Impact of Public Debt on Public Education Expenditure: Does Institutional Quality Matter?[1]

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Abstract

This study investigates how institutional quality influences the relationship between public debt and education expenditure. Using data from 145 advanced and developing economies, over the period 1994 – 2022, we employ System GMM and dynamic panel threshold regression models to capture both linear and nonlinear dynamics. The System GMM results indicate that higher levels of public debt are associated with reductions in education expenditure, whereas institutional quality has a significant positive effect. Notably, the interaction between public debt and institutional quality increases education expenditure. The threshold regression further reveals a regime-dependent effect: when the institutional quality index is below 1.231, public debt significantly reduces education expenditure. However, when institutional quality surpasses this threshold, public debt increases public education expenditure. These findings highlight the critical role of institutional quality in shielding educational budgets from the adverse effects of rising debt. Accordingly, policymakers are urged to strengthen institutional frameworks and prudently manage public debt to sustain investment in education.

Keywords: *public education expenditure, public debt, institutional quality, advanced and developing economies*

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Introduction

Human capital investment is widely recognized as a key driver of economic development. Among the various forms of human capital investment, public education expenditure is the primary channel through which governments invest in human capital. Empirical evidence indicates that public education expenditure plays a critical role in enhancing educational outcomes and promoting human capital formation (Edeme and Nkalu, 2019; Kousar et al., 2023). Beyond its impact on human capital, public investment in education is also positively associated with economic growth (Tomić, 2015; Sunde, 2017; Karacor et al., 2018; Cooray and Nam, 2024). Given the central importance of educational investment, it is essential to examine the factors influencing its effectiveness. The impact of human capital investment is not uniform and may vary depending on a range of demographic, political, and macroeconomic conditions.

Public debt is a pressing global issue that significantly influences education expenditure (Fosu, 2010; Miningou, 2023; Ncanywa and Masoga, 2018). In the aftermath of the COVID-19 pandemic, many countries experienced rising debt levels. According to Kose et al. (2022), global public debt surged to unprecedented levels during and after the pandemic, posing serious fiscal sustainability challenges, particularly in developing economies. Public debt is often used to finance essential social services, including education (UNESCO, 2022). However, because public education is predominantly funded through government resources, periods of macroeconomic instability often lead to reductions in education expenditure, as governments prioritize short-term economic recovery over long-term investment in human capital (Miningou, 2023). Statistics show that approximately 41 percent of low-income countries reduced their education expenditure after the onset of the pandemic, with an average decline of 13.5 percent. These contractions, especially in countries already facing high learning poverty, have deepened the global learning crisis (UNESCO, 2022).

Although several empirical studies have examined the relationship between public debt and education expenditure, the empirical evidence remains inconclusive. While some researchers (Ncanywa and Masoga, 2018; Liyambo and Kaulihowa, 2020; Nureed et al., 2022) report a positive association between public debt and education expenditure, others (Fosu, 2010; Shabbir and Yasin, 2015) argue that rising debt constrains educational expenditure. In light of the unsettled debate in the literature, coupled with rising debt levels and recurring economic shocks, it is essential to examine how public debt is influencing education expenditure

Apart from debt affecting education expenditure, institutional quality has been identified as a key factor in public education expenditure. Quality institutions are associated with increased public education expenditure (Quattri and Fosu, 2012;

Shabbir and Yasin, 2015; Fonchamnyo and Sama, 2016), while weak institutions, particularly those proxied by corruption, are associated with reduced education expenditure (Swaleheen et al., 2018; Hashem, 2014). Therefore, we hypothesize that quality institutions can ensure that debt-financed education expenditure yields positive returns, whereas weak institutions may result in the misallocation of funds, corruption, and fiscal mismanagement.

To the best of our knowledge, this study makes several contributions: First, we examine the independent effects of public debt and institutional quality on public education expenditure. Second, we investigate the nonlinear relationship between public debt and education expenditure. This is motivated by fiscal space and debt overhang theories, which imply that the relationship between debt and expenditure may change direction beyond certain thresholds. Third, we explore the moderating role of institutional quality in the relationship between public debt and education expenditure, an area that, to the best of our knowledge, has not been adequately explored in previous studies. Existing research has largely focused on the debt-investment nexus. For instance, Ojeka et al. (2024) and Turan and Yanıkkaya (2021) examined how institutional quality moderates the effect of external debt on investment, using gross fixed capital formation (GFCF) as the proxy for investment. We diverge from these studies in this way: while GFCF is a broad aggregate that encompasses many forms of physical capital formation, we focus specifically on public education expenditure, which isolates the education budget itself and captures both capital and recurrent spending dedicated to human capital development. Furthermore, unlike prior research, which predominantly focuses on individual countries or regions, this study conducts a comparative analysis of 33 advanced economies and 112 developing countries. Methodologically, we employ the System GMM estimator to address potential endogeneity concerns, which have been largely overlooked in previous studies (Arellano and Bover, 1995; Blundell and Bond, 1998). In addition, we apply a relatively recent approach, dynamic threshold regression (Seo and Shin, 2016). We use institutional quality as the threshold variable to examine how the relationship between public debt and education expenditure changes across different levels of institutional quality.

The remainder of this paper is organized as follows: Section 1 reviews the relevant literature. Section 2 outlines the methodology, and section 3 presents and discusses the empirical results. Finally, the last section concludes the study with the key findings and policy implications.

1. Review of Literature

In this section, we review empirical studies on the relationship between public debt, institutional quality, and public education expenditure.

1.1. Public Debt and Public Education Expenditure

The relationship between public debt and education expenditure has been widely examined in both country-specific and cross-country analyses. Existing studies provide conflicting perspectives, with some suggesting that higher public debt leads to reductions in education expenditure because of fiscal constraints (Fosu, 2010; Shabbir and Yasin, 2015; Mbewe, 2024), while others argue that debt accumulation can stimulate government education expenditure (Ncanywa and Masoga, 2018; Liyambo and Kaulihowa, 2020; Nureed et al., 2022).

Among the studies that argue that public debt is detrimental, Shabbir and Yasin (2015) examined seven developing Asian countries and confirmed that external debt negatively affects social spending, including education. Similarly, Tasleem (2021) finds that debt servicing significantly reduces government expenditure on education and health in developing Asian nations. These studies align with the broader theoretical argument that debt-servicing obligations force governments to cut expenditures, particularly in sectors that are politically less sensitive to immediate cuts.

Lora and Olivera (2006) analysed data from 50 countries between 1985 and 2003 and confirmed that higher debt ratios reduce social expenditures. Using seemingly unrelated regression (SUR), Fosu (2008) further substantiates these concerns by demonstrating that external debt-servicing constraints significantly reduce social sector spending in African economies. Quattri and Fosu (2012) examined the post-Heavily Indebted Poor Countries (HIPC) period and found that debt constraints continued to negatively affect social sector spending, albeit at a reduced level. This suggests that debt relief programs may alleviate some fiscal pressures but do not completely reverse their adverse effects on education expenditure. A more recent study by Miningou (2023) extends this analysis by showing that a 1% increase in external debt is associated with a 2.9% decline in per capita education expenditure. These findings suggest that the negative impact of debt on education expenditure is persistent and may have worsened in the post-COVID-19 era due to rising debt levels.

A contrasting perspective is offered by studies that identify a positive relationship between debt and government expenditure. Kauliwoha (2022) and Uguru (2016) found that increasing public debt led to higher overall government spending in Namibia and Nigeria, respectively. Similarly, Kiminyei (2014) reported a long-run positive correlation between public debt and government expenditure in Kenya. These findings imply that debt can potentially expand fiscal space, at least in the short run, allowing for increased public investment, including in education.

Another strand of related literature examines the effect of public debt on aggregate investment. Using gross fixed capital formation as a proxy, Ojeka et al. (2024), de Mendonça and Brito (2021), Kostarakos (2021), and Turan and Yanıkkaya (2021) find that increases in the public debt-to-GDP ratio significantly reduce investment.

In summary, existing literature presents a mixed perspective. While most studies highlight the negative impact of high debt burdens on education expenditure, particularly through debt servicing obligations, others argue that debt can expand government expenditure under certain conditions. The discrepancies in the findings may stem from differences in the methodology, periods, and country contexts.

1.2. Institutional Quality and Public Education Expenditure

Few studies have examined the impact of institutional quality on public education expenditure. However, scholars such as Quattri and Fosu (2012), Shabbir and Yasin (2015), and Fonchamnyo and Sama (2016) have argued that good governance and institutional quality significantly affect public expenditure. Studies have shown that increased public spending on education is unlikely to yield better outcomes in countries with poor governance. For instance, Rajkumar and Swaroop (2008) demonstrate that differences in the efficacy of public spending can be largely explained by the quality of governance. Their findings show that public spending on primary education is more effective in increasing primary education attainment in well-governed nations, whereas it has virtually no impact on poorly governed countries. Molina-Morales (2013) concluded that countries that are more developed, exhibit higher levels of democracy, and are governed by left-wing parties tend to allocate greater levels of public expenditure to education.

Corruption, a key component of institutional quality, has been extensively studied as a measure of institutional quality. A literature review shows that corruption negatively affects education spending. Swaleheen et al. (2018) and Hashem (2014) observe this trend in a panel of 134 countries and Arab nations, respectively. Delavallade (2006) had earlier examined the impact of corruption on the structure of government spending by sector using the three-stage least squares method in 64 countries between 1996 and 2001. The study shows that corruption distorts public spending by reducing allocation to social sectors, including education.

Dridi (2014) highlights how institutional quality adversely affects the amount and efficacy of international education aid. The effectiveness of vital international aid in developing countries is undermined by nations with poor institutional frameworks. In such an environment, a significant portion of foreign assistance intended for education is diverted from its original purpose.

1.3. Gaps and Novelty

To the best of our knowledge, previous studies have not fully addressed several important aspects. First, the moderating role of institutional quality in the relationship between public debt and education expenditure has not been adequately

explored. Second, many of the reviewed studies overlook key methodological concerns, particularly endogeneity and threshold effects. Third, the potential nonlinear dynamics have not been sufficiently investigated. This study addresses these gaps using System GMM to tackle endogeneity and dynamic panel threshold regression to uncover nonlinear effects and regime-dependent relationships.

2. Data and Methodology

2.1. Data and Sources

This study used panel data from 1994 to 2022, covering 145 countries and providing representative samples of regions worldwide. These countries were selected based on data availability. The primary dependent variable of interest in this study is the public education expenditure. Public education expenditure refers to the total amount of money spent by the government on education and is measured by education expenditure as a percentage of GDP (Buseyemer, 2007; Chartterji et al., 2014; Molina-Morales, 2013; Fonchamnyo, 2016). We use another measure of education expenditure, education expenditure per capita for robustness. Education per capita is proxied by government expenditure per student at the primary level (expressed as a percentage of GDP per capita) from world development indicators (WDI), as this measure accounts for demographic changes in the school-age population.

The primary independent variable of interest is public debt, and the secondary variable is institutional quality. Institutional quality refers to the effectiveness and efficiency of institutions, including governance structures, legal systems, and regulatory frameworks, in promoting development. In this study, it is measured by the institutional quality index. The institutional quality index is constructed using Principal Component Analysis (PCA) from six World Bank governance indicators: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption (World bank, 2024).

The control variables include population size, GDP per capita growth, foreign direct investment (FDI), gross government expenditure, and school enrolment. This choice of control variables was motivated by their use in related literature (Fosu, 2007; Quattri and Fosu, 2012; Miningou, 2023). This study also uses the institutional quality index to moderate the relationship between public debt and public education expenditure across countries. We averaged the data into five-year periods to address missing values and reduce reverse causality (Fosu, 2008). Table 1 provides more details about the variables.

T a b l e 1

Variables Definitions and Sources

Variable and Symbol	Definition	Source
Education expenditure (EDUEX)	Government expenditure on education, total (% of GDP)	WDI
Public debt (PD)	Central government debt as a percentage of GDP	IMF
Inflation (INF)	The rate of increase in prices over a given period is measured by the Consumer Price Index (CPI)	IMF
FDI	Investment made by a company or individual in one country in business interests in another country	WDI
GDP	The growth rate of GDP per capita, indicating economic performance on a per-person basis	WDI
Gross Government Expenditure (GE)	Total government expenditure, including both current and capital expenditures	WDI
School Enrolment Rate (ENR)	School enrolment, secondary (% gross)	WDI
Institutional quality index (IQI)	Institutional Quality Index: constructed using six indicators	Author's computations using WDI
Population (POP)	Population ages 15 – 64 (% of total population)	WDI

Source: Author.

2.2. Empirical Model and Procedure

To estimate the impact of debt on public education expenditure, we use system GMM. Given the potential issue of endogeneity in the relationship between macroeconomic factors and education expenditure, the System GMM approach is preferred as it effectively controls the bias arising from endogenous regressors (Arellano and Bover, 1995). This technique is particularly useful in dynamic panel models, where the lagged dependent variable is included as a regressor, mitigating autocorrelation and unobserved heterogeneity.

Following Adeleye (2024), we specify the dynamic panel model as:

$$Y_{it} = a_0 + y_{i,t-1} + \beta_1 PD_{it} + \beta_2 z_{it} + \mu_i + \partial_t + \epsilon_{it} \tag{1}$$

where $y_{i,t-1}$ refers to the lag of public education expenditure, PD represents public debt, $\mu_i + \partial_t$ are the unobserved country-specific effects and time trends respectively and ϵ_{it} is the error term. β_2 is the coefficient of vector control variables. We investigate the nonlinear relationship between public debt and education expenditure by including both the level and squared terms of public debt (PDSQ) in the System GMM estimation. This approach allows us to test whether the relationship follows a U-shaped or inverted U-shaped pattern. The theoretical expectation is that at low to moderate debt levels, rising public debt may reduce fiscal space for education due to debt servicing and crowding-out effects. However, beyond a certain threshold, policy responses such as debt restructuring or prioritization of social sectors may mitigate these effects and lead to stabilization or increases in education expenditure.

We examine the nonlinear relationship between public debt and education expenditure. Prior studies suggest public debt affects expenditure nonlinearly (Nurudeen et al., 2022; Ndour, 2017), with a positive effect at low debt levels that turns negative beyond a threshold. To test this in the context of education expenditure, we include both the level and squared terms of public debt (PDSQ) in the System GMM estimation. This captures a U- or inverted U-shaped relationship, where moderate debt relaxes fiscal constraints and supports education spending, but higher debt servicing crowds out social sector allocations. Accordingly, we estimate the following model:

$$Y_{it} = a_0 + y_{i,t-1} + \beta_1 PD_{it} + \beta_2 PDSQ_{it} + \beta_3 z_{it} + \mu_i + \partial_t + \epsilon_{it} \quad (2)$$

Institutional quality is expected to moderate the relationship between public debt and education expenditure because strong institutions enhance fiscal discipline, improve debt management, and promote efficient resource allocation. In countries with quality institutions, debt resources are more likely to be channelled toward productive sectors such as education, whereas in weaker institutional settings, debt may be diverted, mismanaged, or crowded out by rising debt-service costs. To examine the moderating effect of institutional quality, we specify the empirical model as:

$$Y_{it} = a_0 + y_{i,t-1} + \beta_1 PD_{it} + \beta_2 IQ_{it} + \beta_3 \left(PD_{it} * IQI_{it} \right) + \beta_4 z_{it} + \mu_i + \partial_t + \epsilon_{it} \quad (3)$$

where β_3 is the coefficient for the interaction term.

We use the dynamic panel threshold regression model proposed by Seo and Shin (2016) as a robustness check to complement the System GMM estimations. This method offers several advantages: it allows us to explore nonlinear relationships by identifying different regimes based on a threshold variable (institutional quality), captures the dynamic nature of the data through lagged dependent variables, and controls for unobserved individual heterogeneity. Compared to System GMM, the threshold provides additional insight by revealing how the effect of public debt on education expenditure varies across different levels of institutional quality, thus confirming and extending the findings of our baseline model.

3. Results and Discussion

This section presents and discusses the results of this study. We begin with preliminary tests, including descriptive statistics and diagnostic checks. We then present the main findings from the System GMM estimation, followed by the results of the dynamic panel threshold regression, which serves as a robustness check.

3.1. Descriptive Statistics

Table 2 presents the descriptive statistics for the dependent and independent variables. The data exhibit significant variation across all variables. Public education expenditure (LNEDUEX) ranges from 0.01 to 3.79, with a mean of 1.42 and a standard deviation of 0.42. Central government debt (PD) varies from 1.97 to 238.74, with an average value of 53.48. Institutional quality index (IQI) ranges from –4.93 to 4.98, with a mean of 0.05. Inflation (INF) ranges from –4.21 to 5,007.02, with a mean of 17.62.

T a b l e 2

Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
LNEDUEX	745	1.421	0.416	0.013	3.792
IQI	863	0.051	2.226	–4.925	4.980
PD	829	53.485	35.974	1.967	238.742
INF	834	17.618	179.118	–4.211	5007.020
FDI	856	4.842	13.476	–40.794	288.784
GE	793	103.226	13.439	54.049	162.610
ENR	744	77.220	31.011	6.122	160.474
POP	870	1.390	1.373	–4.054	13.145
GDP	865	2.218	3.666	–10.759	49.076

Source: Author.

3.2. Pairwise Correlation and Variance Inflation Factor

Table 3 presents the pairwise correlation coefficients of the key variables included in this study. All correlations are below the critical threshold of 0.8, indicating no severe multicollinearity. This finding suggests that multicollinearity is not a concern among the variables, allowing for inclusion in the econometric analysis. Additionally, Table 5 reports the VIF values. The VIFs were all below 10, which suggests no multicollinearity issues. Therefore, the multicollinearity assumption is not violated.

T a b l e 3

Pairwise Correlation Results

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) LNEDUEX	1.000								
(2) IQI	0.397	1.000							
(3) PD	0.009	–0.034	1.000						
(4) INF	–0.081	–0.111	0.159	1.000					
(5) FDI	0.035	0.109	0.077	–0.017	1.000				
(6) GE	0.020	–0.255	0.159	0.007	0.011	1.000			
(7) ENR	0.406	0.700	–0.022	–0.065	0.068	–0.314	1.000		
(8) POP	–0.238	–0.354	–0.008	0.016	–0.018	–0.153	–0.535	1.000	
(9) GDP	–0.046	0.008	–0.101	–0.086	0.139	0.029	–0.024	–0.102	1.000

Source: Author.

T a b l e 4

VIF Test Results

Variable	VIF	1/VIF
ENR	2.65	0.377343
IQI	2.06	0.485164
POP	1.60	0.626101
GE	1.47	0.681353
PD	1.14	0.877403
GDP	1.11	0.897285
INF	1.04	0.962539
FDI	1.03	0.974685
Mean VIF	1.51	

Source: Author.

3.3. Econometric Baseline Results and Discussion

Table 5 presents the System GMM estimation results. Column 1 reports the effects of public debt on education expenditure. Column 2 adds the interaction term to assess the moderating role of the institutional quality. Column 3 introduces the squared term for public debt to capture possible nonlinearities. Column 4 replaces education expenditure as a share of GDP with education expenditure per capita as a robustness test.

The findings show that the coefficients for lagged education expenditure are consistently positive and highly significant, indicating strong persistence in spending patterns. The results for the full sample show that public debt is negatively associated with education expenditure. Public debt is negative, indicating that higher debt levels are associated with lower education expenditure. The statistical significance of this relationship shows that increased debt obligations crowd out essential social investments including education. This finding aligns with the existing literature (Fosu, 2010; Shabbir and Yasin, 2015; Miningou, 2023; Mbewe, 2024), which argues that the debt burden crowds out social spending. Recently, Turan and Iyidogan (2023) found that public debt leads to a reduction in public investment and credit when public debt exceeds the estimated threshold levels. The results of this study suggest that governments allocate more resources to debt servicing, thereby reducing resources for other investments, including education. Debt Overhang Theory (Krugman, 1988; Sachs, 1989) suggests a framework for understanding how excessive public debt may weaken investments. This theory suggests that when public debt reaches high levels, governments face fiscal constraints that force them to prioritize debt servicing over productive investments, such as education, thereby limiting access, quality, and educational attainment. Picarelli et al. (2019) tested the debt overhang hypothesis using data from European countries and found significant evidence in its support, showing that high public debt can negatively affect public investment.

This study also finds that institutional quality is a crucial determinant of public education expenditure. The positive and significant effect of government effectiveness on education expenditure highlights the role of institutional efficiency in allocating resources. This finding is consistent with those of Quattri and Fosu (2012) and Fonchamnyo and Sama (2016), who argue that the quality of governance shapes public expenditure patterns.

The interaction between public debt and institutional quality is positively related to public education expenditure. This shows that the effect of public debt on education expenditure becomes positive when institutional quality improves. This suggests that countries with quality institutions may reduce the adverse effects of public debt on public education expenditure. Quality institutions can reduce the negative impact of national debt on education expenditure, potentially by improving resource management and policy implementation. This novel finding implies that quality institutions facilitate better fiscal management and ensure that education remains a priority in government budgets, despite high levels of debt. The results of this study align with related previous research, suggesting that countries with quality institutions are better able to use public debt effectively, promoting efficient resource allocation and attracting further investment (Ojeka et al., 2024; Nadambo et al., 2025).

The nonlinear relationship between public debt and education expenditure provides further insights. Initially, rising debt levels were associated with reduced education expenditure, supporting the crowding-out hypothesis.

However, as debt increases beyond a certain threshold, its negative impact diminishes, potentially reflecting adjustments in fiscal policies, external debt restructuring, or increased donor assistance targeted at mitigating debt-related fiscal constraints. This evidence indicates that the debt-education expenditure relationship is not strictly linear, contrasting with studies that find persistently adverse effects of high public debt on investment (Cecchetti et al., 2011; Kose and Sugawara, 2020).

Regarding the control variables, this study finds that inflation negatively affects educational expenditure. This is consistent with previous studies (Ihugba et al., 2019; Maher et al., 2020; Sargarik, 2013) that highlight the role of inflation in distorting budgetary allocation. The negative relationship between GDP per capita growth and education expenditure aligns with Bal and Yilmaz (2024) Wong and Yusoff (2018) and Molina-Morales (2013), who find similar trends in Malaysia and OECD countries, respectively.

Similarly, the positive influence of government expenditure on education expenditure supports Shabbir and Yasin (2015), who emphasise the importance of public spending in the developmental sector. The positive association between

primary school enrolment and education expenditure is consistent with Yorucu and Kirikkaleli (2017), highlighting the link between rising enrolment and increased funding needs.

Finally, the demographic factors driving the demand for education reinforce the findings of Akanbi and Schoeman (2010), who highlight the role of population size in shaping education financing decisions.

Robustness checks, including the Arellano-Bond and Hansen tests, confirm the validity of the dynamic panel specifications and instruments used. The absence of second-order autocorrelation and non-significant Hansen test results indicate the reliability of the findings. When education expenditure as a percentage of GDP is replaced with education expenditure per capita, the results for key variables remain broadly consistent but we observe strong effect. Public debt continues to exert a negative effect, while the interaction between and the institutional quality index significantly enhances education expenditure per capita.

T a b l e 5

Baseline System GMM Regression Results

VARIABLES	(1)	(2)	(3)	(4)
L.LNEDUEX	0.394**	0.387**	0.374**	0.635***
	(0.185)	(0.179)	(0.152)	(0.186)
PD	–0.002***	–0.003***	–0.005***	–1.612**
	(0.001)	(0.001)	(0.002)	(0.714)
IQI	0.038***	0.023*	0.038***	0.344
	(0.012)	(0.014)	(0.011)	(0.266)
INF	–0.005	–0.005	–0.005	–0.229**
	(0.003)	(0.003)	(0.004)	(0.102)
FDI	0.001***	0.005**	0.001**	0.014
	(0.002)	(0.002)	(0.002)	(0.010)
GDP	–0.009	–0.010	–0.014**	–0.333
	(0.006)	(0.007)	(0.007)	(0.202)
GE	0.007***	0.007***	0.006***	0.296***
	(0.002)	(0.002)	(0.002)	(0.099)
ENR	0.002*	0.002*	0.002*	0.071***
	(0.001)	(0.001)	(0.001)	(0.020)
POP	–0.002	0.002	–0.013	0.337
	(0.027)	(0.027)	(0.029)	(0.302)
PD*IQI		0.0004*		0.008*
		(0.002)		(0.004)
PDSQ			0.0002*	
			(8.37e–06)	
Constant	0.143	0.149	0.321	–23.744**
	(0.234)	(0.232)	(0.255)	(10.038)
Observations	481	481	481	260
AR 1	0.013	0.012	0.011	0.072
AR2	0.601	0.492	0.563	0.163
SARGAN	0.469	0.471	0.091	0.112
HANSEN	0.504	0.611	0.509	0.163

Note: Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. PDSQ refers to the quadratic term.

Source: Author.

3.4. Further Robustness Check

To supplement the baseline results obtained from the System GMM estimation, we employ a dynamic threshold regression model following Seo and Shin (2016), which is particularly well suited for capturing potential nonlinearities and regime-dependent dynamics in panel data.

This approach allows us to investigate whether the relationship between public debt and education expenditure varies with the level of institutional quality, which is treated as a threshold variable. This is important because the effectiveness of fiscal policies, including public debt utilization, is likely to depend heavily on institutional quality.

The results of the threshold regression, presented in Models 1 and 2 in Table 6, reveal compelling evidence of a regime-dependent effect. In Model 1, corresponding to the regime in which the institutional quality index is below the identified threshold, public debt exhibits a negative and highly significant impact on education expenditure. Specifically, public debt reduces the log of education expenditure by 0.003 at a 1% significance level at the threshold value of the institutional quality index of 1.231.

T a b l e 6

Threshold Effects of Public Debt

Variables	**(1)**	**(2)**
Lag y	–0.265*** (0.087)	0.610*** (0.119)
PD	–0.003*** (0.0006)	0.006*** (0.001)
INF	–0.005*** (0.001)	0.001 (0.006)
FDI	–0.009*** (0.002)	0.009*** (0.002)
GE	0.005*** (0.001)	–0.007*** (0.001)
ENR	0.009*** (0.001)	–0.014*** (0.002)
POP	0.003 (0.004)	0.002 (0.009)
GDP	0.0142*** (0.003)	0.00821 (0.007)
Constant	0.579* (0.339)	
r	1.231** (0.485)	
[95% Conf. Interval]	(.2812787 – 2.181713)	
Bootstrap p-value	0.000	

Note: Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Author.

This finding suggests that in countries with weak governance, public debt increases are more likely to reduce education expenditure. Several mechanisms may underpin this relationship: governments may divert borrowed resources toward debt servicing, or other expenditures, rather than long-term human capital investment. Additionally, weak institutions may suffer from higher levels of corruption, which reduces the benefits of public investment.

In contrast, Model 2 captures the regime above the institutional quality threshold, where the coefficient of public debt becomes positive and significant. This occurs when the institutional quality index reaches a threshold value of 1.231. This indicates that when countries possess quality institutional frameworks, increases in public debt are associated with greater education expenditure. In such contexts, debt can be used more productively to support public investment in infrastructure, social services, and human capital. Ojeka et al. (2024) argued that the benefits of debt can only be realized by the Sub-Saharan African region when the average quality of institutions is above − 1.174, and the threshold value of this study is above that.

These results suggest a nonlinear and conditional relationship between public debt and education expenditure governed by the quality of institutions. Public debt can act as either a constraint or a catalyst for education expenditure, depending on the institutional setting. The bootstrap p-value for the linearity test is 0.000, indicating strong evidence of a threshold effect at the 1% level.

We then categorized the countries into two groups: 33 advanced and 112 developing economies. As shown in Table 7, the results indicate that public education expenditure persists across all three groups. Debt reduces educational expenditure in both advanced and developing economies. Institutional quality is significantly and positively associated with public education expenditure in both groups. Similar to the baseline results, a significant non-linear relationship exists between public debt and education expenditure.

The interaction term in developing countries is significantly and negatively associated with public education expenditure, whereas in developed countries, there is an insignificant positive association. In developing countries, high debt can limit fiscal space, so even strong institutions may not prevent cuts to education expenditure. In developed countries, greater fiscal capacity and safeguards may explain the insignificant positive effect.

T a b l e 7

Regression Results for Developing and Advanced Economies

	Developing Economies			Advanced Economies		
	(1)	(2)	(3)	(1)	(2)	(3)
L.LNEDUEX	0.292**	0.483***	0.668***	0.540***	0.515***	0.529***
	(0.139)	(0.135)	(0.234)	(0.121)	(0.095)	(0.138)
PD	–0.002**	–0.009**	–0.004***	–0.002**	–0.008*	–0.002*
	(0.001)	(0.004)	(0.001)	(0.001)	(0.005)	(0.001)
IQ	0.043**	0.032**	0.135**	0.054***	0.038**	0.035
	(0.020)	(0.014)	(0.061)	(0.020)	(0.019)	(0.041)
INF	–0.004	–0.008**	–0.005	–0.005	–0.002	–0.005
	(0.003)	(0.003)	(0.009)	(0.003)	(0.003)	(0.004)
FDI	0.002	0.002	0.003	–0.002	–0.0002	–0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)
GDP	–0.001	–0.004	–0.001	0.005	0.003	0.005
	(0.006)	(0.007)	(0.007)	(0.005)	(0.007)	(0.005)
GE	0.005	0.005**	0.004	0.004**	0.004*	0.004**
	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
ENR	0.003*	0.001	–0.001	0.0001	0.001	–0.00008
	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
POP	0.003	–0.017	–0.038*	–0.004	0.003	–0.004
	(0.020)	(0.033)	(0.022)	(0.013)	(0.027)	(0.014)
PDSQ		0.0002**			0.0005*	
		(0.0002)			(0.0002)	
PD*IQ			–0.002*			0.0004
			(0.001)			(0.001)
Constant	0.399	0.486	0.342	0.367	0.395	0.404
	(0.493)	(0.316)	(0.332)	(0.255)	(0.390)	(0.290)
Observations	250	332	242	332	274	332
AR1	0.038	0.013	0.011	0.005	0.024	0.007
AR2	0.714	0.822	0.766	0.831	0.895	0.800
SARGAN	0.081	0.636	0.818	0.690	0.508	0.654
HANSEN	0.429	0.719	0.567	0.464	0.510	0.375

Note: Standard errors in parentheses; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: Author.

Conclusion and Policy Implications

This study examined the dynamic relationship between public debt and education expenditure using a two-step system GMM. The study shows that public debt reduces public education expenditure in both the full sample, developing and advanced economies. We also find that quality institutions help to increase public education expenditure. The study also shows that the interaction between public debt and institutional quality increases public education expenditure. Threshold regression results show that public debt increases education expenditure at a threshold value of 1.231. This suggests that in countries with debt, strong institutions can help protect education investments. Countries with quality institutions are more likely to use borrowed funds and use them to invest more in education. Thus, policymakers in both developed and developing economies should aim to reduce public debt levels to avoid the negative effects on public education expenditure.

In addition, institutional quality is crucial to education expenditure, as it can help increase it. Therefore, stakeholders should improve institutional quality to shield educational expenditure from economic shocks.

Limitation of the Study

A potential limitation is that, despite using System GMM with lagged internal instruments to mitigate simultaneity and reverse causality, the bidirectional relationship between institutional quality and education expenditure may not be fully eliminated. Quality institutions can increase education expenditure, while higher education expenditure may improve institutional quality over time, so residual endogeneity could remain. Further studies should examine this.

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Sample of the Study

Armenia, Australia, Austria, Azerbaijan, Bahamas, The, Bahrain, Bangladesh, Belarus, Belgium, Belize, Benin, Bhutan, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burundi, Cabo Verde, Cameroon, Canada, Central African Republic, Chile, China, Colombia, Comoros, Congo, Dem. Rep., Congo, Rep., Costa Rica, Cote d'Ivoire, Croatia, Cuba, Cyprus, Czechia, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, Arab Rep., El Salvador, Equatorial Guinea, Estonia, Eswatini, Ethiopia, Fiji, Finland, France, Gabon, Gambia, The, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti, Honduras, Hungary, Iceland, India, Indonesia, Iran, Islamic Rep., Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kiribati, Korea, Rep., Kuwait, Kyrgyz Republic, Latvia, Lesotho, Liberia, Libya, Lithuania, Luxembourg, Madagascar, Malawi, Malaysia, Maldives, Mali, Malta, Mauritania, Mexico, Moldova, Mongolia, Montenegro, Morocco, Mozambique, Namibia, Nepal, Nicaragua, Niger, Nigeria, North Macedonia, Norway, Oman, Pakistan, Paraguay, Peru, Poland, Portugal, Qatar, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Syrian Arab Republic, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkiye, Uganda, Ukraine, United Kingdom, United States, Uruguay, Vanuatu, Viet Nam, Yemen, Rep., Zambia, and Zimbabwe.