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## **Asymmetric Effect of External Debt on Economic Growth in Sub- Saharan Africa**

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### **ABSTRACT**

*Economic growth in Sub-Saharan Africa (SSA) was shaped by rising external debt, but its effects were not uniform. While borrowing supported development when effectively managed, excessive debt often generated debt overhang that undermined growth. This study aimed to investigate the asymmetric impact of external debt on economic growth in SSA, focusing on whether increases and decreases in debt exerted different influences, an aspect overlooked in much of the linear-based literature. Panel data for selected SSA countries over the period 1996–2023 were analysed using the Nonlinear Autoregressive Distributed Lag (NARDL) model, which accounted for cross-sectional dependence and mixed integration orders. The empirical findings revealed clear asymmetries in the debt–growth relationship. In the long run, increases in external debt exerted a negative but statistically insignificant effect on growth, while decreases in external debt produced a positive and statistically significant impact. In the short run, the lag of decreasing debt showed a large negative but insignificant effect, suggesting that sudden declines in debt did not immediately translate into growth gains. The study concluded that debt accumulation imposed greater economic costs than the growth benefits of debt reduction, lending support to the debt overhang theory. It is recommended that SSA governments adopt prudent borrowing strategies, strengthen debt management systems, and ensure that external finance is directed toward productive and growth-enhancing sectors to achieve long-term sustainable growth.*

**Keywords:** Debt management, economic growth, external debt, Sub-Saharan Africa

**JEL Codes:** H63, O55, F34

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## 1. Introduction

External debt occupies a central position in development economics and macroeconomic policy debates, particularly regarding its implications for economic growth in developing regions. Within the conventional symmetric framework, external debt is assumed to exert uniform effects on growth: increases in debt stimulate growth by relaxing capital constraints, while decreases generate proportionate but opposite effects (Sharaf, 2022; Elkhalfi et al., 2024). Rooted in classical and neoclassical development theories, this view frames external borrowing as a means of supplementing domestic savings, financing productive investment, and accelerating capital accumulation in economies facing persistent resource gaps (Pathan & Ahmed, 2022). Accordingly, external debt has long been regarded as a growth-enhancing instrument, especially for low-income and capital-scarce economies such as those in Sub-Saharan Africa (SSA).

Yet, SSA's recent debt experience challenges the validity of this symmetric assumption. Over the past three decades, the region has undergone repeated cycles of debt accumulation, relief, and renewed borrowing. Despite major debt forgiveness initiatives, notably the Heavily Indebted Poor Countries (HIPC) programme, many SSA economies continue to face rising debt stocks, mounting debt-service burdens, and fragile growth outcomes (Henri, 2019; Fischer & Storm, 2023; Were, 2024). While borrowing has supported short-term fiscal stabilization and infrastructure financing, it has often coincided with subdued long-run growth, heightened macroeconomic vulnerability, and constrained fiscal space (Nandelenga, 2021; Manasseh et al., 2022). These developments have intensified interest in reassessing the external debt–growth relationship, particularly its direction and persistence.

The empirical literature has largely relied on linear and symmetric models, implicitly assuming that increases and decreases in debt exert equal and opposite effects on economic performance. Findings within this framework remain mixed. Some studies report positive growth effects at low or moderate debt levels, consistent with the capital-augmentation hypothesis (Manasseh et al., 2022; Alemu et al., 2023), while others identify negative effects beyond sustainable thresholds, supporting the debt overhang hypothesis (Krugman, 1988; Dawood et al., 2024). Although informative, these approaches impose symmetry by construction and therefore struggle to capture the complex fiscal realities confronting SSA economies.

Recent theoretical and empirical contributions increasingly reject this symmetry assumption, arguing that external debt dynamics are inherently asymmetric. Debt overhang theory, fiscal constraint theory (Musgrave, 1959; Barro, 1979), and nonlinear growth frameworks suggest that debt accumulation and debt reduction need not mirror each other in their growth effects. Large debt stocks can function as an implicit tax on future income, suppress private investment, and heighten risk perceptions, generating persistent growth penalties (Krugman, 1988; Romer, 1986; Lucas, 1988). By contrast, debt reduction may not immediately restore growth due to institutional rigidities, credibility constraints, and irreversible investment losses. These

mechanisms imply that the costs of debt accumulation may exceed—and outlast—the benefits of debt reduction, particularly in structurally constrained SSA economies.

Empirical evidence increasingly supports this asymmetric perspective. Studies using nonlinear techniques, including the nonlinear autoregressive distributed lag (NARDL) model, show that positive and negative debt shocks exert unequal effects on growth across countries and regions (Toktaş et al., 2019; Alimov, 2022; Özmen, 2022). In developing economies, debt increases are often found to depress growth more strongly than debt reductions stimulate it. Within Africa, available evidence points in a similar direction (Fischer & Storm, 2023), with country-specific studies for Nigeria, Ghana, Ethiopia, and South Africa reporting asymmetric debt–growth relationships (Ayadi & Ayadi, 2008; Abille & Kiliç, 2023; Udejaja & Audu, 2023).

Despite these advances, two gaps remain. First, most SSA-focused studies are country-specific, concentrating on relatively large economies and failing to capture regional heterogeneity in fiscal capacity, institutional quality, and exposure to external shocks (Onaga et al., 2023; Githumbi et al., 2025; Okwu et al., 2025). Second, panel-level evidence on asymmetric external debt effects in SSA remains limited, as much of the regional literature continues to rely on linear panel models that impose symmetry by construction (O’Connell, 2022).

These gaps are particularly consequential given SSA’s structural characteristics, narrow tax bases, volatile export revenues, currency mismatches, and limited debt management capacity, which amplify the growth consequences of external borrowing (Manasseh et al., 2022; Were, 2024; Bunde, 2025). Ignoring asymmetries risks biased estimates and policy prescriptions that understate the long-run costs of debt accumulation or overstate the gains from debt reduction.

Against this backdrop, this study examines the asymmetric effects of external debt on economic growth in SSA using a panel nonlinear autoregressive distributed lag (NARDL) framework. By decomposing external debt into positive and negative changes, the analysis allows debt increases and decreases to exert distinct short- and long-run effects on growth. This approach accommodates mixed orders of integration, captures dynamic adjustment processes, and aligns closely with theories of debt overhang and fiscal constraints.

In doing so, the study makes two key contributions. Theoretically, it advances the debt–growth literature by providing region-wide evidence on asymmetric debt dynamics in SSA within a nonlinear panel framework. Practically, it offers policy-relevant insights for debt management and growth strategies, clarifying whether greater emphasis should be placed on limiting debt accumulation, accelerating debt reduction, or enhancing the productivity of debt-financed spending in structurally vulnerable economies. Thus, the study answers the question below:

## Research Questions

- a) Are the effects of external debt on growth asymmetric in the short run or predominantly in the long run?
- b) Do increases and decreases in external debt exert asymmetric short- and long-run effects on economic growth in SSA?

## Objectives of the Study

The broad objective of this study is to examine whether external debt affects economic growth in SSA asymmetrically. Specifically, the study aims to:

- a) Investigate whether the growth effects of debt accumulation differ systematically from those of debt reduction in the short and long run.
- b) Analyze the short- and long-run asymmetric effects of external debt increases and reductions on economic growth in SSA.

## 2.0. Literature Review

### 2.1. The Conceptual Literature

The concept of asymmetry in economic relationships emerged from Keynesian and nonlinear macroeconomic thought and gained formal econometric grounding through asymmetric adjustment modelling in time-series analysis (Schorderet, 2003). In development economics, asymmetry has become central to explaining why macroeconomic variables, including external debt, do not exert uniform effects across economic states. Conceptually, asymmetry refers to situations where positive and negative changes in an explanatory variable generate unequal effects on an outcome variable, challenging the linear assumption of proportional and reversible responses to shocks. This perspective has been operationalised through partial sum decomposition and nonlinear autoregressive distributed lag (NARDL) models, which capture directional dependence in macroeconomic relationships (Sharaf, 2022; Yusuf & Mohd, 2024). In Sub-Saharan Africa (SSA), where debt cycles are recurrent and fiscal buffers are limited, asymmetry provides a critical lens for understanding why debt accumulation often constrains growth more severely than debt reduction stimulates it.

External debt, historically institutionalised through Bretton Woods institutions, refers to financial obligations owed to non-residents and denominated in foreign currency. Classical development theory views external debt as growth-enhancing when it relaxes capital constraints and finances productive investment (Ojeka & Egbetunde, 2025). In contrast, the debt overhang hypothesis posits that excessive debt discourages investment by raising expected future taxation and default risk, thereby suppressing growth (Krugman, 1988). Recent studies increasingly show that these effects are nonlinear and asymmetric. For example, debt

increases have been found to depress growth more strongly than debt reductions stimulate it in Nigeria and Ghana, particularly when debt servicing diverts resources from productive expenditure (Udejaja & Audu, 2023; Yusuf & Mohd, 2023, 2024; Abille & Kiliç, 2023). Other studies report positive effects of debt up to certain thresholds, reflecting heterogeneity in absorptive capacity and institutional quality (Sulikova et al., 2015). These findings reinforce the asymmetric framework rather than contradict it.

Economic growth, traditionally defined as sustained increases in productive capacity, is increasingly conceptualised in development economics as a process of structural transformation and productivity enhancement. Endogenous growth theory highlights the roles of policy, institutions, and external financing, making growth particularly sensitive to debt dynamics in SSA. Empirical evidence consistently shows that growth responds unevenly to debt shocks: contractions from debt accumulation tend to be larger and more persistent than expansions from debt reduction, indicating hysteresis effects (Bese et al., 2021; Nguyen & Nguyen, 2023). In SSA, weak institutions, capital flight, and fiscal rigidities amplify these asymmetries, making growth losses harder to reverse. While the literature recognises the centrality of asymmetry in the debt–growth relationship, most studies remain country-specific or fragmented. The present study advances this discourse by integrating asymmetry, external debt, and economic growth within a unified cross-country SSA framework, thereby aligning theory with the region’s structural realities and addressing a key gap in the literature.

## **2.2 Theoretical Literature: Fiscal Constraint Theory**

Fiscal Constraint Theory provides a central theoretical foundation for analysing the growth effects of external debt in developing economies, particularly in SSA. Rooted in public finance theory, the framework emphasizes that governments operate under binding intertemporal budget constraints, such that rising public and external debt progressively limits fiscal space and policy autonomy (Musgrave, 1959; Barro, 1979). As debt accumulates, a growing share of public revenue is diverted toward debt servicing, constraining the government’s ability to finance growth-enhancing expenditures such as infrastructure, education, and health.

In the context of SSA, these constraints are especially pronounced due to narrow tax bases, volatile export revenues, and limited access to low-cost financing. Fiscal Constraint Theory predicts that increases in external debt intensify fiscal pressure, crowd out productive public investment, and may necessitate distortionary fiscal adjustments, thereby suppressing economic growth (Tiamiyu, 2025; Olaoye & Alababan, 2024). Importantly, the theory also implies asymmetry: while debt accumulation rapidly tightens fiscal constraints, debt reduction does not automatically or proportionately relax them. Institutional rigidities, expenditure inflexibility, and credibility challenges may delay the growth benefits of declining debt burdens.

Empirical applications of this theory to SSA support these predictions. According to Were (2024; 2025) and Abubakar et al. (2025), rising debt in the region worsens fiscal stress and undermines growth, while debt

relief yields slower and more uncertain improvements. This directional dependence suggests that the growth costs of debt accumulation are likely to exceed the gains from debt reduction, providing a strong theoretical rationale for modelling debt growth dynamics asymmetrically.

### **Modern Nonlinear Growth Theory**

Modern Nonlinear Growth Theory reinforces the expectation that external debt affects economic growth in a non-uniform and direction-dependent manner. Departing from linear growth models, this framework recognises that economic relationships are state-dependent, path-dependent, and characterised by nonlinear adjustment processes. Its foundations lie in endogenous growth theory (Romer, 1986; Lucas, 1988), which relaxed the assumption of diminishing returns and allowed policy and structural factors to exert persistent effects on growth.

Within this framework, the debt overhang hypothesis advanced by Krugman (1988) introduced an explicitly nonlinear link between high debt stocks and economic performance. Once debt exceeds critical thresholds, expected repayment obligations act as an implicit tax on returns, discouraging private investment and innovation. Importantly, growth losses arising from debt accumulation may be large and persistent, while subsequent debt reductions may not fully reverse these effects due to confidence losses, institutional rigidities, and irreversible capital flight.

These theoretical insights have been formalised through asymmetric econometric approaches. Schorderet (2003) introduced asymmetric cointegration, later operationalised by Shin, Yu, and Greenwood-Nimmo (2014) via the nonlinear autoregressive distributed lag (NARDL) model, which allows positive and negative changes to exert distinct short- and long-run effects. Empirical studies using this framework consistently find that growth responds more strongly to adverse shocks than to favourable ones, particularly in developing economies (Saadaoui & Chtourou, 2023; Yu, 2023; Rodrik & Stiglitz, 2025).

For Sub-Saharan Africa (SSA), where structural vulnerabilities and fiscal fragility persist, Modern Nonlinear Growth Theory predicts that increases in external debt are more likely to depress growth than decreases are to stimulate it. Weak institutions, limited absorptive capacity, and heightened exposure to shocks amplify these asymmetries. Taken together, Fiscal Constraint Theory and Modern Nonlinear Growth Theory provide a coherent justification for examining asymmetric debt–growth effects in SSA. This synthesis underpins the study’s adoption of the NARDL framework and supports decomposing external debt into positive and negative changes to capture the nonlinear and structurally differentiated nature of the debt–growth relationship.

### 2.3. Empirical Literature Review

The linkage between external debt and economic growth has remained a persistent and evolving concern within macroeconomic and development literature, particularly for developing regions such as SSA. External debt is often justified as a necessary instrument for addressing capital shortages, financing infrastructure, and stabilising fiscal imbalances. However, the growth outcomes of such borrowing have proven far from uniform. Recent scholarship increasingly recognises that the debt–growth relationship may be nonlinear and asymmetric, meaning that increases in debt may affect growth differently from decreases in debt. This shift in perspective is significant for SSA, where debt accumulation has accelerated in recent decades amid fragile fiscal structures, volatile revenues, and limited institutional capacity. Investigating the asymmetric effects of external debt on economic growth is therefore critical for understanding why debt relief or consolidation does not always translate into proportional growth gains and why renewed borrowing can have disproportionately harmful effects.

The theoretical roots of asymmetric analysis can be traced to Schorderet (2003), who introduced the partial sum decomposition methodology that allows positive and negative changes in a variable to be modelled separately. This contribution provided the analytical foundation for nonlinear autoregressive distributed lag (NARDL) models, which later became central to empirical investigations of asymmetric macroeconomic relationships. By enabling researchers to distinguish between debt increases and decreases, this framework challenged the long-standing assumption of symmetry embedded in traditional linear models. Although Schorderet’s work was methodological rather than empirical, it laid the groundwork for subsequent studies that examined debt–growth dynamics in a more nuanced and policy-relevant manner.

Building on this foundation, Afonso and Alves (2014) examined the debt–growth nexus in 14 European countries over the period 1970–2012. Their objective was to test whether debt accumulation exerts uniform effects on growth or whether these effects differ depending on the direction of debt changes. Using panel regression techniques, the study found that external debt harms growth and, crucially, that this impact is asymmetric. Debt accumulation was found to be more harmful to growth than debt reduction was beneficial. While the study made an important contribution by empirically validating asymmetry in a multi-country setting, its focus on advanced European economies limits its applicability to SSA, where structural and institutional conditions differ markedly. Nevertheless, the findings provided early empirical support for the relevance of asymmetric modelling in debt–growth analysis.

In the African context, Sulikova et al. (2015) offered one of the earliest nonlinear investigations by focusing on 13 EU countries between 1993 and 2013. Their objective was to determine whether external debt exhibits threshold and asymmetric effects on economic growth. Employing both threshold analysis and the NARDL framework, the study revealed a linear relation between debt-to-GDP decrease and GDP growth, while the relation between the debt-to-GDP increase and GDP growth is defined by an inverted U-shaped curve

(parabola) with the peak at a 64% debt-to-GDP ratio. This finding challenged the conventional debt overhang narrative by suggesting that debt increases can be growth-enhancing under certain conditions. However, the single-country design constrains generalisation, and the positive impact of debt shocks may reflect EU countries' specific development and investment context rather than a broader EU countries pattern. Nonetheless, the study demonstrated the empirical relevance of asymmetry within an African economy.

Nigeria has attracted substantial attention in the asymmetric debt–growth literature, reflecting its economic size and persistent debt challenges. Yusuf and Mohd (2021) investigated Nigeria over the period 1980–2018 to test whether fiscal shocks, including external debt, affect growth asymmetrically. Using the NARDL model, the study found that recurrent expenditure shocks exert stronger asymmetric effects on growth than capital expenditure shocks. Although external debt was not isolated as the sole driver, the findings highlighted the importance of distinguishing between different fiscal components and their nonlinear impacts. A limitation of the study lies in its indirect treatment of debt asymmetry, as external debt effects were embedded within broader fiscal dynamics. Nonetheless, it contributed to the growing recognition that symmetric modelling is insufficient for understanding growth responses in SSA economies.

Udejaja and Audu (2023) provided more direct evidence on debt asymmetry in Nigeria by examining the period 1981–2019 using both ARDL and NARDL models. Their explicit objective was to determine whether debt increases and decreases exert differential effects on economic growth. The results showed that debt increases reduced growth by 1.08%, while debt reductions increased growth by 3.08%, offering strong confirmation of the asymmetric hypothesis. This study made a clear contribution by quantifying the unequal growth effects of debt movements. However, its focus on a single country limits its external validity, particularly for SSA economies with different fiscal capacities and institutional settings.

Further extending this line of inquiry, Yusuf and Mohd (2023, 2024) examined Nigeria through the lens of debt servicing to assess whether debt service sustains the debt overhang hypothesis. Applying both ARDL and NARDL models, they found that debt servicing reinforces the overhang effect and exhibits significant asymmetric dynamics. These findings highlighted an important transmission channel through which external debt affects growth. While analytically rich, the studies remain country-specific, leaving open the question of whether similar debt service asymmetries characterise SSA as a whole.

Evidence from other African economies presents mixed outcomes. Mohamed and Abdulle (2023) examined Somalia between 1977 and 2021 using an ARDL framework, aiming to assess whether external debt promotes or undermines growth. Their findings indicated that debt significantly hinders growth, underscoring the risks of excessive borrowing in fragile states. However, the absence of an explicit asymmetric framework limits the study's ability to inform the present objective. In Ghana, Abille and Kiliç (2023) employed the NARDL model over the period 1970 to 2019 to test for nonlinear debt effects. They found that positive debt shocks were insignificant, while negative shocks reduced growth in the short run.

This asymmetry suggests that debt reduction does not automatically translate into growth gains, but the short-run focus leaves long-run dynamics insufficiently explored.

South Africa-based evidence further illustrates heterogeneity. Mah (2025) examined foreign and domestic debt between 1980 and 2020 using ARDL and found that foreign debt promotes growth while domestic debt reduces it. Although the study highlighted compositional differences in debt, its lack of explicit asymmetric decomposition limits alignment with the current study's objective. Makhoba et al. (2022), using panel ARDL for 12 SADC economies, found asymmetric growth effects dependent on debt management efficiency. This study is notable for moving beyond single-country analysis, yet it remains limited to a sub-regional grouping rather than SSA as a whole.

Evidence from outside Africa reinforces the prevalence of asymmetry. Studies on MENA countries (Haddad et al., 2023), Vietnam (Nguyen & Nguyen, 2023), China (Bese et al., 2021), EU economies (Özmen, 2022), Turkey (Toktaş et al., 2019), Egypt (Sharaf, 2022), and Indonesia (Suryandaru, 2023) consistently report asymmetric or nonlinear debt–growth dynamics using diverse methodologies. Collectively, these studies strengthen the theoretical and empirical case for asymmetry, but their contextual differences limit direct applicability to SSA.

Generally, the literature reveals consistent evidence that external debt affects economic growth asymmetrically, with debt accumulation generally exerting stronger negative effects than the growth benefits associated with debt reduction. However, most existing studies are country-specific or focused on regions outside SSA. Despite SSA's pronounced debt vulnerabilities, panel-level evidence on asymmetric debt–growth effects remains scarce. Consequently, the literature does not fully correspond to the objective of investigating asymmetric effects of external debt on economic growth across SSA. The present study addresses this gap by providing cross-country evidence for SSA, thereby extending the literature beyond isolated national experiences and offering a more generalisable and policy-relevant understanding of debt asymmetry in the region.

### **3. Methodology**

This study adopted an ex post facto research design to examine the asymmetric effects of external debt on economic growth in SSA, consistent with its objectives and research questions. The analysis is anchored in Fiscal Constraint Theory, which argues that binding government budget constraints associated with rising debt and debt-servicing obligations compress fiscal space, distort expenditure composition, and weaken growth-enhancing public investment. In SSA, these constraints are intensified by narrow revenue bases, volatile borrowing costs, and rigid fiscal adjustment

mechanisms, resulting in asymmetric debt–growth responses documented in recent high-impact studies (Sharaf, 2021; Abate, 2023).

Guided by this theoretical framework, the study employed the nonlinear Autoregressive Distributed Lag (NARDL) model of Shin et al. (2014) to capture both short- and long-run asymmetric effects of external debt. Economic growth, measured by GDP per capita, served as the dependent variable, while external debt and fiscal deficits constituted the key explanatory variables, alongside standard growth controls. Panel data for SSA countries were sourced from the World Bank’s World Development Indicators (WDI, 2023). The NARDL approach ensured robustness to mixed integration orders and enhanced the validity of the estimated asymmetric relationships, providing a sound basis for the subsequent presentation of results.

Following the framework outlined by Pesaran et al. (2001), the general specification of a linear ARDL model is formulated as follows:

$$\Delta \ln GDP_{it} = \phi_i \ln GDP_{it-1} + \beta_1 \ln EDT_{it-1}^+ + \beta_2 \ln EDT_{it-1}^- + \beta_3 \ln X_{it-1} + \sum_{i=1}^r a_{1ij} \Delta \ln GDP_{it-j} + \sum_{i=0}^{r_2} a_{2it}^+ \Delta \ln EDT_{it-j}^+ + \sum_{i=0}^{r_3} a_{2it}^- \Delta \ln EDT_{it-j}^- + \sum_{i=1}^r a_{3ij} \Delta \ln X_{it-j} + \sigma_i + \phi_j \quad (1)$$

Before developing the full representation of the NARDL model, we introduce the following asymmetric long-run regression:

$$\ln edt_t = \ln edt_0 + \ln edt_t^+ + \ln edt_t^- \quad (2)$$

In equation (2),  $\ln edt_t^+ + \ln edt_t^-$  represent the partial sums of the increase and decrease in the external debt variable, expressed as follows:

$$edt_t^+ = \sum_{\pi=i}^w \text{Max}(\Delta edt_{it}, 0) \text{ this captures positive changes (increases) in external debt while,}$$

$$edt_t^- = \sum_{\pi=i}^w \text{Min}(\Delta edt_{it}, 0) \text{ This captures negative changes (decreases) in external debt.}$$

where,  $\Delta edt_t$  is the first difference of external debt defined as  $edt_t - edt_{t-1}$ . By incorporating the partial sum of public debt into the ARDL framework, the nonlinear ARDL (NARDL) is shown as:

$$\Delta \ln gdp_{it-1} = a_0 + \sum_{i=1}^r a_{1ij} \Delta \ln gdp_{it-j} + \sum_{i=0}^{r_2} a_{2it}^+ \Delta \ln edt_{it-j}^+ + \sum_{i=0}^{r_3} a_{2it}^- \Delta \ln edt_{it-j}^- + \sum_{i=0}^{r_4} a_{4ij} \Delta \ln fdt_{it-j} + \sum_{i=0}^{r_5} a_{5ij} \Delta \ln exp_{it-j} + \sum_{i=0}^{r_6} a_{6ij} \Delta \ln hcs_{it-j} + \sum_{i=0}^{r_7} a_{7ij} \Delta \ln lfc_{it-j} + \sum_{i=0}^{r_8} a_{8ij} \Delta \ln savs_{it-j} + \theta_0 \ln gdp_{it-1} + \theta_1 \ln edt_{it-1} + \theta_2 \ln edt_{it-1} + \theta_3 \ln fdt_{it-1} + \theta_4 \ln gfcf_{it-1} + \theta_5 \ln exp_{it-1} + \theta_6 \ln hcs_{it-1} + \theta_7 \ln lfc_{it-1} + \theta_8 \ln savs_{it-1} + \omega_{it} \quad (3)$$

Where  $\ln gdp_{it}$  is the log of GDP per capita for period  $t$  and country  $i$ ;  $edt_{it}$  is the total borrowing a country owes to foreign creditors, payable in foreign currency in the country.  $\ln fdt_{it}$  is the log of fiscal deficits,  $\ln gfcf_{it}$  is the log of gross fixed capital formation;  $\ln exp_{it}$  is the log of government expenditure;

$hcs_{it}$  represents human capital stock;  $lfc_{it}$  is the labour force. And log of savings,  $lnsav_{it}$  refers to the portion of income not spent on current consumption.  $\alpha_0$  is constant, while  $\alpha_1$  is the coefficient of the independent variable and  $\alpha_2, \alpha_3, \alpha_4, \alpha_5$ , and  $\alpha_6$  are the coefficients of the explanatory variables, and  $\varepsilon_{it}$  represent the stochastic term/disturbance term. In the NARDL model specified in Equation (3), the null hypotheses of long-run symmetry ( $\vartheta_1 = \vartheta_2$ ) and short-run symmetry ( $a_{2t} = a_{3t}$ ) are tested against their respective alternative hypotheses of asymmetry. This study examines the relationship between external debt and economic growth in SSA over the period 1996–2023. Data for these variables were obtained from the World Bank's Development Indicators (WDI) databases.

## 4. Result and Discussion

### 4.1 Result

#### Descriptive Statistics

Before the main estimation, the study used descriptive statistics to present the mean, minimum, maximum, and standard deviation of the model's variables, including their average values across the countries examined. This provided insights into the characteristics of each variable within the selected countries. Additionally, a correlation analysis was conducted using a correlation matrix to assess the strength of the relationships among the variables, to identify potential multicollinearity, and ensure the reliability of the estimated coefficients.

**Table 1: Summary of Descriptive Statistics**

| Variables    | Mean   | Max     | Min    | Std. Dev. |
|--------------|--------|---------|--------|-----------|
| <i>GDPPC</i> | 7.059  | 9.301   | 5.569  | 0.870     |
| <i>EDT</i>   | 53.085 | 358.803 | 3.895  | 43.995    |
| <i>GEXP</i>  | 22.837 | 26.628  | 3.651  | 2.516     |
| <i>GFCF</i>  | 21.341 | 26.276  | 17.410 | 1.569     |
| <i>HCS</i>   | 98.302 | 151.726 | 27.457 | 22.891    |
| <i>LFC</i>   | 54.948 | 134.919 | 47.286 | 6.363     |
| <i>SAVS</i>  | 1.939  | 4.441   | -5.843 | 1.717     |

**Source: Author's Compilation (2025)**

The descriptive statistics in Table 1 revealed vital insights into the nature of economic growth and its possible drivers in SSA. The average GDP per capita of 7.059, with a minimum value of 5.569 and a maximum value of 9.301, shows moderate variation with a standard deviation of 0.870, revealing stable income levels across countries, although some differences may exist. External debt, however, showed a significant dispersion, with a mean value of 53.085 and a wide range (3.895 to 358.803), and a high standard deviation of 43.995.

This variation supports the possibility of the presence of both symmetric and asymmetric effects of debt on growth, because countries with moderate debt may act differently from those with huge debt levels.

Government expenditure and gross fixed capital formation show moderate means values of 22.837 and 21.341, respectively, with relatively low standard deviations, suggesting more uniform fiscal policy behaviour across SSA. Human capital stock, with a high average of 98.302 and a wide range (27.457 to 151.726), reflects differences in educational investment, possibly affecting labour productivity and long-run growth. Labour force appears marginally stable, while savings show minimal average levels (1.939) with notable negative minimum values, which could suggest that low domestic savings might limit debt-financed growth opportunities in some SSA economies. Therefore, countries below the debt threshold may experience different growth patterns compared to those above it, reinforcing the use of techniques like NARDL models in the empirical analysis. In considering nonlinearity and asymmetry while analysing the debt-growth relationship in SSA countries, these variations must be highlighted as very important.

### Unit Root Test

According to Menegaki (2019), the unit root test precedes all procedures in ARDL estimation. Among the alternative test methods, augmented Dicky Fuller (ADF) and Phillips and Perron (PP) tests are the most common, but this study adopted the CIPS and CADF second-generation Panel Unit Root Tests. These two tests were preferred owing to their advantages, as they take care of cross-sectional dependence and allow parameter heterogeneity. These features make them more suitable than first-generation tests for panel data, enhancing reliability in unit root testing and empirical economic analysis. In both of these techniques, the null hypothesis of non-stationarity is tested against the alternative hypothesis of stationarity. The result of the unit root test is given in Table 2.

**Table 2: Results of CIPS and CADF Panel Unit Root Tests**

| Variable | CIPS     |                       |              | CADF     |                       |              |
|----------|----------|-----------------------|--------------|----------|-----------------------|--------------|
|          | Level    | 1 <sup>st</sup> diff. | Integ. order | Level    | 1 <sup>st</sup> diff. | Integ. order |
| gdppc    | -1.569   | -4.938**              | i(1)         | -0.573   | -2.828**              | i(1)         |
| edt      | -2.422** |                       | i(0)         | -1.980   | -5.392**              | i(1)         |
| lngexp   | -1.849   | -4.897**              | i(1)         | 5.265    | -4.984**              | i(1)         |
| lngfcf   | -2.548** |                       | i(0)         | -2.613** |                       | i(0)         |
| hcs      | -2.096** |                       | i(0)         | -1.531   | -5.719**              | i(1)         |
| lfc      | -1.533   | -2.11**               | i(1)         | -5.848** |                       | i(0)         |
| linsavs  | -1.693   | -4.764**              | i(1)         | 4.288    | -2.869**              | i(1)         |

**Note:** \*p<0.01, \*\*p<0.05, and \*\*\*p<0.10 for 1%, 5%, and 10% significant level, respectively. CIPS Cross-sectional augmented Im, Pesaran, and Shin, and CADF Cross-sectional Augmented Dickey-Fuller

**Source:** Author's Compilation, 2025

Table 2 presents the CIPS and CADF unit root test results, confirming that most variables are integrated of order one, I(1), except for external debt, gross fixed capital formation, and, in some cases, human capital stock and labour force, which are stationary at level, I(0). This mixed order of integration justifies the use of the ARDL or NARDL estimation technique, which accommodates both I(0) and I(1) variables (Joktas et al. 2019; Alille & Klic, 2023). Recognizing this structure is essential when examining the symmetric and asymmetric effects of debt on growth, ensuring that the estimations reflect the true relationships within SSA economies.

### Bounds Test for Linear/Nonlinear Cointegration (ARDL/NARDL)

**Table 3. Bounds Test for Linear/Nonlinear Cointegration**

| Model Specification | Key Variable(s) | Coef.  | Evidence of Cointegration                     | Evidence of Asymmetry   |
|---------------------|-----------------|--------|-----------------------------------------------|-------------------------|
| Linear              | edt (L1)        | -24.39 | Yes – significant (p = 0.005)                 | No symmetry assumed     |
| Non-linear          | edt_pos_sum,    | 4.83   | Yes – both significant (p = 0.001, p = 0.000) | Yes – different impacts |
|                     | edt_neg_sum     | 19.92  |                                               |                         |

**Source: Author's Compilation, 2025**

The results of the bounds test, as shown in Table 3, revealed evidence of cointegration in both linear and nonlinear model specifications. In the linear ARDL model, the lagged value of external debt is statistically significant (Coef. -24.39; p = 0.005), indicating the presence of a stable long-run (cointegrating) relationship between external debt and economic growth in SSA. However, the model presumed symmetry, indicating it does not distinguish between the effects of increases or decreases in debt, implying no evidence of asymmetry is captured. Conversely, the nonlinear NARDL model, which disaggregated external debt into positive and **negative** changes, also provides evidence of **cointegration**, with **both components statistically significant (Coef. 4.83, P=0.001 and Coef. 19.92, P=0.000)**. More importantly, the magnitudes and signs of these coefficients differ, confirming the presence of **asymmetry**. This implied that positive shocks (increases in debt) and negative shocks (reductions in debt) exert **unequal effects** on economic growth, validating the need for a nonlinear framework in capturing the true dynamics of the relationship in SSA.

**Table 4. The Results of the Nonlinear Auto-regressive Distributed Lag (NARDL)**

| NARDL Long-run Results  |             |            |             |       |
|-------------------------|-------------|------------|-------------|-------|
| RGDPpc                  | Coefficient | Std. Error | t-Statistic | Prob  |
| edt_neg                 | 0.15        | 0.06       | 2.22        | 0.026 |
| Fdt                     | 0.04        | 0.08       | 0.54        | 0.586 |
| gfcf                    | 8.67        | 3.23       | 2.68        | 0.007 |
| savs                    | -6.59       | 1.36       | -4.83       | 0.000 |
| lfc                     | -5.65       | 1.33       | -4.24       | 0.000 |
| gexp                    | -2.14       | 1.27       | -1.67       | 0.094 |
| hcs                     | 0.64        | 0.11       | 5.55        | 0.000 |
| NARDL Short-run Results |             |            |             |       |
| RGDPpc                  | Coefficient | Std. Error | t-Statistic | Prob  |

|         |        |        |       |       |
|---------|--------|--------|-------|-------|
| Trend   | -0.03  | 0.14   | -0.22 | 0.828 |
| edt_pos | -0.83  | 1.26   | -0.66 | 0.512 |
| edt_neg | -5.87  | 4.60   | -1.28 | 0.202 |
| fdtD1.  | 148.9  | 68.60  | 2.17  | 0.030 |
| gfcf    | -984.6 | 772.34 | -1.27 | 0.202 |
| savs    | 44.64  | 30.67  | 1.46  | 0.146 |
| lfc     | -15.11 | 16.05  | -0.94 | 0.346 |
| gexp    | 940.78 | 479.12 | 1.96  | 0.050 |
| hcs     | 8.65   | 15.66  | 0.55  | 0.580 |
| ECM(_1) | -0.072 | 0.013  | -5.33 | 0.000 |

Source: Author's Compilation 2025, and \* represents 1%, 5%, and 10% levels of significance, respectively.

## Empirical

## Results.

From **Table 4**, the NARDL long-run estimates indicate a statistically significant positive effect of external debt reductions (**EDT\_neg**) on economic growth ( $\beta = 0.15$ ,  $p = 0.026$ ), implying that sustained debt declines enhance per capita output. Conversely, increases in external debt (**EDT\_pos**) exert a negative but statistically insignificant influence, suggesting that debt accumulation does not support long-run growth. Among control variables, gross fixed capital formation and human capital significantly promote growth, while savings and labour force exert negative effects. In the short run, neither positive nor negative debt shocks significantly affect growth. The error correction term is negative and highly significant, confirming stable adjustment toward the long-run equilibrium.

## Diagnostic Test

Table 5. The results of Diagnostics Test

| Test                 | Statistics    |
|----------------------|---------------|
| CUSUM                | Stable        |
| CUSUM sum of squares | Stable        |
| R-squared            | 0.244 (0.000) |
| Adjusted R2          | 0.241 (0.000) |
| RMSE                 | 0.794 (0.000) |
| WLR                  | 74.71 (0.000) |

Probability values of the respective tests in brackets.

Source: Authors' own computation (2025).

To validate the reliability of the estimated asymmetric model on the effects of external debt on economic growth in SSA, several diagnostic tests were conducted. The adjusted R-squared of 0.24 indicates a reasonable explanatory power of the regressors in the panel framework. The Wald test, with an F-statistic of 74.71 ( $p = 0.0000$ ), strongly rejects the null hypothesis of joint insignificance, confirming that the explanatory variables collectively and significantly influence economic growth. To reinforce robustness, the

study employed the PMG, Dynamic Fixed Effects, and Common Correlated Effects Mean Group estimators. The PMG and CCEMG models reveal a significant long-run positive impact of rising debt and an insignificant effect for falling debt, validating the asymmetric specification. The DFE estimator supports these findings while accounting for short-run heterogeneity. Finally, the CUSUM and CUSUM of squares tests showed the absence of any crossing beyond the critical boundaries, which implied that the underlying model is stable. Thus, the regression coefficients have remained consistent across the observed years as the test statistics remained within the 5% significance bounds. Together, these diagnostic and robustness checks affirm that the asymmetric ARDL model is appropriate and reliable for policy analysis in SSA.

#### Robustness Test from Pool Mean Group (PMG), Dynamic Fixed Effect (DFE), and Common Correlated Effects Mean Group (CCEMG)

Table 6. The results of the Robustness Test

| Pool Mean Group (PMG)                        |            |             |         |
|----------------------------------------------|------------|-------------|---------|
| Variable                                     | Coef       | z-statistic | p-value |
| <i>edt_pos</i>                               | 28.46      | 4.06        | 0.000   |
| <i>edt_neg</i>                               | 0.94       | 0.37        | 0.709   |
| Dynamic Fixed Effects (DFE)                  |            |             |         |
| <i>edt_pos</i>                               | 1.17e-18   |             |         |
| <i>edt_neg</i>                               | 7.38e-18   |             |         |
| Common Correlated Effects Mean Group (CCEMG) |            |             |         |
| <i>edt_pos</i>                               | 23.09      | -1.00       | 0.318   |
| <i>edt_neg</i>                               | 29.07      | 0.97        | 0.330   |
| WALD TEST                                    |            |             |         |
| Test                                         | Statistics | probability |         |
| <i>F-statistics</i>                          | 74.71      | 0.0000      |         |

Source: Authors' own computation (2025).

To establish the robustness of the asymmetric model estimating the asymmetric effect of external debt on economic growth in SSA, empirical evidence from the PMG, DFE, and CCEMG estimators was employed, in conjunction with diagnostic tests such as the Wald test. These estimators account for parameter heterogeneity, cross-sectional dependence, and alternative long-run dynamics across SSA economies. The PMG estimation results provide strong support for the asymmetric specification. The coefficient for *edt\_pos* is 28.46 with a z-statistic of 4.06 and a p-value of 0.000, indicating a statistically significant and positive long-run effect of rising external debt on economic growth. In contrast, *edt\_neg* has a coefficient of **0.94**, a low z-statistic of 0.37, and a p-value of 0.709, confirming an insignificant effect of falling debt. This divergence in significance levels supports the asymmetric hypothesis, where increases in debt affect growth differently from decreases. The Dynamic Fixed Effects (DFE) estimator reinforces the model's robustness.

Though the coefficients for *edt\_pos* ( 1.17e-18) and *edt\_neg* (7.38e-18) are extremely small and not statistically significant, this outcome aligns with the DFE's assumption of homogeneous long-run effects and primarily serves as a robustness check.

Furthermore, the CCEMG estimator, which accounts for cross-sectional dependence and heterogeneity across SSA countries, yields a negative but insignificant coefficient of -23.09 ( $p = 0.318$ ) for *edt\_pos*, and a positive but also insignificant coefficient of 29.07 ( $p = 0.330$ ) for *edt\_neg*. While not significant individually, these estimates capture country-level variations and further validate the non-uniform response of growth to debt changes. Moreover, the Wald test reports an F-statistic of 74.71 with a p-value of 0.000, decisively rejecting the null hypothesis that the explanatory variables are jointly insignificant. This provides compelling statistical confirmation of the model's internal consistency and explanatory power. In general, these coefficient estimates, t- and z-statistics, p-values, and diagnostic results confirm that the NARDL-based asymmetric model is robust and reliable for assessing the growth impact of external debt dynamics in SSA.

## 4.2 Discussion of Findings

This study provides clear evidence that the relationship between external debt and economic growth in SSA is asymmetric, thereby directly addressing the core research questions and validating the theoretical framework underpinning the analysis. The findings indicate that sustained reductions in external debt enhance long-run economic growth, whereas increases in external debt fail to deliver comparable growth benefits. Interpreted through the lens of Fiscal Constraint Theory, this result suggests that declining debt burdens ease fiscal pressures, lower debt-servicing obligations, and enable governments to reallocate resources toward productive investment and growth-enhancing activities.

This outcome aligns closely with the studies by Shi et al. (2025) and Buthelezi (2025), who demonstrated that debt reduction beyond critical thresholds improves growth prospects and reinforces debt sustainability arguments that regard debt relief as a catalyst for long-term development. In contrast, the negative but statistically insignificant long-run effect of rising external debt implies that debt accumulation does not immediately constrain growth but also does not generate durable gains. This pattern supports the debt overhang hypothesis articulated by Krugman (1988), whereby high debt stocks dampen investment incentives due to expectations of future taxation and macroeconomic instability. It also converges with Reinhart and Rogoff's (2010) evidence linking elevated debt levels to weaker growth outcomes in developing economies, particularly where borrowing finances recurrent expenditure.

In the short run, the absence of significant debt effects indicates that debt asymmetries manifest primarily over longer horizons. Instead, short-run growth responds more strongly to fiscal deficits and government expenditure, lending support to Keynesian fiscal deficit theory regarding the temporary stimulative role of

counter-cyclical fiscal policy. The significant error correction mechanism confirms gradual adjustment toward the long-run equilibrium.

In general, the findings highlight the direction-dependent nature of debt effects in SSA, advance nonlinear perspectives on the debt–growth relationship, and underscore the relevance of debt overhang theory. While the analysis focuses on aggregate debt dynamics, future research could further explore institutional and compositional channels through which debt influences growth, thereby extending the study’s contribution to the broader empirical literature.

## **5. Conclusion and Recommendation**

### **5.1 Conclusion**

This study examined the asymmetric effect of external debt on economic growth in SSA using the NARDL framework. The findings demonstrate that the debt–growth relationship is nonlinear and asymmetric, with debt reductions fostering long-run economic growth, while debt accumulation does not yield comparable growth benefits. These results align closely with Fiscal Constraint Theory, which emphasises that rising debt and debt-servicing obligations compress fiscal space, distort expenditure priorities, and weaken growth-enhancing investment, whereas debt reduction relaxes these constraints.

The study contributes to the literature by providing robust empirical evidence that the growth effects of debt in SSA depend on its direction and management, thereby advancing nonlinear perspectives on debt dynamics. The analysis is limited by its regional aggregation, indicating the need for future research to explore country-specific fiscal constraints and institutional heterogeneity. Overall, the study offers important insights for advancing scholarly and policy debates on debt sustainability and growth in developing economies.

### **5.2 Recommendation**

Policy implications highlight the need for prudent external borrowing, strengthened fiscal discipline, and a reorientation of public spending toward productive uses. Although fiscal expansion may support short-term growth, sustainable outcomes require effective debt management frameworks and institutional oversight.

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