) and Caner et al. (2010) for developing countries. Specifically, the study established that debt contributes positively to growth when it is below 40 percent of GDP. Beyond 55.5% of GDP debt becomes a drag on growth.

Although estimation of debt threshold can be informative, it should be interpreted with caution. This study has utilized comprehensive historical data spanning over nearly 40 years. Temporary deviations from the average may not impact negatively on future economic growth particularly in a developing country such as Kenya. If the debt-GDP ratio exceeds the established threshold for one or two years because of an economic slowdown such as that witnessed during the post-election conflict of 2007-2008, the long-term growth may not get hampered. The debt threshold should only be of major concern if there is no short-term fiscal stabilization policy in place. It should nonetheless worry the policymakers if debt ratios above the threshold were to persist for decades. This is when economic growth is likely to drag. Policymakers should direct government expenditures on public infrastructure investments, since the returns in the long run improves the long term budgetary position by enhancing the tax base. Instead of abruptly curtailing government expenditure and raising taxation, fiscal policy should adjust over the long term.

A limitation of this study is that we have not investigated the long-run effects of public debt accumulation on economic growth, regardless of whether there exists a threshold effect. We have also not considered the dynamics and feedback mechanism from economic growth to debt. We note that without dynamics analysis, the estimates of the long-run effects could be inconsistent due to the persistence of GDP growth rates. Moreover, our analysis is prone to potential endogeneity concerns that should caution against drawing strong policy implications. Further analysis is therefore needed to properly address these identification issues.

APPENDIX

Table A1. Threshold Regression at Debt/GDP=23.3%

	Coefficient (*t-statistic* in parenthesis)
High Debt Regime (β_1)	-0.0098 (-0.29)
Low Debt Regime (β_2)	0.0192 (0.12)
Investment	0.3141 (3.02***)
Inflation	-0.1110 (-2.68**)
Terms of Trade	-0.0238 (-0.56**)
Debt Service	-0.0740 (-2.16)
Constant	1.7099 (0.51)

Notes: *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table A2. Threshold Regression at Debt/GDP 40.1%

	Coefficient (*t-statistic* in parenthesis)
High Debt Regime (β_1)	-0.0273 (-0.61)
Low Debt Regime (β_2)	0.0236 (0.40)
Investment	0.3218 (3.09***)
Inflation	-0.1113 (-2.71**)
Terms of Trade	-0.0221 (-0.53)
Debt Service	-0.0650 (-1.83*)
Constant	1.4074 (0.46)

Notes: *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table A3. Threshold Regression at Debt/GDP = 55.5%

	Coefficient (*t-statistic* in parenthesis)
High Debt Regime (β_1)	-0.01670 (-1.14)
Low Debt Regime (β_2)	0.0257 (0.61)
Investment	0.3298 (3.22***)
Inflation	-0.0998 (-2.36**)
Terms of Trade	-0.0125 (-0.29)
Debt Service	-0.0582 (-1.65)
Constant	0.7014 (0.25)

Notes: *** Significant at 1%, ** significant at 5%, * significant at 10%.

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