

Government Debt and Economic Growth in Developing Countries: Macroeconomic Determinants and Non-Linear Threshold Effect

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Abstract

This study focuses on the non-linear relationship between government debt and economic growth while investigating the major determinants of government debt. This panel study uses data for 129 developing countries from the World Bank database spanning from 2000 to 2024. The study has used the Method of Moments Quantiles Regression (MMQR) and the Panel Threshold Regression to identify the non-linear effects and optimal point in the debt-growth nexus in developing countries. The analysis of determinants of government debt using MMQR analysis highlights that GDP growth, trade openness, government expenditures (productive), and institutional quality are positively associated with government debt. While official exchange rates and gross capital formation have been negatively associated with debt, except for inflation, which has a U-shaped association. The estimation of economic growth determinants reveals that labor force participation, gross capital formation, trade, and institutional quality are growth-enhancing factors, while the growth-deteriorating factors are inflation, exchange rate, and government debt. The study confirms the presence of a non-linear relationship between economic growth and government debt. A threshold point is 18.67% of GDP, where the structural break occurs in the debt-growth relationship. The findings of this study suggested policy recommendations with respect to the low and high debt regimes. The countries in low debt regimes should perform counter-cyclical fiscal policy, regulate the exchange rate, avoid trade and institutional reforms, and cut consumption expenditures. The countries in the high debt regime should focus on trade, public provisions, capital formation, and the rate system to control the government and boost economic growth. The finding of the threshold point suggests a debt ceiling, requires annual reporting of debt accumulation, and links investment with debt planning.

Keywords: Debt-growth nexus, non-linear effects, Threshold regression, Governance

JEL Code: H63, H74, O11, O40, E62, C23, C24

Introduction

The central government debt is not merely a stock of liabilities; it also serves as a crucial policy tool for developing countries due to its dual nature. It imposes a burden by claiming resources, and it serves as a tool by financing growth-driven investment projects (Barro, 1990). The composition of central government debt is important to understand, as it underpins exchange rate shocks and changes in investor confidence in developing countries. Therefore, policy decisions

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using debt as a policy instrument are highly dependent on the composition of government debt. On the other side, economic growth focuses on long-term sustainable output, growth in factor inputs, and growth in the productivity of factor inputs under modern growth theories, instead of temporary cyclical output growth (Checherita-Westphal & Rother, 2012). While maintaining the relationship between government debt and economic growth, the major concern of developing nations is to meet their present and expected obligation without drawing any exceptional financing or major changes in fiscal balance. But the non-linear and regime-based nature of the debt-growth relationship moves beyond linear and universal presumption and is creating challenges for the developing countries (Cecchetti et al., 2011). Therefore, developing countries need to consider single or multiple debt threshold levels after which the neutral or growth-driven effect of government debt changes to a growth-damaging effect. The developing countries are more vulnerable because the crowding-out effect can be more extreme and speedier due to less mature financial markets. The context of considering government debt as a constructive tool is supported through endogenous growth theories, where government borrowing is used to finance productive projects, infrastructure, human capital development, and innovation (Baum et al., 2013). Therefore, the theoretical evidence supports the dual nature of government debt. This provides a fundamental foundation for the argument of non-linear debt through association, where moderate and low government borrowing works as a constructive tool to drive economic growth. But after crossing a certain threshold, this positive or neutral relationship turns into negative through crowding out, increasing interest rates, high uncertainty, increasing risk premium, and debt overhang. The threshold is not uniform but context-based, which makes it an important discussion point in developing countries because debt is one of the major policy tools of these economies (Reinhart & Rogoff, 2010).

Budget deficits and cyclical macroeconomic shocks lead to the need for borrowing in developing countries. The governments of developing countries justify the central government debt by using it as a tool to deal with financial instability, cyclical instability, and slow economic growth (IMF, 2013). But there is numerous empirical evidence that high accumulation of government debt can lead to slow GDP growth, macroeconomic instability, inflation, and crowd out private capital. The dynamics of the linear relationship between economic growth and debt are becoming complex and non-linear in the case of developing countries due to weak institutions, low domestic savings, and external shocks and volatility (Panizza & Presbitero, 2014). There are numerous studies that examine the non-linear nexus of government debt and GDP growth rate, which suggests that borrowing beyond a certain threshold harms GDP growth due to high debt servicing costs (Presbitero, 2012), inflation (Woo, 2003), and limited fiscal space (Pattillo et al., 2004).

Although researchers are taking an interest in debt sustainability, there is limited research that combinedly analyse framework for developing countries on the determinants of central government debt, the role of central government debt in determining GDP growth, and the presence or magnitude of a threshold level for central government debt. Further, the existing literature focuses on linear modelling techniques to explore the debt-growth nexus, which assumes the universal association between government debt and GDP growth rate across the panel of developing countries, disregarding regime shifts and cross-sectional heterogeneity (Blanchard, 2019; Clements et al., 2003). Therefore, there is a gap in understanding how the central government debt reacts and its impact on economic growth in different debt regimes and macroeconomic conditions.

Therefore, the purpose of this study is to provide empirical evidence on the determinants of central government debt and their implications, to verify the threshold level for government debt, and to examine the major determinants of GDP growth in developing countries by explicitly taking the central government debt as a regressor to highlight its implications on economic growth in developing countries. Further, this study employs advanced panel methods to account for the factors of non-linearity and heterogeneity in the debt-growth nexus. The purpose of the study is to provide a more relevant understanding of debt-growth dynamics in developing countries to support government policy and a growth-oriented budget.

This study addresses three key research questions.

- What are the major macroeconomic determinantal factors of central government debt in developing countries?
- Is there a debt threshold level after which the impact of government debt shifts in developing economies?
- Is there a non-linear relationship between central government debt and GDP growth rate?

This study significantly contributes to the existing literature by filling the methodological gap, using the MMQR method to include heterogeneity in panel studies. The study has robust check the association between government debt and economic growth, on which there is consensus in previous literature. Moreover, it combined the economic, institutional, and external determinants of government debt in a single framework to estimate the key policy variables to mitigate the negative effects of government borrowings.

Review of Literature

The literature review brings together relevant studies, with a particular focus on the interaction between debt build-up and macroeconomic performance in developing economies. It specifically considers the determinants that affect state borrowing and assesses the dynamic non-linear threshold effects of government debt on economic growth. The review of related literature is given as:

Table 1: Literature of Government Debt and Economic Growth

Authors	Countries	Frequency	Methodology	Main Results
Studies on Government Debt and Economic Growth				
Rahman et al. (2019)	Global Panel (OECD, Non-OECD, Asia, Europe, Africa)	2017–2019	ARDL, System GMM, 2SLS, PVAR, Panel Fixed and Random Effect	Linear & non-linear regime effects verified
Raheem & Quddus (2020)	SAARC	1990–2018	Panel ARDL	Consistent short-run & long-run negative growth effect
Ndoricimp	39 African	1980–2012	PSTR, Dynamic	Regime-dependent; non-

a (2020)	Nations		Panel Threshold	linear threshold dynamics (positive/neutral below, strong negative above)
Eke & Akujuobi (2021)	Nigeria	1981–2018	VAR	Horizon-dependent dynamics: SR internal debt (+), SR foreign debt (-), LR neutrality
Hilton (2021)	Ghana	1978–2018	ARDL, ECM	Horizon-dependent dynamics: LR positive effect, SR neutrality
Gómez-Puig et al. (2022)	115 Economies (Advanced, Emerging, Low-Income)	1995–2016	Dynamic Pooled OLS, 2SLS Fixed Effects	Moderated relationship: Positive via productive spending & strong institutions; negative under high debt & weak institutions
Onofrei et al. (2022)	28 EU Economies (inc. UK)	1995–2019	ARDL, Dynamic Fixed Effects	Robust persistent negative SR & LR debt impact
Matandare & Tito (2022)	Zimbabwe	1980–2010	OLS, Correlation Matrix	Linear negative growth effect
Rekha & Karan (2024)	India	1991–2022	Log-Linear Regression	Positive growth contribution (internal & external debt)
Alsamara et al. (2024)	14 MENA Countries	1980–2021	CS-ARDL, Dynamic Panel Threshold	Heterogeneous LR impact: Negative in non-oil economies, weak positive in oil-rich economies
Studies on Determinants of Government Debt				
Isomitdino v et al. (2020)	115 Countries (9 Regions)	1980–2015	Bayesian DFM, PCA, Interactive Fixed Effects	Regional & global shock spillovers; financial vulnerability & foreign debt dependence drive debt accumulation
Nguyen & Luong (2021)	27 Economies	2000–2018	System GMM, OLS, Panel FE/RE	Revenue (-), anti-corruption (-), shadow economy (-), Expenditure (+), administrative efficiency (+), rule of law (+) Insignificant: Political balance, accountability
Waqas et al. (2021)	Pakistan	1996–2018	Quantile Regression, OLS, Robust Regression	Positive drivers: Anti-corruption, rule of law, accountability

Magnini & Vojnovic (2022)	71 Economies (32 Advanced, 39 Developing)	1990–2020	Dynamic Panel GMM, Non-parametric Regression	Negative drivers: Regulatory quality, public efficiency, political balance Negative driver: Economic freedom Structural drivers: Trade openness & spending (advanced); rule of law (developing)
Toth et al. (2022)	28 EU Economies (inc. UK)	1999–2019	Panel Fixed Effects	Negative Drivers: Fiscal balance, current account balance, public investment, GDP growth, inflation Positive drivers: Fiscal spending, demographic concentration Insignificant: Unemployment, PPP
Vale (2022)	ASEAN+3 (13 ASEAN + CN, JP, KR)	1989–2020	Panel FE/RE	Unemployment (+), inequality (+), corruption perception (+), poverty headcount (-). Insignificant: Per capita GDP, BOP
Manalo et al. (2022)	Philippines	1990–2019	Multiple Linear Regression (OLS)	Capital formation (-), FDI (-). Insignificant: Trade openness, inflation rate
Raheem, Cao, Yousaf and Yousaf (2022)	7 South Asian economies	Annual, 2008-2018	Fixed-effect panel regression for debt determinants; Hansen (1999) fixed-effect panel threshold model for the debt-growth link	Inflation, exchange rate and total investment raise government debt, while government expenditure and trade openness reduce it. Debt and growth follow a nonlinear, Laffer-type pattern with a single threshold of 16.24% of GDP, above which further debt harms economic growth
Nikolaïdo u & Okwoche (2023)	38 Sub-Saharan African Countries	1996–2019	Panel FE, FE-IV	Debt persistence present. Positive/Negative drivers: Conflict events (+), Governance quality (-), real GDP (-). Insignificant: FX reserves,

Shaari et al. (2024)	Malaysia	1980–2020	NARDL	inflation, population growth Asymmetric effects: FDI, public investment & CO2 (+); FDI & trade diversity (-)
Das (2025)	Bangladesh	1975–2022	ARDL, CUMSUM/CUMSU MSQ	LR: Exports (+); Inflation, imports (-); Growth, FDI, spending (Insignificant) SR: Imports, spending, FDI (-); Growth (weak -)
Helmi et al. (2025)	5 ASEAN Economies	1990–2021	ARDL	Key drivers: High interest rates (+), low growth (-), fiscal deficits (-) Asymmetric country-specific CA balance dynamics
Studies on the Threshold Effect of Government Debt				
Arčabić et al. (2018)	219 Countries (OECD & Non-OECD)	1880–2009	Dynamic Panel Threshold, System GMM, PVAR	Non-linear dynamics; no robust statistical evidence of threshold-breach growth penalty
Khanfir (2019)	North Africa (4 Countries)	2003–2012	Panel Threshold Regression	Threshold = 42.8% GDP Regime behavior: Positive below, negative above
Fir (2022)	23 EU Economies	1995–2019	LSDV, Panel FE, Lagged Variables	Public Debt Threshold = 104.8% GDP (Inverted U-shape) Private Debt Thresholds: Household (145.1%), Corporate (138.3%)
Ostrihoň et al. (2023)	27 EU Economies	1995–2019	Panel Threshold Regression	Reject uniform 60% rule; macro-dependent threshold (up to 90% GDP) conditional on institutional quality & financial depth
Yousaf & Aziz (2024)	Highly Indebted African Countries	1990–2021	CS-ARDL, Panel Dynamic Threshold	Threshold = 56.0% GDP Statistically significant post-threshold growth deterioration
Shah et al. (2024)	Developing Countries (UMICs & LMICs)	1990–2020	Dynamic Panel Threshold, Sub-sample Estimation	Overall Threshold = 50.99% GDP Heterogeneous limits: LMICs (50.24%), UMICs (62.65%); inverted effect post-threshold
Jusaj et al. (2025)	18 CEE Countries	2010–2022	Panel OLS, GMM	Structural shift dynamics: Pre-COVID threshold =

42.50% GDP
Post-COVID threshold =
33.69% GDP (Inverse post-
threshold effect)

The literature review shows that the relationship between public debt and economic growth is complex, highly context-dependent, and has non-linear characteristics, with threshold effects and variations in time-horizon depending on the different macroeconomic and institutional environments. Debt can provide short-term growth stimulus but often carries long-term growth penalties that are larger than debt-to-GDP thresholds that differ significantly based on economic development and structural conditions (like resource endowments or post-shock dynamics). Likewise, factors that influence public debt include macro-fiscal imbalances, external shocks, and institutional quality, but there is no consensus on the empirical effects of each factor. Critically, four main gaps in the previous literature emerge. First is a methodological gap, because many studies rely on mean-based estimations, which mask the regime-specific heterogeneities across the distribution of growth. Second is an analytical gap, because focus on narrow geographical or income-group sampling leads to limited threshold generalizability. The widespread unidirectional causation analysis used in studies ignores simultaneous bidirectional feedback loops between government debt and economic expansion. The final gap found is the lack of previous non-linear threshold studies specifically designed for developing economies.

Model, Data, Methodology

The data used in this study are secondary panel data. It consists of annual observations of the 129 developing countries classified by the World Bank. There were some missing observations in the data for Ethiopia, which can lead to inaccurate results. This study used an interpolation method to fill the missing observations in a selected dataset of developing countries.

Table 2: Data Source, Narration, and Measurement Metrics of Key Variables

Key Variables	Narration of Variables	Unit of Measurement	Source of Data
CGD	Central Government Debt	Percentage of GDP	World Development Indicators (WDI)
OEXR	Official Exchange Rate	LCU per USD	
TRADE	Trade	Percentage of GDP	
INF	Inflation	Annual percentage	
GFKF	Gross capital formation	Annual Percentage	
GDP	Gross domestic product	Annual percentage	
GFCE	General Government Final Consumption Expenditures	Percentage of GDP	WDI & ILO
LFPR	Labour Force Participation Rate	Percentage of the total population age 15 or above	
WGI	World Governance Index	Standard normal unit	World Governance Indicators

Followed Raheem, Cao, Yousaf and Yousaf (2022), three models have been introduced in this study. Model 1 central government debt (CGD) is the explained variable representing the country's internal debt burden.

The functional form of the model is as follows:

$$CGD = f(OEXR, TRADE, INF, GFKF, GDP, GFCE, WGI) \quad (1)$$

The econometric form of the model is developed as follows:

$$CGD_{i,t} = \theta_0 + \theta_1 OEXR_{i,t} + \theta_2 TRADE_{i,t} + \theta_3 INF_{i,t} + \theta_4 GFKF_{i,t} + \theta_5 GDP_{i,t} + \theta_6 GFCE_{i,t} + \theta_7 WGI_{i,t} + \varepsilon_{i,t} \quad (2)$$

While θ_0 = intercept term to measure the effect of omitted variables

$\theta_1, \theta_2, \theta_3, \dots, \theta_7$ = slope coefficients and $\varepsilon_{i,t}$ = error term

i represents countries, and t represents years.

The structure of the econometric model in the form of Method of Moments quantile (MM-QR) regression is as follows:

$$Q_{CGD_{i,t}}(\tau | \gamma_i, \delta_t, X_{i,t}) = \gamma_i + \delta_t + \theta_{1,\tau} OEXR_{i,t} + \theta_{2,\tau} TRADE_{i,t} + \theta_{3,\tau} INF_{i,t} + \theta_{4,\tau} GFKF_{i,t} + \theta_{5,\tau} GDP_{i,t} + \theta_{6,\tau} GFCE_{i,t} + \theta_{7,\tau} WGI_{i,t} + \varepsilon_\tau \quad (3)$$

This is showing the MMQR model where $Q_{CGD_{i,t}}$ is the conditional quantile of the central government debt and τ is quantile (expressing 10th, 25th, 75th, 90th quantiles. The country-specific influence is expressed by γ_i , time-specific influence is expressed by δ_t and other explanatory determinants of central government debt expressed by $X_{i,t}$. While i subscript is for countries or cross sections 1,2,3,...,k. The t subscript is for time from year 1,2,3,...,t.

Model 2 demonstrates the key determinants of economic growth, where economic growth is measured through GDP growth rate (GDP). The functional form of the model is given as:

$$GDP = f(LFPR, GFKF, CGD, INF, OEXR, TRADE, WGI) \quad (4)$$

The econometric specification has been developed as:

$$GDP_{i,t} = \theta_0 + \theta_1 LFPR_{i,t} + \theta_2 GFKF_{i,t} + \theta_3 CGD_{i,t} + \theta_4 INF_{i,t} + \theta_5 OEXR_{i,t} + \theta_6 TRADE_{i,t} + \theta_7 WGI_{i,t} + \varepsilon_{i,t} \quad (5)$$

Where θ_0 It is the intercepting term to measure the effect of the omitted variable. $\theta_1, \theta_2, \theta_3, \dots, \theta_7$ are slope coefficients of the variables, respectively. $\varepsilon_{i,t}$ is the error term or disturbance term, while i represents countries and t represents years.

The equation is also expressed in MMQR regression form as follows:

$$Q_{GDP_{i,t}}(\tau | \gamma_i, \delta_t, X_{i,t}) = \gamma_i + \delta_t + \theta_{1,\tau} LFPR_{i,t} + \theta_{2,\tau} GKFK_{i,t} + \theta_{3,\tau} CGD_{i,t} + \theta_{4,\tau} INF_{i,t} + \theta_{5,\tau} OEXR_{i,t} + \theta_{6,\tau} TRADE_{i,t} + \theta_{7,\tau} WGI_{i,t} + \varepsilon_\tau$$

(6)

The conditional quantiles of gross domestic product are $Q_{GDP_{i,t}}$. The subscript τ is standing for 10th, 25th, 75th, 90th quantiles. The country-specific effect is expressed by γ_i and the time-specific influence is expressed by δ_t and other explanatory determinants of central government debt are expressed by $X_{i,t}$.

Model 3 has used the central government debt as an explanatory factor, while GDP as an explanatory factor to determine the non-linear threshold effect of government debt on economic growth. This study employs a panel threshold regression model to examine the impact of central government debt (the explanatory variable) on economic growth in two distinct regimes, separated by a threshold value. Wang (2015) has proposed the threshold regression model for balanced panel data as follows:

$$Y_{i,t} = \mu + X_{i,t}(q_{i,t}, \gamma)\theta_i + v_{i,t} + \varepsilon_{i,t} \quad (7)$$

i represents the transcript used to demonstrate cross-sections, t is used to present time or years, explanatory variable $Y_{i,t}$ represents the dependent variable, $q_{i,t}$ is a threshold variable, γ is the threshold value, which can be known or unknown. $v_{i,t}$ measures the personalized or individual effect, while $\varepsilon_{i,t}$ The disturbance term is used to eliminate the problem of nuisance factors. θ_i is the slope (regression) coefficient, which has been used to divide the equation into different regimes. Hansen (1999) and Wang (2015) divide the equation into two different regimes using single threshold regression as follows:

$$Y_{i,t} = \mu + X_{i,t}(q_{i,t} < \gamma)\theta_1 + X_{i,t}(q_{i,t} \geq \gamma)\theta_2 + v_{i,t} + \varepsilon_{i,t} \quad (8)$$

In this equation, the relationship between the dependent and independent variables is divided into two regimes using slope coefficients. θ_1 represents the first regime in which the value of the threshold variable $q_{i,t}$ is less than the estimated threshold value γ . While θ_2 is showing the second regime in which the value of the threshold variable $q_{i,t}$ is greater than or equal to the estimated threshold value γ . It can be written into the indicator function (I) equation as,

$$Y_{i,t} = \begin{cases} X_{i,t} + I(q_{i,t} < \gamma) \\ X_{i,t} + I(q_{i,t} \geq \gamma) \end{cases}$$

(9)

&

$$Y_{i,t} = \begin{cases} X_{i,t} + I(q_{i,t} < \gamma) & I(0) \\ X_{i,t} + I(q_{i,t} \geq \gamma) & I(1) \end{cases} \quad (10)$$

The panel threshold regression model by Wang (2015) is compatible with panel balanced data, even when cross-dependency and heteroscedasticity are found in the data variables, which is more compatible with the undertaken study than Hansen (1999), which only faces the problem of heteroscedasticity. Therefore, using the threshold regression model by Hansen (1999) and Wang (2015), the construction of the econometric model for threshold regression is as follows when the explanatory variable is economic growth measured by the GDP growth rate (GDP) and the explained variable is central government debt (CGD):

$$GDP_{i,t} = \mu + CGD_{i,t}(q_{i,t}, \gamma)\theta_i + v_{i,t} + \varepsilon_{i,t} \quad (11)$$

$$GDP_{i,t} = \mu + CGD_{i,t}(q_{i,t} < \gamma)\theta_1 + CGD_{i,t}(q_{i,t} \geq \gamma)\theta_2 + v_{i,t} + \varepsilon_{i,t} \quad (12)$$

The debt regime 1 is $(q_{i,t} < \gamma)$ or θ_1 where the value of central government debt is less than the estimated value of the central government debt threshold. Debt regime 2 is $(q_{i,t} \geq \gamma)$ or θ_2 where the value of central government debt is greater than or equal to the estimated value of the central government debt threshold.

The econometric construction of the threshold model using the variable of interest is:

$$GDP_{i,t} = \mu_i + \theta_1 CGD_{i,t} I(CGD_{i,t} < \gamma) + \theta_2 CGD_{i,t} I(CGD_{i,t} \geq \gamma) + v_{i,t} + \varepsilon_{i,t} \quad (13)$$

This analysis has employed two economic techniques, which are complementary in addressing the skewed effect, country-specific heterogeneity, and potential government debt threshold in developing countries. These techniques are as follows: Method of Moments Quantiles Regression (MMQR) and Panel Threshold Regression (PTR). The Cross-Sectional Dependence test by Pesaran (2004) and the Unit Root test by Maddala and Wu (1999) and Pesaran (2007) were conducted to test stationarity and no cross-dependence conditions of MMQR. The slope homogeneity is tested by the Delta test by Pesaran & Yamagata (2008) based on Swamy (1970) slope dispersion test statistic, both adjusted and non-adjusted, which is a requirement for MMQR application. Moreover, the Panel Cointegration test using Kao (1999), Pedroni (1999), and Westerlund (2007) is used to check the long-term relationship among CGD and GDP, which is a prerequisite of panel threshold regression.

This study has used the MMQR developed by Machado and Silva (2019) for the estimation of Model 1 and Model 2. The selection of the quantile, which is 10th, 25th, 50th, 75th, and 90th quantiles, and the estimation of MMQR with fixed effect is obtained by using Stata. The quantiles indicate different debt regimes in model 1 and growth regimes in model 2, respectively. The lower quantiles, 10th and 25th, show a lower debt (or growth) regime, the middle quantile, 50th, shows a moderate debt (or growth) regime, and the upper quantiles, 75th and 90th show a

high debt (or growth) regime in model 1 and model 2, respectively. The MMQR has been applied using fixed effects.

$$Y_{i,t} = \alpha_i + \theta X_{i,t} + (\gamma X_{i,t}') \mu_{i,t} \quad (14)$$

The fixed effects in quantile regression is expressed as follows for each model, where the $q(\tau)$ is the disturbance term:

$$Q_{Y_{i,t}}(\tau | X_{i,t}, \alpha_i) = \alpha_i + \theta X_{i,t} + (\gamma X_{i,t}') q(\tau) \quad (15)$$

In the beginning, the fixed effect α_i is removed from the model using the first-order difference method. As the fixed effect is removed, the slope coefficients are estimated using the simple OLS method. The quantile-specific effect is interpreted as the effect of the regressor on the regressand is strong in lower quantiles and weak in upper quantiles. When the value of the quantile coefficient increases from lower to upper quantiles, it indicates a weak effect of the regressor on the dependent variable in lower quantiles and a strong effect in upper quantiles. The slope coefficients of quantiles are composed of sign and value, where sign indicates the nature of the association and value indicates the magnitude.

The central government debt is estimated as the threshold variable, and the threshold model is developed using equations (8) and (9) as:

$$GDP_{i,t} = \mu_i + \begin{cases} \theta_1 CGD_{i,t} + \delta_1 X_{i,t} + \varepsilon_{i,t} & \text{when } CGD_{i,t} < \gamma \\ \theta_2 CGD_{i,t} + \delta_2 X_{i,t} + \varepsilon_{i,t} & \text{when } CGD_{i,t} \geq \gamma \end{cases} \quad (16)$$

The plausible values are selected by trimming, which is further selected by optimisation using minimum residual sum of squares. The trimming percentage ensures that each debt regime contains π percent observations of the threshold variable is equally out of the total observations.

$$\text{Trimming Rule}(\Gamma) = [q_{i,t}(\pi), q_{i,t}(\pi-1)] \quad (17)$$

The threshold parameter γ is unknown, then first it must be computed by grid search from panel data, as suggested by Hansen (1999). The grid search of data is conducted through the obtained observations of the threshold variable, which is CGD in this case, and selects the one threshold value that has the minimum residual sum of squares (RSS) in each debt regime regression.

$$\gamma = \arg \min_{\gamma \in T} S_i(\gamma)$$

(18)

Once the threshold parameter is estimated, the bootstrap method is used to obtain the confidence intervals for the threshold parameter γ to test the model for threshold effects. The null hypothesis would be that there is no central government debt threshold. The alternative hypothesis is that there is at least one central government debt threshold ($H_1: \theta_1 \neq \theta_2$ and $\delta_1 \neq \delta_2$

). The threshold effect across regimes is estimated and compared by the likelihood ratio statistic across two debts, which is backed by a basic F-statistic that follows a chi-square distribution.

$$F = \frac{S_0 - S_1(\gamma)}{\sigma_i^2}$$

(19)

Where the F is non-standard (Hansen, 1999), which is indicated to use of the bootstrap method to attain the asymptotic distribution of the first order. The likelihood ratio statistic is computed by assuming the null hypothesis that there is no threshold ($H_0: \gamma = \gamma_0$) and the alternative hypothesis that there is at least a threshold ($H_1: \gamma \neq \gamma_0$). The likelihood ratio is computed by using the formula:

$$LR_i(\gamma) = \frac{S_1(\gamma) - S_i(\gamma)}{\sigma_i^2}$$

(20)

Although the practical implementation of Wang (2015) in Stata using the command xthreg helps to analyse the government debt threshold effect on GDP growth rate. The last step is the interpretation of the threshold effect. The threshold value of central government debt where the relationship between GDP growth and central government debt changes magnitude or nature of association can be called the turning point of economic growth in policy formation, and provides a guide to the government regarding deficit management.

Results and Discussion

Correlation Analysis

The correlation analysis of all variables is presented in Table 2. The variables are showing a weak correlation, and the degree of linear relationship (correlation) between all key variables is weak.

Table 3: Correlation Analysis of Key Variables

Variables	CGD	GDP	OEXR	TRADE	INF	LFPR	GFKF	GFCE	WGI
CGD	1.00	-0.07	0.03	-0.14	-0.11	-0.18	-0.10	-0.13	0.14
GDP	-0.07	1.00	0.03	0.07	0.02	0.03	0.27	-0.22	0.09
OEXR	0.03	0.03	1.00	-0.20	-0.003	0.18	0.21	-0.20	-0.08
TRADE	-0.14	0.07	-0.20	1.00	0.14	0.03	0.01	0.28	0.20
INF	-0.11	0.02	-0.003	0.14	1.00	-0.01	0.05	0.003	-0.18
LFPR	-0.18	0.03	0.18	0.03	-0.01	1.00	0.01	0.05	0.01
GFKF	-0.10	0.27	0.21	0.01	0.05	0.01	1.00	-0.03	0.0008
GFCE	-0.13	-0.22	-0.20	0.28	0.003	0.05	-0.03	1.00	-0.09
WGI	0.14	0.09	-0.08	0.20	-0.18	0.01	0.0008	-0.09	1.00

CD Test

The cross-sectional link analysis for each of the major variables under investigation is shown in Table 3.

Table 4: CD Test Results for the Key Variables

Factors	CD-values	P-value
CGD	13.42	0.00
GDP	102.85	0.00
OEXR	156.88	0.00
TRADE	39.10	0.00
INF	61.80	0.00
LFPR	38.66	0.00
GFKF	29.03	0.00
GFCE	20.76	0.00
WGI	-0.867	0.38

The alternative hypothesis of the CD test suggests that there exists an interconnection in the cross sections (countries) under investigation, whereas the null hypothesis asserts that there exists no interconnection. The null hypothesis is rejected based on the p-value of every crucial factor except WGI. Therefore, MMQR is a suitable technique for the analysis of determinants of GDP and determinants of CGD as proposed by pre conditions of MM

Slope Homogeneity Test

Slope heterogeneity estimations are displayed in Table 5.

Table 5: Results of Slope Homogeneity Tests for Models

Models	Delta Test				HAC Robust Adjusted Delta Test			
	Ad-justed	p-value	Unadjust-ed	p-value	Adjusted	p-value	Unad-justed	p-value
1	24.70	0.00	22.82	0.00	20.25	0.00	21.27	0.00
2	8.68	0.00	8.09	0.00	7.21	0.00	6.23	0.00

The HAC Robust Adjusted Delta metric test (Blomquist and Westerlund, 2013), which is identical to the Delta test, is used to assess the durability of the outcome. Therefore, both CD tests confirm that slopes are non-homogeneous. These findings imply that different cross-sections (countries) have different effects of input on the output factor. The MMQR analysis's prerequisite of variability across cross-sections has been fulfilled.

Panel Unit Root

The Fisher-type panel unit root test (MW) by Maddala and Wu (1999) and the cross-sectional modified IPS test (CIPS) by Pesaran (2007) are displayed in Table 5. It indicates that all variables have no unit roots (stationary) except LFPR which has unit roots (non-stationary).

After correcting for cross-sectional dependence, which is used to assess the reliability, reveals conclusions that are equivalent to those of the MW test. All of the main variables, aside from LFPR, which is non-stationary, are confirmed to be static by similar outcomes of the CIPS and MW tests.

Table 6: Results of Second-Generation Panel Unit Root

Variables	MW Without Trend Lags	Zt Sta- tistics	P- value	MW With Trend Lags	Zt Sta- tistics	P- value	CIPS Without Trend Lags	Zt Sta- tistics	P- value	CIPS With Trend Lags	Zt Sta- tistics	P- value
CGD	1	12.48	0.00	1	10.97	0.00	1	-3.21	0.00	1	-4.86	0.00
GDP	0	206.55	0.00	0	186.70	0.00	0	-23.48	0.00	0	20.87	0.00
OEXR	1	9.87	0.00	1	11.26	0.00	1	-4.21	0.00	1	-4.86	0.00
TRAE	0	317.97	0.00	0	383.87	0.00	0	-10.64	0.00	0	-13.24	0.00
INF	0	22.25	0.00	0	18.96	0.00	0	-24.40	0.00	0	-24.03	0.00
LFPR	1	0.50	0.17	1	0.77	0.54	1	5.99	1.00	1	10.70	1.00
GFKF	0	8.94	0.00	0	7.62	0.00	0	-3.87	0.00	0	-3.53	0.00
GFCE	1	14.60	0.00	1	12.49	0.00	1	-5.21	0.00	1	-3.83	0.00
WGI	0	478.18	0.00	0	412.16	0.00	0	-2.97	0.00	0	-1.85	0.00

Panel Co-integration Test

The model-based outcomes of cointegration tests employing the Westerlund, Kao, and Pedroni tests are displayed in Table 7.

Table 7: Results of the Co-integration Test for Panel Data

Models	W Test				
1		-3.12		-15.84	-10.27
		(0.001)		(0.00)	(0.00)
2		-2.67		-13.91	-8.94
		(0.004)		(0.00)	(0.00)
Models	Kao Test				
1		-4.86	-3.91	-3.54	-5.12
		(0.00)	(0.00)	(0.00)	(0.00)
2		-4.21	-3.47	-2.09	-4.68
		(0.00)	(0.001)	(0.001)	(0.00)
Models	Pedroni Test				
1		-6.37		-5.19	-4.42
		(0.00)		(0.00)	(0.00)
2		-5.74		-4.69	-3.98
		(0.00)		(0.00)	(0.00)

Note: Values in parentheses denote p-values.

Westerlund test results indicate the presence of coherence among the variables in Model 1 and Model 2, implying a steady and persistent association between key factors. This indicates that there is a consistent permanent link between the variables in Models 1 and 2 for both the entire panel and individual units. Kao and Pedroni estimations coincide with the Westerlund analysis.

All panel cointegration tests confirm the same results, which means there is the existence of cointegration across the panel under study.

MMQR Results Explanation for Model 1

MM-QR results for Model 1 are given in Table 8. The lower quantiles Q0.10 and Q0.25 are demonstrating low debt regimes, while the upper quantiles Q0.50, Q0.75, and Q0.90 are indicating high debt regimes. The official exchange rate (OEXR) impact is statistically significant at the upper tail of the central government debt distribution. Therefore, OEXR increased from Q0.10 (0.0014) to Q0.90 (0.0018), indicating that the identical change in OEXR creates a 26.6 percent higher rise in CGD in higher quantiles compared to lower quantiles. This research confirms a positive association between OEXR and CGD because national borrowing in foreign currency increases the burden on foreign currency reserves and also causes the domestic currency of debtor nations to depreciate (Aizenman et al., 2013). TRADE is showing negative, increasing, and significant across all quantiles. But it has become more negative or increasing at the upper quantiles. It implies that trade has increasing tax earnings and export earnings, which could help to reduce the fiscal deficit or to reduce the central government debt (Tahir and Khan, 2014). Inflation (INF) shows a U-shaped pattern. It is weak (significant) at lower quantiles Q0.10 (0.07) to Q0.50 (0.04), and it is strong (insignificant) at upper quantiles Q0.75 (0.04) to Q0.90 (0.05). It also shows a positive association between CGD and INF across all quantiles. The U-shaped relationship between inflation and government debt implies uncertainty about the anticipated revenue and expenditures of the government (Das, 2025).

Table 8: MMQR Estimates of Central Government Debt

Factors	Loc	Scale	10 th Q	25 th Q	50 th Q	75 th Q	90 th Q
OEXR	0.001***	0.0001	0.001	0.00**	0.0016**	0.0017***	0.0018**
	(0.00)	(0.00)	(0.0010)	(0.0007)	(0.0005)	(0.0005)	(0.0007)
Trade	-0.084***	-0.035*	-0.025	-0.052	-0.086***	-0.112***	-0.14***
	(0.03)	(0.01)	(0.04)	(0.03)	(0.03)	(0.034)	(0.04)
INF	0.01	0.07**	0.09	0.04	0.02	0.08**	0.16***
	(0.04)	(0.03)	(0.07)	(0.05)	(0.04)	(0.04)	(0.05)
GFKF	0.06**	0.01	0.03	0.04	0.06**	0.07**	0.08**
	(0.02)	(0.01)	(0.04)	(0.03)	(0.02)	(0.03)	(0.04)
GDP	-0.07***	-0.03**	-0.02	-0.04	-0.07***	-0.10***	-0.14***
	(0.02)	(0.01)	(0.04)	(0.03)	(0.02)	(0.02)	(0.03)
GCE	-0.02***	-0.003	-0.02***	-0.03***	-0.02***	-0.021***	-0.018*
	(0.00)	(0.004)	(0.006)	(0.004)	(0.005)	(0.008)	(0.01)
WGI	-0.03**	-0.02	-0.06***	-0.04***	-0.03**	-0.02	-0.01
	(0.01)	(0.013)	(0.017)	(0.012)	(0.016)	(0.02)	(0.029)
Constant	43.59***	23.03***	4.89	22.41***	44.55***	61.65***	80.44***
	(5.36)	(3.28)	(7.45)	(6.34)	(5.42)	(6.15)	(7.818)

GFKF has a positive relationship with public debt, indicated by positive signs across quantiles. The positive impact is stronger or increasing at upper quantiles. The reason for the positive link between gross capital formation and debt is that the government requires finance for investment, which it usually relies on borrowing from either internal or external resources (Waheed, 2017; Ambrocio, 2021). GDP shows a negative association with central government debt across all

quantiles. The impact is increasing and negative in upper quantiles Q0.75(-0.10) and Q0.90(-0.14). The association between GDP and GCD is statistically insignificant and weak at lower quantiles, while it is statistically significant at upper quantiles. The primary explanation for the negative link is that as GDP increases, the denominator in the government loan-to-GDP ratio decreases, and this reduces the total value of the government liability burden (Megersa & Cassimon, 2015; Kim et al., 2017).

GFCE shows a negative association with central government debt. The magnitude of the coefficients is decreasing at the upper quantiles. It means the negative impact is strong at lower quantiles and becomes weak at upper quantiles. The relationship between GFCE and government debt is negative because the government doesn't primarily rely on borrowing to finance its consumption expenditures (Alesina et al., 2019; Egert, 2015; Ciminelli et al., 2023). WGI has been showing a negative association with central government debt. The magnitude of the coefficients declines from the low quantile to the upper quantile. The relationship is statistically significant and strong in low quantiles. The relationship is weak and insignificant in upper quantiles from Q0.75 (0.02) to Q0.90(0.03). A better WGI can increase fiscal discipline, which promotes fiscal transparency, tax compliance, and improves the productivity of government spending. It will provide a sustainable budget that mitigates the need for deficit financing and reduces the burden of central government debt (Aizenman et al., 2013; Kharusi & Ada, 2018).

Due to potential endogeneity issues, we have also applied the IVQR technique and found similar results in Table 9.

Table 9: IVQR Estimates of Central Government Debt

Variables	10th Q	25th Q	50th Q	75th Q	90th Q
OEXR	0.0012*** (0.0004)	0.0013*** (0.0004)	0.0014*** (0.0005)	0.0016*** (0.0005)	0.0019*** (0.0007)
Trade	-0.079*** (0.024)	-0.044** (0.021)	-0.031* (0.018)	-0.061** (0.027)	-0.118*** (0.036)
INF	0.018 (0.038)	0.061* (0.034)	0.083** (0.040)	0.096** (0.044)	0.151*** (0.052)
GFKF	0.055** (0.025)	0.026 (0.021)	0.041* (0.023)	0.063** (0.029)	0.076** (0.034)
GDP	-0.065*** (0.019)	-0.035** (0.016)	-0.026* (0.015)	-0.069*** (0.021)	-0.126*** (0.029)
GCE	-0.019*** (0.006)	-0.006 (0.005)	-0.018** (0.008)	-0.024*** (0.009)	-0.020** (0.010)
WGI	-0.027** (0.013)	-0.018 (0.012)	-0.052*** (0.016)	-0.038** (0.018)	-0.016 (0.024)
Constant	42.17*** (5.12)	24.86*** (4.01)	7.21 (6.83)	43.38*** (6.01)	77.26*** (7.52)

MMQR Results Explanation for Model 2

MM-QR results for the second model are given in Table 10. The negative sign of quantile coefficients suggests that CGD is detrimental to economic growth. The magnitude of the negative effect of CGD is increasing from lower quantiles to upper quantiles. The association between CGD and GDP is weak and insignificant at the low growth regime Q0.10 (0.006), while it becomes strong and significant in high growth regimes Q0.75 (0.03) and Q0.90 (0.04). This is because the high debt level increases the burden on the government budget, and a considerable portion of the government budget is used for debt servicing (Woo & Kumar, 2015). Higher future tax reduces the current savings and ultimately investment, which reduces the GDP growth rate (Panizza and Presbitero, 2014). The workforce involvement rate (LFPR), which shows a direct and statistically significant association with the expansion of GDP across all quantiles. The magnitude of the positive association reduced from the lower quantile to the upper quantiles, showing diminishing marginal GDP. The LFPR generates income, which encourages consumption and aggregate demand, which leads to GDP growth (Solow, 1956). But in upper quantiles, the positive effect of LFPR is decreasing. After a higher level of GDP growth has been achieved, labor participation does not significantly influence GDP growth, but labor productivity does (Feyrer, 2007). The GFKF shows a direct correlation with GDP. The association is significant across quantiles except 0.10Q. The magnitude of the coefficients is increasing toward the upper quantiles.

Table 10: MMQR Estimates of Economic Growth

Variables	Loc	Scale	10 th Q	25 th Q	50 th Q	75 th Q	90 th Q
LFPR	.041*** (.009)	-.017** (.007)	.067*** (.016)	.0509*** (.011)	.0395*** (.00931)	.0280*** (.00975)	.0168 (.0123)
GFKF	.040*** (.011)	.004 (.009)	.032 (.022)	.037** (.014)	.0408*** (.0112)	.0439*** (.0104)	.0476*** (.0136)
CGD	-.017*** (0.003)	-.005** (0.002)	-.008 (0.006)	-.014*** (0.004)	-.0178*** (0.00342)	-.0217*** (0.00358)	-.0254*** (0.00453)
INF	-0.02* (0.0129)	-0.003 (0.0115)	-0.02*** (0.00717)	-0.02*** (0.007)	-0.022 (0.013)	-0.020 (0.020)	-0.018 (0.028)
OEXR	-0.02*** (0.008)	-0.01** (0.007)	-0.05*** (0.01)	-0.03*** (0.010)	-0.02*** (0.008)	-0.01* (0.009)	-0.008 (0.01)
TRADE	0.04*** (0.01)	0.018* (0.011)	0.07*** (0.02)	0.05*** (0.017)	0.04*** (0.013)	0.03*** (0.012)	0.01 (0.015)
WGI	0.03*** (0.01)	0.006 (0.008)	0.04** (0.01)	0.03*** (0.012)	0.03*** (0.011)	0.02** (0.012)	0.02 (0.016)
Constant	1.13 (0.80)	3.80*** (0.66)	-4.86*** (1.62)	-1.09 (1.01)	1.43* (0.76)	3.94*** (0.71)	6.46*** (0.92)

It shows a strong association between GFKF and output expansion in higher-growth regimes. The direct link between GFKF and output expansion is due to an increase in investment in physical assets, which directly strengthens the production capacity of the country. The production capacity boost through investment encourages output expansion and sets a path for GDP growth (Barro, 1991). INF shows an adverse and substantial correlation with GDP expansion in the lower quantiles. In the upper quantiles, the relationship is shown to be inverse and weak (insignificant). The uncertainty brought on by high prices is the cause of the negative correlation between INF and GDP expansion (Fisher, 1993). The negative effect of inflation decreases in magnitude within a higher growth regime and can be explained by the inflation

threshold. Therefore, at a higher GDP growth level, the inflation impact becomes weak (Khan & Senhadji, 2001). OEXR demonstrates a negative association with GDP growth rate across the quantiles. The association is strong and significant in the lower quantiles and the middle quantile. But it becomes weak and insignificant at the (0.90Q) high growth regime. The negative impact of OEXR is strong and significant in low-growth regimes because less-growing economies do not absorb shocks effectively (Rodrik, 2008). The negative impact of OEXR on GDP is weak in the higher growth regime because fast-growing countries have lower imports (Taylor, 2000). TRADE indicates a positive association with GDP growth rate across quantiles. The association between TRADE and GDP is significant and strong in lower and middle quantiles. The link between TRADE and GDP becomes weak and insignificant at the Q0.90. It can be explained by the theory of knowledge diffusion (Frankel & Romer, 1999). But trade liberalization cannot have an impact when most of the trade barriers have already been removed, and GDP growth is already high because the benefits of most of the new opportunities, technology, and markets have already been utilized. WGI has a positive association with GDP. But the magnitude of the positive relationship is slightly declining from lower to upper quantiles. The association between WGI and GDP is strong and significant across quantiles. The investment will produce greater output under quality institutions compared to poor institutions and thus increase the GDP or output growth (Acemoglu et al., 2001; North, 1990). The positive impact of WGI on GDP is low in high-growth regimes because of the convergence effect. In high-growth regimes, there is an institutional quality threshold after which the marginal impact of WGI on GDP declines, while other factors play a role in growth-driven factors (Rodrik et al., 2004).

Due to potential endogeneity issues, we have also applied the IVQR technique and found similar results in Table 11.

Table 11: IVQR Estimates of Economic Growth

Variables	10th Q	25th Q	50th Q	75th Q	90th Q
LFPR	0.038*** (0.010)	0.022** (0.009)	0.061*** (0.017)	0.048*** (0.012)	0.020 (0.014)
GFKF	0.037*** (0.012)	0.009 (0.010)	0.029 (0.021)	0.035** (0.015)	0.044*** (0.014)
CGD	-0.015*** (0.004)	-0.007** (0.003)	-0.009 (0.006)	-0.016*** (0.004)	-0.023*** (0.005)
INF	-0.018* (0.010)	-0.006 (0.012)	-0.021*** (0.008)	-0.019** (0.009)	-0.016 (0.025)
OEXR	-0.018** (0.009)	-0.012* (0.007)	-0.043*** (0.012)	-0.029*** (0.011)	-0.010 (0.011)
TRADE	0.036*** (0.011)	0.021* (0.012)	0.064*** (0.021)	0.048*** (0.018)	0.014 (0.016)
WGI	0.028*** (0.011)	0.009 (0.009)	0.035** (0.015)	0.028** (0.013)	0.018 (0.017)
Constant	1.26 (0.86)	3.51*** (0.72)	-4.31*** (1.71)	-0.82 (1.08)	6.12*** (1.01)

Panel Threshold Results

The non-linearity of the relationship between central government debt and GDP is confirmed by the MMQR analysis, and it gives an indication of the existence of a debt threshold. Table 12 displays the single threshold regression findings that were found to be most appropriate by threshold effect testing.

Table 12: Results of the Threshold Regression

Threshold Type	Threshold Value	Bootstrap p-value	95% C.I.	F-Statistic	Crit10	Crit5	Crit1
Single Threshold	18.67	0.0001	11.42, 22.83	19.36	9.12	11.08	14.25

There, the F-statistic is 19.36, and it rejects the statistical hypothesis. The directional hypothesis is accepted (there is a single threshold effect among variables) in view of the findings. The findings imply that CGD and economic expansion in developing nations have a quadratic connection. Additionally, it supports the division of the sample values into two distinct regimes according to the predicted threshold value. The bootstrap value suggests that the F-statistic analysis, which shows that there exists an individual threshold effect involving output expansion and CGD, is robust. There is a single debt threshold of 18.67% of GDP, according to the strong evidence establishing the nonlinear association among variables in developing nations. This suggests that the impact of CGD on the expansion of output differs according to whether the total sovereign debt is under or above the 18.67 threshold. The government debt works as a positive driver of growth before the threshold, and it will play as a negative driver of GDP after the threshold.

Policy Recommendations

- Based on the findings of this study, the following policy recommendations are suggested to highly indebted countries:
- Countries in high debt regimes must maintain a stable and competitive exchange rate, and policies to artificially inflate local currency must be avoided to control debt burdens.
- The highly indebted countries should focus on promoting property rights and strengthening legal contracts.
- The countries with high existing debt should open their borders for trade to reduce the debt burden.
- The highly indebted countries should focus on investing in advanced infrastructure. The policymakers should ensure that the allocation of government resources to infrastructure investment is backed by the feasibility studies.
- It is suggested that the fiscal authorities in highly indebted countries should maintain counter-cyclical behaviour because accumulation of output would face diminishing returns in developing countries.
- Based on the findings of this study, the following policy recommendations are suggested to low-indebted countries:

- Countries with low debt must allow the invisible hands of the market to determine the official exchange rate and absorb the economic shocks.
- The expenditures of the government should move from consumption to investment purposes. Because the capital formation effect on CGD is positive in the upper quantiles, this fiscal shift is necessary for further growth.
- Efficient governance should be focused through regulatory simplifications, transparent tax collection, and business licensing, because the cost of regulating governance is overshadowing the advantages of institutions in developing countries.
- Budget deficits should not be excessively monetized to increase inflationary pressure, and aggregate demand must be backed by fiscal policy to avoid deflationary pressure.
- Low-indebted countries should focus on protecting small-scale domestic industries and avoid free trade.
- Developing countries in low-debt regimes should ensure the quality of government investment before investing more.
- Based on the findings of this study, the following policy recommendations are suggested to low-growth developing countries:
 - Productive investment in labour and trade should be focused on instead of focusing on reducing the budget deficit.
 - Labour force participation should increase through reforms such as tax slab reduction for low-wage labour.
 - According to the findings of this study, investment does not yield much growth in low-growth economies. Therefore, policymakers must focus on increasing efficiency and quality of investment instead of increasing the fiscal budget.
 - The governments of low-growth developing countries should be more vigilant in controlling inflation.
 - Fiscal policy should focus on avoiding large capital inflows through foreign debt that can cause appreciation of the currency.
 - Trade should be promoted through free trade agreements and decreased tariffs and non-tariff trade barriers because it will open new doors for technology and innovation sharing.
 - The government of slow-growing countries should focus on better institutional quality through transparent budgeting to reduce corruption, an effective customs department, and efficient enforcement of contracts, property rights, and the rule of law.
- Based on the findings of this study, the following policy recommendations are suggested to high-growth developing countries:
 - The fast-growing countries should practice a counter-cyclical budget and avoid
 - In high-growth economies, the number of labour participants doesn't matter; therefore, they must focus on increasing the productivity of workers through investing in human capital.
 - Invest in infrastructure and incentives to encourage private investment.
 - Be vigilant regarding inflation, but can turn their focus and resources to other growth areas, increasing aggregate demand to avoid recession.
 - Should increase exports in high-value-added commodities and diversify exports to avoid the dependency of the economy on one sector.

- Although the analysis indicates that economies that are growing rapidly already have greater institutional quality, this has little to no influence on GDP growth. The fast-growing countries should promote a more specialized form of regulatory quality.
- Based on the findings of this study, the following policy recommendations are suggested to avoid the debt threshold in developing countries:
- The countries that close the debt threshold should implement fiscal consolidation, start debt restructuring, and seek debt management assistance from international institutions. They can focus on forming an independent parliamentary body whose permission is required before taking non-concessional debt.
- The countries beyond the debt threshold level can use trade liberalization, enhance the standard of governance, and create a business-friendly atmosphere for investment inflow to spur growth without adding to the debt load.
- The government should include a debt ceiling as a warning when the level of debt is close to the threshold in fiscal legislation.
- Since the debt-to-GDP level crossed 18.67%, a fiscal adjustment mechanism must be started.
- To avoid reaching the debt threshold, countries should manage their government expenditures. This can be achieved through linking government spending to measurable output, tracking annual returns on government investment, publishing annual project performance reports financed through debt, and using this performance information to make borrowing decisions in the future.

Limitations of the Study

This study has taken the debt as a stock variable rather than a flow variable and ignores the composition and time structure of government debt that can alter the debt-growth association. This investigation is conducted short run analysis and doesn't give insights for the long run. The study applied MMQR analysis to address the distributional heterogeneity, but it fails to capture the country-specific institutional distinctiveness that can be conditional in the debt-growth association. The study also ignores the regional cluster by taking a global panel model, which will show the average rather than the critical region-specific debt threshold level. This study investigates the debt-growth association and government debt threshold in developing countries without including the periods of volatility or external shocks, which is a common characteristic of the developing world and can alter the traditional associations. Moreover, the study has incorporated different drivers of debt, but it does not explicitly consider the quality or productivity of government expenditures financed through government debt. The current investigation includes panel data but fails to examine any change in the threshold level over the period, and it does not incorporate the global crisis effect on the level of debt threshold. The threshold analysis has not taken into account the causality and ignores the Granger Causality Test application.

Roadmap for Future Research

Future research can include the composition and maturity structure of government debt, which will provide deep insight into how different kinds of government debt influence fiscal sustainability and output growth differently in developing countries. Future researchers can assess the moderating effect of government expenditure productivity, which will give more

policy-oriented insights. The upcoming research should integrate crisis dummy variables and structural break tests to analyse the influence of global shocks on the debt-GDP association and outcome. Future researchers can focus on the question that the debt threshold may change over time, taking it as a flow concept, using a time-varying parameters model that helps the threshold to change gradually over time. Future research can also emphasize the maturity of the threshold, whether it is adequate for long-term policy formation, or it is short-term and requires frequent updates using a Bayesian approach or time-varying threshold models.

References

1. Acemoglu, D., & Robinson, J. A. (2019). Rents and economic development: The perspective of Why Nations Fail. *Public Choice*, 181(1), 13–28. <https://doi.org/10.1007/s11127-019-00644-0>
2. Arčabić, V., Tica, J., Lee, J., & Sonora, R. J. (2018). Public debt and economic growth conundrum: nonlinearity and inter-temporal relationship. *Studies in Nonlinear Dynamics & Econometrics*, 22(1). <https://doi.org/10.1515/snde-2016-0086>
3. Alsamara, M., Mrabet, Z., & Mimouni, K. (2024). The threshold effects of public debt on economic growth in MENA countries: Do energy endowments matter? *International Review of Economics and Finance*, 89(Part B), 458–470. <https://doi.org/10.1016/j.iref.2023.10.015>
4. Aizenman, J., Hutchison, M., & Jinjarak, Y. (2013). What is the risk of European sovereign debt defaults? Fiscal space, CDS spreads and market pricing of risk. *Journal of International Money and Finance*, 34(1), 37–59. <https://doi.org/10.1016/j.jimonfin.2012.11.011>
5. Alesina, A., Favero, C., & Giavazzi, F. (2019). Effects of austerity: Expenditure- and tax-based approaches. *Journal of Economic Perspectives*, 33(2), 141–162. <https://doi.org/10.1257/jep.33.2.141>
6. Ambrocio, G. (2021). Public debt and public investment: An empirical investigation (Bank of Finland Research Discussion Paper No. 7/2021). <https://doi.org/10.2139/ssrn.3814405>
7. Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91(5), 1369–1401. <https://doi.org/10.1257/aer.91.5.1369>
8. Barro, R. J. (1990). Government spending in a simple model of endogenous growth. *Journal of Political Economy*, 98(5, Part 2), S103–S125. <https://www.jstor.org/stable/2937633>
9. Barro, R. J. (1991). Economic growth in a cross section of countries. *The Quarterly Journal of Economics*, 106(2), 407–443. <https://doi.org/10.2307/2937943>
10. Barro, R. J. (1991). Economic growth in a cross section of countries. *The Quarterly Journal of Economics*, 106(2), 407–443. <https://doi.org/10.2307/2937943>
11. Blanchard, O. (2019). Public debt and low interest rates. *American Economic Review*, 109(4), 1197–1229. <https://doi.org/10.1257/aer.109.4.1197>
12. Checherita-Westphal, C., & Rother, P. (2012). The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area. *European Economic Review*, 56(7), 1392–1405. <https://doi.org/10.1016/j.euroecorev.2012.06.007>

13. Clements, B., Bhattacharya, R., & Nguyen, T. Q. (2003). External debt, public investment, and growth in low-income countries (IMF Working Paper No. 03/249). <https://doi.org/10.5089/9781451875904.001>
14. Ciminelli, G., Ding, T., & Fattore, G. (2023). The composition of fiscal adjustments and sovereign risk premia. *Journal of International Money and Finance*, 137, 102892. <https://doi.org/10.1016/j.jimonfin.2023.102892>
15. Cecchetti, S. G., Mohanty, M. S., & Zampolli, F. (2011). The real effects of debt (BIS Working Paper No. 352). Bank for International Settlements. <https://www.bis.org/publ/work352.htm>
16. Das, M. R. (2025). Macroeconomic Determinants of Public Debt in Bangladesh: An ARDL Approach. *Jahangirnagar University Journal of Business Research*, 25(01), 39–54. <https://doi.org/10.53461/jujbr.v25i01.85>
17. Égert, B. (2015). Public debt, economic growth and nonlinear effects: Myth or reality? *Journal of Macroeconomics*, 43, 226–238. <https://doi.org/10.1016/j.jmacro.2014.11.006>
18. Eke, C. K., & Akujuobi, N. E. (2021). PUBLIC DEBT AND ECONOMIC GROWTH IN NIGERIA: AN EMPIRICAL INVESTIGATION. *International Journal of Development and Management Review*, 16(1), 178–192. <https://doi.org/10.4314/ijdmr.v16i1>
19. Feyrer, J. (2007). Demographics and productivity. *The Review of Economics and Statistics*, 89(1), 100–109. <https://doi.org/10.1162/rest.89.1.100>
20. Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of Monetary Economics*, 32(3), 485–512. [https://doi.org/10.1016/0304-3932\(93\)90027-D](https://doi.org/10.1016/0304-3932(93)90027-D)
21. Fisher, I. (1933). The debt-deflation theory of Great Depression. *Econometrica*, 1(4), 337–357. <https://doi.org/10.2307/1907327>
22. Frankel, J. A., & Romer, D. (1999). Does trade cause growth? *American Economic Review*, 89(3), 379–399. <https://doi.org/10.1257/aer.89.3.379>
23. Fir, N. (2022). Does Debt Have Threshold Effects on Medium-Term Growth? Evidence from European Union Countries. *Naše Gospodarstvo/Our Economy*, 68(2), 1–18. <https://doi.org/10.2478/ngoe-2022-0007>
24. Gómez-Puig, M., Sosvilla-Rivero, S., & Martínez-Zarzoso, I. (2022). On the heterogeneous link between public debt and economic growth. *Journal of International Financial Markets, Institutions and Money*, 77(101528), 1042–4431. <https://doi.org/10.1016/j.intfin.2022.101528>
25. Hansen, B. E. (1999). Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of Econometrics*, 93(2), 345–368.
26. Hilton, S. K. (2021). Public debt and economic growth: contemporary evidence from a developing economy. *Asian Journal of Economics and Banking*, 5(2), 173–193. <https://doi.org/10.1108/ajeb-11-2020-0096>
27. Helmi, M., Ahmad, Z., Lun, L. K., Mansur, M., & Gomaa, S. (2025). Determinants of Government Debt in ASEAN-5 Nations: An ARDL Analysis of Economic Factors. *Qubahan Academic Journal*, 4(4), 250–267. <https://doi.org/10.48161/qaj.v4n4a1119>
28. IMF. (2013). Staff guidance note for public debt sustainability analysis in market-access countries. International Monetary Fund.
29. Isomitdinov, H., Arcabic, V., Lee, J., & Yun, Y. (2020). International Co-Movements and Determinants of Public Debt. *SSRN Electronic Journal*, Bank of Korea WP 2020-15. <https://doi.org/10.2139/ssrn.3640087>

30. Jusaj, Y., Avdimetaj, K., Zogaj, V., & Gara, A. (2025). The impact of public debt threshold on economic growth before and after the COVID-19 pandemic: An empirical analysis of Central and Eastern European developing countries. *Economics and Culture*, 22(1), 124–135. <https://doi.org/10.2478/jec-2025-0010>
31. Khanfir, W. (2019). Threshold Effect of Public Debt on Economic Growth: An Empirical Investigation for Selected North African Countries. *Economic Alternatives*, 12(3), 429–436.
32. Khan, M. S., & Senhadji, A. S. (2001). Threshold effects in the relationship between inflation and growth. *IMF Staff Papers*, 48(1), 1–21. <https://www.imf.org/external/pubs/ft/staffp/2001/01/pdf/khan.pdf>
33. Kao, C. (1999). Spurious regression and residual-based tests for cointegration in panel data. *Journal of Econometrics*, 90(1), 1–44. [https://doi.org/10.1016/S0304-4076\(98\)00023-2](https://doi.org/10.1016/S0304-4076(98)00023-2)
34. Kharusi, S. A., & Ada, M. S. (2018). External debt and economic growth: The case of emerging economy. *Journal of Economic Integration*, 33(1), 1141–1157. <https://doi.org/10.11130/jei.2018.33.1.1141>
35. Kim, E., Ha, Y., & Kim, S. (2017). Public Debt, Corruption and Sustainable Economic Growth. *Sustainability*, 9(3), 433–461. <https://doi.org/10.3390/su9030433>
36. Maddala, G. S., & Wu, S. (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics*, 61(S1), 631–652. <https://doi.org/10.1111/1468-0084.0610s1631>
37. Mupunga, N., & Roux, P. L. (2015). Estimating growth-maximizing public debt thresholds for the SADC region. *African Development Review*, 27(4), 404–415. <https://doi.org/10.1111/1467-8268.12159>
38. Manalo, J. L., Villamiel, M., & Dela Cruz, E. (2022). Macroeconomic Determinants of Public Debt in the Philippines. *Journal of Economics, Finance and Accounting Studies*, 4(1), 530–551. <https://doi.org/10.32996/jefas.2022.4.1.40>
39. Matandare, M. A., & Tito, J. (2022). Public Debt and Economic Growth Nexus in Zimbabwe. *Journal of Economics and Sustainable Development*, 9(2), 84–89. <https://doi.org/ISSN2222/2855>
40. Magnini, G., & Vojnovic, J. (2022). Economic Freedom and Debt: An Empirical Investigation on the Institutional Determinants of Public Debt. *Research Square (Research Square)*, 3(2). <https://doi.org/10.21203/rs.3.rs-2081923/v2>
41. Megersa, K., & Cassimon, D. (2015). Public Debt, Economic Growth, and Public Sector Management in Developing Countries: Is There a Link? *Public Administration and Development*, 35(5), 329–346. <https://doi.org/10.1002/pad.1733>
42. North, D. C. (1990). *Institutions, institutional change and economic performance* (pp. 143-167). Cambridge University Press.
43. Nikolaidou, E., & Okwoche, P. (2023). Determinants of Government Debt in Sub-Saharan African Countries: The Role of Conflict, Governance, and Economic Factors. *Peace Economics, Peace Science and Public Policy*, 29(2), 145–170. <https://doi.org/10.1515/peps-2022-0038>
44. Nguyen, T. A. N., & Luong, T. T. H. (2021). Fiscal Policy, Institutional Quality, and Public Debt: Evidence from Transition Countries. *Sustainability*, 13(19), 10706. <https://doi.org/10.3390/su131910706>

45. 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. <https://doi.org/10.1108/jed-01-2020-0001>
46. Onofrei, M., Bostan, I., Firtescu, B. N., Roman, A., & Rusu, V. D. (2022). Public Debt and Economic Growth in EU Countries. *Economies*, 10(10), 254. <https://doi.org/10.3390/economies10100254>
47. Ostrihoň, F., Siranova, M., & Workie, M. (2023). Reassessing the public debt threshold in the EU: Do macroeconomic conditions matter? *Panoeconomicus*, 70(1), 47–69. <https://doi.org/10.2298/pan181114007o>
48. Panizza, U., & Presbitero, A. F. (2014). Public debt and economic growth: Is there a causal effect? *Journal of Macroeconomics*, 41 (12), 21–41. <https://www.sciencedirect.com/science/article/abs/pii/S0164070414000715>
49. Presbitero, A. F. (2012). Total public debt and growth in developing countries. In *Sovereign debt: From safety to default* (R. W. Kolb, Ed.). Wiley.
50. Pattillo, C., Poirson, H., & Ricci, L. (2004). What are the channels through which external debt affects growth? IMF Working Paper No. 04/15. <https://doi.org/10.5089/9781451843293.001>
51. Panizza, U., & Presbitero, A. F. (2014). Public debt and economic growth: Is there a causal effect? *Journal of Macroeconomics*, 41 (12), 21–41. <https://www.sciencedirect.com/science/article/abs/pii/S0164070414000715>
52. Pesaran, M. H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. *Journal of Econometrics*, 142(1), 50–93. <https://doi.org/10.1016/j.jeconom.2007.05.010>
53. Pedroni, P. (1999). Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics*, 61(S1), 653–670. <https://doi.org/10.1111/1468-0084.0610s1653>
54. Pesaran, M. H. (2004). *General diagnostic tests for cross-section dependence in panels* (CESifo Working Paper No. 1229). CESifo. <https://www.ifo.de/en/cesifo/publications/2004/working-paper/general-diagnostic-tests-cross-section-dependence-panels>
55. Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, 22(2), 265–312. <https://doi.org/10.1002/jae.951>
56. Raheem, A., Cao, X., Yousaf, M., & Yousaf, R. (2022). Macroeconomics determinants of government debt and threshold effect of debt on economic growth in South Asia: A panel analysis. *Pakistan Economic and Social Review*, 60(2), 169–197.
57. Rekha, Dr., & Karan, Dr. D. (2024). Public Debt Economic Growth Nexus: How Effective to Allay Resetting Economic Growth of India. *International Journal of Innovative Research in Multidisciplinary Education*, 03(08), 1377–1382. <https://doi.org/10.58806/ijirme.2024.v3i8n11>
58. Rahman, N. H. A., Ismail, S., & Ridzuan, A. R. (2019). How does public debt affect economic growth? A systematic review. *Cogent Business & Management*, 6(1). <https://doi.org/10.1080/23311975.2019.1701339>
59. Raheem, M. R., & Quddus, M. A. (2020). Impact of High and Growing Public Debt on Economic Growth in SAARC Countries: An Econometric Analysis. *Journal of Political Science*, 27(1), 125–142.

60. Rodrik, D. (2008). The real exchange rate and economic growth. *Brookings Papers on Economic Activity*, 2008(2), 365–412. <https://www.jstor.org/stable/27561647>
61. Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions rule: The primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9(2), 131–165. <https://doi.org/10.1023/B:JOEG.0000031425.72248.85>
62. Shah, A., Dickinson, D., Tao, K., Wang, C., & Zhang, L. (2024). The Heterogenous Threshold Effects of Public Debt on Economic Growth: Empirical Evidence from Developing Countries. *Open Economies Review*, 36(12). <https://doi.org/10.1007/s11079-024-09756-7>
63. Swamy, P. A. V. B. (1970). Efficient inference in a random coefficient regression model. *Econometrica*, 38(2), 311–323. <https://doi.org/10.2307/1913012>
64. Shaari, M. S., Sulong, A., Ridzuan, A. R., Esquivias, M. A., & Lau, E. (2024). The Carbon Conundrum: Exploring CO2 Emissions, Public Debt, and Environmental Policy. *Emerging Science Journal*, 8(3), 933–947. <https://doi.org/10.28991/esj-2024-08-03-08>
65. Taylor, J. B. (2000). Low inflation, pass-through, and the pricing power of firms. *European Economic Review*, 44(7), 1389–1408. [https://doi.org/10.1016/S0014-2921\(00\)00037-4](https://doi.org/10.1016/S0014-2921(00)00037-4)
66. Toth, P., Tkacova, A., Gavurova, B., & Pechova, V. (2022). Determinants Of Public Debt In Eu Countries. *Polish Journal of Management Studies*, 25(1), 406–424. <https://doi.org/10.17512/pjms.2022.25.1.25>
67. Tahir, M., & Khan, I. (2014). Trade openness and economic growth in the Asian region. *Journal of Chinese Economic and Foreign Trade Studies*, 7(3), 136–152. <https://doi.org/10.1108/JCEFTS-05-2014-0006>
68. Vale, M. P. (2022). Economic, social, and institutional determinants of public debt in the ASEAN+3. *The American Journal of Humanities and Social Sciences Research (AJHSSR)*, 5(4), 103–111. Retrieved from <https://www.theajhssr.com>
69. Waheed, A. (2017). Determinants of external debt: A panel data analysis for oil and gas exporting and importing countries. *International Journal of Economics and Financial Issues*, 7(1), 234–240.
70. Waqas, M., Rasidah, M.-R., Attia, A.-U., Chui, Z., & Ong. (2021). Country-Level Institutional Quality and Public Debt: Empirical Evidence from Pakistan. *Journal of Asian Finance*, 8(4), 21-0032. <https://doi.org/10.13106/jafeb.2021.vol8.no4.0021>
71. Westerlund, J. (2007). Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics*, 69(6), 709–748.
72. Woo, J. (2003). Economic, political, and institutional determinants of public deficits. *Journal of Public Economics*, 87(3–4), 387–426. [https://doi.org/10.1016/S0047-2727\(01\)00143-8](https://doi.org/10.1016/S0047-2727(01)00143-8)
73. Woo, J., & Kumar, M. S. (2015). Public debt and growth. *Economica*, 82(328), 705–739. <https://doi.org/10.1111/ecca.12138>
74. Wang, Q. (2015). Fixed-effect panel threshold model using Stata. *The Stata Journal*, 15(1), 121–134.
75. Yousaf, U. S., & Aziz, B. (2024). Unveiling the relationship between the optimal debt threshold level and debt-economic growth in selected indebted countries: panel threshold analysis. *Quality and Quantity*, 58(12), 5003–5025. <https://doi.org/10.1007/s11135-024-01888-9>