Journal of Economics and Business Review
ISSN 3065-176X
Vol. 2, No. 2, 2025
Published by STSL Press

Original Paper

Debt Threshold and Economic Growth: Time Series Analysis of Ghana

Godwill Atta Boakye[1], Williams Abayaawien Atuilik[2] & Ernest Geraldo Yaw[3]

[1] Accra Institute of Technology (AIT), Department of Business Administration, Ghana

[2] Heritage Christian University, Ghana

[3] Bank of Ghana, Ghana

Corresponding Author, Godwill Atta Boakye, E-mail: godwillattaboakye@gmail.com

Abstract

Purpose: This study aims to investigate the critical impact of public debt on economic growth in the post-COVID era, with a particular focus on Ghana. Policymakers in governments, central banks, and international organizations need to understand when public debt becomes unsustainable and begins to hinder economic development. The goal is to determine the debt threshold at which public debt adversely affects economic growth.

Design/Methodology/Approach: The research employs annual time series data from 1975 to 2021 to explore the relationship between public debt and economic growth in Ghana. Methods used in the analysis include the Augmented Dickey-Fuller (ADF) test, the Phillips-Perron (PP) test, and threshold regression analysis.

Findings: The study identifies a debt threshold of 50.15% of Ghana's GDP. When public debt is below this threshold, it positively influences economic growth. However, once the debt exceeds this threshold, the impact on economic growth becomes negative. These findings underscore the importance of monitoring sustainability indicators such as the debt-to-GDP ratio, debt service-to-revenue ratio, and primary surplus or deficit to evaluate a country's debt management capabilities and ensure long-term economic stability.

Originality: This research provides a nuanced understanding of the debt-growth relationship in the context of a developing country, particularly in the aftermath of the COVID-19 pandemic. By identifying a specific debt threshold for Ghana, the study offers valuable insights for policymakers aiming to balance public debt levels and economic growth, contributing to the broader discourse on sustainable funding and economic prosperity in developing regions.

Keywords: Debt threshold, Public debt, Sustainable, Threshold regression, Economic Growth, Ghana

Introduction

Public debt has long been a global focal point of economic policy discussions, with considerable attention directed towards its implications for economic growth and sustainability. In recent years, the issue has gained particular prominence in the context of developing economies, where the management of public finances plays a critical role in fostering long-term prosperity and stability. Public debt, encompassing both domestic and external borrowing, is a critical aspect of fiscal policy that plays a significant role in shaping economic outcomes for countries around the world. In the context of Ghana, the dynamics of public debt have become increasingly pertinent as the country grapples with the challenges of financing development projects, addressing budgetary shortfalls, and promoting sustainable economic growth (Osei-Assibey et al., 2020). Over the past decade, Ghana has experienced a notable increase in public debt levels, driven by factors such as fiscal deficits, infrastructure investment, and external borrowing (Adusei and Appiah, 2020).

The significance of this inquiry lies in the unique economic landscape of Ghana, a nation situated in West Africa with a rich history of economic development efforts amidst various challenges. Over the past few decades, Ghana has experienced fluctuations in its public debt levels, influenced by factors such as fiscal policy decisions, external shocks, and domestic economic conditions (Nugent and Dabalen, 2020). Against this backdrop, understanding the dynamics between public debt accumulation and economic growth outcomes is paramount for informing effective policy formulation and implementation strategies.

Empirical evidence on the relationship between public debt and economic growth is mixed, with studies reporting varying findings across different countries and contexts. While some research suggests that high levels of public debt can exert a drag on economic growth by crowding out private investment and increasing borrowing costs (Reinhart and Rogoff, 2010), others argue that judiciously managed debt can serve as a catalyst for growth-enhancing investments in infrastructure, human capital, and social services (DeLong and Summers, 2012).

In the Ghanaian context, the issue of public debt is particularly salient given the country's ambitious development agenda and the imperative to sustain robust economic growth while ensuring fiscal prudence. Against the backdrop of recent fluctuations in public debt levels and evolving economic challenges, there is a pressing need to assess the relationship between public debt and economic growth to inform policy decisions and enhance economic resilience.

This paper adopts a rigorous empirical approach to investigate the existence of a potential threshold effect in the relationship between public debt and economic growth in Ghana. By analyzing a comprehensive dataset spanning multiple years and employing advanced econometric techniques, this paper seeks to contribute to this discourse by examining the relationship between public debt and economic growth in the specific context of Ghana. We aim to shed light on the optimal level of public debt beyond which its adverse effects on economic growth may become more pronounced.

This study contributes to the existing literature by offering insights tailored to the Ghanaian context, informing policymakers, economists, and other stakeholders involved in shaping the country's economic trajectory. The findings of this research are expected to have implications for fiscal policy formulation, debt management strategies, and broader efforts to promote sustainable and inclusive economic development in Ghana.

Literature Review

Theoretical Review

The theory underpinning this paper is the debt overhang theory. Debt overhang theory, initially proposed by Krugman, (1988), examines the repercussions of elevated debt levels on economic growth and investment. It posits that when a nation's debt burden surpasses its repayment capacity, it obstructs economic growth by deterring investment and imposing fiscal constraints. This scenario, known as debt overhang, arises when investors are hesitant to fund new ventures due to default risks, constraining future economic activity. Sturzenegger and Zettelmeyer (2007) elaborate, suggesting that debt overhang fosters a detrimental cycle of low growth and escalating debt, as investors demand higher interest rates to offset perceived risks. Empirical studies, notably by Reinhart and Rogoff (2010), corroborate this theory, showing that nations with substantial external debt often experience diminished economic growth. Critics, however, such as Borensztein and Panizza (2009), underscore limitations, emphasizing that the impact of debt on growth hinges on factors like debt composition and institutional quality.

Empirical Review

Fetai, Aydimetai, Bexhetr and Malaj (2020) analyzed the impact of public debt on economic growth in European transition countries. They aimed to identify the threshold point at which the public debt-to-GDP ratio hinders economic development. Utilizing econometric methods including pooled OLS, fixed and random effects models, GMM, and bootstrap techniques, the study determined distinct thresholds for public debt-to-GDP among these nations. Results confirm that within certain limits, reducing government debt positively influences economic growth, but beyond a certain point, it

becomes detrimental. Consequently, tailored fiscal strategies are essential for European transition economies to manage debt while fostering growth.

Bexheti, Sadiku and Sadiku (2020) explore the correlation between public debt and economic growth across Western Balkan nations from 2003 to 2016, utilizing panel data analysis. Employing techniques such as 2SLS, fixed and random effects models, and causality tests, they found public debt to have an insignificantly negative impact on economic growth. Their analysis identified a threshold debt level of 50.87% of GDP. Policy implications suggest governments prioritize fiscal sustainability and robust debt management strategies, as exceeding this threshold could hinder economic growth. It underscores the importance of prudent fiscal policies to mitigate adverse effects on economic development in the region.

Kjosev, Noveski and Kjoseva (2023) investigated North Macedonia's Public Debt Threshold. Their study aimed to discern a potential non-linear link between government debt and economic progress. Utilizing a non-linear multiple regression model alongside Ordinary Least Square (OLS) and Generalized Method of Moments (GMM) tests to address endogeneity, their findings echoed Leed and Kueh's (2020) discoveries. The research pinpointed North Macedonia's public debt threshold at around 30% of GDP. Consequently, the government must heed this threshold to sustain debt levels, as surpassing it could impede economic growth. This underscores the necessity for prudent borrowing practices to foster economic stability in North Macedonia.

Pegkas (2019) examined Greece's public debt threshold from 1970 to 2016, using threshold model techniques. The study found a negative correlation between general government debt and economic growth. It suggests the strength of this correlation varies with debt regimes. Results support the idea that moderate public debt levels correlate with decreased economic growth. Specifically, the study indicates that economic growth is hindered by increases in the general government debt-to-GDP ratio below 23.5%, while extremely high levels, up to 109.4% of GDP, do not exhibit the same detrimental effect.

Gashi (2020) investigated the influence of public debt on economic growth across six Southeast European nations from 2008 to 2017, employing three distinct panel methods: fixed-effect model, generalized method of moments (GMM), and system generalized method of moments. The study aimed to discern any non-linear (quadratic) relationship among these countries. Findings revealed a statistically significant negative impact of increasing government debt on growth. Moreover, the research identified a "U-shaped" correlation between the variables, with a 58% GDP threshold. Beyond this point, escalating public debt is anticipated to impede sustainable growth through heightened interest rates, urging governments to prioritize policies that minimize interest rates.

Saungweme and Odhiambo (2019) analyzed the repercussions of public debt payment on Zambia's economic growth. Employing the autoregressive distributed lag (ARDL) method with data spanning from 1970 to 2017, they discovered that servicing public debt initially impedes economic development but eventually bolsters long-term growth. The study also highlighted a crowding-out effect in the short term and a crowding-in effect in the long term. Consequently, it suggests Zambia's government should strategically utilize borrowed funds to invigorate and diversify the economy, facilitating sustained growth, diversified revenue streams, and timely debt repayments.

Ndoricimpa (2022) investigated the link between South African public debt and economic growth. Employing time series data and Hansen's (2017) regression kink approach, the study identified a critical debt threshold at 37% of GDP. Below this threshold, debt fosters growth; however, surpassing it becomes detrimental to South Africa's economic progress. The implication underscores the need for a fiscal consolidation policy, including reforms in state-owned enterprises to reduce reliance on public funding and initiatives to stimulate long-term economic growth.

Saungweme and Odhiambo (2020) examine the impact of governmental debt payment on economic growth in Zambia from 1970 to 2017. The autoregressive distributed lag (ARDL) bound method was used in the investigation. The outcomes of this research indicate that government debt has a time-varying effect on Zambia's economic growth. In addition, the results of the research reveal that, despite a negative link between government debt service and economic growth in the short and medium

term, the relationship is neutral.

Saungweme and Odhiambo (2021) scrutinized the relationship between debt and growth in South Africa spanning from 1970 to 2017. Their aim was to gauge the cumulative government debt's impact on economic development, alongside distinguishing between domestic and international debt effects on South Africa's expansion. Utilizing the autoregressive distributed lag (ARDL) method, their findings revealed a statistically significant negative influence of South Africa's total public debt on both short- and long-term economic growth. Domestic borrowing displayed a similarly adverse effect on short-term growth, while foreign borrowing exhibited a negative impact, primarily in the short term. They recommend prudent debt management and promotion of long-term, high-yield investments to foster economic development.

Ndoricimpa (2020) explored the impact of government debt on economic growth in Africa. Utilizing a panel smooth transition regression method by Gonzalez et al. (2017), they identified a debt threshold ranging from 62–66%. Results indicate varied debt thresholds among African nations, suggesting the necessity for country-specific models. This implies that further research is essential for each African country, as no universal debt threshold applies.

Furthermore, Daher Alshammary, Abdul Karim, Khalid and Ahmad (2020) delved into the existence of a debt-to-GDP threshold between governmental debt and economic growth. Utilizing the threshold estimation method on data spanning from 1990 to 2016 across a sample of 20 Middle East and North African (MENA) countries, they observed a threshold effect between public debt-to-GDP ratio and economic growth. Their findings suggest that maintaining government borrowing below a certain level significantly benefits economic growth. Specifically, their study revealed that economic growth is stimulated when public debt remains below 58% of GDP. This highlights the need for cautious initiatives when addressing debt concerns.

Nzeh (2020) analyzed the optimal debt threshold level amidst Nigeria's significant public debt escalation, analyzing annual data from 1981 to 2018. Employing Autoregressive Distributed Lag (ARDL) constraints, the study unveiled a favourable impact of government borrowing on economic growth up to a particular threshold, beyond which it turned detrimental. According to the research, the ideal government debt level, in both short and long terms, stands at 40.2% of GDP. This underscores the importance for regulatory bodies to consider various metrics beyond the debt-to-GDP ratio when making borrowing decisions to ensure long-term debt sustainability.

Awadzie, Garr and Tsoekeku (2022) investigated the interplay between the public debt threshold and Ghana's economy. Spanning thirty-one years from 1990 to 2020, their analysis utilized time series data. Employing Tong's (1978) and Hansen's (1996) threshold autoregressive model, the study aimed to identify Ghana's singular debt threshold. Gross Domestic Product per Capita (GDPPC) quantified economic growth as the dependent variable, while public debt served as the independent variable. Results revealed a sole threshold value at 57.09%, indicating a non-linear association between economic growth and public debt. Beyond this threshold, public debt impairs economic development, while below it, it fosters growth. This underscores the necessity for Ghana's government to implement stringent debt management practices and judiciously allocate external debt for investment to sustain economic progress.

Rutayisire (2021) investigated Rwanda's public borrowing dynamics and its nonlinear impact on economic development, assessing the short- and long-term relationship between economic growth and its determinants. Utilizing time-series data from 1970 to 2018, co-integration was explored through a quadratic polynomial function in debt and the autoregressive distributed lag (ARDL) bounds testing approach. An econometric analysis revealed a significant nonlinear, concave relationship between government debt and economic growth in Rwanda, resembling a U-shaped curve. The study identified a critical threshold of 50.2%, beyond which public debt negatively affects economic development. This underscores the necessity for tighter budgetary consolidation and debt management strategies to sustain Rwanda's debt levels.

Padda (2020) ascertained the optimal public debt level for Pakistani economic progress using time series data. Employing the ARDL bound test approach, the study delved into debt's short- and

long-term impacts on economic growth. Econometric findings pinpointed 60% of GDP as the ideal public debt threshold, beyond which debt becomes detrimental. The research underscores the necessity to steer clear of excessive public debt, suggesting that persistently high-interest rates impede economic growth. Hence, a reevaluation of the government's current high-interest rate strategy is recommended to foster economic advancement.

Lee and Kueh (2021) explored the correlation between government debt and economic growth across several Southeast Asian nations, including Malaysia, Singapore, and Thailand. Their investigation aimed to discern the impact of sovereign debt thresholds on economic development rates. Analyzing annual data from 1996 to 2016, the researchers employed the threshold regression method to examine how public debt levels affect economic growth, both below and above the threshold. Additionally, the Polled-Mean group (PMG) estimator method was utilized to assess the connection between government debt and economic performance. The empirical results indicated a threshold level of 68.31% of GDP for the six selected Southeast Asian countries. Notably, a positive correlation was observed between the variables when public debt remained below this threshold, while the opposite trend was noted when debt exceeded it. The study suggests that policymakers must regularly monitor and manage public debt to prevent it from surpassing the predetermined threshold, as doing so could have significant implications for economic growth.

Sagire and Muriu (2021) conducted a comprehensive analysis of Kenya's economic growth dynamics and its associated public debt limits. The core objective was to discern whether a nation's debt has a critical threshold and, if so, how it influences future economic development. Spanning thirty-eight years from 1980 to 2018, the study employed time series data, with real gross domestic product (GDP) as the dependent variable for evaluating economic growth. Independent factors included public debt, inflation, total investment, trade openness, and debt service. Employing the threshold estimation approach pioneered by Khan and Senhadji (2001) via statistical loss functions, the analysis revealed a debt threshold level equivalent to 55.5% of GDP. Findings indicated that a debt below 40% of GDP is conducive to economic development, with each 10% increase beyond this threshold resulting in a 1.4% decline in economic growth. The research suggests redirecting government expenditure towards public infrastructure investments to enhance long-term fiscal stability by expanding the tax base. It advocates for gradual changes in fiscal policy to prevent abrupt tax hikes and reductions in government expenditure, emphasizing the importance of targeted government spending on public infrastructure projects to ensure sustained economic growth and revenue expansion.

Sadeghi Amroabadi (2021) researched the effect of income disparities on OPEC nations' public debt. The purpose of the study was to determine the impact of income inequality on government debt in OPEC nations from 2010 to 2018. The threshold panel was used in the study. The results of the research found that the relationship between income inequality and public debt in OPEC nations is U-shaped, not linear. In other words, the effects of income inequality on the public debt of OPEC member states are comparable to the threshold.

Bentour (2021) examined both the Public Debt and Growth Threshold. His study aimed to evaluate the precision of Reinhart and Rogoff's findings (2010). Hansen (2017) used a regression kink model to examine a sample of twenty developed countries from 1880 to 2010. His findings contradict Reinhart and Rogoff (2010) but support the findings of Ndoricimpa (2020) and Mensah et al. (2019) that there is no universal debt threshold and that country-specific threshold models are required. The implication for counties is that to maintain debt levels, it is of utmost importance to develop country-specific policies towards achieving sustainable debt.

Law, Kutan and Law (2021), examined the link between the public debt threshold and the economic growth of 71 rising nations. The independent variable in the research was public debt, whereas the dependent variable was gross domestic product as a proxy for economic growth. The research used panel data from 1984 to 2015 and used the dynamic panel threshold approach. The research indicated that at high levels of public debt, debt has a statistically significant negative influence on economic development, but it has no effect at low levels of public debt. Importantly, the research found that the predicted threshold value for the 71 chosen economies was 51.65%. Also, the evidence indicates that more efficient institutions tend to mitigate the damage that public debt contributes to economic growth.

Augustine and Rafi (2023)in their 2023 research, determined the debt threshold for 39 developing and rising nations. The objective was to examine the nonlinear links between public debt and economic growth in such economies. According to the study's findings, the debt threshold for these countries varied greatly, ranging from 24 to 132 per cent. The analysis also indicated that only six countries had either a whole or partial inverted U-shaped relationship. In contrast, the research indicated that in certain nations, raising debt even over the threshold stimulates economic growth, and in others, even low levels of debt inhibit growth. The implication is that when creating debt management strategies, it is important for countries to concentrate on the thresholds that apply to each individual country instead of relying on a threshold discovered for a group of countries.

In this study, the link between debt growth and per capita income and the historical categorization of national income was analyzed (Okwoche and Nikolaidou, 2022). In addition, the researchers examined how the nexus changes across low-, lower-middle-, middle-, and high-income countries. According to the findings of their research, the level of the national debt over which debt has a detrimental impact on economic development is around 45 per cent.

Summary

From the literature reviewed conclusion drawn from it is that governments should implement structural reforms that improve the efficiency of public spending, enhance revenue collection, promote economic activities, and encourage effective governance and anti-corruption. In terms of debt sustainability, since higher debt negatively impacts economic growth, governments and policymakers should pay much attention to key sustainability indicators like debt service-to-revenue ratio and primary surplus or deficits since these indicators provide insights into a country's ability to manage its debt efficiently. In summary, while a debt threshold can serve as a useful indicator, it must be considered within the broader context of a country's unique circumstances and the global landscape. What is sustainable for developing countries may not apply to another, and a nuanced assessment is essential to understand the implications and potential risks associated with high debt levels.

Data and Methodology

The research utilizes annual time series data spanning from 1975 to 2021. The dependent variable is GDP per capital proxied for economic growth while public debt (external) is the independent variable. Furthermore, the study incorporates various factors such as trade openness, public debt service, financial development, inflation, and savings as control variables. The selection of these variables is informed by the works of multiple scholars, including Kjosev et al (2021), Nzeh (2020) and Daher Alshammary et al. (2020), among others, who have previously employed similar variables in their research. All variables were sourced from the World Development Indicators (WDI).

Variable Description and Source

Variable	Description	Source
Gross Domestic Product per Capita (GDP_C)	The yearly rate of increase in real GDP per capita (a proxy for economic growth)	World Development Indicators (WDI)
Trade Openness (TO)	The sum of imports and exports expressed as a percentage of GDP (a proxy for Trade Openness)	World Development Indicators (WDI)
Debt Service (DS)	Total debt service is the sum of principal repayments and interest paid in currency, goods, or services on long-term debt, interest paid on short-term debt, and repayments (repurchases and charges) to the IMF.	World Development Indicators (WDI)
External Debt (ExD)	Total external debt is debt owed to nonresidents repayable in currency, goods, or services.	World Development Indicators (WDI)
Inflation (INF)	Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket	World Development Indicators (WDI)

	of goods and services that may be fixed or changed at specified intervals	
Saving (SAV)	Gross savings are calculated as gross national income less total consumption, plus net transfers.	World Development Indicators (WDI)
Financial Development (FD)	Financial Development is measured as a share of domestic credit to the private sector as a percentage of GDP.	World Development Indicators (WDI)

Testing Procedure

Augmented Dickey-Fuller (ADF) Test

Prior to estimating the time series data, the order of integration of the variables is established to ensure consistency across all series. The conventional unit root tests of Augmented Dickey-Fuller (ADF, 1979) and Phillip Perron (PP, 1988) are employed to test the null hypothesis of a unit root against mean stationarity. The ADF is modelled as follows:

$$\Delta Y_t = \alpha + \beta t + \gamma y_{t-1} + \sum_{i=1}^{p} \sigma \Delta y_{t-i} + \mu_t \dots\dots\dots\dots\dots\dots 1$$

Where:

Δyt is the first difference of the time series, $yt-1$ is the lagged value of the time series, t represents a trend term if included, α, β, γ, and δi are coefficients to be estimated and μ_t is the error term.

Cointegration Test

The Bound F-test assesses if variables are cointegrated, often after an Engle-Granger test. We begin by regressing one variable (y) on another (y_2) to derive residuals (μ):

$$Y_{it} = \alpha + \beta y_{2t} + \hat{\mu}_t \dots\dots\dots\dots\dots\dots\dots 2$$

After checking the residuals ($\hat{\mu}_t$) for stationarity using a unit root test like ADF, stationary residuals indicate potential cointegration between y_2 and y_2. Upon confirmation, we calculate the Bound F-statistic to assess cointegration significance as follows:

$$F = \frac{(T-K-1)}{K} \times \frac{SSR_1 - SSR_2}{SSR_2} \dots\dots\dots\dots\dots\dots 3$$

Where:

T is the number of observations, k is the number of cointegrating relationships in the model (usually 1), SSR_1 is the sum of squared residuals from the unrestricted model and SSR_2 is the sum of squared residuals from the restricted model.

Model Specification

According to Hansen (1999), one of the approaches for determining the likelihood ratio tests for the threshold variable is to use threshold regression. This model is adopted because it can capture non-linear dynamics in the relationship debt and economic growth, which standard linear regression models might not adequately address. The threshold variable will be used to divide the sample into two groups. The functional equation is defined as follows:

$$y_i = \beta'_1 x_i + e_i, \qquad q_i \leq \alpha \quad \dots\dots\dots\dots 4$$

$$y_i = \beta'_2 x_i + e_i, \qquad q_i \geq \alpha \quad \dots\dots\dots\dots 5$$

Equations (4) and (5) can be rewritten in the form:

$$y_i = \beta_0 + \beta'_1 x_i 1(q_1 \leq \alpha) + \beta'_2 x_i (q_i \geq \alpha) \quad \dots\dots\dots\dots 6$$

where y_1 is GDP which is the dependent variable, x_i is the whole set of independent variables, β'_1

represents the coefficients of parameter interest if the threshold variable is below the threshold level, β'_2 represents the coefficients of parameter interest if the threshold variable is exceeding the threshold level, q_1 is the threshold variable, α refers to a threshold level, 1(.) is the function of q(x_i) and made up of a continuous distribution. Furthermore, the interaction between the economic growth which is the dependent variable and public debt which is the independent variable will be the parameters' interest in this study.

Results and Analysis

Table 1. Summary Statistics

Variable	Obs.	Mean	Std.Dev.	Min	Max
GDP_PC	44	1.2617	4.4925	-14.5085	11.3155
OP	44	58.8970	29.4523	6.3203	116.0484
EXD_GDP	44	56.6868	32.5452	16.5170	135.3263
INF	44	29.3704	24.7173	7.1264	116.5036
PDS_X	44	10.6919	6.3564	2.0800	23.1745
SAV_GDP	44	7.7009	6.3023	-2.9634	24.1884
FIN_DV'T	44	8.6975	5.1669	1.5423	15.8820

Source: Author's Construct (2024)

Table 1 provides an overview of the variables included in the analysis. The average annual growth in GDP per capita is 1.26%, with a standard deviation of 4.5% and a range from -14.51% to 11.32%. Trade openness has a mean value of 58.9% of GDP, with a variation of 29.4% and a range between 6.3% and 116.0%. The external debt to GDP ratio averages 56.7%, suggesting significant foreign indebtedness, with a standard deviation of 32.5% and values spanning from 16.5% to 135.3%. Inflation averages 29.4% per year, with a standard deviation of 24.7% and a range from 7.1% to 116.5%. The public debt service as a percentage of exports averages 10.7%, with a range from 2.1% to 23.2% and a standard deviation of 6.4%. These figures highlight the critical economic factors influencing Ghana's fiscal health and emphasize the need for effective financial management to sustain economic stability and growth.

Table 2. Pairwise Correlation

Variable	GDP_PC	OP	EXD_GDP	INF	PDS_X	SAV_GDP	FIN_DV'T
GDP_PC	1.0000						
OP	0.4874**	1.0000					
EXD_GDP	0.0643	0.4896**	1.0000				
INF	-0.3306*	-0.5378**	-0.0659	1.0000			
PDS_X	-0.1437	-0.2195	0.4942**	0.0172	1.0000		
SAV_GDP	-0.0965	0.1401	-0.0118	-0.0588	-0.0772	1.0000	
FIN_DV'T	0.4753**	0.8193**	-0.0187	-0.5445**	-0.5855**	0.1805	1.0000

Note. *, ** denotes 5% and 1% sig. levels respectively

Source: Author's Construct (2024)

Table 2 displays the pairwise correlation matrix, illustrating notable relationships among the variables. At the 5% significance level, trade openness is positively correlated with GDP per capita, indicating that as trade openness increases, GDP per capita tends to rise as well. Similarly, external debt to GDP shows a positive correlation with trade openness, suggesting that these variables tend to move together. Inflation, on the other hand, is negatively correlated with GDP per capita, trade openness, and financial development, indicating that higher inflation is associated with lower values of these variables. Public debt service has a positive correlation with external debt to GDP, meaning they increase or decrease together. Financial development shows a strong positive correlation with both GDP per capita and trade openness, while it is negatively correlated with inflation and public debt service. These correlations suggest relationships between the variables, but it is important to note that correlation does not imply causation.

Table 3. Augmented Dickey-Fuller Unit Root Test

Level				First Difference		
Variable	Drift	Trend	None	Drift	Trend	None
GDP_PC	-3.808**	--	--	--	--	--
OP	1.267	-2.066	-1.267	-6.002**	--	--
EXD_GDP	-1.644	-1.629	-1.644	-3.088**	--	--
INF	-2.668**	--	--	--	--	--
PDS_X	-1.507	-1.953	-1.507	-5.339**	--	--
SAV_GDP	-1.062	-1.545	-1.062	-4.341**	--	--
C	-0.817	-2.298	-0.817	-4.878**	--	--

Note. *, ** denotes rejection of the Null at 5% and 1% sig. levels respectively

Source: Author's Construct (2024)

Table 4. Philips Perron Unit Root Test

Level				First Difference	
Variable	None	Trend		None	Trend
GDP_PC	-23.015**	--		--	--
OP	-3.009	-8.301		-40.327**	--
EXD_GDP	-4.206	-4.044		-33.411**	--
INF	-19.518**	--		--	--
PDS_X	-5.204	-6.762		-49.728**	--
SAV_GDP	-7.116	-9.410		-51.784**	--
FIN_DV'T	-1.701	-9.665		-46.919**	--

Note. *, ** denotes rejection of the Null at 5% and 1% sig. levels respectively

Source: Author's Construct (2024)

In this study, we applied both the ADF and PP tests to check for the presence of unit roots. The results, presented in Tables 3 and 4, indicate that trade openness (OP), the external debt to GDP ratio

(EXD_GDP), public debt service as a percentage of exports (PDS_X), savings as a percentage of GDP (SAV_GDP), and financial development (represented by domestic credit to the private sector) exhibit unit roots. Conversely, GDP per capita and inflation are found to be stationary at their levels. The PP test results support these findings, showing that while GDP per capita and inflation are stationary at level, the other variables become stationary only after first differencing. These results align with the ADF test outcomes, demonstrating that the series are integrated at different orders, both I(0) and I(1). This satisfies the prerequisites for the ARDL bound testing approach to investigate long-run cointegration relationships. Unlike the Johansen test, which requires all variables to be I(1) and not I(2), the ARDL bound test is more flexible as it does not necessitate specific integration orders before conducting the test. Hence, we proceeded with the Auto-regressive Distributed Lag (ARDL) bound test to explore the long-run equilibrium relationships.

Table 5. Bound F Test Results for Cointegration

F-Statistic	Lag	Significance	Bound Critical Values	
Value	Length	Level	I(0)	I(I)
		1%	3.681	5.749
11.124	3	5%	2.620	4.220
		10%	2.185	3.589

Source: Author's Construct (2024)

The ARDL bound test hypothesis evaluates the existence of cointegration among variables against the alternative hypothesis of no cointegration. The Schwartz information criterion was used to select the maximum lag for the cointegration test. If the F-statistic is below the I(0) critical bound values, it suggests the absence of a long-run cointegrating relationship, and only short-run dynamic parameters are estimated. When the F-statistic falls between the I(0) and I(1) bounds, the results are inconclusive. However, if the F-statistic exceeds the I(1) bounds, it indicates a long-run relationship, requiring the estimation of an error correction model. According to Table 5, the results show cointegration among the variables at the 10%, 5%, and 1% significance levels. The F-statistic of 11.124 exceeds the critical values for the I(1) bound, leading to the rejection of the null hypothesis.

Table 6. Threshold Analysis Results

Order	Threshold(EXD_GDP)	SSR
1	0.5015	354.1412

Source: Author's Construct (2023)

Table 7. Threshold Analysis Results

GDP_PC		Coef.	Robust Std.Err.	Z-Stats
Lower Region				
	OP	0.1043	0.0946	1.10
	PDS_X	-0.1003	0.1978	-0.51
	SAV_GDP	0.3594	0.3369	1.07
	FIN_DV'T	0.1753	0.5846	0.30

	INF	0.0796*	0.0701	2.15
	C	2.6063**	0.1873	3.19
Upper Region				
	OP	0.0349	0.0358	0.90
	PDS_X	-0.5209**	0.1088	-4.79
	SAV_GDP	-0.0992	0.1071	-0.93
	FIN_DV'T	-0.5528	0.4054	-1.36
	INF	-0.0893**	0.0200	-4.46
	C	2.0921**	0.4984	4.20

Note. *, **, denotes 5% and 1% sig. levels respectively

Source: Author's Construct (2024)

Tables 6 and 7 present the results of the threshold analysis. This model intends to estimate the acceptable external debt to GDP level beyond which it is dangerous for debt sustainability.

Results in table 6 shows that the maximum acceptable debt to GDP level is 50.15% of GDP. This confirms the finding of Nzeh (2020), Awadzie et al. (2022), Rutayisire (2021) that public debt is nonlinear and concave, or U-shape inverted even though the threshold differ in each case. This indicates that public debt has a positive effect on the econonic growth of Ghana below this threshold. Beyond this point public debt negatively hampered the economic growth of Ghana. In this case, Ghana's public debt should not exceed 50.15 % of her GDP. Ghana's optimal threshold according to this study is influenced by its unique economic, fiscal and governance circumstances. Other developing countries may have different levels of debt tolerance based on their individual economic strengths, revenue generation capacity and policy choices. With the mean value of external debt stock to GDP of 56.7% as captured in the summary statistics table, Ghana has exceeded its external debt to GDP threshold. In table 7 only inflation is significant at the 5% level in the lower region which indicates that lower values of inflation are good for GDP per capita growth. One plausible explanation is that lower inflation rates imply lower cost of doing business and hence lower cost of production. In the upper region, public debt service is negative and significant at the 1% level. The economic implication is that higher values of public debt service crowds out economic growth in Ghana. Inflation in the upper region rather appears to be negative suggesting higher values of inflation produce adverse impact on the GDP per capita in Ghana. The other variables in the regions are not statistically significant. However, the signs are useful guides for policy and planning purposes.

Conclusion and Recommendations

It is anticipated that prudent borrowing will accelerate economy's growth and improve its formation of capital. Overborrowing, nevertheless, might be harmful to economic prosperity. The argument of negative implication of excessive public borrowing on economic growth has been the subject of debate in numerous academic literatures and its various modes of dissemination, such as the debt overhang and ideas of crowding out. By examining whether there are any threshold effects in the correlation between public debt and economic growth, we add to the already extensive empirical literature on the debt-growth connection from the perspective of Ghana. The objective of this paper was to examine the link between debt and economic growth by exploring the threshold level below which public debt contribute positively to economic growth and beyond which debt negatively impacts economic growth of Ghana. The study adopted annual time series data from 1975 to 2021.

The results from the threshold analysis showed that there exists an inverted U-shape (non-linear) correlation between public debt and economic growth in Ghana. The results showed a threshold of 50.15% of GDP. This shows that Ghanaian economic growth is negatively impacted by the public

debt's accumulation after it reaches the projected level. The mean value of external debt stock to GDP of 56.7% is an indication that Ghana has exceeded its external debt to GDP threshold overtime from 1975 to 2021. The implications are that if Ghana's debt exceeds this threshold, a significant portion of government revenue may be allocated to debt servicing, including interest payments. This can reduce the funds available for critical public services and infrastructure investments. Also, high debt levels can lead to "crowding out," where government borrowing competes with private sector borrowing. This can result in higher interest rates for businesses and households, potentially stifling private sector investment and economic growth.

It is recommended that government need to implement sound fiscal policies, improve debt management practices, and seek debt relief or restructuring options if available. Government should reduce reliance on external borrowing, promote economic diversification and increasing revenue collection can also be strategies to manage debt and ensure economic stability. It is therefore essential for Ghana government to monitor key sustainability indicators such as debt-to-GDP ratio, debt service-to-revenue ratio, primary surplus or deficit as these indicators provide insights into a country's ability to manage debt effectively.

References

Augustine, B., & Rafi, O. M. (2023). Public debt-economic growth nexus in emerging and developing economies: Exploring nonlinearity. *Finance Research Letters*, *52*, 103540.

Awadzie, D. M., Garr, D. K., & Tsoekeku, T. D. (2022). The Relationship Between Economic Growth and Public Debt: A Threshold Regression Approach in GHANA. *Journal of Business Economics and Finance*, *11*(1), 15–23.

Adusei, M., & Appiah, S. (2020). Public Debt and Economic Growth: Evidence from Ghana. Journal of African Economies, *29*(1), 25-42.

Bentour, E. M. (2021). On the public debt and growth threshold: One size does not necessarily fit all. *Applied Economics*, *53*(11), 1280–1299.

Bexheti, A., Sadiku, L., & Sadiku, M. (2020). The Impact of Public Debt on Economic Growth: Empirical Analyses for Western Balkan Countries. *Economic and Financial Challenges for Balkan and Eastern European Countries*, 13–32.

Borensztein, E., & Panizza, U. (2009). The Costs of Sovereign Default. *IMF Staff Papers*, *56*(4), 683–741. https://doi.org/10.1057/imfsp.2009.21

Daher Alshammary, M., Abdul Karim, Z., Khalid, N., & Ahmad, R. (2020). Debt-growth nexus in the MENA region: Evidence from a panel threshold analysis. *Economies*, *8*(4), 102.

Fetai, B., Avdimetaj, K., Bexhetr, A., & Malaj, A. (2020). Threshold effect of public debt on economic growth: An empirical analysis in the European transition countries·. *Zbornik Radova Ekonomski Fakultet u Rijeka*, *38*(2), 381–406.

Gashi, B. (2020). The Impact of Public Debt on the Economic Growth in South Eastern Europe: An Empirical Panel Investigation. *Икономически Изследвания*, *2*, 3–18.

Hansen, B. E. (1999). Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of Econometrics*, *93*(2), 345–368.

Kjosev, S., Noveski, M., & Kjoseva, N. M. (2023). Public Debt Threshold in the Republic of North Macedonia. *Management: Journal of Sustainable Business and Management Solutions in Emerging Economies*, *28*(1), 1–10.

Krugman, P. (1988). Financing vs. Forgiving a debt overhang. *Journal of Development Economics*, *29*(3), 253–268.

Law, S. H., Ng, C. H., Kutan, A. M., & Law, Z. K. (2021). Public debt and economic growth in developing countries: Nonlinearity and threshold analysis. *Economic Modelling*, *98*, 26–40.

Lee, W.-Y., & Kueh, J. (2021). Public Debt-Growth Nexus: Threshold Effects on Selected Southeast

Asian Countries. *Global Business & Management Research*, *13*(2).

Ndoricimpa, A. (2020). Threshold effects of public debt on economic growth in Africa: A new evidence. *Journal of Economics and Development*, *22*(2), 187–207.

Ndoricimpa, A. (2022). Threshold effects of public debt on economic growth in South Africa: An application of a regression kink with an unknown threshold. *Journal of Economic and Administrative Sciences*, *ahead-of-print*.

Nugent, P., & Dabalen, A. (2020). Economic Transformation and Poverty in Ghana: Comparative Perspectives and Policy Implications. Journal of African Economies, *29*(Supplement 1), i1-i23.

Nzeh, I. C. (2020). Public debt and economic growth in Nigeria: Investigating the optimal threshold level. *Asian Development Policy Review*, *8*(2), 112–127.

Okwoche, P., & Nikolaidou, E. (2022). Determinants of external, domestic, and total public debt in Nigeria: The role of conflict, arms imports, and military expenditure. *Defence and Peace Economics*, 1–16.

Osei-Assibey, E., Osei, R. D., & Adu, G. (2020). Fiscal Deficits, Public Debt and Economic Growth in Ghana: A Trivariate Causality Analysis. African Development Review, *32*(2), 213-225.

Padda, I. U. H. (2020). Estimating the optimal level of public debt for economic growth: An evidence from Pakistan. *Ashfaq, M., & Padda, I.(2020). Estimating the Optimal Level of Public Debt for Economic Growth: An Evidence from Pakistan. Quest Journal of Management and Social Sciences*, *1*(2), 222–232.

Pegkas, P. (2019). Government debt and economic growth. A threshold analysis for Greece. *Peace Economics, Peace Science and Public Policy*, *25*(1).

Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a Time of Debt. *American Economic Review*, *100*(2), 573–578. https://doi.org/10.1257/aer.100.2.573

Rutayisire, J. M. (2021). *Public debt dynamics and nonlinear effects on economic growth: Evidence from Rwanda*.

Sadeghi Amroabadi, B. (2021). Analyzing the effects of income inequality on public debt in OPEC member states by threshold panel. *Journal of Economic Research and Policies*, *29*(97), 313–335.

SAGIRE, L., & MURIU, P. W. (2021). *Economic Growth And Public Debt Threshold: New Evidence From An Emerging Economy*.

Saungweme, T., & Odhiambo, N. M. (2019). Does public debt impact economic growth in Zambia? An ARDL-bounds testing approach. *SPOUDAI-Journal of Economics and Business*, *69*(4), 53–73.

Saungweme, T., & Odhiambo, N. M. (2020). The impact of public debt service on economic growth: Empirical evidence from Zambia. *International Journal of Revenue Management*, *11*(3), 172. https://doi.org/10.1504/IJRM.2020.109414

Saungweme, T., & Odhiambo, N. M. (2021). Public Debt Service in South Africa and Its Impact on Economic Growth: An Empirical Test. *The Review of Black Political Economy*, *48*(3), 313–327.

Sturzenegger, F., & Zettelmeyer, J. (2007). *Debt defaults and lessons from a decade of crises*. MIT press.