External Debt and Economic Growth in Sierra Leone: A Threshold Analysis

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ABSTRACT
The main focus of this study is to investigate the impact of external debt on economic growth and determine the threshold level of external debt that is favourable for economic growth in Sierra Leone, within the framework of a non-linear model (quadratic function). The study employs the Ordinary Least Squares estimation technique with annual time series data for the period 1980 to 2022.

The empirical findings reveal that, lagged GDP, external debt, external debt squared and investment are the main drivers of economic growth in Sierra Leone. Specifically, the result reveals that external debt, investment and lagged GDP have a positive impact on growth whilst, external debt squared has a harmful impact on growth. Furthermore, the study establishes a nonlinear relationship between external debt and economic growth. The result indicates that the optimal threshold level of external debt (as a % of GDP) in Sierra Leone is 115%. The findings reveal that, external debt below the threshold level is growth enhancing. However, the accumulation of external debt beyond the threshold level of 115% is detrimental to growth. The diagnostic result confirms that about 76% of the variation in economic growth is explained by the regressors (independent variables). Also, the granger causality test result suggests a unidirectional causality from external debt to economic growth with no reverse causality, indicating that external debt granger caused economic growth at the 5% level. Based on the findings, the study recommends that, government should develop a robust debt management policy, to keep debt levels within sustainable limits and also cultivate an economic culture of transparency, on the issue of debt management and contract negotiations.

Keywords: Sierra Leone, External Debt, Economic Growth, Granger Causality, Non-Linear Model, Threshold Analysis

Introduction

The benefits of external borrowing and the adverse effect of huge external debt accumulation on growth in developing economies have been widely discussed in the literature. The dependence on external debt by developing economies resonates mainly due to the failure of governments in these countries to finance much required expenditure programmes through domestic resource mobilization and domestic savings. Most developing countries are epitomized by low revenue mobilization, large savings-investment gap, chronic fiscal deficit, large current account deficit and high inflation [1]. As a result, there are limited resources to finance basic infrastructure projects, which compel developing economies to borrow in order to finance social and economic infrastructure, stimulate economic activities, boost growth and development. Also, countries borrow from external sources in the short term to finance current account deficits arising from external imbalances to build up external reserves position and strengthen external liquidity. However, despite the continuous reliance on external debt, most developing countries growth potential remains sluggish. In other words, while it is acknowledged that external borrowing is inevitable for financing of infrastructure programmes, it is worth to note that poor debt management practices may crowd-out any potential welfare benefits that could have been gained through such borrowing. The inability of the borrowing economies to use the funds obtained from external borrowing to achieve economic growth has led to long term problems such as debt overhang, crowding out, exchange rate depreciation, low private sector investment and high inflation.

The theoretical paradigm has put forward five theories that discuss the external debt-economic growth nexus, including the debt-overhang theory, the dual-gap model, the debt-crowding out model, the Harrod-Domar model, and the liquidity constraint theory. The debt-overhang theory establishes a link between external debt and economic growth. The debt-overhang theory is akin to the Laffer curve, which suggests that there is a certain threshold level beyond which debt impedes growth. The theory indicates that at low level of external debts, a country's ability to service its debt is greater than its debt obligations and economic growth rate is expected to rise. However, beyond a certain external debt threshold, if the debt obligation is higher than the country's ability to service its debt, then the growth rate is expected to fall. The crowding-out theory postulates that a huge debt service burden on the government may crowd-out

public spending on key productive sectors of the economy. Thus, due to limited external borrowing arising from loss of credit worthiness and high interest rates on loans from foreign markets, most governments resort to domestic borrowings to finance their expenditure. As a result, the demand for loanable funds also increases leading to an increase in the interest rate charged on domestic borrowings, which adversely affects private investment, leading to a fall in investment and output.

Also, the dual-gap theory suggests that economic development is a positive function of foreign aids and investment/capital inflows. The dual-gap hypothesizes that the existence of the foreign exchange and savings gaps impedes economic development. The theory suggests that the low level of export performance by most developing countries, constraint foreign exchange earnings that is needed to finance the importation of capital goods. Also, the low level of income creates a savings-investment gap, with negative impact on growth. Thus, to overcome the dual-gap involving the exchange rate-gap and savings-investment gap, countries engage in external borrowing. Furthermore, the liquidity-constraint hypothesis posits that a high debt burden requires adequate foreign exchange inflows to service the country's debt. The hypothesis suggests a negative relationship between external debt and economic growth, at high level of external debt. Thus, according to the liquidity-constraint theory, a country that cannot generate enough foreign exchange earnings from export, will be constrained in servicing its debt. To increase its export competitiveness and boost growth, there is a need for such a country to devalue its domestic currency. Finally, the Harrod-Domar school postulates a positive relationship between external debt and growth. The theory suggests that, an increase in savings will result in capital accumulation, which is an important element for growth. Hence, external borrowing is considered as capital that is used to bridge the financing gap, hence boost economic growth.

The empirical literature is replete with studies that contributes to the debate on the external debt-economic growth nexus. However, the empirical findings have produced mixed results. While some researchers have established a positive relationship between external debt and economic growth [2-4]. Other studies reveal a negative relationship between debt and growth [5,6]. However, other researchers find no relationship between these two variables [7]. Also, some researchers establish various threshold levels beyond which external debt is detrimental to growth.

Sierra Leone, like most countries in Sub-Saharan Africa, has relied heavily on external debt to complement domestic revenue and narrow the savings-investment gap, to finance public investments and stimulate economic growth. The country benefitted from the HIPC debt cancellation programme in 2006, amounting to a debt cancellation of US$ 675.2 million of the total debt. Despite the debt cancellation, the country has accumulated huge external debt over the years, which has also caused an increase in its debt servicing, with consequences on the exchange rate, inflation and growth. However, despite the huge external debts that the country continues to accumulate over the period, this has not resulted in robust economic growth, as the country continues to witness sluggish growth. The country's economic performance has been constrained by both global and domestic shocks. On the global front, the first oil shock in the 1970s, the twin shocks associated with Ebola and the decline in iron prices between 2014-15 as well as the coronavirus pandemic in 2021 caused a lot of macroeconomic imbalances in the Sierra Leone economy. As a result, the country experienced fiscal pressures due to surge in government expenditure, weak macroeconomic management, high inflation, increased debt budget, unfavorable terms of trade, exchange rate depreciation and weak external sector performance. On the domestic front, the hosting of the Organization of the Africa Unity (OAU) Summit in 1980, the civil war in the 1990s, coupled with the weak revenue mobilization drive also contributed significantly to imbalances in Sierra Leone.

Sierra Leone's external debt which averaged US$ 319.6 million in the late 1970s, rose to an average of US$ 1.04 billion in the late 1980s, partly due to the huge expenditure outlay towards the hosting of the OAU Summit. The country was engulfed in a civil war in the 1990s, which significantly affected economic activities and revenue mobilization. Government expenditure surged during the period to purchase military equipment, provide relief materials and import basic food and medical supplies. Due to the low revenue mobilization, the country relied on external borrowing, with external debt averaging US$ 1.3 billion (125% of GDP) between 1990-1999. The country benefitted from the multilateral debt reliefs programs, which resulted in the cancellation of the country's external debt under the HIPC programme. By 2007, the country debt stock averaged US$ 910 million (42.2 % of GDP). However, the country's debt position worsened after HIPC, due partly to persistent corruption and implementation of weak macroeconomic policies. The country recorded an external debt of US$ 1.4 billion (49.1% of GDP) between 2008 to 2012, which increased further to an average of US$ 1.9 billion (43.5% of GDP) between 2013 to 2016, following the outbreak of the Ebola and the decline in iron ore prices, which constrained the country's ability to mobilize domestic resources. However, external debt increased gradually from US$2.5 billion (69.2% of GDP) in 2017 to US$ 3.1 billion (76% of GDP) in 2020, and stood at US$ 3.8 billion (95.8% of GDP) in 2022. The external debt as a percent of GDP is presented in Figure 1. Analysis of Figure 1 shows that external debt as a percent of GDP remained high between 1980s and 2000, a period characterized by the hosting of the OAU and the civil war. The country witnessed a fall in external debt as a percent of GDP between 2000 and 2006, a period associated with post war period and the HIPC debt cancellation programme. However, the country continues to witness a surge in external debt as a percent of GDP during the post-HIPC era, due partly to weak revenue mobilization amidst high expenditure outlay to finance infrastructure projects. Since 2014, external debt as a percent of GDP increased from 35% of GDP (2014) to 76% of GDP in 2020 and stood at 96% in 2022.
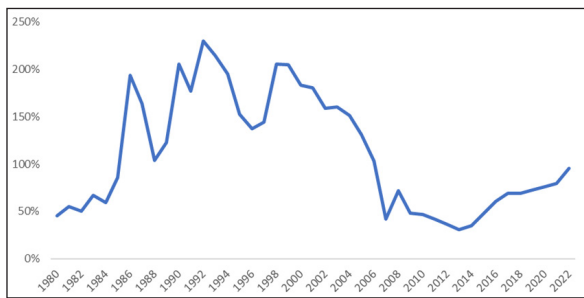
Figure 1: External Debt (% of GDP)
Source: Authors compilation

Figure 2: Real GDP Growth Rate
Source: Authors compilation

Sierra Leone's economic performance deteriorated in the 1970s following the oil shock and the implementation of poor macroeconomic policies. However, in the 1980s the country experienced favorable economic performance as growth increased from an average of 1.3 percent between 1980-85, to an average of 2.2 percent from 1986-90. The positive growth was as a result of the hosting of the OAU summit which saw an increase in economic activities due to a surge in government expenditure in the services, mining and industrial sectors. The country witnessed negative growth and went into recession during the 1990s informed by the impact of the civil war, which created economic and political instability and disrupted economic activities in the agriculture, mining and transport sectors. During this period, the country recorded an average growth of -3.9 percent between 1991-1999. Following the end of the civil war, the economy rebounded with positive growth averaging 7.1 percent between 2000 and 2007, due to the implementation of the economic recovering programme as well as the disarmament, demobilization and reintegration (DDR) programme that integrated the rebels within the country, which saw an increase in economic activities in all sectors of the economy. Growth moderated to an average of 5.2 percent between 2008 to 2011.

However, the country recorded an impressive growth rate of 15.2 percent in 2012 and further picked up to 20.7 percent in 2013, largely due to a boom in the mining sector, especially iron ore production and export and the service sectors, respectively, which rated Sierra Leone among the top five fastest growing economies in the world. The impressive growth was short-lived as the country recorded a growth rate of 5.2 percent in 2014 and -20.6 percent in 2015 due to the twin shocks of Ebola outbreak and fall in iron ore prices. Growth however rebounded thereafter, as the country recorded positive growth of 4.5 percent between 2017 and 2019 due to the implementation of the post-Ebola recovery plan and surge in economic activities in the mining and agricultural sectors, coupled with an increase in commodity prices. The outbreak of the coronavirus pandemic reversed the positive growth trajectory, as the country recorded a negative growth rate of 2.0 percent in 2020. The country however, recorded positive growth rates of 4.1 and 3.5 percent in 2021 and 2022, respectively. The trend in real GDP growth for the period is presented in Figure 2.
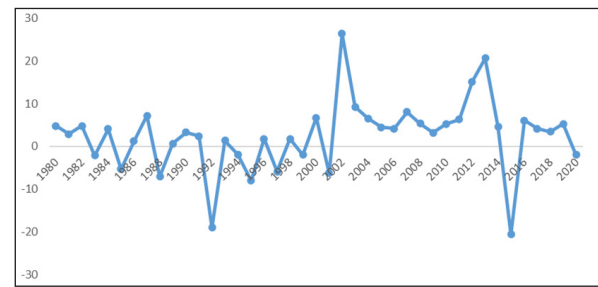
The empirical discussion suggests that the accumulation of external debt is not a bad policy measure, but the efficient use of the resources to finance productive infrastructure programmes and boost growth remains a critical issue. In addition, the literature has produced mixed results on the optimal level of debt that is conducive to growth. Some researchers argued that government borrowing helps to enhance economic growth and has a positive effect on disposable income, aggregate demand and overall output [8]. Other researchers posit that a high level of debt is harmful to growth, especially after a certain threshold has been reached [9]. Against this background, the issues for the Sierra Leonean authorities are: to establish the actual relationship between external debt and economic growth, and determine the optimal level of external debt that promote growth in Sierra Leone. In this regard, the objective of this study is to investigate the impact of external debt on economic growth and determine the threshold level of external debt that is favorable for economic growth in Sierra Leone. This study contributes to the empirical debate on the external debt-growth nexus by estimating a non-linear model, which is premised as a second-degree polynomial. This approach for estimating a non-linear relationship allows us to identify the threshold level of external debt that is favorable for economic growth. Also, to the best of our knowledge, this is the first country-specific study on Sierra Leone that investigates the threshold level of external debt beyond which, the incurrence of additional debt is detrimental to growth. Furthermore, the findings of the study will provide the framework to guide policymakers in formulating and designing an optimal debt strategy that stimulates growth in Sierra Leone. The study utilizes annual time series data for the period 1980 to 2022. The rest of the paper is organized as follows: Section two discusses the empirical literature and section three presents the methodology. Section four analyzes the empirical findings, while section five gives the conclusion and policy recommendations.

Literature Review
The literature on the external debt-growth nexus has produced conflicting views on the effective use of external debt to enhance growth and the identification of the threshold level of external debt favorable for growth. Whilst the Keynesian school postulates a positive relationship between external debt and growth, the Neoclassical school suggests a negative relationship between external debt and growth. The empirical literature is replete with studies on the external debt-growth nexus. In terms of threshold analysis, examines the effect of external debt on economic growth for 31 sub-Sahara African (SSA) countries using panel data from 2005 to 2017, within the system-generalized method of moment (system GMM) and the panel smooth transition regression (PSTR) [10]. The findings reveal a positive relationship between

external debt and economic growth, with a threshold value of 45% for the selected SSA countries. Using data for 20 Middle East and North Africa (MENA) countries from 1990 to 2016, examines the threshold level of external debt on growth, employing the threshold estimation technique [11]. The results show a positive relationship between external debt and economic growth with a threshold level of 58% for the MENA countries. Similarly, investigates the relationship between external debt and economic growth for Middle East and North Africa (MENA) countries covering the period 2002 to 2016 [12]. Employing the dynamic panel threshold model, the findings show a negative relationship between external debt and economic growth with a threshold level of 15.28%. Investigates the relationship between public debt and economic growth in OECD countries, with data from 2002 to 2016, using panel threshold regression methods [13]. Their results reveal a negative relationship between public debt and economic growth, with an estimated threshold level of 99.75%. Using data from eight emerging market economies (Brazil, India, Indonesia, Malaysia, Mexico, South Africa, Thailand, and Turkey) for the period 1980 to 2011, investigates the relationship between public debt and economic growth [14]. Within the framework of the Fixed effect and random effect estimators, the results reveal that debt has a positive impact on the emerging market economies, but no significant evidence of nonlinear effects was found in these economies.

Investigates the impact of external debt on economic growth for 15 ECOWAS countries, and determines the optimal threshold level of external debt that promotes growth [1]. The study employs a combination of the Pooled Ordinary Least Squares (POLS), Fixed Effect Model (FEM), Random Effect Model (REM) and Panel Corrected Standard Errors (PCSE) estimation techniques with data from 2000 to 2019. Their findings reveal that external debt, Openness to trade and Control of Corruption are the main drivers of economic growth, with an optimal threshold level of external debt of 111%. Investigates the relationship between external debt and economic growth for a sample of 93 developing countries over the period 1969-1998, using the Generalized Method of Moments (GMM) [15]. The findings identify two distinct threshold values. The first threshold value called point A is between 17.5-20% of GDP and the second threshold called point B is between 35-40%. Beyond these points, growth becomes negative. Conducts a study to re-examine the threshold effects of public debt on economic growth in Africa using the panel smooth transition regression technique and data from 1980-2012 [16]. The findings show a threshold level of debt in the range of 62–66% for the whole sample, while a threshold level of debt is 58-63% for middle-income and resource-intensive countries.

Using country specific data, examines the asymmetric and threshold impact of external debt on economic growth in Egypt with data from 1980-2019, within the context of a nonlinear autoregressive distributed lag (NARDL) bounds testing approach [17]. The findings indicate a negative relationship between external debt and economic growth, with a threshold level of external debt-to-GDP ratio of 96.7%. Examines the threshold level of external debt sustainability for Morocco, employing the Vector Error Correction Method (VECM) with quarterly data from 2004 to 2013 [18]. Their findings a threshold level of external debt ratio of 45%. Using similar methodology,

Evaluates the effects of external debt on the economic growth of Tunisia, with data from 1970-2012 [18]. The results reveal that, the optimal level of external debt for Tunisia during the study period is 51% of GDP. Examines the effect of public debt on growth in Mexico with data from 1994 and 2016 [5]. Using the non-linear regression model, their findings establish a threshold level of 27%, beyond which, external debt was harmful to economic growth. Examines the relationship between external debt and economic growth in Ghana using annual time series from 1970-2017 within the co-integration and vector error correction analysis framework [19]. The findings indicate that external debt stimulates growth and also confirms the crowding out effect, debt overhang effect and other non-linear effects on economic growth in Ghana. Furthermore, investigates the impact of external debt on economic growth in Ghana from 1970 to 1999 [7]. The study employs the Johansen cointegration and error correction model. The results posit that GDP growth is positively influenced by external debt inflows and negatively by debt servicing, which indicates a crowding-out effect of debt in the Ghanaian economy. Investigates the impact of external debt on economic growth in Nigeria from 1985 to 2018 using the vector autoregressive (VAR) approach [20]. Their findings reveal that external debt stock and external debt servicing exert negative impact on economic growth.

Few studies have been conducted on Sierra Leone on the relationship between external debt and economic growth. Examines the relationship between public debt and economic growth from 1986-2015, using Granger causality, Johansen co-integration, and error correction model analysis [21]. The findings show that public debt is negatively related to economic growth, while domestic debt is positively related to economic growth [22]. Furthermore, investigates the nexus between external debt and economic growth in Sierra Leone for the period from 1973 to 2021 using Hendry's general-to specific approach [6]. The results reveal that debt accumulation, terms of trade and debt servicing hurt economic growth, while public sector investment has a positive impact on growth. The literature posits that studies on the external debt-growth nexus for Sierra Leone are limited in scope and coverage. Specifically, the current study not only investigates the relationship between external debt and economic growth, it also determines the threshold level of external debt conducive to growth in Sierra Leone, using the non-linear regression model.

Methodology

To achieve the objective of this study in establishing the threshold level of external debt and its impact on economic growth, the empirical model draws largely from the research work of [1]. However, a major departure from is that the current study utilizes country-specific annual time series data. The specification of the model and choice of variables is premised on theoretical underpinning and empirical debate on the external debt-growth nexus, and the structure of the Sierra Leone economy [1]. The specification of the linear model that establishes the link between external debt is given as follows.

$$Y_t = \beta_0 + \beta_1 ED_t + \beta_2 Inf_t + \beta_3 ER_t + \beta_4 Inv_t + \beta_5 Opn_t + \lambda D_t + \varepsilon_t \quad (1)$$

Where, Y_t is real GDP growth rate which measures economic performance of Sierra Leone, ED_t is external debt which

is the variable of interest. Furthermore, the model captures other control variables including INF_t, ER_t, inv_t and $Open_t$, representing inflation, exchange rate, investment and trade openness, respectively. In addition, the model includes D, the dummy variable for war which takes a value of one for the war period (1992-2000) and zero elsewhere. Furthermore, β_0 is the intercept term, and β_i (i= 1….5) represents the parameters to be estimated; t is the time period and ε_t is the error term that is identically and independently distributed with mean zero and constant variance, i.e., $\varepsilon t \approx iid$ (0, δ).

In other to determine the threshold level of external debt, the study transformed Equation (1) into a non-linear quadratic regression model. The advantage of this approach is its ability to estimate the threshold level external debt that is favorable for growth, and above which, external debt may be growth retarding. To obtain the quadratic model from Equation (1), we add the squared term of external debt in the growth equation. Thus, the non-linear quadratic model is specified in the following form:

$$Y_t = \beta_0 + \beta_1 ED_t + \beta_2 ED_t^2 + \beta_3 Inf_t + \beta_4 ER_t + \beta_5 Inv_t + \beta_6 Opn_t + \lambda D_t + \varepsilon_t \quad (2)$$

Where the squared term of external debt (ED^2) is included in the model to assess the impact of high external debt on economic growth and allow us to obtain the turning point in the external debt-growth relationship. All other variables are as defined in Equation (1). To validate the non-linear model, the study proceeds with the estimation of Equation (2) using the Ordinary Least Square (OLS) estimation technique, which is appropriate in order to determine the significance of both external debt and external debt squared. If the coefficients are significantly different from zero, we then proceed to determine the optimal or threshold level of external debt, beyond which, external debt will have negative impact on growth. In order to establish the threshold value of external debt, we compute the partial derivative of Equation (2) with respect to external debt and set to zero. That is;

$$\frac{\delta Y}{\delta ED} = \beta_1 + 2\beta_2 ED = 0 \quad (3)$$

We proceed to solve Equation (3) for ED, and obtain the threshold value of external debt beyond which external debt will be detrimental to growth.
That is;

$$ED = \frac{-\beta_1}{2\beta_2}$$

Thus, to ascertain that this is the maximum point and not the minimum point, the sign of β_2 must be negative. Taking the second derivative gives the following:

$$\frac{\delta^2 Y_t}{\delta ED^2} = -2\beta_2$$

The study utilizes annual time series data covering the period 1980 to 2022. Data were sourced from World Development Indicators, International Financial Statistics yearbook, and Bank of Sierra Leone database.

Discussion Of Empirical Results
Unit Root Test (Stationarity test)
The study performs the unit root test to establish the stationarity of variables with a view to address the issue of spurious

regression. The study employs both the Augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) tests. The result of the unit root test as presented in Table 1, reveals that all the variables are stationary in first difference. That is, they are characterised as I (1) variables, implying that are stationary in their first difference.

Table 1: Results of Unit Root Test

Variables	Augmented Dickey-Fuller		Philips-Perron		Order of Integration
	Levels	1st difference	Levels	1st difference	
Real GDP	-2.222	-5.448**	-2.093	-5.830**	I (1)
External debt	-2.394	-5.102**	-2.255	-5.148**	I (1)
Exchange Rate	-2.108	-4.921**	-1.873	-4.860**	I (1)
Inflation	-2.419	-8.462**	-2.419	-9.602**	I (1)
Openness	-2.224	-7.963**	-2.292	-7.847**	I (1)
Investment	-2.602	-3.824*	-2.653	-3.904*	I (1)

Note: ** = 1% significance level = -3.62, and * = 5% significance level =-2.94.

Co-Integration Test Analysis
Based on the unit root results, the study proceeds to conduct a cointegration test to determine whether a long run relationship exists among the variables. This study employs the Johansen cointegration test. The Johansen cointegration test results based on both the trace statistics and maximum Eigen values as presented in Tables 2 and 3, respectively, indicate there is no cointegrating vector. That is there is no long run relationship among the variables.

Table 2: Unrestricted Co-integration Rank Test Result (Trace Statistics)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None	0.412958	45.46717	47.85613	0.0824
At most 1	0.325577	25.75879	29.79707	0.1361
At most 2	0.255117	11.18460	15.49471	0.2004
Trace test indicates no cointegrating eqns at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Authors computation from EViews

Table 3: Unrestricted Co-integration Rank Test Result (Maximum Eigen Value)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None	0.496531	25.39064	33.87687	0.3591
At most 1	0.325577	14.57419	21.13162	0.3199
At most 2	0.255117	10.89756	14.26460	0.1594
Max-eigenvalue test indicates no cointegrating eqns at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: Authors computation from EViews

Granger Causality

In addition to the non-linearity debate in the debt-growth nexus, the issue of reverse causality needs to be taken into consideration, that is, whether debt leads to higher growth or vice-versa. The study conducts the granger causality test in other to establish the causal relationship in the debt-growth relationship. The rationale for the granger causality test is to determine whether one time series is relevant in forecasting another. Thus, the granger causality test will establish whether there is a unidirectional causality or bidirectional causality in the debt-growth relationship. The result of the granger causality test is presented in Table 4. The result suggests a unidirectional causality from external debt to economic growth with no reverse causality, indicating that external debt granger cause economic growth at the 5% level. Also, the findings reveal unidirectional causality from inflation to economic growth, as well as from investment to economic growth. However, a bi-directional causality was established between exchange rate and economic growth.

Table 4: Granger Causality Test Results

Sample: 1980-2022			
Null Hypothesis	**Observation**	**F-Stat.**	**Prob.**
External debt does not granger cause Economic growth	43	3.60	0.03
Economic growth does not granger cause external debt		2.36	0.12
Inflation does not granger cause Economic growth	43	4.07	0.03
Economic growth does not granger cause Inflation		1.17	0.34
Exchange rate does not granger cause Economic growth	43	3.05	0.05
Economic growth does not granger cause Exchange rate		3.58	0.03
Investment does not granger cause Economic growth	43	4.37	0.01
Economic growth does not granger cause Investment		2.21	0.14

Non-linear (Quadratic) Regression Results

Consistent with the objective, the study proceeds to estimate the quadratic model (equation 2) in order to ascertain the existence of a non-linear relationship in the external debt-growth nexus and determine the threshold value of external debt. The result of the quadratic model is presented in Table 5. The results reveal that the lagged value of growth, external debt, external debt squared and investment are the main drivers of economic growth in Sierra Leone. Specifically, the result shows that, the lagged value of growth has a positive impact on growth during the review period. Furthermore, the result posits that external debt and investment impacts positively on growth with statistically significant coefficients at the 5% level. However, a negative

relationship exists between external debt squared and economic growth. This implies, high level of external debt dampens growth.

Table 5: Non-Linear Regression Results

Variable	Coefficient	Standard error	t-statistics	Prob
C	20.620	6.434	3.205	0.0224
Y_t (-1)	0.043	0.018	2.389	0.0426
ED_t	0.462	0.121	3.818	0.0015
ED_t^2	-0.204	0.066	-3.091	0.0398
Inf_t	0.062	0.036	1.719	0.0946
ER_t	0.025	0.016	1.563	0.2481
Inv_t	0.028	0.009	3.111	0.0365
Opn_t (-1)	0.039	0.022	1.773	0.0892
D	-0.017	0.012	-1.417	0.2635
R-squared	0.761			
Adjusted R-Squared	0.784			
Durbin-Watson Stat	1.892			
Prob (F-Statistics)	0.007			

Source: Authors compilation from EViews result output

To calculate the threshold value of external debt, we take the first derivative of Equation 4, with respect to external debt and set to zero. That is,

$$Y_t = 20.6 + 0.46ED_t - 0.20ED_t^2 + 0.06Inf_t + 0.0ER_t + 0.03Inv_t + 0.04Open_t - 0.02D_t \quad (3)$$

$$\frac{\delta Y}{\delta ED} = 0.46 - 0.40ED = 0$$

$$0.46 = 0.40ED$$

$$ED = \frac{0.46}{0.40}$$

$$ED^* = 1.15 \times 100$$

$$ED^* = 115\%$$

The result suggests that the threshold level of external debt for Sierra Leone is 115%. Thus, the result validates the existence of a non-linear relationship in the external debt-growth nexus for Sierra Leone during the review period. The result confirms that external debt below the threshold is growth enhancing. However, accumulation of external debt above the threshold of 115% will have a detrimental impact on growth. Remarkably, this closely aligns with the research by (1), which identified an optimal threshold level of external debt at 111% for ECOWAS nations. The diagnostic result confirms that about 76% of the variation in economic growth is explained by the regressors (independent variables).

Conclusion

The objective of this study was to investigate the impact of external debt on economic growth and determine the threshold level of external debt that is favourable for economic growth in Sierra Leone, within the framework of a non-linear model (quadratic function). The Ordinary Least Squares estimation

technique was employed with annual time series data for the period 1980 to 2022.

The unit root test results confirmed that all the variables were integrated of order one, i.e. I (1), while the cointegration results based on the trace statistics and maximum eigen values confirmed that, the variables were not cointegrated. The empirical results revealed that, lagged value of growth, external debt, external debt squared and investment were the main drivers of economic growth in Sierra Leone. Specifically, the result suggested that external debt, investment and lagged GDP growth had positive impact on growth with statistically significant coefficients at the conventional level. The result further indicated that, external debt squared had a negative impact on economic growth, which implied that, high level of external debt dampens growth. In addition, the granger causality test result suggested a unidirectional causality from external debt to economic growth with no reverse causality, indicating that external debt granger caused economic growth at the 5% level.

Furthermore, the finding revealed the existence of a nonlinear relationship between external debt and growth. The results indicated that the optimal threshold level of external debt in Sierra Leone is 115%. The result confirmed that, external debt below the threshold is growth enhancing. However, accumulation of external debt beyond the threshold level of 115% is detrimental to growth. The diagnostic result confirms that about 76% of the variation in economic growth is explained by the regressors (independent variables).

Based on the findings, the study recommends that, the government should develop a robust debt management strategic policy, in order to keep debt levels within the threshold limits and also cultivate an economic culture of transparency, on the issue of debt management and contract negotiations. Furthermore, the government is urged to enhance domestic revenue mobilization in order to reduce the over reliance on external financing. This can be achieved by strengthening the capacity of the revenue authority to design and implement policies that will capture the untaxed informal sectors into the tax net, and also mitigate revenue leakages. Also, the government is encouraged to develop public investment policies that will promote private sector investment in order to boost growth.

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