The Threshold Effect of Public and Internal Debt on Economic Growth: The Case of Kenya[*]

Kamu ve İç Borçların Ekonomik Büyüme Üzerindeki Eşik Etkisi: Kenya Örneği

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Abstract

This paper investigates the presence of the threshold effect of public debt and internal debt on economic growth in Kenya for the period 1970-2018. The Smooth Transition Regression model of analysis is used to analyze the effect of public and internal debt on growth. The findings of the study indicate that the threshold level of internal debt in Kenya is 17.3115% implying that domestic debt positively impacts economic growth when this threshold level is exceeded. The public debt threshold estimate is 33.29% and growth is positively affected when public debt exceeds this level. The results of this study imply that public and internal debt have a U-shaped relationship with the economic growth rate in Kenya and that the rate of economic growth is dependent on the amount of debt owed by the country. These results imply that there is a need for appropriate policy actions on more productive use of debt to ensure economic growth.

Keywords: Public Debt, Internal Debt, Economic Growth, Threshold Level of Debt.

Öz

Bu çalışma 1970-2018 dönemi için Kenya'da kamu borcunun ve iç borcun ekonomik büyüme üzerindeki eşik etkisinin varlığını araştırmaktadır. Kamu ve iç borcun büyüme üzerindeki etkisini analiz etmek için Smooth Transition regrasyon modeli kullanılmaktadır. Çalışmanın bulguları, Kenya'da iç borç eşik seviyesinin %17,3115 olduğunu ve bu eşik değer aşıldığında iç borcun ekonomik büyümeyi olumlu etkilediğini göstermektedir. Kamu borç eşiği tahmini %33,29'dur ve kamu borcu bu seviyenin üzerine çıktığında büyüme pozitif etkilenmektedir. Bu sonuçlar Kenya'da kamu ve iç borcun ekonomik büyüme ile U-şeklinde bir ilişkiye sahip olduğuna ve ekonomik büyüme oranının ülkenin borç miktarına bağlı olduğuna işaret etmektedir. Bu sonuçlar, ekonomik büyümenin sağlanması için borcun daha verimli kullanılmasına yönelik uygun politikalara ihtiyaç duyulduğuna işaret etmektedir.

Anahtar Kelimeler: Kamu Borcu, İç Borç, Ekonomik Büyüme, Borç Eşik Değeri.

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Debt is important for developing countries owing to their constrained number of creditors, inefficient resources, and inadequate investments which are unable to finance their budget deficits (Babu et al., 2015). On the other hand, excessive borrowing could lead to crowding out, low investment, slowed growth and reduced productivity in these economies. (Kasidi & Said, 2013; Matiti, 2013; Umaru et al., 2013). The impact of debt, both public and internal, on growth rate varies from one country to another depending on their initial debt accumulation and how the debt is used. In recent years, Kenya's public debt has been on the rise reaching 61.1% of GDP in 2019 (Ministry of Finance, 2019, p.13) up from 43.8% in 2007 (Ministry of Finance, 2008, p. 5). Kenya's external debt is sourced from institutions like IMF, World Bank, from other donor countries like China and France while internal debt is mainly obtained from the sale of treasury bills and bonds. These debts have been used to finance various structural projects in the country like Standard Gauge Railway (SGR) which seeks to improve transportation in the country and building of other public roads and stadia. However, the rapid increase in public debt levels raises questions among many Kenyans who are not quite sure about the implications placed by the high debt amounts on them and their future generations. While some believe that the investments will pay off and improve the country's economic condition, others believe that their future generations will have to deal with increased living costs. Therefore, it is considered that it is important to perform a threshold analysis on Kenyan public debt data in order to determine the debt threshold level and its possible impact on the economic growth rate.

Numerous studies examine the effect of a threshold value of debt on growth for both developing and developed countries (Caner et al., 2010; Mensah et al., 2019; Ndoricimpa, 2020; Reinhart & Rogoff, 2010; Topuz & Sekmen, 2019). These studies conclude, however, that the threshold value of debt varies from one country to another depending on a country's characteristics and the method of analysis used. Therefore, it seems that it is important to perform a threshold analysis on Kenya's public debt data in order to determine the debt threshold level and its possible impact on the economic growth rate. To the best of our knowledge, there are no previous studies conducted to confirm the existence of debt threshold in Kenya and therefore this study is expected to contribute to the existing literature.[i] Furthermore, it is necessary to examine public debt and internal debt because previous studies have neglected these two and focused mostly on external debt. Since external debt is not the only source of debt in Kenya, the effect of internal and public debt is also examined separately. Different from the previous studies about Kenya on debt and growth relationship, this study will use a different methodology which allows for a smooth transition of the variable coefficients across different regimes. This follows the results of the linearity test which indicated that the debt and growth relationship in Kenya is best captured using a nonlinear model. The current study provides an analysis of the threshold effect of public debt to GDP ratio on growth and the threshold effect of internal debt to GDP ratio on growth in Kenya for the period 1970-2018.

The study consists of six sections. The second and third section presents the relevant theoretical and empirical literature. The fourth section details the methodology. The fifth section includes data set and the analysis of the results and the last section includes the conclusion and policy evaluations.

Theoretical Literature on Public Debt and Growth

Adam Smith addresses the issue of public debt in the last chapter of his book 'An inquiry into the nature and causes of the wealth of Nations' where he states that public debt and taxes are necessary evils because an economy should ideally operate a balanced budget. Households and businesses in many economies are already struggle with high tax rates and should not be overburdened with increased debts. The debts contracted today are just postponed taxes because of future repayment obligations

alongside the high-interest payments. Debts are seen to be a way in which funds are transferred from the productive class of the society to the less productive class and this reduces economic growth[ii]. The government when given easy access to debt whenever money is needed will soon stop saving on account of the available lenders (Smith, 1776, pp. 910-911). On the other hand, John Stuart Mill argues that debt should be taken only if it will be invested in productive activities or taken from the savings available in the economy so as not to reduce the investment levels. Loans are therefore not entirely bad, and they only become 'evil' once they lead to very high interest rates and by an extension lead to the exclusion of the private sector from actively participating in growth activities. Economies should thus embark on debts if they have surplus amounts of funds with which to settle the debts. This would be useful in preventing over taxation and its associated negative effects on disposable income and welfare (Mill, 1885, p. 687).

David Ricardo's views are not entirely different from those of Adam Smith. He argues that debt among other factors can cause a disturbance to an otherwise flourishing economy that is at equilibrium. Debt is considered an 'evil' that interferes with businesses and the economy as a whole. Unlike Adam Smith who argues that an economy should take debts in the event of war, Ricardo thinks that people should be taxed highly to settle the burden that comes with war rather than resorting to debts. Another undesirable effect of public debt is that it leads to capital flight as it causes the movement of many capitalists from their native homes to invest and live abroad for fear of future high taxes which will cripple their businesses. He mostly argues for taxation as a means of raising revenue in place of debts (Churchman, 2001).

John Maynard Keynes has a different view from the classical economists because he views debt as a fiscal stabilizer that revamps the economy, especially during recessions by boosting aggregate demand. According to the Keynesian school of thought, the economy usually grows through the multiplier effect whereby one person's expenditure is seen as the source of another person's income, and in this way, the economy is rejuvenated when consumption and expenditures increase. When debts are contracted, it is possible to increase people's income and by extension their consumption, and as a result, growth is experienced in the economy. Keynes argued that tax is not as effective as debt in rejuvenating the economy because taxation reduces disposable income thereby reducing consumption. Keynes, therefore, suggests that debt is not entirely bad as posited in the classical school of thought as it may encourage growth.

The debt overhang hypothesis which is put forward by Myers (1977) is formulated to explain a firm's financing options but has since been extended to explain the options in financing an economy through debt. By applying this concept to high indebted countries, Krugman (1988) shows that when a country cannot finance its debt obligation, the debt is likely to be reprofiled or defaulted. High indebtedness is likely to lead to reduced economic growth occasioned by low investment due to the crowding-out effect and high debt servicing. A country is thus said to have reached debt overhang when it is spending much of its income on debt repayment rather than on activities that encourage economic growth. Also, debt overhang is likely to affect the total factor productivity negatively further reducing growth rates (Hwang et al., 2010).

Recently, aside from the theories discussed above, a new school of thought has emerged which redefines the debt and growth relationship as being nonlinear and dependent on the level of debt to GDP ratio in the economy. This school of thought became popular after the financial crisis of 2009 and since then many studies have been conducted to find the threshold debt level for different economies. After Reinhart and Rogoff (2010) published their seminal work in which they showed that only a debt to GDP ratio of 90% and above impacted negatively on the growth of selected economies, many studies have since used it as a benchmark to arrive at different threshold levels for various economies.

Empirical Literature on Public Debt and Growth

The national debt values in many countries, both developing and developed, have been on the rise since the early 1980s. This was after the great recession of the 1970s where countries were borrowing to offset the undesirable effects of the recession. The growth in debt, however, has been accompanied by economic growth in some countries and periods of stagnation and slow growth in others (Watson & Regling, 1992). Previous studies analyzing the relationship between public debt and economic growth have been unsatisfactory and failed to reach a clear conclusion. Authors have provided mixed evidence with some reporting the positive impact of debt on growth, others negative impact, non-existence of any relationship, and yet others the existence of a non-linear relationship between debt and growth. These results depend on the sample size, sample period, and method applied in the study.

In support of this view, many empirical studies suggest that debt cannot improve economic growth. Ehikioya (2012) indicates that domestic debt has a negative effect on economic growth in Nigeria for the period 1980-2009. Munzara (2015), Kasidi and Said (2013), Rais and Anwar (2012) use external debt data and examine the impact of external debt on the growth process for Zimbabwe, Tanzania, and Pakistan, respectively. A negative relationship is claimed to exist between the variables and therefore policies to mobilize more resources and reduce overdependence on external aid should be encouraged in these countries. Similarly, the findings of Umaru et al. (2013) indicate that external debt has a negative effect on the economic growth rate, but domestic debt impacts positively on economic growth. Therefore, the authors claim that domestic debt is a more reliable source of funds in Nigeria as compared to external debt. Babu et al. (2015) state that the role of domestic debt on GDP growth in East Africa is positive using data for the period 1990-2010. Owosu-Nantwi and Erickson (2016) also argue for the existence of a positive relationship between public debt and economic growth in Ghana based on results from data for the period 1970-2012. Similar to our study, Mwaniki (2016), Ngugi (2016), and Kimtai (2019) examine this relationship for Kenya and show that domestic debt positively affects growth and external debt negatively affects growth. However, Kimtai (2019) finds no evidence of a significant relationship between external debt and growth. On the other hand, Umaru et al. (2013) point out that the impact of external debt on growth is positive in the long run for transition economies for the 1991-2010 period. Therefore, it can be said that the positively sloping side of the debt-Laffer curve is valid for transition countries. Unlike other studies, Pegkas (2018) focuses on the issue of the break effects between debt and economic growth in Greece. Authors claim that this relationship depends on the debt breaks. When structural breaks models are observed, and evidence is found in favor of a negative relationship between debt and growth. Matiti (2013) concludes that external debt is a cheaper source of finance than domestic debt in Kenya.

The proponents of the existence of a non-linear relationship between debt and growth become popular after the 2008 recession. The existence of an inverted U relationship between debt and growth is observed in some countries. While before debt values reach the threshold value the relationship is positive and when the debt to GDP ratio exceeds the threshold level is negative. This threshold value changes from one country to another.

Doğan and Bilgili (2014) in an analysis of the nonlinear impact of external debt on growth uses the data set for the period 1974-2016 for Turkey. The results indicate that debt and growth do not follow a linear pattern of relationship and this changes for different regimes of debt. Other variables like investment and human capital were found to affect growth positively in all the regimes. Markov switching regime model was used in the analysis.

Although limited, there are studies on the threshold effect of debt on growth, especially for low-income developing countries. Ndoricimpa (2020) ascertains a threshold level of 62-66% for the African countries. On the other hand, Chudik et al. (2015) fail to establish the existence of a single threshold

value for all the 40 countries analyzed in their study. This is because countries are all different with special characteristics and economic conditions responsible for their debt positions.

In a study aimed at analyzing the threshold debt level that discourages growth in Africa, Mensah et al. (2019) find that most countries in Africa have a threshold value of between 20-50% of debt to GDP ratio. This study is important because it represents the threshold effect of African countries which is lower than the 90% threshold value established for developed countries by Reinhart and Rogoff (2010). Caner et al. (2010) establish the threshold level which is at 64% debt to GDP ratio for developing countries. Veiga, Ferreira-Lopes and Sequeria (2016) find that Sub-Saharan countries achieve the highest growth rate when the public debt to GDP ratio is about 30-60%. These papers help put forward the idea that the threshold effect of debts exists for both developed and developing countries.

Other researchers like Topuz and Sekmen (2019) and Chudik et al. (2015) highlight the fact that public debt could have a negative impact on growth both below and above the threshold. The latter study uses 40 countries including both developed and underdeveloped economies while the former uses data belonging to OECD countries. These results point out that there is no one size fit all for all the countries for the public debt to growth relationship.

In a more specific study on South Africa, Baaziz et al. (2015) analyze the effect of public debt to GDP ratio using the Smooth Transition method. The results indicate the presence of the debt threshold at 31.37% of debt to GDP ratio. Beyond this point, debt has a negative effect on GDP. A similar study was conducted for a panel of countries by Ueshina and Nakamura (2019) using the endogenous growth model. The authors analyze the debt in different levels including household level, debts owned by firms, and government debts. The inverted U relationship is found to exist when the government finances public investment through issuing of new bonds. But the bonds should not exceed the current public investment level.

Eberhardt and Presbitero (2015) find heterogeneous public debt and growth relationships among countries with some countries exhibiting the existence of an inverse U-shaped relationship between public debt and growth with others having U shaped relationship between public debt and growth. Presbitero (2012) finds that for developing countries, when the threshold value of public debt is below 90%, a negative debt to growth relationship is observed.

Egert (2013) conducts an analysis to prove the postulation of Reinhart-Rogoff's study. Four different thresholds were chosen at 30 percent debt level, between 30 and 60 percent, between 60 and 90 percent, and above 90 percent. The linear models for the different regimes were obtained but they failed to prove the 90 percent threshold level proposed by Reinhart-Rogoff.

Studies by Okiro and Murungi (2018) and Mweni (2014) provide no conclusive evidence on the existing relationship between public debt and economic growth indicating that debt and growth relationships are not a one size fit all, the relation varies from one country to another depending on the country's policies, level of development, and what use the debt amount is subjected to. Similar results are obtained by Lof and Malinen (2013) in an analysis of 20 developed countries for the period 1954-2008 using the VAR model. In a causality analysis, Njoroge (2015) finds no evidence of the existence of a causal relationship between public debt and economic growth for Kenya.

Methodology

The relationship between debt and economic growth is analyzed using the Smooth Transition Regression model.[iii] The term "smooth transition" first is suggested by Bacon and Watts (1971). The authors suggest a model in which the transition from one extreme linear regime to another is smooth. The STR model, which provides the opportunity to determine nonlinearity, and the basic framework of this model are presented in detail by Terasvirta (1998).

The standard nonlinear STR model is as follows:

$$y_t = x_t' \varphi + (x_t' \theta) G(\gamma, c; s_t) + u_t \qquad (t = 1, \ldots \ldots T) \qquad (i)$$

Where $x_t = \left(1, x_{1t}, \ldots x_{pt}\right)' = (1, y_{t-1}, \ldots, y_{t-k}; z_{1t}, \ldots, z_{mt})'$ $p = k + m$ is a vector of explanatory variables, while $(\varphi = \varphi_0, \varphi_1, \ldots, \varphi_p)'$ and $(\theta = \theta_0, \theta_1, \ldots, \theta_p)'$ are parameter vectors. u_t is the error term. $G(\gamma, c, s_t)$ is a continuous function of the transition variable s_t. The STR model allows for switching between regimes but is limited to one or two regimes only. The choice of variables to include in the model is backed up by economic theory while the threshold value is not chosen by the researcher.

There are different definitions for G in the literature. One of them is as follows:

$$G_1(\gamma; c, s_t) = (1 + exp\{-\gamma(s_t - c)\})^{-1} \ , \quad \gamma > 0 \qquad (ii)$$

Equations (i) and (ii) above jointly define the Logistic STR model of the LSTR1 model. The parameters of the LSTR1 model change monotonically as a function of s_t. Parameter γ controls the slope while c is the determined location parameter and indicates where the transition occurs. When $\gamma = 0$, the transition function is $G_1(\gamma; c, s_t)$ equal to 1/2, and thus the STR model (i) includes the linear model. On the other hand, when $\gamma \rightarrow \infty$, the LSTR (1) model approaches the switching regression model with two regimes having equal variances. On the other hand, if the transition function is as follows:

$$G_2(\gamma, c; s_t) = (1 + ex\{-\gamma(s_t - c_1)(s_t - c_2)\})^{-1} \ , \quad \gamma > 0, \qquad c_1 \leq c_2 \qquad (iii)$$

Equations (i) and (iii) above jointly define the Logistic STR model of the LSTR2 model. When $\gamma \rightarrow \infty$ in the LSTR (2) model, the result is another switching regression model with three regimes such that the outer regimes are identical, and the mid regime is different from the other two. An alternative to the LSTR (2) model is called the exponential STR (ESTR) model. It is (i) with the transition function:

$$G(\gamma, c; s_t) = 1 - exp\{-\gamma(s_t - c)^2\}, \quad \gamma > 0 \qquad (iv)$$

Modeling of an STR model consists of three stages namely specification, estimation, and evaluation. In the specification, a linearity test is conducted on the variables to determine whether their relationship is best specified using a linear model, STR model with one regime, or STR model with two regimes. As already stated above, the choice of variables is influenced by economic theory as only those variables which have been consistently shown to affect growth are included but the value of the threshold and number of regimes is determined in the model (Terasvirta et al., 1994). Another way in which the appropriate regime can be chosen is with Taylor expansion under the null $\gamma = 0$. This specification produces the function below (Terasvirta, 1998, p. 514).

$$y_t = x_t' \delta_0 + (x_t s_t)' \delta_1 + u_t^* \ t = 1, \ldots \ldots T \qquad (v)$$

where: $u_t^* = u_t + (x_t' \theta) R_1(\gamma, c; s_t)$, δ_1 is a $(p + 1) \times 1$ parameter vector.

For univariate models, the appropriate lag selection is important for the reliability of results. If the linearity relationship fails to be rejected in this step, then the nonlinear model cannot be specified and so the researcher proceeds with an appropriate linear model selection. If, however, the linearity relationship is rejected, an appropriate nonlinear model is then specified.

The specification of an LSTR (1) or LSTR (2) model can also be dependent on equation (v). the coefficient vectors $\delta_j, j = 1,2,3$ are functions of the parameters of the original STR model and these vectors depend on the type of the model. When $c = 0, \delta_2 = 0$, and the model is LSTR (1). When $\delta_1 = \delta_3 = 0$, the model can either be LSTR (2) or ESTR model. The model can still be classified as LSTR (1) model when δ_2 is closer to the null vector than $\delta_1 \ and \ \delta_3$. The summary of this alternative test is presented below:

a)   Test the hypothesis $H_{04}: \delta_3 = 0$

b)   Test the hypothesis $H_{03}: \delta_2 = 0 \,/\, \delta_3 = 0$

c)   Test the hypothesis $H_{02}: \delta_1 = 0 \,/\, \delta_3 = \delta_2 = 0$

In the above hypotheses, if (b) yields the strongest rejection based on the probability values then LSTR2 or ESTR model is preferred. LSTR (1) is preferred in the remaining cases (a) and (b) above having stronger rejection values based on their respective probabilities. This alternative procedure is specified by Terasvirta (1994) and is equally effective in deciding the more appropriate model between LSTR (1) and LSTR (2). H_{04} is tested by F_4, H_{03} by F_3, and H_{02} by F_2. Based on the results, the appropriate model is selected, and estimation is then conducted by use of conditional maximum likelihood estimation. Different parameter values are chosen and the one which minimizes the residual sum of squares is then presented. The appropriate model is specified based on the chosen values of c and γ.

Data and Empirical Results

In this study, Annual data is used for the period 1970-2018. The dependent variable is the annual GDP growth rate while public debt to GDP ratio and internal debt to GDP ratio are the threshold variables.[iv] The other control variables that are used include human capital, trade openness, inflation, and investment rate are factors that affect growth[v]. Table 1 presents a brief description of the data and the sources.

Table 1

Summary Statistics and Data Source

Variable	Data definition and Sources	Obs	M	SD	Min	Max
GDP growth rate (GDP gr rate)	The annual percentage growth rate of GDP/ WDI data	49	4.593	4.16	-4.65	22.17
Public Debt (PD_GDP)	Public Debt (%GDP)/ KNBS data	49	53.16	20.32	26.81	120.60
Internal Debt (ID_GDP)	Internal Debt (%GDP)/ KNBS data	49	22.58	6.417	12.49	39.49
Inflation (Inf)	Inflation data in percentages/ WDI data	49	11.76	8.07	1.55	45.97
Investment (Inv)	Investment (%GDP)/ Theglobaleconomy.com	49	20.61	3.33	15.00	29.79
Trade Openness (TO)	Trade openness (sum of exports and imports as a function of GDP)/ The globaleconomy.com	49	56.64	8.38	36.15	74.57
Human Capital (SSE)	Human economic capital (Secondary school enrolment %gross)/ The globaleconomy.com	49	40.98	15.21	16.43	70.30

Before examining the STR model, unit root test is applied to determine the stationary of variables. Following this purpose, the conventional unit root test, ADF, is conducted together with the Zivot Andrews breakpoint unit test, and KPSS. This is because the ADF unit root test has been criticized for not being able to distinguish between persistent stationary process from non-stationary process clearly. Subjecting the variables to more than one-unit root test is important in overcoming the shortcomings of each test. These tests are applied for all variables. The results are presented in Table 2:

Table 2

Unit Root Test Results

Variable	Test statistic	Level		First Difference	
		Intercept	**Intercept and Trend**	**Intercept**	**Intercept and Trend**
GDP_gr_rate	ADF	-5.54***	-5.69***	-11.96***	-12.03***
	ZA	-3.65	-4.65	-6.30***	-6.37***
	KPSS	0.2070	0.1656**	0.2249	0.1634**
PD_GDP	ADF	-1.8683	-1.7720	-6.8585***	-6.8346***
	ZA	-2.8907	-4.2129	-8.2614***	-8.1749***
	KPSS	0.2184	0.1913**	0.1168	0.0668
ID_GDP	ADF	-2.4524	-2.4317	-8.1951***	-8.1158***
	ZA	-5.186**	-6.9746***	-9.3019***	-9.4139***
	KPSS	0.2205	0.1478**	0.0853	0.0632
Inf	ADF	-3.97***	-4.07**	-7.28***	-7.28***
	ZA	-5.10**	-5.419**	-8.18***	-8.0782***
	KPSS	0.4032*	0.2482***	0.0208	0.0093
TO	ADF	-2.2899	-3.2297	-7.9714***	-7.9425***
	ZA	-4.1750	-4.2652	-6.5844***	-6.5722***
	KPSS	0.5380**	0.0778	0.1285	0.0818
Inv	ADF	-3.79***	-4.41***	-10.08***	-9.97***
	ZA	-6.2332***	-6.4042***	-7.0395***	-6.9665***
	KPSS	2.1609***	0.3651***	0.0208	0.0190
SSE	ADF	-0.0549	-1.7534	-7.6540***	-7.9425***
	ZA	-3.0624	-3.1028	-8.2547***	-8.1922***
	KPSS	0.8570***	0.1150	0.0966	0.0704

Note. ***, **, and * indicate statistical significance level at 1%, 5% and 10%, respectively.

The results of the unit root tests conducted in Table 2 indicates stationarity for most of the variables. Inflation and Investment are found to be stationary at level for all the tests conducted. GDP growth rate is stationary for ADF and KPSS. Public debt is found to be non-stationary in the tests except for KPSS. Internal debt and human capital are stationary for ZA and KPSS while trade openness data is stationary for KPSS only. Taken together, these results prove that all the variables were found to be stationary in at least one test.

STR Regression

Before the application of an STR model, a linearity test should be conducted to ascertain whether public debt and GDP growth rate are best defined by a linear or nonlinear relationship. The results are presented in Table 3.

Table 3

Linearity Test on the Transitional Variables

F stat	PD _GDP	ID_GDP
	P- value	P- value
F	4.7855e-04	7.7901e-05
F4	1.5821e-02	5.2807e-02
F3	2.0882e-01	5.8258e-03
F2	1.0750e-03	1.0734e-03

Based on the results obtained in Table 3 the F values reject the linearity relationship for both internal and public debt Both public debt and economic growth relationship and internal debt and economic growth relationship in Kenya for the period under study is nonlinear and best described by an LSTR (1) model which is preferred when F2 and F4 are more strongly rejected. The model is thus estimated as shown in Table 4:

Table 4

Results for the LSTR Model

Variable	PD _ GDP growth		ID _ GDP growth	
	Coefficient of Linear Part	Coefficient of nonlinear part	Coefficient of Linear Part	Coefficient of nonlinear part
GDP_gr_rate(t-1)	-1.2541*	2.2976*	-0.9686*	1.7401*
	(0.7068)	(1.3083)	(0.5821)	(1.1116)
Inf(t)	-1.5164***	1.8116***	-0.9286**	0.8752*
	(0.3390)	(0.600)	(0.3278)	(0.4722)
PD_GDP(t)	-2.1670**	1.4856**	-	-
	(1.0637)	(0.7233)		
ID_GDP (t)	-	-	-8.2886***	6.4160***
			(2.7307)	(2.5241)
SSE	-0.4025*	0.6667*	-0.1417	0.3243
	(0.2330)	(0.4072)	(0.2360)	(0.3546)
Inv	0.1910	0.00617	0.3384	-0.0949
	(0.7827)	(1.0946)	(0.6621)	(1.0474)
TO	-0.5895	0.9147	-0.7625**	1.1621**
	(0.5397)	(0.7034)	(0.3873)	(0.5178)
Intercept	94.833***	-52.8909	164.21***	-120.84***
	(27.1648)	(0.000)	(41.2454)	(12.6636)
Gamma	0.7839***		1.000***	
	(0.1467)		(0.1651)	
C	33.2938**		17.3115***	
	(0.0269)		(1.9965)	
R^2	0.8203		0.7463	

Note. Significance levels are '***', '**' and '*' for 1%, 5% and 10% respectively. Standard errors in parentheses.

From Table 4 it seems that a threshold value of 33.29% public debt to GDP ratio and 17.31% internal debt to GDP ratio has been obtained. The smoothing parameters have been obtained as 0.7839 and 1.00 respectively indicative of a smooth transition from the lower regime to the upper regime. The public debt threshold lies within the 20-50% range put forward by Mensah et al. (2019) for developing

countries and is comparable to the 31.37% threshold for South Africa by Baaziz et al. (2015). The internal debt threshold value is similarly comparable to the 13.6% internal debt threshold obtained for Nigeria by Eboreime and Sunday (2017). These threshold values are however significantly different from the threshold values of 62-66% for African countries obtained by Ndoricimpa (2020).

The coefficient estimate of the public debt variable is found to be negative and significant in the lower regime but positive and significant in the upper regime. The coefficient of internal debt is also negative and significant in the lower regime but positive and significant in the upper regime. No evidence is found to support the existence of an inverse U-shaped public debt and growth relationship and internal debt to growth relationship in Kenya. The results of this study imply that public debt to GDP growth in Kenya and internal debt to GDP growth in Kenya all have a U- shaped relationship with the rate of growth of the economy. The reason for achieving the U-shaped relationship may be due to weak institutional factors as noted by Butkus and Seputiene (2018). With good institutions, government expenditures are used appropriately, and growth can be realized even at lower debt levels thus preventing the need of depending on more debt for growth (Masuch et al., 2016, p. 2).

For both models, the first lag of GDP has a negative impact in the lower regime but a positive impact on growth in the upper regime both of which are significant. Inflation has a negative impact in the lower regime and a positive significant impact on growth in the upper regime the rate of secondary school enrollment has a negative impact on growth in the lower regime but a positive impact on growth in the upper regime albeit the impact is only statistically significant in the public debt model. This goes against the expected positive impact of human capital on growth in both the lower and upper regimes. Investment has a positive impact on growth in all the regimes of the two models except the upper regime of the internal debt model although these impacts are statistically insignificant. The finding could be because high public spending by the government crowds out investment and hence the insignificant impact on growth. Trade openness has a negative impact on growth in the lower regime and a positive impact in the upper regime for both models. This impact is only significant in the internal debt model. The positive impact is attributed to increased total factor productivity especially as a result of improved technology and movement of capital associated with trade openness.

Figure 1

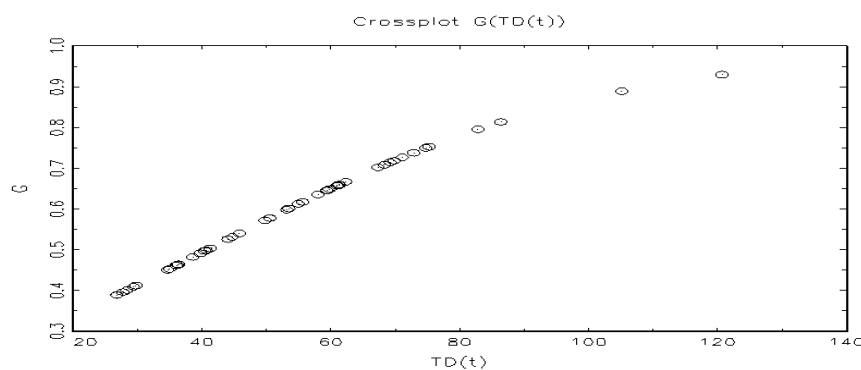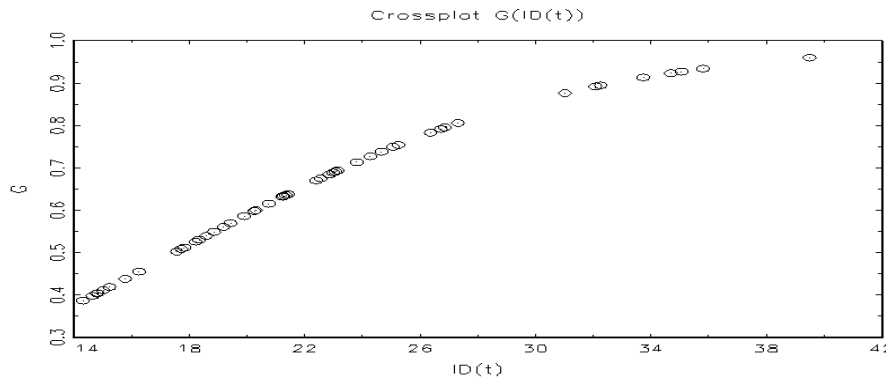*Transition Function of LSTR (1) Model for Public Debt to GDP Ratio*

Figure 2

Transition Function of LSTR (1) Model for Internal Debt to GDP Ratio

Crossplot G(ID(t))

Figures 1 and 2 show that the observed thresholds are smooth over the respective regimes. This implies that the impact of debt on growth is not immediate but is observed over time.

To confirm the results above, misspecification tests were conducted, and the results are as shown in Table 5.

Table 5

Misspecification Tests

		PD model	ID model
Test	H_0	P-value	P-value
LM	No Autocorrelation	0.3962	0.5163
ARCH	No ARCH effects	0.3892	0.8311
JB	Residuals are normal	0.8072	0.3335

The results from Table 5 indicate that the model is well specified, and the residuals are normal and not suffering from heteroscedasticity or autocorrelation.

Conclusion

This study aims to examine whether the public and internal debt have a threshold effect on the economic growth in Kenya for the period 1970-2018. The STR model is used for this purpose. The findings indicate that the threshold level of domestic debt is estimated at 17.3115% and internal debt has a positive effect on economic growth above this threshold. The public debt threshold level is determined at 33.29% and has a positive effect on economic growth when this level is exceeded. Below the threshold values, public debt and domestic debt harm economic growth. This can be attributed to institutional factors. With weak institutions, public sector funds including debts are not properly managed and so the low public debt to GDP ratio ends up in corruption and repayment of other initially existing debts thereby negatively affecting the economy. Creating the need for more debts before economic growth is realized. The negative impact of debt on growth is in line with the views put forward by Adam Smith who views debt as a necessary evil. This is because debt redistributes money into the hands of the unproductive rich officials from the productive classes of the society.

The positive impact of higher public debt to GDP ratio can be attributed to the debt being used productively in funding public investments. This conclusion indicates that the public debt can contribute economic growth of the country only if invested productively. Furthermore, these findings estimated

for Kenya are in line with the Keynesian view where debt is defined as a source of government income and can have a positive impact on the economy through the multiplier effect. It also supports the view by Georgieva (2019) that debt by itself is not bad but the negative or positive impact that it has on the growth rate depends on the uses of the debt. If the debt is used to finance recurrent expenditure, for consumption or is misused by government officials, then its impact on economic growth is likely to be negative. The positive impact of public debt and internal debt on growth does not however imply that Kenya can rely on public debt as a source of funding without limit to the debt to GDP ratio. Alternative sources of funding should be preferred by authorities. Overreliance on the method of debt financing can lead to higher debt distress.

When these results are evaluated, appropriate policy recommendations can be made to ensure the proper use of public debt. The main goal should be to keep the debt at a sustainable level and to reduce the misuse of public debt by government officials. Clear guidelines defining how debt is obtained and used can help to channel debt in financing more productive activities like research and development. Similarly, a more transparent and frequent debt finance supervision could be useful in curbing misuse of funds by government officials. It is envisaged that the implementation of these policies will contribute to sustained growth without debt default. However, since the threshold levels obtained for Kenya are quite low, these results suggest that the threshold value of the public and internal debt may be more than one. Therefore, the relationship between these variables can also be studied by the use of alternative approaches that allow for the determination of more threshold levels. From this point of view, the results of this study are a guide to future similar studies.

References

Baaziz, Y., Guesmi, K., Heller, D., & Lahiani, A. (2015). Does public debt matter for economic growth? Evidence from South Africa. *Journal of Applied Business Research*, *31*(6), 2187-2195.

Babu, J. O., Kiprop, S., Kalio, A. M., & Gisore, M. (2015). The effect of public expenditure on economic growth in the East African community. *Journal of Business Management*, *3*(10), 09-13.

Bacon, D. W., & Watts, D. G. (1971). Estimating the transition between two intersecting straight lines. *Biometrica*, *58*(3), 525-534.

Butkus, M., & Seputiene, J. (2018). Growth effect of public debt: The role of government effectiveness and trade balance. *Economies, 6*(62), 1-27.

Caner, M., Grennes, T., & Koehler-Geib, F. (2010). Finding the tipping point: When sovereign debt turns bad. *The World Bank*, 63-75.

Chudik, A., Mohaddes, K., Pesaran, M. H., & Raissi, M. (2018). Rising public debt to GDP can harm economic growth. *DallasFED*, *13*(4), 1-4.

Chudik, A., Mohaddes, K., Pesaran, M., & Raissi, M. (2015). Is there a debt-threshold effect on output growth? *IMF Working Papers, 15*(197), 1-55.

Churchman, N. (2001). *David Ricardo on public debt.* Palgrave Publishers.

Doğan, İ., & Bilgili, F. (2014). The non-linear impact of high and growing government external debt on economic growth: A Markov Regime-switching approach. *Elsevier*, *39*(3), 213-220.

Eberhardt, M., & Presbitero, A. F. (2015). Public debt and growth: Heterogeneity and non-linearity. *Journal of International Economics*, *97*(1), 45-58.

Eboreime, M. I., & Sunday, B. (2017). Analysis of public debt-threshold effect on output growth in Nigeria. *Econworld*, 1-43.

Egert, B. (2013). Public debt, economic growth and nonlinear effects: Myth or reality?. *CESIFO, 4157*, 1-32.

Ehikioya, L. (2012). Impact of public debt on an emerging economy: Evidence from Nigeria *(1980 - 2009). International Journal of Innovative Research & Development, 1*(8), 242-262.

Georgieva, K. (2019). How to use debt wisely. https://www.imf.org/en/News/Articles/2019/11/07/sp110719

Hwang, J.-T., Chung, C.-P., & Wang, C.-H. (2010). Debt overhang, financial sector development, and economic growth. *Hitotsubashi University*, *51*(1), 13–30.

Kasidi, F., & Said, A. M. (2013). Impact of external debt on economic growth: A case study of Tanzania. *Advances in Management & Applied Economics*, *3*(4), 59-82.

Kimtai, C. C. (2019). *The impact of high and increasing public debt on economic growth of Kenya* [Master's Thesis, University of Nairobi]. http://erepository.uonbi.ac.ke/handle/11295/108649

Krugman, P. (1988). Financing vs forgiving a debt overhang. *National Bureau of Economic Research, 5*(2486), 1-34.

Lof, M., & Malinen, T. (2013). Does sovereign debt weaken economic growth? A panel VAR analysis. In *Munich Personal RePEc Archive*, 52039, 1-13.

Masuch, K., Moshammer, E., & Pierluigi, B. (2016). Institutions, public debt, and growth. *European Central Bank*, 1963, 1-38.

Matiti, C. (2013). The relationship between public debt and economic growth in Kenya. *International Journal of Sciences and Project Planning Management*, *1*, 65-86.

Mensah, L., Allotey, D., Sarpong-Kumankoma, E., & Coffie, W. (2019). What debt threshold hampers economic growth in Africa?. *International Journal of Development Issues*, *19*(1), 25–42.

Mill, S. (1885). Principles of Political Economy. *D Appleton and Company*, *1*(1), 684-689.

Ministry of Finance. (2008). Annual debt management report July 2006-June 2007. *Debt Management Department,* 1. http://www.parliament.go.ke/sites/default/files/2019-05/ANNUAL%20PUBLIC%20DEBT%20_REPORT%2006-2007.pdf

Ministry of Finance. (2019). The national treasury and planning annual public debt management report 2018/19. http://www.parliament.go.ke/sites/default/files/2019-05/ANNUAL%20PUBLIC%20DEBT%20REPORT%202018-2019.pdf

Muinga, R. M. (2014). *External public debt and economic growth in Kenya* [Master's Thesis, University of Nairobi]. http://41.204.161.209/handle/11295/76247

Munzara, A. T. (2015). Impact of foreign debt on economic growth in Zimbabwe. *IOSR Journal of Economics and Finance, 6*(5), 87-91.

Mwaniki, G. W. (2016). Effect of public debt on the gross domestic product in Kenya. *Journal of Economics and Finance*, *7*(6), 59-72.

Mweni, F. (2014). *A critical review of external debt and economic growth in Kenya* [Doctoral dissertation, United States International University].

Myers, S. C. (1977). Determinants of corporate borrowing. *Journal of Financial Economics, 5*, 147-175.

Ndoricimpa, A. (2020). Threshold effects of public debt on economic growth in Africa: A new evidence. *Journal of Economics*

and *Development*, *22*(2), 187-207.

Ngugi, W. N. (2016). Effect of public debt on economic growth in Kenya. https://ir-library.ku.ac.ke/bitstream/handle/123456789/15050/

Njoroge, C.M. (2015). *Effect of domestic public debt on economic growth in Kenya,* [Master's thesis, University of Nairobi].

Okiro, K., & Murungi, S. M. (2018). Impact of government debt on economic growth in Kenya: A critical literature review. *European Scientific journal,14*(1), 240-257.

Omotosho, B. S., Bawa, S., & Doguwa, S. I. (2016). Determining the optimal public debt threshold for Nigeria, *CBN Journal of Applied Statistics*, *7*(2), 1-26.

Owosu-Nantwi, V., & Erickson, C. (2016). Public debt and economic growth in Ghana. *African Development Review*, *28(*1), 116-126.

Pegkas, P. (2018). The effect of government debt and other determinants on economic growth: The Greek experience. *Economies*, *6*(1), 1-19.

Presbitero, A. F. (2012). Total public debt and growth in developing countries. *European Journal of Development Research*, *24*(4), 606-626.

Rais, S. I., & Anwar, T. (2012). Public debt and economic growth in Pakistan: A time series analysis from 1972 to 2010. *Academic Research International*, *2*(1), 535-545.

Reinhart, M. C., & Rogoff, S. K. (2010). Growth in a time of debt. *American Economic Review*, *100*(2), 573-578.

Smith, A. (1776). An inquiry into the nature and causes of the wealth of the nations. *Glasglow Edition Edited by S.M Soares. Meta Libri Digital Library, 2*(1), 707-741.

Terasvirta, T. (1994). Specification, estimation, and evaluation of smooth transition autoregressive models. *Journal of the American Statistical Association*, *89,* 208-218.

Terasvirta, T., Tjostheim, D., & Granger, W. J. C. (1994). Aspects of modelling nonlinear time series. In *Handbook of econometrics*: *IV*, 2917-2957.

Terasvirta, T. (1998). Modelling economic relationships with smooth transition regression. In A. Ullah & D. E. A. Giles (Eds.), *Handbook of Applied Economics Statistics* (pp. 229-246)*.* Marcel Dekker Inc.

Topuz, S. G., & Sekmen, T. (2019). Is there a threshold effect of public debt on economic growth? In *Global Challenges in Public Finance and International Relations*, *1*, 49-64.

Ueshina, M., & Nakamura, T. (2019). An inverted u-shaped relationship between public debt and economic growth under the golden rule of public finance. *Theoretical economics letters, 9*, 1792-1803.

Umaru, A., Haamidu, A. A., & Musa, S. (2013). External debt and domestic debt impact on the growth of the Nigerian economy. *International Journal of Educational Research, 1*(2), 70-85.

Veiga, J. A. L., Ferreira-Lopes, A., & Sequeria, T. N. (2016). Public debt, economic growth, and inflation in African economies. *South African Journal of Economics*, *84*(2), 294-322.

Watson, C., & Regling, K. (1992). History of the debt crisis. In R. C. Effros (Ed.), *Current Legal Issues Affecting Central Banks IMF* (pp. 67-76). Washington DC.

Notes

[i] Country-specific studies that have been conducted in the past include Baaziz et al. (2015) who found a debt threshold of 31.37% for South Africa and Omotosho et al. (2016) who found a debt threshold of 73.7% for Nigeria.

[ii] Adam Smith and by extension the classical economists are supply-side economists. They argue that overtaxing the productive class is counterproductive which stifles economic growth.

[iii] Terasvirta (1994) can be followed for detailed information on the STR model. This model has been applied by previous studies examining public debt threshold and economic growth including Baaziz et al. (2015) and Ndoricimpa (2020).

[iv] Two models are estimated: one of them indicates the threshold public debt level and the another indicates the threshold internal debt level.

[v] Previous studies such as (Babu et al., (2015), Muinga (2014), and Ndoricimpa (2020)) suggest that these variables affect growth and are suitable options for control variables.