

Research Article

Public Debt Management and Economic Growth in Sierra Leone (1973-2022)

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Abstract

Sierra Leone is a small developing country that continues to encounter enormous public debt challenges, principally as a result of inadequate Gross Domestic Product (GDP) and imprudent debt management. The country's current debt-to-GDP ratio stands at 78.70%. The study investigates and analyses the impact of public debt on economic growth in Sierra Leone for the period 1973-2022. The study employs time series secondary data which were collected from various sources including the Central Bank of Sierra Leone and the Ministry of Finance. Key macroeconomic variables such as external debt stock-to-GDP ratio and domestic debt stock-to-GDP ratio were specified in the models employed in this study. The variables were tested for stationarity using unit root tests before applying the Autoregressive Distributed Lag (ARDL) approach in running the regression with a view to ascertaining both short run and long run effects of public debt on economic growth in Sierra Leone. Various diagnostic tests were carried out to appraise the robustness of the estimated growth equations using appropriate econometric criteria. The study empirically reveals a negative impact of public debt (both domestic and external) on economic growth in Sierra Leone both in the short run and in the long run. Furthermore, the study reveals that in order to ensure effective public debt management in Sierra Leone, there must be effective management of capital projects financed by public debt and to ensure stable exchange rates to reduce cost of financing debt. The study, therefore, proffers strategic recommendations in line with the findings, including a review of Sierra Leone's debt management strategy to ensure that public debt is directed towards productive capital projects.

Keywords

External Debt, Domestic Debt, Debt Accumulation, Debt Service, GDP, Macroeconomic Variables

1. Introduction

Public debt concerns all financial liabilities of government requiring service over time. Public debt portfolio comprises domestic and external debt. Domestic debt refers to debt owed by government to residents of a country whether denominated in local or foreign currency while external debt is debt owed to non-residents of a country.

Public debt remains a significant macroeconomic policy

and development financing instrument aimed at correcting countries' fiscal imbalances towards stimulating and promoting economic growth. For developing countries with very limited fiscal space, public borrowing becomes critical in the process of generating economic growth, as domestic savings are usually quite insufficient to run their economies. Public debt is, therefore, a significant measure of bridging the gov-

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Received: 12 June 2024; **Accepted:** 1 August 2024; **Published:** 27 August 2024



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ernment's financing gaps, otherwise called government budget deficits. Government budget deficit occurs when government expenditures exceed government revenues. So public borrowing is very crucial as it is one of the major ways government finances its deficits.

However, while public borrowing is crucial, its prudent management is extremely fundamental in the bid to drive economic growth. Public debt management concerns the strategy adopted by the government in managing its debt in order to generate the needed amount of funding at the lowest possible cost over the medium to long run, consistent with a prudent degree of risk. Prudent management of public debt results in higher economic growth and enhances the ability of governments to service and repay their debts. It also enables governments to achieve their social and development goals such as poverty reduction.

Developing countries experienced debt crisis in the 1980s as a result of a wide range of circumstances, including, oil price shocks in the 1970s, increased international lending to developing countries in the 1970s, sharp rise in international interest rates on loans in the 1980s, world recession in the 1980s, terms of trade deterioration leading to balance of payments (BoP) problem, lack of prudent public debt management policies, and poor project management.

In August 1982, Mexico, despite being an oil exporter, declared its inability to service its debts and had to have them rescheduled. Many other developing countries immediately followed Mexico. This marks the genesis of developing countries' debt problem which has led to the 'debt crisis' debate over the past three decades.

Between 2010 and 2012, following the Great Recession of 2008-09 drawn from the large global financial imbalances informed by the collapse of the United States housing market, there occurred acute public debt crisis in developed countries, Europe and Eurozone being the epicentre, whose gruesome effects cascaded down to developing economies.

Public Debt: The Sierra Leonean Context

Sierra Leone's public debt represents "public and publicly guaranteed disbursed and outstanding debt owed to residents and non-residents of the country" [16].

Sierra Leone's public debt can be traced from 1958 when the World Bank issued a loan of US\$ 28 million for the purpose of constructing a railway [11]. The public debt stock in 1960 skyrocketed to US\$ 69.7 million. A decade later, public debt stock in Sierra Leone increased to US\$ 246 million. In the late 1970s, Sierra Leone's mineral prices fell considerably in the world market which led to the incapacitation of the country to meet its financial obligations. In 1977, the country's total debt was US\$ 346 million [11]. The acute lack of required foreign exchange to finance the country's development is a major reason for the continued public debt procurement and expansion [1].

The Turbulent Period in Sierra Leone (Late 1970s-1980s to 2020)

From the late 1970s-1980s to 2020, there occurred several

events which have presented a turbulent socio-economic and political history for Sierra Leone that has had serious implications for public debt procurement and management in the country. These include:

High oil price in 1979: The high oil price in 1979 increased the country's oil import bills which necessitated huge external borrowing.

The hosting of the 1980 Organisation of African Unity (OAU) summit: In 1980, the Government of Sierra Leone hosted the OAU summit meeting which required a huge expenditure. To meet the related expenses such as hotel bills, the government procured large external debt with short repayment period. The hosting of the 1980 summit, coupled with the 1979 oil price increase prepared the stage for Sierra Leone's debt problem.

The eleven (11) years rebel war: In March 1991, a rebel war emerged in the country which caused devastating socio-economic consequences on the nation. More loans were procured to import rice, oil and military equipment to combat the war.

The 1997 military coup: In May 1997, a military junta ousted a democratically elected president. This illegal exercise precipitated further destruction of the socio-economic fabrics of the state. More loans were procured to fix the lost infrastructures.

The emergence of Ebola Virus Epidemic: In 2014, Ebola virus epidemic emerged in Sierra Leone which led to further socio-economic and human destruction. To contain the virus, the country again procured additional loans which increased the country's debt stock.

Landslide and floods of August 2017: In 2017, there occurred a landslide in the Sierra Leonean capital city of Freetown, coupled with a series of intensive floods in and around the city, following a three-day torrential rainfall, also leading to socio-economic and human destruction. This event necessitated further loan procurement to cushion the effect.

The outbreak of Coronavirus (COVID-19): In 2020, the country experienced an outbreak of the COVID-19 which led to loss of many precious lives. The country again procured loans to contain the pandemic. This exacerbated the country's debt problems.

Other Factors Responsible for Sierra Leone's Debt Problem.

In addition to the drastic fall in the country's mineral prices and the turbulent events, there are other factors responsible for Sierra Leone's debt problem. These include imprudent public debt management, poor project management, exchange rate volatility, implementation of weak agricultural policies and corruption.

2. The Problem Statement

Many developing countries like Sierra Leone have witnessed rising debt levels without commensurate rise in their economic growth rates. Many have experienced persistent

fluctuation in their gross domestic product (GDP) growth rates and other critical macroeconomic variables.

For the period under investigation, Sierra Leone's GDP growth rate has generally been fluctuating without any growth spell despite the generally rising public debt trend the country has seen. Since independence, the country's GDP has not been adequate enough to generate financial resources to run the economy, hence recourse to public borrowing. Export growth has also generally been fluctuating, denying the state the needed foreign exchange to finance debt service as well as critical development projects at the same time. Private investment has also not been doing well.

Under these continued circumstances, questions about the effectiveness of public debt management among other macroeconomic variables will continue to linger. The need to pay sustained attention to these circumstances cannot be overemphasised given the continued socio-economic challenges the globe is currently facing, including the fallouts of COVID-19 pandemic and Ukraine-Russia War as well as the effect of climate change and biodiversity loss.

This research has prompted key broad questions underlying the research problem including:

- i. What could have principally caused the rising public debt procurement and problems?
- ii. How would public debt impact economic growth and development?
- iii. Under what circumstances public debt management can or cannot be effective?
- iv. Could rising debt be seen as a fiduciary and project management issue while GDP growth rate is fluctuating?
- v. Have development projects implemented in the past been economically founded and viable?

These are the broad questions set out to be investigated and addressed, among others, which this research has done.

3. Literature Review

3.1. Theoretical Literature

Hitherto, there is no unified explanation of the impact of public debt on economic growth in both developed and developing countries.

In economic literature, the impact of public debt on economic growth is underpinned by three key theoretical arguments:

One argument is that there is a negative impact of public debt on economic growth. Proponents of this argument, including Modigliani [14] and Diamond [3], believe that economic growth will be hampered by large debt levels. They are of the view that financing public debt has the effect of crowding out private investment which translates into poor economic growth.

Another argument is that there is a positive impact of public debt on economic growth. The Keynesian theorists are the

proponents of this argument and they believe that fiscal policy aimed at financing public debt has expansionary effects on the economy, if and only if, the resources are productively employed. They opine that financing budget deficits has the effect of increasing the aggregate demand which improves economic growth.

The third argument, according to the Ricardian Equivalence Hypothesis (REH), reveals that there exists no relationship between public debt and economic growth. According to the proponents of this argument, public debts are repaid through future taxes and payment of future taxes encourages savings against current consumption. They are of the view that the impact of public debt on economic growth is neutralised since interest rates and private consumption are unaffected.

3.2. Empirical Literature

A number of empirical studies have been carried out by many economists over time to ascertain the impact of public debt on economic growth in developing countries. The undermentioned researchers have conducted empirical studies on the impact of public debt on economic growth in different countries.

Yusuf and Saidatulakmal [21] examine the impact of public debt on Economic growth in Nigeria using time series data from 1980 to 2018. Domestic debt and external debt were used as measures of public debt. The study employed the Autoregressive Distributed Lag (ARDL) approach to analyse the data. Authors find that domestic debt negatively and significantly impacted Nigeria's economic growth in the short run while it had positive impacts on the country's growth in the long run. On the contrary, external debt retarded the country's long term growth for the period under study. The regression results also reveal that debt servicing had an adverse effect on the economic growth in Nigeria.

Maxwell et al. [12] assess the long run impact of external debt on economic growth in Nigeria applying a dynamic variant of the Autoregressive Distributed Lag (ARDL) model. The study shows that external debt accumulation and its associated debt service payments exert negative impacts on the country's economic growth in the long run.

Bangura [2] examines the effects of public debt (i.e. domestic debt and external debt) on economic growth in Sierra Leone for the period covering 1980 to 2015. The study employs the ordinary least squares method and the variables in the model are real GDP (the regressand), external debt, domestic debt and exchange rate (the regressors). The author concludes that, for the period under investigation, external debt negatively impacted the country's economic growth while domestic debt exerts a positive effect on growth.

Saungweme and Odhiambo [17] examine the impact of public debt on the economic growth in Zimbabwe using Autoregressive Distributed Lag (ARDL) approach for the period 1970 to 2017. The study reveals that domestic debt nega-

tively affected economic growth of Zimbabwe in higher proportion than the external debt.

Lim [9] revisits the debt-growth relationship from a vantage point that takes into consideration the total private and public debt using study sample of 41 countries covering the period 1952 to 2016. The study employs a vector autoregression (VAR) model as its baseline and uses the generalised method of moments (GMM) to estimate the panel VAR. The finding reveals a negative association between the rate of total debt accumulation and economic growth, with a one standard deviation innovation in the former causing a 0.2 percentage point reduction in the latter.

Favour et al [5] investigate the relationship between public debt and economic growth in Nigeria for the period 1985 to 2015 using the Vector Error Correction Model (VECM) and Granger Causality test. Authors conclude that public debt negatively impacted the economy and they attributed the negative result to misallocation of borrowed funds.

Michael et al [13] undertake an empirical investigation of public debt-economic growth nexus using multiple regression analysis, ARDL and Chow breakpoint test. The study reveals a negative nexus between the two variables.

Johnson [7] investigates the effect of large stock of public debt and its servicing requirements on the economic growth of Sierra Leone and South Africa using the neo-classical growth model. He finds out that public debt and its servicing requirements negatively affected the economic growth of both economies.

Snieska and Burksaitiene [19] analyse the effect of changes in real private debt, real public debt and deflated house prices on Gross Domestic Product (GDP) in 24 European Union (EU) countries by adopting an ordinary least squares (OLS) and autoregressive (AR) model with cross - section data. The authors excluded small eurozone countries from the analysis as a result of fluctuations of their small economies precipitated by the volatile effect of offshoring financial services on their growth dynamics. The authors suggest a negative and significant effect of public debt growth on the economies in the 24 EU countries obviously observed when evaluated using zero, one, and two year lags.

Haffner et al. [6] examine the impact of domestic debt on economic growth in Sierra Leone for the period 1970 to 2015 using the Autoregressive Distributed Lag (ARDL) approach. The authors conclude that domestic debt had a negative and significant impact on the country's economic growth both in the short run and in the long run.

Lucky and Godday [10] using simple and multiple regression analyses empirically investigated the relationship between public debt and economic growth of Nigeria for the period covering 1990 to 2015. The variables employed in the analysis included external debt, domestic debt, gross domestic product (GDP) and total debt. The findings of the simple regression analysis revealed that public debt impacted positively on the economic growth of Nigeria.

Khan et al. [8] investigate the effect of public debt on the

economic growth of Pakistan using quantitative research method as secondary data covering the period 1972 to 2013. Inferential analyses were used to determine the data meant for this study. The study reveals a positive relationship between public debt and economic growth in Pakistan.

Ejigayehu [4] carries out an empirical study on the impact of public debt on the economic growth of 8 (eight) heavily indebted African countries (Senegal, Mali, Benin, Umarunda, Ethiopia, Tanzania, Mozambique and Madagascar) using panel data for the period spanning between 1991 and 2010 through debt overhang and debt crowding out effect with public debt-gross national income ratio as a proxy for debt overhang and debt service-export ratio as a proxy for debt crowding out. The study applied Augmented Dickey-Fuller (ADF) tests, heteroscedasticity and ordinary regression and the author concludes that public debt negatively affected the economic growth of the said countries through debt crowding out instead of debt overhang.

Sulaiman and Azeez [20] examine the impact of public debt on the economic growth of Sierra Leone employing time series data for the period 1970 to 2010. The study applied Ordinary Least squares (OLS) technique, Augmented Dickey-Fuller unit roots test, Johansen Co-integration test and Error correction method. The findings show that public debt has a positive effect on the country's economic growth for the said period.

Sheikh et al. [18] using the OLS technique examine the impact on economic growth of domestic debt in Pakistan between 1972 and 2009. The study reveals a positive relationship between domestic debt stock and economic growth in Pakistan. The study also shows a negative relationship between domestic debt servicing and economic growth. The findings of the study show that the positive impact on economic growth of domestic debt is less than the impact on economic growth of domestic debt servicing.

4. Model Specification, Description of Variables and Estimation Procedures

Before the parameters are estimated and various hypothesis tests carried out, a major procedure for any good research that employs econometric technique requires the reiteration of the relevance of considering data producing process underpinning the variables. The application of this approach helps avoid the issue of erroneous correlation that exists between variables in a specified regression equation.

The Ordinary Least Squares (OLS) method assumes that the data are stationary when making estimates with time series data. Stationarity is defined as the absence of a systematic change in the moments of the distribution (mean, variance, etc.) across time. However, this is not always the case as autocorrelation, a likely cause of non-stationarity, may be present in the error terms arising from subsequent observations. The series will be non-stationary if the distribution's

moments employed in drawing a series of observations are not time invariant (i.e. not constant), but rather vary on the time point at which the observations were made. The state of a variable being steady first of all needs to be ascertained before testing such a claim.

Unit Root Test

In accordance with the recent advancements in time series modeling, unit root tests of the variables in a model need to be carried out to ascertain their time series qualities. The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) class of tests will be conducted to determine the order of integration of each series. The ADF test equation is identified as:

$$\Delta x_t = \alpha + \delta x_{t-1} + \dots \sum_{i=1}^k \delta_i \Delta x_{t-i} + \dots \delta_m \Delta x_{t-m} + \varepsilon_t \quad (1)$$

$$\Delta x_t = \alpha + \beta_t + \delta x_{t-1} + \dots \sum_{i=1}^k \delta_i \Delta x_{t-i} + \dots \delta_m \Delta x_{t-m} + \varepsilon_t \quad (2)$$

Clearly, equation (1) has an intercept without a time trend while equation (2) has not only an intercept but also a time trend. A constant is represented by α ; an autoregressive process coefficient is represented by δ ; a difference operator is depicted by Δ ; a time trend is denoted by t ; a variable is denoted by x ; a number of lags is denoted by k ; and a stochastic error term is represented by ε . The test model is supplemented with lag differences of the variables in order to minimise the issues of autocorrelation in the disturbance term. The Schwarz Bayesian Criterion (SBC) and the Akaike Information Criterion (AIC) are used to establish the ideal lag length k in equations (1) and (2).

The Phillips-Perron test equation and the Augmented Dickey-Fuller test equation are similar but the difference lies in the omission of the lag k from Phillips-Perron test equation to adjust for the standard error in view to correcting for heteroscedasticity and autocorrelation. The PP test equation is consequently specified as:

$$\Delta x_t = \alpha + \delta x_{t-1} + \dots \sum_{i=1}^k \delta_i \Delta x_{t-i} + \dots \delta_m \Delta x_{t-m} + \varepsilon_t \quad (3)$$

The tests rely on rejecting the null hypothesis of a unit root (the series are non-stationary) in favour of the alternative hypothesis of no unit root (the series are stationary). If the absolute values of the ADF and PP test statistics are higher than the critical values, we reject the null hypothesis of non-stationary and conclude that the series is stationary. On the other hand, we accept the null hypothesis and conclude that the series is non-stationary if the absolute values of the ADF and PP statistics are less than the critical levels.

Bounds Test of Co-integration and Error Correction Model

The study employs the Autoregressive Distributed Lag (ARDL) approach to estimate the models. An ARDL model is a dynamic model which uses lags of the explained and explanatory variables to estimate the short-run effects as well as the long-run equilibrium relationship between the variables using a single equation.

Since public debt portfolio comprises both domestic and external debt, the focus here is to ascertain the impacts of both domestic and external debt on economic growth in Sierra Leone.

Empirically, to ascertain the impact of domestic debt on economic growth in Sierra Leone, we develop an Autoregressive Distributed Lag (ARDL) model predicated on a modified neoclassical growth function to examine the dynamic relationship between the dependent variable (economic growth) and domestic debt (stock of current domestic debt inflow, domestic debt service, export growth and private investment).

$$\text{GDPGR} = f(\text{DDGDP}, \text{DDSEXP}, \text{EXPGR}, \text{PRINVGDP}) \quad (4)$$

Where all the variables are expressed in logarithmic form:

GDPGR = GDP growth rate

DDGDP = stock of current domestic debt inflow to GDP ratio

DDSEXP = domestic debt service as a ratio of export earnings

EXPGR = export growth

PRINVGDP = private investment as a ratio of GDP

The model, equation (5), is simply specified to capture the impact of domestic growth on economic growth having included the impactful control variables.

$$\ln \text{GDPGR}_t = \beta_0 + \beta_1 \ln \text{DDGDP}_t + \beta_2 \ln \text{DDSEXP}_t + \beta_3 \ln \text{EXPGR}_t + \beta_4 \ln \text{PRINVGDP}_t + \varepsilon_t \quad (5)$$

To study the short run and long run relationships between the variables, equation (5) is transformed into an Error Correction Model form of the ARDL model which is denoted by equation (6).

$$\begin{aligned} \Delta \ln \text{GDPGR}_t = & \beta_0 + \sum_{i=1}^p \beta_1 \Delta \ln \text{GDPGR}_{t-i} + \sum_{i=1}^p \beta_2 \Delta \ln \text{DDGDP}_{t-i} + \\ & \sum_{i=1}^p \beta_3 \Delta \ln \text{DDSEXP}_{t-i} + \sum_{i=1}^p \beta_4 \Delta \ln \text{EXPGR}_{t-i} + \\ & \sum_{i=1}^p \beta_5 \Delta \ln \text{PRINVGDP}_{t-i} + \delta_1 \ln \text{GDPGR}_{t-1} + \\ & \delta_2 \ln \text{DDGDP}_{t-1} + \delta_3 \ln \text{DDSEXP}_{t-1} + \delta_4 \ln \text{EXPGR}_{t-1} + \\ & \delta_5 \ln \text{PRINVGDP}_{t-1} + \lambda \text{ECM}_{t-1} + \varepsilon_t \end{aligned} \quad (6)$$

The employment of the bounds test is one of the major reasons why the ARDL model estimation technique is used. This helps examine the long run relationship between the variables. The bounds test by Pesaran and Shin [15] is, therefore, employed to test for co-integration in an ARDL model.

From equation (6), the coefficients $\delta_1, \delta_2, \delta_3, \delta_4, \delta_5$ represent the long run relationship in the model. To perform the bounds test on equation (6) given the long-run coefficients, the F-statistic will be used to test the following hypothesis:

$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$ Null hypothesis of no co-integration against the alternative,

$H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0$ existence of a co-integration.

The result of bounds test provides a joint F-statistic, lower bound critical value and upper bound critical value. To test the hypotheses above, we examine the calculated F-statistic against the critical values. If the estimated F-statistic exceeds the upper bound critical value, we reject the null hypothesis, H_0 , and conclude that the variables are co-integrated. However, if the F-statistic is less than the lower bound critical value, we accept the null hypothesis, H_0 , implying there is no long run relationship between the variables.

After confirming the existence of a long-run relationship between the variables from the bounds test, we can then move on to estimating the long and short-run coefficients. Here, equation (6) is transformed to capture the short-run dynamics as can be seen in the equation (7). From equation (4), we derive an Error Correction Model to help determine the short run impacts of domestic debt on economic growth as shown in equation 7.

$$\Delta \ln GDPGR_t = \alpha_0 + \sum_{i=1}^{m_1} \partial_i \Delta \ln GDPGR_{t-1} + \sum_{i=0}^{m_2} \eta_i \Delta \ln DDGDP_{t-1} + \sum_{i=0}^{m_3} \theta_i \Delta \ln DDSEXP_{t-1} + \sum_{i=0}^{m_4} \tau_i \Delta \ln EXPGR_{t-1} + \sum_{i=0}^{m_5} \varphi_i \Delta \ln PRINV GDP_{t-1} + \lambda ECM_{t-1} + \varepsilon_t \quad (7)$$

Equation (7) represents the short run dynamics of ARDL error correction form, where the lags of our explained and explanatory variables are captured.

After establishing the long-run relationship between the variables, we then test for the short-run dynamics as in equation (7). The short run dynamics is adjusted to capture a one period lag of the error correction term. The Error Correction term, $EC T_{-1}$, refers to the speed of adjustment parameter which explains the rate at which the variables return to their long run equilibrium after an exogenous shock. A negative Error Correction term shows an effective feedback, signifying a quick convergence to the long run equilibrium after a disequilibrium or shock. Conversely, a positive Error Correction term implies a slower feedback or divergence from the long run equilibrium after a shock. If the Error Correction term is zero, then there is no adjustment.

For our empirical study, to ascertain the impact of external debt on economic growth in Sierra Leone, we examine the dynamic relationship between economic growth and external debt (stock of current external debt inflow, external debt service, export growth and private investment).

$$GDPGR = f(EDGDP, EDSEXP, EXPGR, PRINV GDP) \quad (8)$$

Where,

EDGDP = external debt-to-GDP ratio

EDSEXP = external debt service-to-export ratio

Other variables are defined as before.

The model, equation (9), is simply constructed to capture the nexus between economic growth and external debt with the enclosure of control variables that have impact on it.

$$\ln GDPGR_t = \beta_0 + \beta_1 \ln EDGDP_t + \beta_2 \ln EDSEXP_t + \beta_3 \ln EXPGR_t + \beta_4 \ln PRINV GDP_t + \varepsilon_t \quad (9)$$

To study the short run and long run relationships between the variables, the equation (6) is transformed into an Error Correction Model form of the ARDL model. This is represented by equation (10).

$$\Delta \ln GDPGR_t = \beta_0 + \sum_{i=1}^p \beta_1 \Delta \ln GDPGR_{t-1} + \sum_{i=1}^p \beta_2 \ln EDGDP_{t-1} + \sum_{i=1}^p \beta_3 \Delta \ln EDSEXP_{t-1} + \sum_{i=1}^p \beta_4 \Delta \ln EXPGR_{t-1} + \sum_{i=1}^p \beta_5 \Delta \ln PRINV GDP_{t-1} + \delta_1 \ln GDPGR_{t-1} + \delta_2 \ln EDGDP_{t-1} + \delta_3 \ln EDSEXP_{t-1} + \delta_4 \ln EXPGR_{t-1} + \delta_5 \ln PRINV GDP_{t-1} + \lambda ECM_{t-1} + \varepsilon_t \quad (10)$$

From equation (7), the coefficients $\delta_1, \delta_2, \delta_3, \delta_4, \delta_5$ represent the long run relationship in the model. To perform the bounds test on equation (10) given the long-run coefficients, the F-statistic will be used to test the following hypothesis:

$H_0: \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$ Null hypothesis of no co-integration against the alternative,

$H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0$ existence of a co-integration.

After confirming the existence of a long-run relationship between our variables from the bounds test, we can then move on to estimating the long and short-run coefficients. To this end, equation (8) is transformed to capture the short-run dynamics as can be seen in equation (11).

From equation (9), we derive an Error Correction Model to help us measure the short run impacts of external debt on economic growth as seen in equation (11).

$$\Delta \ln GDPGR_t = \alpha_0 + \sum_{i=1}^{m_1} \partial_i \Delta \ln GDPGR_{t-1} + \sum_{i=0}^{m_2} \eta_i \Delta \ln EDGDP_{t-1} + \sum_{i=0}^{m_3} \theta_i \Delta \ln EDSEXP_{t-1} + \sum_{i=0}^{m_4} \tau_i \Delta \ln EXPGR_{t-1} + \sum_{i=0}^{m_5} \varphi_i \Delta \ln PRINV GDP_{t-1} + \lambda ECM_{t-1} + \varepsilon_t \quad (11)$$

Equation (11) represents the short run dynamics of ARDL error correction form. The lags of our explained and explanatory variables are captured.

4.1. Summary of Estimation Technique

Given that the models deal with macroeconomic variables, there is need to test for the stationarity of each of the variables of the stochastic equations. The importance of this obtains from the fact that estimation with non-stationary variables leads to biased and inconsistent estimates of the standard errors of the coefficients and this leads to misleading inferences if appropriate technique is not applied to overcome this problem. Put another way, a regression carried out with such non-stationary series gives spurious results and such regression is appropriately referred to as 'spurious' or 'non-sense' regression. In the bid to systematically address the problem of spurious correlation that arises when non-

stationary series are present in regression models, this study deems it fit to carry out appropriate tests for stationarity. The tests for stationarity were, therefore, carried out using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The use of both the ADF and the PP class of tests rests on the ground that the former assumes that the residuals from the test regression are white noise while the latter makes no assumption about these residuals.

There is also a need to conduct multicollinearity test to ascertain whether the independent variables in a model are correlated. Running a regression with independent variables that are correlated also gives a spurious or misleading result. Multicollinearity among independent variables is a problem as it results in less reliable statistical inferences. It undermines the statistical significance of an independent variable. Multicollinearity reduces the precision of the estimated coefficients which weakens the statistical power of a regression model. If an estimation is carried out using correlated independent variables, the P-values will not be trusted to identify variables that are statistically significant. In general, multicollinearity can lead to wider confidence intervals that produce less reliable probabilities in terms of the effect of independent variables in a model. The existence of multicollinearity in a data set can lead to less reliable results due to larger statistical errors. Both stationarity and multicollinearity tests are referred to as pre-estimation tests.

In estimating the model, the study then carries out the co-integration test using the autoregressive distributed lag (ARDL) bounds test to ascertain the long run relationship between the dependent variable and the independent variables of the model. Testing for co-integration implies testing for long run relationship among the variables of the model.

The study then carries out the post-estimation tests, otherwise called diagnostic tests, to validate the model employed. The diagnostic tests are meant to confirm whether the model is good enough to inform policy. The diagnostic tests carried out in the study include:

- i. Breusch-Pagan-Godfrey serial correlation test: testing for the presence or absence of serial correlation in the residuals.
- ii. Heteroscedasticity test: testing for the presence or absence of heteroscedasticity in the models.
- iii. Jarque-Bera residual distribution test: testing the normality of the residuals.

- iv. Ramsey RESET test: testing whether the models were correctly specified.

Note: RESET=Regression Specification Error Test

4.2. Data Sources

The data sets employed in conducting the analysis in this study were obtained from annual time series for the period 1973-2022 on key macroeconomic variables including GDP growth rate, stock of external debt to GDP ratio, debt service as a ratio of export earnings. The analysis in this study was carried out using data obtained from various sources: Ministry of Finance, Bank of Sierra Leone, Sierra Leone Central Statistics Office (Statistics Sierra Leone), International Financial Statistics (IFS), World Bank and World Debt Tables-various issues.

5. Presentation and Analysis of Empirical Results

5.1. Empirical Results of Domestic Debt

This section concerns the relationship between domestic debt and economic growth in Sierra Leone for the period 1973-2022. The section starts with the discussion of the correlation matrix of the model followed by time series analysis of stationarity and co-integration before discussing the long run and short run estimations of the model.

5.1.1. Correlation Results

Before estimating the regressions for the model, a straightforward correlation study between economic growth and the explanatory variables was conducted. The results are presented in Table 1. The table shows that there is a moderately negative correlation between GDP growth rate and domestic debt, as well as between GDP growth rate and domestic debt service to export ratio. There is a moderate but positive correlation between economic growth, private investment and export growth as could be predicted.

Table 1. Correlation Matrix of the Model.

	GDPGR	DDGDP	DDSEXP	EXPGR	PRINVGDP
GDPGR	1.0000				
DDGDP	-0.3107	1.0000			
DDSEXP	-0.2606	0.5489	1.0000		
EXPGR	0.0939	0.0613	0.0188	1.0000	
PRINVGDP	0.0642	-0.2564	-0.2361	-0.0385	1.0000

There is absence of multicollinearity among the variables in the model as seen in Table 1 which is supported by Kennedy (2008) who suggested a threshold of a correlation coefficient of above 0.7, arguing that if the coefficient exceeds this level, it could cause a serious multicollinearity problem which will lead to inefficient estimation and less reliable results. The estimates in this study are all below 0.7 and therefore the variables are maintained.

5.1.2. Unit Root Test Results

The results of unit root tests based on the Augmented

Dick Fuller (ADF) and Phillips-Perron (PP) tests are presented in Table 2. The tests showed that GDP growth is stationary since the ADF test statistic of negative -5.4115 is less than the critical value at 5%. The p-value is less than 0.05. This also holds for export growth variable whose p-value is less than or equal to the critical value at 5% and therefore stationary at level. On the other hand, domestic debt stock, domestic debt service and private investment were stationary at first difference implying they are integrated of order I(1).

Table 2. Unit Root Tests for the Model.

Augmented Dickey-Fuller (ADF) Tests						
Variable	Level/ Δ Level	Constant and No Trend		Constant and Trend		Conclusion
		Test Statistics	ADF critical values (5%)	Test Statistics	ADF critical values (5%)	
GDPGR	Level	-5.4115**	-2.7344	-6.1138**	-3.6274	I(0)
DDGDP	Level	-2.7428	-2.8623	-3.1492	-3.5827	I(1)
	Δ Level	-7.8288**	-2.8324	-7.9029**	-3.4334	
DDSEXP	Level	-1.9651	-2.9925	-1.8901	-3.5381	I(1)
	Δ Level	-13.2422**	-2.8294	-13.2651**	-3.6222	
EXPGR	Level	-5.4812**	-2.8619	-5.5367**	-3.4399	I(0)
PRINVGDGP	Level	-1.4041	-2.8337	-9.7227**	-3.4269	I(1)
	Δ Level	-7.3555**	-2.9053	-18.2661**	-3.6301	

Phillips-Perron (PP) Tests						
Variable	Level/ Δ Level	Constant and No Trend		Constant and Trend		Conclusion
		Test Statistics	PP critical values (5%)	Test Statistics	PP critical values (5%)	
GDPGR	Level	-5.7581**	-2.8111	-6.2824**	-3.6802	I(0)
DDGDP	Level	-2.9268	-2.8777	-2.9229	-3.5888	I(1)
	Δ Level	-8.7171**	-2.9005	-9.3424**	-3.6221	
DDSEXP	Level	-3.8872**	-2.9117	-3.9028**	-3.5277	I(0)
EXPGR	Level	-5.4664**	-2.9333	-5.8282**	-3.6279	I(0)
PRINVGDGP	Level	-5.9414**	-2.8714	-5.9914**	-3.7757	I(0)

5.1.3. Optimal Lag Length for the Model

We first of all need to establish an estimate of a VAR to select the appropriate number of lags for inclusion into the models. This will help us with estimation and decision regarding the most optimal lag length for the model and for the variables. The literature prescribes five different criteria for optimal lag length selection namely, Likelihood Ratio (LR),

Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn information criterion (HQ). Table 3 presents the results of the optimal lag length. Based on the selection criteria, it is shown that the optimal lag length is zero (0). The study, therefore, employs zero (0) lag for each variable in the model based on the AIC criteria.

Table 3. Optimal Lag Selection for the Model.

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	-40.11456	NA*	0.5651*	2.438744*	2.82909*	2.623468*
1	-39.19519	1.512236	0.662709	2.492237	2.822112	2.4588861
2	-38.99454	0.348819	0.666913	2.416607	2.825756	2.6655494
3	-38.88444	0.008844	0.700194	2.532518	2.897771	2.6966763
4	-38.72559	0.342911	0.734708	2.536133	3.072919	2.6971128
5	-38.19962	0.654525	0.771729	2.555926	3.144122	2.7011196

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SIC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

5.1.4. Co-integration Test

We conducted co-integration test using the Auto Regressive Distributed Lag (ARDL) model based on the unit root test results presented in Table 2. This is meant to capture the existence of a long run relationship between the endogenous and exogenous variables. According to the decision rule, we can reject the null hypothesis of non-existence of co-integration if the F-statistic is greater than the upper bound (limit) at the 1%, 5% and 10% significance levels. Looking at the results presented in Table 4, the F-statistic (6.63965) is found to be greater than the upper bound (1), at the 1% and 5% levels of significance which leads to the conclusion that there is co-integration, implying the existence of a long run relationship among the variables.

Table 4. ARDL Bounds Test for the Model.

Test Statistic	Value	K
F-statistic	6.63965	4
Critical Value Bounds		
Significance	I(0)	I(1)

Test Statistic	Value	K
10%	1.87	2.84
5%	2.12	3.14
2.5%	2.44	3.47
1%	2.61	3.76

5.1.5. ARDL Long Run Results

The bounds test showed that there was co-integration among the variables when lnGDPGR was used as an endogenous variable. The equation for the long run coefficients was then estimated. The long run result as presented in Table 5 is reported using AIC which reveals a negative relationship between domestic debt and economic growth. The coefficient is statistically significant at the 5% significance level. It has a p-value of 0.0264 which is less than 0.05.

A 1% increase in domestic debt stock would result in decline in growth of GDP by 0.376%. This finding is in conformity with the studies by Yusuf and Saidatulakmal (2021), Saungweme and Odhiambo (2020), and Haffner et al. (2017) who conclude that accumulated domestic debt stock negatively affects economic growth. This has a negative implication for public debt management as more loans will be procured to service the old debt which will further increase the

country's debt burden.

Table 5. ARDL Long Run Coefficient Estimation of the Model.

Dependent Variable: lnGDPGR				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
lnDDGDP	-0.376512	0.173021	-2.265443	0.0264**
lnDDSEXP	-0.47559	0.122113	-4.303334	0.0000***
lnEXPGR	-0.95838	0.105324	-9.303033	0.0000***
lnPRINVGD	0.478714	0.216431	2.292219	0.0281**
C	-0.026081	1.911196	-0.023456	0.9923

Source: Authors's computation

Note: *, **, *** means significance at the 10, 5 and 1 percent levels respectively. The results are from the ARDL

The relationship between economic growth and domestic debt service to export ratio was discovered to be unfavorable over the period under study. The study revealed that the domestic debt service coefficient was statistically significant at the 5% level of significance. The crowding out effect created by an increase in domestic debt stock is the most significant negative effect of domestic debt service. The finding revealed that economic growth will decline by 0.475% for every 1% increase in domestic debt service. This finding is consistent with the study by Sheikh et al (2010) who opine that debt servicing negatively affects economic growth. Debt servicing has the effect of increasing the country's level of borrowing since export earnings are often insufficient to service debt.

Export growth (EXPGR) is found to impact economic growth negatively in the long run. The coefficient (-0.95838) is statistically significant.

Economic growth and private investment (PRINVGD) are positively related throughout the study period. The findings indicate that an increase of 1% in private investment will lead to an increase of 0.478 % in economic growth. It was revealed that the coefficient of private investment was statistically significant at the 5% level of significance

5.1.6. ARDL Short Run Results

The ARDL short run results are presented in Table 6. Findings reveal that economic growth in the present is influenced by economic growth in earlier time periods. The coefficient is positive (0.078443) and statistically significant at the 5% level. Economic growth will rise by 0.078% in the short term or present period for every 1% rise in growth from the preceding period.

Table 6. ARDL Short Run Coefficient Estimation of the Model.

Dependent Variable: Δ lnGDPGR				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.972221	0.555253	5.344974	0.0000***
D(lnGDPGR(-1))	0.078443	0.023323	4.090951	0.0000***
D(lnDDGDP)	-0.087761	0.034434	-3.218887	0.0014***
D(lnDDSEXP)	-0.256639	0.026666	-5.454532	0.0000***
D(lnEXPGR)	0.126678	0.029449	4.149998	0.0000***
D(lnPRINVGD)	0.160001	0.077784	2.622243	0.0097***
ECM(-1)	-1.441117	0.234356	-6.496902	0.0000***
R-squared	0.681873	Mean dependent var		0.000000

Dependent Variable: $\Delta \ln GDPGR$				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Adjusted R-squared	0.598476	S.D. dependent var		1.132262
S.E. of regression	0.736862	Akaike information criterion		2.399225
Sum squared resid	16.968144	Schwarz information criterion		2.710441
Log likelihood	-41.456674	Hannan-Quinn criterion		2.559910
F-statistic	7.419999	Durbin-Watson stat		2.277448
Prob(F-statistic)	0.000005			

Also, it is shown that domestic debt (DDGDP) had a short-term negative effect on economic growth. The impact is statistically significant and strong. Short-term economic growth will fall by 0.087% for every 1% rise in domestic debt.

Economic growth in the short run is negatively and statistically impacted by domestic debt service as a ratio of export (DDSEXP). Economic growth will fall by 0.256% as a result of a 1% increase in domestic debt service.

Export growth (EXPGR) in the short run impacted economic growth positively with a statistically significant coefficient. The correlation value is 0.126678, implying that a 1% rise in export growth will result in a 0.126% increase in GDP growth.

Private investment (PRINVGDP) had a positive short run correlation with economic growth. The results reveal that a 1% rise in private investment will lead to 0.160% rise in economic growth. The coefficient is statistically significant at the 5% level of significance.

The results of the diagnostic tests performed on the predicted ARDL model are presented in Table 7. The results are

as follows:

1. Since the probability value is greater than 5% (p-value = 0.1083 > 0.05), the null hypothesis, which assumes there is no serial correlation in the model, can be accepted in the Breusch-Godfrey serial correlation test.
2. The null hypothesis, which states that there is no heteroscedasticity in the model, is accepted in the Breusch-Pagan-Godfrey test at a 5% significance level as the probability value exceeds 5% (p-value = 0.1278 > 0.05).
3. In the Ramsey-RESET test, the null hypothesis that assumes there is no specification (identification) error in the model can be accepted at a 5% significance level since the p-value is greater than 0.05. The study concludes that the model has no specification error.
4. In the Jarque-Bera test, at a 5% significance level, we accept the null hypothesis which shows that the residual distribution is normal as the probability value is greater than 5% (0.4467 > 0.05). The study concludes that the residues of the ARDL model are normally distributed.

Table 7. Diagnostic Tests.

Diagnostic Tests	Statistic	p-value
Breusch-Godfrey Serial Correlation LM Test	2.716673 (F-stat.)	0.1083
Heteroscedasticity Test: Breusch-Pagan-Godfrey	1.727717 (F-stat.)	0.1278
Heteroscedasticity Test: ARCH	0.032236 (F-stat.)	0.8713
Ramsey RESET Test	1.086651 (F-stat.)	0.3131
Normality Test (Jarque-Bera)	1.668593 (JB-stat.)	0.4467

5.2. Empirical Results of External Debt

This section focuses on the relationship between external

debt and economic growth in Sierra Leone for the period 1973-2022. This section first of all discusses the correlation matrix of the model. Thereafter, time series analysis of stationarity and co-integration are presented followed by the

discussion of the long run and short run estimations of the model.

5.2.1. Correlation Results

Prior to running the regressions, a simple correlation analysis between economic growth and the explanatory variables was carried out. The results are reported in Table 8. The table

shows that there is relatively moderate negative correlation between economic growth (GDPGR) and external debt (EDGDP) and between economic growth and external debt service as a ratio of export earnings. The relationships between export growth, private investment and economic growth are moderate but positive as would be expected.

Table 8. Correlation Matrix of the Model.

	GDPGR	EDGDP	EDSEXP	EXPGR	PRINVGDP
GDPGR	1.0000				
EDGDP	-0.3550	1.0000			
EDSEXP	-0.2995	0.3727	1.0000		
EXPGR	0.0925	0.0428	-0.0422	1.0000	
PRINVGDP	0.0638	-0.3705	-0.2119	-0.0393	1.0000

In Table 8, there is absence of multicollinearity among the variables in the model. This is supported by Kennedy (2008) who suggested a threshold of a correlation coefficient of above 0.7, arguing that if the coefficient is above this level, it could cause a serious multicollinearity problem leading to inefficient estimation and less reliable results. In this study the estimates are all below 0.70 and therefore the variables are maintained.

5.2.2. Unit Root Test Results

Table 9 presents the results of unit root tests based on the Augmented Dickey-Fuller (ADF) test and Phillips-Perron

(PP) test and the findings are presented. According to the unit root tests, it is noted that GDP growth rate is stationary since the ADF test statistic of negative 5.5106 is less than the critical value at 5%. The p-value is less than 0.05. The null hypothesis states that the variable has unit root, or it is non-stationary which means p-value is greater than 0.05. In this case the p-value is 0.00 implying that the null hypothesis is rejected. This is also the case with export growth variable whose p-value is less than or equal to the critical value at 5% and therefore stationary at level i.e. integrated of order I(0). On the other hand, external debt was stationary at first difference thus integrated of order I(1).

Table 9. Unit Root Tests for the Model.

Augmented Dickey-Fuller (ADF) Tests						
Variable	Level/ Δ Level	Constant and No Trend		Constant and Trend		Conclusion
		Test Statistic	ADF critical values (5%)	Test Statistic	ADF critical values (5%)	
GDPGR	Level	-5.5106**	-2.9281	-6.1094**	-3.5131	I(0)
EDGDP	Level	-1.7008	-2.9281	-1.7390	-3.5131	I(1)
	Δ Level	-6.0230**	-2.9297	-5.9338**	-3.5181	
EDSEXP	Level	-4.3373**	-2.9281	-4.2934**	-3.5131	I(0)
EXPGR	Level	-5.4709**	-2.9281	-5.5179**	-3.5131	I(0)
PRINVGDP	Level	-1.3718	-2.9331	-9.6341**	-3.5181	I(0)
	Δ Level	-7.3622**	-2.9331	-18.1807**	-3.5181	

Phillips-Perron (PP) Tests						
Variable	Level/ Δ Level	Constant and No Trend		Constant and Trend		Conclusion
		Test Statistic	PP critical values (5%)	Test Statistic	PP critical values (5%)	
GDPGR	Level	-5.7921**	-2.9281	-6.1918**	-3.5131	I(0)
EDGDP	Level	-1.6859	-2.9281	-1.6419	-3.5131	I(1)
	Δ Level	-6.0044**	-2.9297	-9.1114**	-3.5155	
EDSEXP	Level	-4.4334**	-2.9281	-4.3838**	-3.5131	I(0)
EXPGR	Level	-5.3611**	-2.9281	-5.6073**	-3.5131	I(0)
PRINVGDP	Level	-5.8690**	-2.9281	-5.8914**	-3.5131	I(0)

The results from the ADF and PP tests found that the series are integrated of different orders. The variables GDPGR, EDSEXP, EXPGR, and PRINVGDP are integrated of order zero i.e. I(0). That is, they are stationary at their levels.

After confirming the order of integration of the variables, it is then confirmed that no variable is integrated of the order 2, i.e. I(2). There is also a mix of I(0) and I(1). Therefore, since the interest is to estimate the short run and long run relationships between the variables, an ARDL model will be the appropriate model for the study. The study, therefore, proceeds to estimate an ARDL model.

5.2.3. Optimal Lag Length for the Model

The models were evaluated and the ARDL was chosen. It is imperative that we examine how well other models perform in terms of minimising the Akaike Information Criterion (AIC). This procedure is important as it will help us use a model with Gaussian error terms. That is, error terms without non-normality, autocorrelation or heteroscedasticity problems. The main selection criteria used are sequential modified LR test statistic, Final Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC) or Hannan-Quinn Criterion (HQC). The results can be found in [table 10](#).

Table 10. Optimal Lag Selection for the Model.

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	-31.79330	NA*	0.609556*	2.331046	2.730992*	2.469107*
1	-30.78625	1.438633	0.612090	2.330643*	2.775028	2.484045
2	-30.63740	0.204150	0.646242	2.379280	2.868103	2.548022
3	-30.55267	0.111352	0.685671	2.431581	2.964843	2.615663
4	-30.21012	0.430631	0.717899	2.469150	3.046851	2.668572
5	-29.89202	0.381730	0.753924	2.508115	3.130254	2.722878

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SIC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

5.2.4. Co-Integration Test

Based on the unit root test results presented in Table 9, we performed co-integration test using the ARDL model. From the result presented in Table 11, the F-statistic (6.560956) is found to be greater than the upper bound (1), at the 1% and 5% levels of significance. Therefore, the study concludes that there is co-integration, indicating that there exists a long run relationship among the variables.

The null hypothesis of our bounds tests as stated previously is that there exists no long run relationship between our variables and it is tested against the existence of a long-run relationship. From the bounds test results in Table 11, we have an F-statistic of 6.560956. Comparing that to the critical values, we can reject the null hypothesis of no long-run relationship as the F-statistic value exceeds the 5% critical value for the upper bound. Consequently, we reach the conclusion that there exists a long run relationship between our variables.

Table 11. ARDL Bounds Test.

Test Statistic	Value	K
F-statistic	6.560956	4
Critical Value Bounds		

Test Statistic	Value	K
Significance	I(0)	I(1)
10%	1.85	2.85
5%	2.11	3.15
2.5%	2.33	3.42
1%	2.62	3.77

Source: Authors's computation.

Note: The results are from the ARDL model

After confirming the long run relationship between our variables, we proceed to estimate the long run coefficients. The results are presented in Table 12.

5.2.5. ARDL Long Run Results

Given that the bounds test revealed the existence of co-integration when lnGDPGR was used as an endogenous variable, the equation was hence estimated for the long run coefficients. From Table 12, the long run result is reported using AIC and the result revealed a negative relationship between external debt and economic growth with statistically significant coefficient at the 5% significance level.

Table 12. ARDL Long Run Coefficient Estimation of the Model.

Dependent Variable: lnGDPGR				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LnEDGDP	-0.480227	0.118498	-4.052610	0.0001***
LnEDSEXP	-0.506211	0.203131	-2.492038	0.0299**
LnEXPGR	0.101121	0.054915	1.841398	0.0854*
lnPRINVGD	0.741774	0.305660	2.426797	0.0215**
C	-2.192059	0.681185	-3.218007	0.0082***

Source: Authors's computation

Note: *, **, *** means significance at the 10, 5 and 1 percent levels respectively. The results are from the ARDL model

The long term synchronised relationship between the co-integrated variables can be derived from Table 12. As the test results indicate, in the long-run, all variables are statistically significant.

The results in Table 12 show that the coefficient of the variable representing the external debt stock to GDP ratio (EDGDP) is negative (-0.480227) which signifies that external debt has a negative effect on Sierra Leone's economic growth in the long run. Interestingly, the probability of its coefficient is statistically significant at 1% level of signifi-

cance. Consequently, we reject the null hypothesis of no long run relationship and conclude that there is long run relationship between external debt and economic growth. The coefficient of this variable indicates that a 1% rise in Sierra Leone's external debt to GDP ratio will lead to a decline in economic growth by 0.4802%. This finding conforms to the studies by Maxwell et al. (2021) and Bangura (2020) who find out that large external debt stock adversely impacts economic growth.

The sign of the variable representing external debt service

as a ratio of export earnings (EDSEXP) is negative and consistent with the expected sign in the specified model and also significant at the 5% level of significance. This variable negatively impacted economic growth in the long run. The coefficient of this variable (-0.506211) shows that Sierra Leone's economic growth will decelerate by approximately 0.5062% with a 1% rise in debt service as a ratio of export earnings. This finding is consistent with the studies by Maxwell et al. (2021) and Johnson (2018) who opine that debt servicing negatively affects economic growth. Debt servicing has the effect of increasing the country's level of borrowing since export earnings are often insufficient to service debt.

Results in Table 12 further reveal a positive and statistically significant relationship between export growth (EXPGR) and economic growth in the long run. The coefficient is positive (0.101121) which is in line with the expected sign in the specified model. This clearly shows that an increase in ex-

ports will precipitate a long term improvement in economic growth. This implies that a 1% increase in exports will lead to 0.1011% increase in economic growth.

It is further proven that Private investment (PRINVGDP) and economic growth are positively related in the long run as indicated by the coefficient (0.741774). The results show that a 1% increase in private investment will lead to 0.7418% increase in economic growth. The coefficient of the private investment was found to be statistically significant at the 5% level of significance.

5.2.6. ARDL Short Run Results

We estimated the short run impact of our explanatory variables using the ARDL Vector Error Correction Model (VECM) Approach. The results are presented in Table 13.

Table 13. ARDL Short Run Coefficient Estimation of the Model.

Dependent Variable: $\Delta \ln \text{GDPGR}$				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.563817	2.159605	2.576312	0.0109**
$\Delta \ln(\text{GDPGR}(-1))$	0.334679	0.138294	2.420054	0.0166**
$\Delta \ln(\text{EDGDP})$	-0.836040	0.073708	-11.34264	0.0000***
$\Delta \ln(\text{EDSEXP})$	-0.200059	0.108192	-1.849118	0.0737*
$\Delta \ln(\text{EXPGR})$	0.252296	0.134030	1.882388	0.0689*
$\Delta \ln(\text{PRINVGDP})$	0.793486	0.323336	2.454056	0.0245**
ECM(-1)	-0.575818	0.225614	-2.552221	0.0200**
R-squared	0.872559	Mean dependent var	-0.027637	
Adjusted R-squared	0.763412	S. D. dependent var	1.110158	
S. E. of regression	0.733535	Akaike info criterion	2.442328	
Sum squared resid	16.14220	Schwarz criterion	2.902066	
Log likelihood	-39.06771	Hannan-Quinn criter.	2.609739	
F-statistic	6.161958	Durbin-Watson stat	2.251093	
Prob (F-statistic)	0.000048			

Source: Authors's computation

Note: *, **, *** means significance at the 10, 5 and 1 percent levels respectively. The results are from the ARDL model

The results from Table 13 show that previous period economic growth had a positive effect on current economic growth. The effect is positive (0.334679) and is statistically significant at the 5% level of significance. A 1 % increase in economic growth in the previous period will lead to a 0.3345% percent increase in economic growth in the current period or short run.

It can also be seen that external debt (EDGDP) had a negative effect on economic growth in the short run. The effect is strong and statistically significant. A 1 % increase in external debt will lead to 0.836% decrease in economic growth in the short run.

External debt service as a ratio of export earnings (EDSEXP) has a negative and statistically significant effect

on economic growth in the short run. A 1% increase in the external debt service will lead to a 0.20% decrease in economic growth.

Export growth (EXPGR) has a positive and statistically significant impact on economic growth in the short-run. The coefficient is 0.252296. This means that a 1 percent increase in the export growth will lead to a 0.2522% increase in economic growth. This explains increase in economic growth as a result of the increase in export earnings.

Private investment (PRINVGDGP) was found to have a positive short run relationship with economic growth. The results show that a 1% increase in private investment will lead to 0.7935% increase in economic growth. The coefficient of the private investment was found to be statistically significant at the 5 percent level of significance.

Table 14 shows the results of the diagnostic tests performed on the predicted ARDL model. Results are as follows:

1. In the Breusch-Pagan-Godfrey serial correlation test, at a 5% significance level, the null hypothesis which assumes no serial correlation in the model cannot be rejected as the prob>0.05 (0.1520>0.05).
2. In the Breusch-Pagan-Godfrey test, at a 5% significance level, the null hypothesis which indicates that there is no heteroscedasticity in the model cannot be rejected as the prob>0.05 (0.1644>0.05).
3. In the Ramsey-RESET test, using a 5% significance level, the null hypothesis assuming no specification (identification) error in the model cannot be rejected (p-value>0.05), so it can be concluded that the model does not yield any specification error.
4. In the Jarque-Bera test, at a 5% significance level, the null hypothesis which indicates the residual distribution is normal cannot be rejected as prob>0.05 (0.444303>0.05). Thus, it was concluded the residues of the ARDL model are normally distributed.

Table 14. Diagnostic Tests.

Diagnostic Tests	Statistic	P-value
Breusch-Pagan-Godfrey Serial Correlation LM Test	2.164679 (F-stat.)	0.1520
Heteroscedasticity Test: Breusch-Pagan-Godfrey	2.039076 (F-stat.)	0.1644
Heteroscedasticity Test: ARCH	0.125827 (F- stat.)	0.7248
Ramsey RESET Test	0.508623 (F- stat.)	0.4814
Normality Test (Jarque-Bera)	1.622499 (JB- stat.)	0.4443

6. Summary of Main Findings

This research has attempted to investigate and analyse the impact of public debt on economic growth in Sierra Leone and to contribute to the discourse on resolving the country's debt challenges in a bid to attain sustainable economic growth and development. Despite the fact that Sierra Leone is endowed with abundant natural resources, large debt stocks have persisted in the country as a result of a range of reported factors, including continued GDP growth rate fluctuation, low level of private sector investment, low export growth, endemic corruption, imprudent project management and recurring dreadful diseases, among others.

The general objective that has been addressed in this research in contribution to the ongoing discourse on debt is the critical analysis of the effectiveness of Sierra Leone's public debt management and its implications for achieving sustainable economic growth in the country covering the period 1973-2022.

The study specifically attempted to investigate and analyse the effects of both domestic and external debt on economic

growth in Sierra Leone

The regression results indicate that domestic debt stock adversely affects economic growth in Sierra Leone both in the short run and in the long run. This finding is in conformity with the studies by Yusuf and Saidatulakmal [21] and Haffner et al. [6].

Results also reveal that domestic debt servicing has adverse effects on the country's economic growth both in the long run and in the short run. This finding is consistent with the study by Sheikh et al [18] who opine that debt servicing negatively affects economic growth.

The regression results reveal that external debt stock negatively affects economic growth in Sierra Leone both in the short run and in the long run. This finding is consistent with the studies by Maxwell et al. [12] and Bangura [2].

The research also shows that external debt servicing has ruinous effects on the country's economic growth both in the long run and in the short run for the study period. This finding is in conformity with the study by Maxwell et al. [12].

The study, therefore, concludes that public debt had devastating effects on economic growth in Sierra Leone for the study period.

7. Policy Recommendations

Based on the findings, the study has proffered the following strategic recommendations towards ensuring prudent public debt management for enhanced economic growth and sustainable development in Sierra Leone.

1. **Effective utilisation of borrowed funds:** The Ministry of Finance in Sierra Leone should improve its capacity in formulating and guiding public policy to ensure effective management of public debt. The role of the Public Debt Management Office (PDMO) and the Fiscal Risks Management and Oversight Department in the Ministry should be strengthened. To achieve this, well informed, capable and honest personnel should be employed to evaluate the effects of public borrowing from time to time and provide policy advice to the government on the implications of debt accumulation.
2. **Review of public debt management strategies:** It is extremely necessary to review Sierra Leone's public debt management strategies so that public debt is directed towards promoting critical infrastructure developments such as in roads, energy, and water supply for the purpose of facilitating private investment and economic growth. This can be achieved by financing long term public investment objectives rather than concentrating borrowed funds on financing short term government recurrent expenditures. Revenue mobilised from taxes, grants and other sources of government revenue can be used to finance short term government recurrent expenditures rather using public debt.
3. **Prudent and efficient project management:** Government should direct borrowed funds towards productive capital projects and such projects should be well implemented, monitored and evaluated on a regular basis.
4. **Maintenance of political stability:** The government should ensure that political stability in the country is maintained as it is one of the investment prerequisites. Political instability will discourage investors from investing in such environment and this will translate into poor economic growth.
5. **Promote private sector investment:** There is a strong need to promote private sector investment geared towards enhancing productivity in the economy. The Government should provide the business environment with political stability and investors should be given equitable treatment. The implementation of this approach is largely expected to increase investment levels which will in turn lead to a rise in returns to investment/ GDP critical to economic growth. This will reduce the country's interest in procuring public debt.
6. **Exchange rate stabilisation:** The need to implement strategies to stabilise exchange rate in the country should be prioritised. This is achievable through increased domestic production of goods. This will en-

courage the country to embark on import substitution by producing some of the goods that could have been imported. At the same time, some of the domestically produced goods can be exported to other countries for foreign exchange. An increase in exports enhances inflow of foreign exchange while a reduction in imported goods will reduce demand for foreign exchange. This approach will allow foreign earnings from exports to exceed expenditure on imports. This will consequently stabilise exchange rate. A Stable exchange rate reduces the cost of financing debt.

7. **Minimisation of corruption:** Corruption must be minimised. The government should ensure full existence of accountability, transparency and good governance in all sectors of the country. The Office of the Anti-Corruption Commission (ACC) should monitor this process and culprits should be punished accordingly irrespective of status.

Abbreviations

ACC	Anti-Corruption Commission
ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
AR	Autoregressive (AR)
ARDL	Autoregressive Distributed Lag
BoP	Balance of Payments
COVID-19	Coronavirus
FPE	Final Prediction Error
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
HQ	Hanna-Quinn information criterion
IFS	International Financial Statistics
LR	Likelihood Ratio
OLS	Ordinary Least Squares
PDMO	Public Debt Management Office
PP	Phillips-Perron
REH	Ricardian Equivalence Hypothesis
RESET	Regression Specification Error Test
SIC	Schwarz Information Criterion
VAR	Vector Autoregression

Author Contributions

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Conflicts of Interest

The authors declare no conflicts of interest.

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