



Nonlinear Debt-Growth Dynamics in ECOWAS: A Regime-Switching Threshold Analysis

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Abstract

Rising external debt across Economic Community of West Africa States (ECOWAS) has renewed concerns about debt sustainability and its implications for long-run economic growth, yet existing empirical evidence remained mixed and often methodologically constrained. This study examined whether the external debt-growth relationship in ECOWAS is nonlinear and whether a statistically meaningful debt threshold exists beyond which external borrowing becomes growth-inhibiting. Addressing this question is important given the resurgence of external borrowing in the region and the limited ECOWAS-specific evidence using dynamic nonlinear frameworks. Using an unbalanced panel of 14 ECOWAS countries over the period 1996-2024, the study employed a dynamic panel threshold regression approach that explicitly accounts for growth persistence, unobserved heterogeneity, and endogeneity. The results identified a significant external debt threshold at 64.68 percent of GDP. Below this level, external debt exerted no statistically significant effect on real GDP per capita growth, suggesting that moderate borrowing neither constrained nor substantially accelerated growth. In contrast, once external debt exceeds the threshold, its impact became negative and economically meaningful. The analysis further showed that fiscal deficits condition the debt-growth relationship, with better managed deficits mitigating adverse growth effects in high-debt regimes. By providing updated, region-specific threshold estimates using a dynamic nonlinear framework, this study contributes to the debt-growth literature by refining the understanding of sustainable external borrowing in ECOWAS. The findings offer quantitative benchmarks that complement existing theoretical and empirical work and have direct relevance for debt management and fiscal policy design in highly indebted low-income economies.

Keywords: Dynamic panel threshold analysis, Economic growth, Nonlinearity and External debt

1. Introduction

The accumulation of external public debt has re-emerged as a central macroeconomic concern in both advanced and developing economies, particularly in the aftermath of successive global shocks. Since the 2007-2008 global financial crisis, followed by the European sovereign debt crisis and the COVID-9 pandemic, governments worldwide have relied heavily on debt-financed fiscal stimulus to stabilise output and support recovery. While such strategies have been largely manageable in advanced economies due to deeper financial markets and stronger institutional frameworks, the implications for developing regions, especially ECOWAS, have been far more complex. In ECOWAS, renewed access to international capital markets, declining concessional financing, and persistent structural constraints have contributed to a rapid resurgence of external debt, reviving long-standing debates on the sustainability of debt and its consequences for long-term economic growth.

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From a theoretical standpoint, the relationship between external debt and economic growth is well grounded in classical and modern growth theories. The Dual Gap Theory argued that external borrowing can accelerate growth in developing economies by bridging domestic savings and foreign exchange gaps (Ariyibi et al. 2023; Ojeka & Simon-Oke, 2023). This framework provides

a strong justification for debt-financed development, particularly in capital-scarce economies such as those in ECOWAS. However, it also implicitly recognised that the growth-enhancing role of debt is conditional on sustainability; once borrowing exceeds absorptive and repayment capacities, its benefits diminish (Ibrahim Amoo, 2024; Seghini, 2024; Tamborini, 2025). This insight is reinforced by the Debt Overhang Theory, which argued that excessive debt discourages both domestic and foreign investment by creating expectations of future distortionary taxation or default (Guo, 2024; Ezenwa-Ohaeto & Umenweke, 2024). When investors anticipate that returns on productive activities will be appropriated to service debt obligations, investment incentives weaken, leading to slower growth. Complementarily, the crowding-out hypothesis suggests that rising debt-servicing costs divert public resources away from growth-enhancing expenditures such as infrastructure, education, and health, thereby constraining long-term development (Liu & Niyongabo, 2025; Onafowora & Owoye, 2026).

The Solow–Swan growth framework, although not explicitly debt-focused, further strengthens these arguments by emphasising diminishing returns to capital accumulation (Missaglia & Vaggi, 2025; Aibinu et al. 2025). Within this framework, external borrowing can raise capital stocks and output in the short run, but beyond a certain point, additional capital, particularly when financed through debt, yields progressively lower growth returns. When debt servicing obligations rise faster than productive capacity, the economy may experience a net growth loss. Taken together, these theoretical perspectives converge on a critical implication: the external debt–growth relationship is inherently nonlinear. Moderate levels of borrowing may stimulate growth, but excessive debt can become a binding constraint, reversing growth gains. (Cooper & Sachs, 1984; Krueger, 1987; Borensztein, 1990).

Despite this strong theoretical consensus, empirical evidence on the precise nature and location of debt thresholds remains inconclusive, particularly for ECOWAS. Recent studies increasingly documented nonlinear and threshold effects in the debt–growth nexus, with adverse growth effects emerging only after debt surpasses specific levels (Okwoche & Makanza, 2023; Ibañez Martín et al. 2024; Mihajlović, 2025; Amoh et al. 2025). These empirical findings from both global and regional samples suggest that debt thresholds vary significantly across countries and income groups, reflecting differences in institutional quality, fiscal capacity, and financial market development. For ECOWAS economies, these differences are especially pronounced due to weaker governance structures, higher exposure to external shocks, and limited policy buffers. As a result, debt thresholds estimated for advanced or emerging economies may be inappropriate for guiding fiscal policy in ECOWAS, underscoring the need for region-specific analysis.

Nevertheless, much of the existing empirical literature

on ECOWAS continues to rely on quadratic specifications or static cross-sectional approaches to capture nonlinearity. While quadratic models impose a convenient functional form, they assume smooth and symmetric effects of debt on growth and often exaggerate turning points due to multicollinearity between debt and its squared term (Makhoba et al. 2022). Cross-sectional and static panel approaches further suffer from an inability to account for growth persistence, endogeneity, and country-specific heterogeneity, features that are particularly salient in ECOWAS economies. Consequently, these methods provide limited insight into the dynamic and regime-dependent nature of the debt–growth relationship (Musah et al. 2024; Nazlioglu & Karul, 2024; Jackson, et al. 2024; Aminu, 2025).

This study identifies a clear and defensible research gap at the intersection of theory and empirics: the lack of robust, dynamic, and region-specific evidence on external debt thresholds in ECOWAS. While recent threshold-based studies have advanced the literature, few explicitly focus on ECOWAS using dynamic panel techniques capable of addressing endogeneity and growth inertia. Moreover, existing ECOWAS-focused analyses often yield inconsistent threshold estimates, limiting their policy relevance. Addressing this gap is essential, given the renewed surge in external borrowing across the region and the heightened risk of debt distress documented in recent policy reports.

In response, the primary objective of this study is to empirically examine the nonlinear impact of external debt on economic growth in ECOWAS by identifying the threshold level beyond which external debt becomes growth-dampening. Specifically, the study asks: Does a statistically significant external debt threshold exist for ECOWAS economies, and how does the growth effect of debt differ below and above this threshold? To answer this question, the study employed a dynamic panel threshold modelling framework that allowed the debt–growth relationship to vary across regimes while accounting for persistence in economic growth and unobserved heterogeneity.

The expected contribution of this study is twofold. Theoretically, it shall provides empirical validation of nonlinear debt–growth mechanisms implied by the Dual Gap, Debt Overhang, and Solow–Swan growth theories within a ECOWAS-specific context. Methodologically, it shall advance the regional literature by moving beyond static and quadratic approaches, offering more credible estimates of debt thresholds relevant for policy design. Practically, the findings aim to inform fiscal and debt management strategies by identifying sustainable borrowing limits and highlighting the conditions under which external debt can support, rather than hinder, economic growth. This focus naturally motivates a critical review of the existing empirical literature on the relationship between external debt and economic growth in ECOWAS region using the panel threshold analysis. The

remainder of the paper proceeds as follows. Section 2 reviews the relevant literature, Section 3 outlines the methodology, Section 4 presents the results, and Section 5 and discusses of findings and section 6 presents conclusion with policy implications.

2. Literature Review

The relationship between external debt and economic growth occupies a central position in both monetary and development economics, reflecting long-standing debates over the role of external financing in capital accumulation and macroeconomic stability. At its theoretical core, this literature is informed by the Dual Gap framework, neoclassical growth theory, and the debt overhang hypothesis, each of which provides competing yet complementary insights into how external borrowing affects long-run growth. The Dual Gap perspective conceptualises external debt as a necessary instrument for overcoming savings and foreign exchange constraints in developing economies, thereby enabling higher investment and faster growth (Chenery & Strout, 1968). In contrast, neoclassical growth theory cautions that debt-financed capital accumulation is subject to diminishing returns, implying that the growth benefits of borrowing are inherently bounded (Solow, 1956; Swan, 1956). These theoretical tensions are reconciled by the debt overhang hypothesis, which posits that once external debt rises beyond a critical level, expectations of future taxation or default discourage private investment and productivity-enhancing activities, ultimately depressing growth (Reinhart et al. 2012). Collectively, these frameworks imply that the debt-growth relationship is nonlinear and potentially characterised by threshold effects rather than a uniform linear association.

Motivated by these theoretical propositions, the empirical literature has increasingly focused on identifying whether external debt exerts growth-enhancing or growth-inhibiting effects at different levels of indebtedness. A seminal contribution in this regard is Reinhart and Rogoff (2010), who examine the debt-growth nexus across advanced and emerging economies and report that external debt below 90 per cent of GDP has limited effects on growth, while debt exceeding this threshold is associated with significantly lower growth rates. Their analysis further suggests that emerging markets face even lower external debt thresholds, particularly because foreign-currency-denominated debt amplifies vulnerability to external shocks. Specifically, when external debt reaches 60 per cent of GDP in emerging economies, annual growth declines by approximately two percentage points. Despite its influence, this study has been widely criticised for methodological shortcomings, including sensitivity to outliers, reliance on averages, and missing observations. These limitations undermine the robustness of the proposed thresholds and have prompted subsequent research to revisit the issue using alternative data and econometric strategies.

In response, a growing body of literature has sought to identify debt thresholds that are more appropriate for developing economies by employing region-specific samples and nonlinear estimation techniques. Tarawalie and Jalloh (2021), focusing on ECOWAS countries, employ multiple panel estimators, including pooled ordinary least squares, fixed effects, random effects, and panel-corrected standard errors, to capture heterogeneity and cross-sectional dependence. Their results indicate an optimal external debt threshold of 111 per cent of GDP, below which debt supports growth and above which its marginal contribution becomes negative, albeit modestly. They attribute this nonlinearity to country-specific factors such as institutional quality and macroeconomic policy credibility, reinforcing the argument that the growth effects of external debt are conditional rather than universal. Similarly, Sharaf (2022) applies a nonlinear autoregressive distributed lag framework combined with a vector error-correction model to examine both short- and long-run effects of external debt on growth over the period 1980-2019. Using World Development Indicators data to isolate external debt more precisely, Sharaf finds that growth becomes adversely affected once the debt-to-GDP ratio exceeds approximately 96.7 per cent, thereby providing further empirical support for threshold-driven dynamics.

While these studies advance the literature by explicitly modelling nonlinearity, earlier empirical contributions laid important groundwork by distinguishing between types of public debt and exploring alternative functional forms. Panizza (2008) emphasises the importance of separating domestic and external debt, arguing that their macroeconomic consequences differ significantly due to currency denomination, rollover risks, and exposure to external shocks. Presbitero (2012) builds on this distinction by employing a quadratic specification to identify a hump-shaped relationship between debt and growth, suggesting that moderate debt levels may support growth while excessive debt undermines it. However, quadratic approaches impose symmetry in the marginal effects of debt and predetermine the shape of the relationship, limiting their ability to capture abrupt regime shifts or asymmetric responses. Gravina and Lanzafame (2021), although focusing on income inequality rather than growth, illustrate the broader reliance on quadratic specifications in applied macroeconomics and underscore their inherent constraints when modelling complex nonlinear processes.

These methodological limitations have motivated a shift toward threshold regression techniques that allow the data to determine regime changes endogenously. Early applications of threshold models to the debt-growth nexus are exemplified by Pattillo et al. (2002), who analyse 93 developing countries and identify a critical external debt threshold of approximately 35-40 per cent of GDP, beyond which the average impact of debt on growth turns negative. Their findings also suggest that debt relief under the Heavily Indebted

Poor Countries (HIPC) initiative can raise per capita growth, provided complementary structural and macroeconomic reforms are in place. Cordella et al. (2010) further examine the relationship between external debt and growth in heavily indebted poor countries (HIPC), highlighting the importance of debt relief and concessional financing. However, the datasets employed in these studies end in the early 2000s, limiting their relevance in light of subsequent global developments such as the 2007-2008 financial crisis and the renewed surge in external borrowing across developing regions.

Subsequent research has refined these insights by examining how debt effects vary across different ranges of indebtedness and institutional contexts. Sichula (2012) and Presbitero (2012) employ panel data techniques to show that the marginal impact of external debt on growth is negative at intermediate debt levels but becomes statistically insignificant at very low or very high levels, corresponding to the concepts of debt overhang and debt irrelevance. Their results suggest that economies with sound fiscal and institutional frameworks begin to experience debt overhang effects when external debt exceeds roughly 90 per cent of GDP, while the marginal impact diminishes at levels above 70-80 per cent. Notwithstanding their contributions, these studies rely on Hansen's (2000) static threshold estimation applied to cross-sectional data spanning 1970-2002, raising concerns about their ability to capture dynamic adjustment, endogeneity, and more recent structural changes in global debt markets.

Contrasting sharply with the threshold-oriented literature, more recent IMF-affiliated and cross-country studies question the existence of stable or universal debt thresholds. Law et al. (2021), Ndoricimpa (2020), and Fetai et al. (2020) employ linear dynamic models, weak exogeneity tests, asymmetric specifications, and nonlinear static approaches across large panels of countries. While these studies detect some evidence of nonlinear effects in the long run, they fail to identify consistent or time-invariant debt thresholds within individual countries. Their findings suggest that growth responses to debt accumulation may be better approximated by linear or near-linear relationships once country-specific dynamics and feedback effects are properly accounted for. This divergence highlights the sensitivity of empirical results to identification strategies and econometric choices, particularly with respect to how endogeneity and persistence are treated.

The absence of consensus is further illustrated by competing estimates of debt thresholds across different country groups. While Reinhart and Rogoff (2010) propose a 90 per cent threshold, Caner et al. (2010) estimate a lower tipping point of 77 per cent for both developed and developing economies, above which each additional percentage point of debt reduces annual growth by 0.017 percentage points. For emerging markets, they identify an even lower threshold of 64 per cent. Cecchetti et al. (2011) report a threshold of 85 per

cent for OECD countries, whereas Egert (2015) finds that negative growth effects can emerge at debt levels as low as 20–60 per cent of GDP. These disparities underscore the difficulty of extrapolating debt benchmarks across regions and institutional settings.

Whether such thresholds are applicable to ECOWAS remains an open question. ECOWAS economies face distinctive structural challenges, including limited fiscal space, higher borrowing costs, shallow financial markets, and heightened exposure to external shocks. These characteristics suggest that debt thresholds derived from advanced or emerging economies may be inappropriately high for ECOWAS contexts. Consequently, there is growing recognition that region-specific analyses are required to identify the tipping points at which external debt transitions from growth-enhancing to growth-dampening in ECOWAS, particularly using updated datasets and econometric methods that reflect contemporary economic realities.

A related strand of the literature emphasises the mediating role of fiscal policy and institutional quality in shaping the debt–growth relationship. Presbitero (2012) argued that debt overhang effects are more pronounced in economies with stable and sound fiscal policies, as investors anticipate that future fiscal surpluses will be used to service debt rather than support growth. Empirical evidence from European economies supports this view. Chugunov et al. (2021) and Larch et al. (2021) show that high initial government debt combined with weak fiscal policy quality leads to persistently lower growth in the European Union, while credible and disciplined fiscal frameworks can mitigate the adverse effects of high debt. These findings reinforced the notion that the growth impact of external debt is conditional on policy credibility rather than debt levels alone.

Country-specific studies further illustrate the heterogeneity of debt thresholds and the centrality of fiscal dynamics. Law et al. (2021) find that in China, external debt becomes growth-dampening once it exceeds 41.14 per cent of GDP, a threshold substantially lower than those reported for advanced economies. Complementary evidence from Zhang (2023) and Karim et al. (2022) highlights the risks associated with expansionary fiscal policies in the post-COVID-19 period, showing that nonlinearities and structural breaks worsened debt unsustainability. Guo and McDermott (2020) add another dimension by demonstrating a positive nonlinear relationship between sovereign debt and the duration of economic depressions, suggesting that high external debt does little to accelerate recovery during downturns.

The interaction between fiscal deficits and external debt is further explored by Mohsin et al. (2021), who show that the negative growth effects of external debt are reduced in countries with high-quality fiscal institutions but intensified in the presence of poorly

managed deficits. Using spline functions and Caner and Hansen's (2004) threshold estimation, Law et al. (2021) identified markedly lower debt thresholds in countries with weaker governance structures. Manasseh et al. (2022) extend this analysis by demonstrating that shadow economies worsened external debt accumulation by eroding tax revenues and amplifying the effects of corruption, thereby weakening growth outcomes. Relatedly, Qehaja-Keka et al. (2023) highlight how large fiscal deficits driven by excessive government spending undermine investor confidence and divert resources away from productive investment, while Casalin et al. (2020) show that even relatively stable borrowers can experience sudden debt instability during sharp nominal income slowdowns, particularly when tax systems are inefficient.

Additional evidence from Fetai et al. (2020), who examine European transition economies using pooled OLS, fixed and random effects, GMM, and bootstrap techniques, confirms the presence of threshold effects linked to fiscal deficits, with high external debt disproportionately harming growth in fiscally imbalanced countries. These findings underscore the interconnectedness of fiscal policy quality, institutional strength, and debt dynamics. Trionfetti (2015) further contributes to this debate by analysing 132 fiscal episodes in OECD countries and showing that high-debt countries are disadvantaged in tax competition, although debt reduction ultimately strengthens their long-term economic position.

Taken together, the literature reveals broad agreement that the external debt–growth relationship is nonlinear and context-dependent, yet it also exposes substantial contradictions regarding the magnitude, stability, and policy relevance of debt thresholds. For ECOWAS, these contradictions are amplified by data limitations, methodological heterogeneity, and the relative scarcity of studies employing dynamic threshold techniques tailored to the region. The unresolved question of where debt thresholds lie in ECOWAS, and how they interact with fiscal policy quality and institutional constraints, constitutes a critical gap that this study seeks to address. By adopting a dynamic panel threshold approach and focusing explicitly on external debt in ECOWAS, the present study aims to contribute more credible and policy-relevant evidence to an increasingly fragmented empirical literature.

3. Methodology

This study investigated the relationship between external debt and economic growth in 14 ECOWAS countries from 1996 to 2024, employing a dynamic panel threshold model. Unlike quadratic or cross-sectional techniques often used in earlier ECOWAS studies, this approach addresses their key limitations by capturing nonlinearities, controlling for country-specific heterogeneity, and accounting for persistence in economic growth and potential endogeneity (Kremer et al., 2013; Panizza & Presbitero, 2013). Fiscal deficits were introduced as the threshold variable, given their

role in driving debt accumulation and shaping growth outcomes. Data were sourced from the World Bank's World Development Indicators (WDI, 2024), and averaged into four-year intervals to minimise short-term fluctuations. The dependent variable was real GDP per capita growth, with external debt-to-GDP as the main explanatory variable. Control variables included initial income, government expenditure, human capital, gross fixed capital formation, labor force, and savings. This methodological design provided more reliable estimates and stronger policy implications.

3.1 Empirical model

To develop a model that identifies the threshold point in the relationship between external debt and economic growth, this study builds an augmented economic growth equation as follows:

$$\begin{aligned} \ln gdp_{it} = & \alpha_0 + \ln gdp_{it-1} + \\ & \alpha_1 \ln ed_{it} + \alpha_2 \ln fcf_{it} + \alpha_3 hcs_{it} + \alpha_4 \ln fc_{it} + \alpha_5 \ln sav_{it} \\ & + \alpha_6 \ln exp_{it} + \theta_i + \mu_t + \varepsilon_{it} \end{aligned} \quad (1)$$

The empirical model specifies real GDP per capita growth as the dependent variable to capture economic performance, consistent with standard growth theory. A lagged growth term is included to account for growth persistence and dynamic adjustment, as commonly adopted in debt-growth analyses (Mohsin et al., 2021; Agyeman et al., 2022). External debt is the key explanatory variable, reflecting debt overhang and crowding-out mechanisms highlighted in the literature. Gross fixed capital formation is included to capture investment-driven growth effects, following Mohsin et al. (2021). Human capital and labour force variables account for productivity and scale effects, while savings is incorporated due to its role in promoting investment and financial intermediation (Bresser-Pereira & Nakano, 2020; Ribaj & Mexhuani, 2021; Konstantakopoulou, 2023). Government expenditure is included given evidence that public spending supports growth through infrastructure provision and economic stabilisation (Dudzevičiūtė et al., 2018; Onifade et al., 2020; Poku et al., 2022). Country and time effects control for unobserved heterogeneity and common shocks, while logarithmic transformation ensures elasticity-based interpretation and mitigates heteroscedasticity.

3.1. Dynamic Panel Threshold Estimation

To rigorously examine the nonlinear relationship between external debt and economic growth, this study employs the dynamic panel threshold regression framework developed by Kremer et al. (2013), which is explicitly designed to capture regime-dependent effects in dynamic panel settings. This approach is particularly suitable for the present analysis as it allows the impact of external debt on economic growth to vary endogenously across regimes defined by a threshold variable, rather than imposing a predetermined functional form. By simultaneously accounting for growth persistence, unobserved country-specific

heterogeneity, and potential endogeneity, the model provides a robust framework for identifying the debt threshold beyond which the growth effects of external borrowing change. Consequently, the methodology enables a clear distinction between growth-enhancing and growth-dampening debt regimes, offering more credible and policy-relevant insights than conventional linear or quadratic specifications.

$$gdppc_{it} = \varphi_i + \gamma_1 edt_{it} I(edt_{it} \leq \emptyset) + \vartheta_1 I(edt_{it} \leq \emptyset) + \gamma_2 edt_{it} I(edt_{it} > \emptyset) + \omega \mu_{it} + \pi_t + \varepsilon_{it} \quad (2)$$

Subsequently, the impacts of fiscal deficits on external debt and economic growth, both before and after a specific debt threshold, are determined as follows:

$$gdppc_{it} = \varphi_i + \gamma_1 edt_{it} I(fdt_{it} \leq \emptyset) + \vartheta_1 I(fdt_{it} \leq \emptyset) + \gamma_2 edt_{it} I(fdt_{it} > \emptyset) + \omega \mu_{it} + \pi_t + \varepsilon_{it} \quad (3)$$

In Equations (2) and (3), $gdppc$ represents GDP per capita growth, serving as a measure of economic growth. The variable edt denotes external debt, while fdt refers to fiscal deficits. μ represents the vector of control variables specified in Equation (1), including government expenditure, gross fixed capital formation, labor force, human capital, savings, and fiscal deficits. The term φ_i captures country-fixed effects to account for the heterogeneity arising from differences in countries' policies and their implications, while π_t denotes time effects. The indicator function $I(\cdot)$ identifies whether the debt threshold $\emptyset$ is exceeded.

The two regimes in the model are distinguished by whether the threshold variable, external debt, is above or below the threshold value $\emptyset$. These regimes are further characterized by differing regression slopes, denoted as γ_1 and γ_2 . Most threshold estimates for debt in existing literature, such as those by Hansen (1999) and Gonzalez et al. (2005), are based on non-dynamic frameworks that do not account for the role of initial income in growth models. Following Kremer et al. (2013), this study constructs a dynamic panel threshold model as an extension of Hansen (1999), allowing for the inclusion of endogenous regressors such as lagged dependent variables. Specifically, the approach incorporates the cross-sectional threshold model proposed by Caner and Hansen (2004) into a dynamic setting, where endogeneity is handled using generalized method of moments (GMM)-type estimators. Kremer et al.'s (2013) method permits the effect of external debt on economic growth to vary depending on whether the debt level is above or below an unknown threshold value $\emptyset$.

4. Empirical Results

5. 4.1 Descriptive Statistics

Descriptive statistics for these variables are presented in Table 1, indicate moderate variability in real GDP per capita growth (mean = 7.06; SD = 0.87), suggesting relatively stable growth performance across ECOWAS countries. External debt displays substantial dispersion

(mean = 53.09; max = 358.80; SD = 43.99), highlighting pronounced heterogeneity in debt exposure. Fiscal deficits are persistently negative on average, while investment, government expenditure, and savings show comparatively lower volatility.

4.2 Correlation Analysis

The correlation and VIF results in Table 2 provide useful insights into the relationship between external debt, fiscal indicators, and economic growth in ECOWAS from 1996 to 2024. Fiscal deficits, investment, government expenditure, human capital, labor force, and savings show positive correlations with GDP per capita, indicating their supportive role in promoting growth during the study period. In contrast, external debt has a weak negative correlation of -0.085 with GDP per capita, suggesting that rising debt levels tend to hinder growth outcomes. Importantly, no variable pair exhibits high correlation, as coefficients remain below 0.80, minimizing the risk of multicollinearity. The VIF test further confirms this, with all values below 3, ensuring that the explanatory variables provide reliable results for subsequent econometric analysis.

4.3 Dynamic Panel Threshold Results

Table 3 presents the results of the threshold analysis of external debts on economic growth in ECOWAS. The dynamic panel threshold results identify a statistically significant external debt threshold at 64.68% of GDP ($p < 0.05$), confirming the presence of two distinct regimes. In the lower-debt regime (external debt $\leq 64.68\%$), lagged GDP per capita growth is positive and highly significant (coef = 0.7814, $p < 0.001$), indicating strong growth persistence. Fiscal deficit exerts a small but positive and significant effect (coef = 0.0006, $p = 0.0319$). Gross fixed capital formation (coef = 0.0726, $p = 0.0272$) and labour force (coef = 0.0071, $p = 0.0064$) also positively and significantly influence growth. Government expenditure, savings, and human capital are statistically insignificant in this regime.

In the upper-debt regime (external debt $> 60.07\%$), lagged growth becomes negative and significant (coef = -0.1862 , $p = 0.005$). Investment (coef = -0.1071 , $p < 0.001$) and labour force (coef = -0.0238 , $p < 0.001$) exert significant negative effects. Fiscal deficit, savings, government expenditure, and human capital remain statistically insignificant.

4.4 .Robustness Checks

The triple-threshold analysis in Table 4, reinforces the main study's established external debt threshold of 64.68% of GDP in ECOWAS. The estimated thresholds at 41.18, 49.63, 71.32, and 93.23 percent illustrate the heterogeneous impact of debt across regimes. Notably, the thresholds below and above 64.68% align with the earlier finding that economic growth benefits when debt remains below the threshold and becomes muted or potentially adverse when debt

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>FDT</i>	-10.184	23.749	-26.180	17.827
<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

NOTE: external debts, *edt*; fiscal deficits, *fdt*; government expenditure, *gexp*; gross fixed capital formation, *gfcf*; Human capital Stock, *hcs*; labour force, *lfc* and savings, *savs*. The variables remain as defined in table 3.1 in Chapter three.

Source: Author's Compilation (2026).

Table 2: Correlation Matrix

	<i>gdppc</i>	<i>edt</i>	<i>lfdt</i>	<i>lgexp</i>	<i>lgfcf</i>	<i>hcs</i>	<i>lfc</i>	<i>savs</i>	<i>vif</i>
<i>GDPPC</i>	1.000								
<i>EDT</i>	-0.085	1.000							1.077
<i>LFDT</i>	0.303	0.250	1.000						2.186
<i>LGEXP</i>	0.082	-0.131	-0.175	1.000					2.569
<i>LGFCF</i>	0.382	-0.170	-0.007	0.556	1.000				1.701
<i>HCS</i>	0.233	-0.222	-0.053	0.121	-0.007	1.000			1.335
<i>LFC</i>	0.570	-0.032	0.197	-0.486	0.109	0.127	1.000		2.229
<i>SAVS</i>	0.403	-0.084	0.257	0.169	0.508	-0.050	0.078	1.000	1.460

Source: Author Compilation (2026)

remains below the threshold and becomes muted or potentially adverse when debt exceeds it. The coefficients of the categorical debt variables confirm this pattern: debt below the threshold (category 0) positively influences growth, while debt in higher regimes shows diminishing or statistically weaker effects, consistent with the notion of a nonlinear, threshold-dependent relationship as proposed by Hansen (1999). This evidence underscores the policy imperative for ECOWAS governments to maintain external debt at sustainable levels to avoid compromising growth.

Furthermore, from Table 4, the P-values results revealed that the established 60.07% debt-to-GDP threshold, indicate that introducing multiple thresholds does not significantly improve model fit, as evidenced by the high p-values for the single (0.652), double (0.742), and triple (0.918) threshold tests. This suggested that the previously estimated single threshold of 664.68% remained robust and sufficient to capture the nonlinear effect of external debt on economic growth in ECOWAS. In terms of robustness, these statistics confirm that the growth-debt relationship is reliably

characterised by a single critical debt level, reinforcing the credibility of policy recommendations based on this threshold and indicating that adding additional thresholds does not materially alter the main findings.

Table 5 presents beyond the p-values, rho statistics, and triple-threshold analysis, the within, between, and overall R-squared values provide further support for the robustness of the regression results. The within R² of 0.4165 indicates that about 41.7% of the variation in GDP per capita within countries over time is explained by the model, while the between R² of 0.4591 shows that 45.9% of the variation across countries is captured. The overall R² of 0.3575 confirms the model reasonably fits the entire panel. Additionally, the F-statistic of 77.22 (p < 0.001) demonstrates joint significance of regressors, reinforcing the validity and appropriateness of the model for ECOWAS economies.

6. Discussion of Findings

The findings confirm a nonlinear external debt-growth relationship in ECOWAS, with a statistically

Table 3. Results of Dynamic Panel Threshold Estimations

Model	Threshold level	Lower	Upper			
Threshold value of edt	60.07**	31.82	88.32			
Constant	4.79	2.59	6.99			
Variables Dep. Gdppc						
	Coef.	Std. Err.	Z	P>z	(95% Conf. Interval)	
Lower regime						
lngdppc-1	0.7814***	0.1413	5.53	0.0000	0.50435	1.0584
lnfdt	0.0006**	0.0002	2.16	0.0319	0.00005	0.0011
lnGexp	-3.83e-07	0.0133	-0.00	1.0000	-0.0262	0.0262
lngfcf	0.0726**	0.0328	2.21	0.0272	0.00832	0.1370
lfc	0.0071**	0.0026	2.73	0.0064	0.00201	0.0122
lnsav	0.0169	0.0247	0.68	0.4941	-0.0315	0.0654
hcs	0.0002	0.0012	0.18	0.8575	-0.0021	0.0026
Upper regime						
lngdppc-1	-0.1862**	0.0657	-2.83	0.005	-0.3151	-0.0573
lnfdt	-0.0004	0.0009	-0.53	0.597	-0.0022	0.0013
lngfcf	-0.1071***	0.0286	-3.74	0.000	-0.1632	-0.0509
lfc	-0.0238***	0.0041	-5.70	0.000	-0.0320	-0.0156
lnsavs	0.0307	0.0330	0.93	0.352	-0.0339	0.0954
hcs	-0.0002	0.0017	-0.10	0.918	-0.0035	0.0032
lngexp	-0.0064	-0.0135	0.48	0.634	-0.0331	0.0201

Note: ***, ** and * represents 1%, 5% and 10% levels of significance respectively.

Source: Author's Compilation 2026

Table 4: The triple-threshold analysis

Model	Threshold	Lower	Upper
Thr-1	41.1817	39.8847	41.5907
Thr-21	49.6291	44.1049	49.7430
Thr-22	71.3163	65.4395	71.5532
Thr-3	93.2273	92.9119	93.9282

within $R^2 = 0.4165$

between $R^2 = 0.4591$

overall $R^2 = 0.3575$

F-statistic = 77.22 (p < 0.001)

Table 5: Threshold effect test (p-values)

Threshold	RSS	MSE	Fstat	Prob	Crit10	Crit5	Crit1
Single	19.5928	0.0177	17.04	0.6520	47.4692	58.1206	89.0040
Double	19.4187	0.0175	9.93	0.7420	28.5972	36.7299	46.4055
Triple	19.3205	0.0175	5.63	0.9180	23.3637	27.1935	33.7802

threshold at 64.68% of GDP. Below this level, external debt supports growth, consistent with the Dual Gap Theory and the Solow-Swan framework, where borrowing complements domestic savings and capital accumulation. The positive role of fiscal deficits in the low-debt regime aligns with Keynesian demand-side arguments. However, once the threshold is exceeded, external debt exerts a negative effect on growth, validating the Debt Overhang and Crowding-Out

hypotheses (Krugman, 1988; Sachs, 1989). These results are consistent with Reinhart and Rogoff (2010) and Panizza and Presbitero (2014), reinforcing the view that debt is beneficial only within sustainable limits.

7. Conclusion and Policy Recommendations

This study concludes that external debt can foster economic growth in ECOWAS only when maintained below a critical threshold. Beyond this point, excessive

debt undermines growth through reduced investment incentives and constrained fiscal space. Policymakers should therefore adopt prudent borrowing strategies anchored in debt sustainability frameworks. External financing should be channelled toward high-return investments in infrastructure, technology, and human capital rather than recurrent expenditure. Strengthening fiscal institutions, improving public expenditure efficiency, and enhancing domestic revenue mobilisation are essential to reduce over-reliance on external borrowing. Debt relief initiatives should be complemented by credible domestic reforms to prevent recurrent debt distress and ensure long-term growth stability.

This study contributes to the ECOWAS debt-growth literature by providing robust empirical evidence of a region-specific external debt threshold using a dynamic panel threshold approach, thereby advancing beyond linear and quadratic models. It offers policy-relevant insights into sustainable borrowing limits and regime-dependent growth effects. However, limitations exist. Data quality and reporting inconsistencies across ECOWAS countries may affect precision. The assumption of a common threshold may overlook country-specific institutional heterogeneity. Additionally, key factors such as governance quality, political stability, and corruption are not explicitly modeled. Future research should incorporate these dimensions and explore heterogeneous thresholds across country groups.

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