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Public debt and economic growth: Does governance quality matter?

Penny Septina*, Vid Adrison

Faculty of Economics and Business, Universitas Indonesia, West Java, Indonesia

ABSTRACT

Rising public debt has become a central policy concern as governments increasingly rely on borrowing to finance development and recovery programs. Yet the impact of debt on growth remains debated, depending on how effectively countries manage and allocate borrowed resources. This study examines the relationship between public debt and economic growth, with governance quality as a moderating factor. Anchored in an extended neoclassical framework, public debt is treated as a financing tool whose effect depends on governance quality and fiscal allocation. Using panel data from 188 countries for 1996–2023, the analysis applies fixed-effects and instrumental-variable estimations based on non-overlapping five- and ten-year averages to capture medium- also long-term dynamics while addressing endogeneity. The results show that debt reduces growth when governance is excluded; however, the effect becomes positive and significant once governance interactions are included—especially in the five-year model with lagged debt as an instrument. By contrast, the three-way interaction among debt, governance, and public capital is insignificant in the medium term, suggesting that investment effects may require longer horizons or stronger institutional alignment. Overall, the findings highlight that sound governance and efficient fiscal allocation are prerequisites for transforming public debt from a fiscal burden into a driver of sustainable economic growth.

KEYWORDS:
Economic growth; fixed effect-instrumental variable; governance quality; public debt; public capital

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*Corresponding author's
Email: pennyseptina@gmail.com

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INTRODUCTION

Governments frequently finance budget deficits through public debt to sustain priority expenditures such as infrastructure, education, healthcare, economic stimulus, and subsidies. These measures are intended to stimulate economic activity and counter cyclical downturns. However, when revenue growth does not keep pace, rising debt increases the debt-to-Gross Domestic Product (GDP) and debt service ratios, thereby elevating fiscal vulnerability. In 2023, the World Bank reported that low- and middle-income countries allocated 3.7% of their total revenue to debt service, including 1.1% for interest alone, the highest burden in two decades (World Bank, 2024). Persistent deficits also shift the tax burden forward, requiring future generations to bear the cost of current consumption.

From a Keynesian perspective, public debt can spur short-run growth by enabling tax reductions and higher government spending, thereby increasing disposable income, wealth, and demand. Under conditions of wage and price rigidity, such expansionary fiscal policy raises output and employment during recessions (Mankiw, 2016). Conventional theory, however, holds that sustained debt accumulation harms long-run growth by raising interest rates and crowding out private investment. Higher debt elevates risk premiums and borrowing costs, diverting resources from consumption and capital formation (Reinhart et al., 2012). Even where high debt ratios do not immediately trigger interest rate increases (Sun, 2023), persistent debt still generates welfare costs and fiscal vulnerabilities (Blanchard, 2019; Rogoff, 2020).

Empirical evidence echoes these views. Excessive public debt reduces governments' ability to fund productive sectors, increases borrowing costs, and crowds out private investment (Eberhardt & Presbitero, 2015). Over time, the resulting decline in capital accumulation and productivity heightens fiscal distress and threatens sustainability (Woo & Kumar, 2015). Still, public debt can support growth when managed well. For example, emerging markets tend to benefit when debt ratios remain below thresholds—approximately 60% of GDP in the post-pandemic period (Jusaj et al., 2025). Debt-financed spending can also accelerate structural transformation when allocated to productive sectors (Casares, 2015) or deployed countercyclically during downturns (Abiad et al., 2016). These benefits, however, rely heavily on governance quality and institutional capacity (Tarek & Ahmed, 2017).

Institutions, therefore, occupy a central role in shaping fiscal performance. At the macro level, institutions drive long-term growth by shaping incentives, resource allocation, and fiscal effectiveness (Acemoglu et al., 2005). Stronger institutions are linked to higher growth, less volatility, and better fiscal management (Jungo, 2024). Governance captures the exercise of authority in government, encompassing political accountability, regulatory capacity, the rule of law, and corruption control (Kaufmann & Kraay, 2024). Yet, global governance remains weak: in 2023, all Worldwide Governance Indicator (WGI) dimensions averaged negative or near-zero values, indicating persistent institutional fragility across effectiveness, stability, and accountability.

Studies have further linked weak governance to rising debt ratios. Short political time horizons often lead to fiscal choices that favor immediate gains while shifting burdens to future administrations (Alesina & Tabellini, 1990). Poor institutional quality also fosters inefficiency, rent-seeking, and resource misallocation, worsening debt-to-GDP ratios (Acemoglu et al., 2005). Recent evidence from Sub-Saharan Africa shows that weak governance magnifies the negative consequences of debt, raising vulnerability to debt overhang (Oppong et al., 2023).

Governance also shapes how debt affects economic growth. Strong governance improves

debt management, particularly through effective capital spending (Barro, 1990; Gómez-Puig et al., 2022). Trust in government enhances tax compliance and the productivity of debt-financed investment, reinforcing growth (Musa et al., 2023). Conversely, weak governance often turns debt into a drag on the economy: poor service quality reduces compliance, increases fiscal deficits, and triggers additional borrowing that crowds out investment and dampens growth. Based on this reasoning, the conceptual framework in Figure 1 is developed.

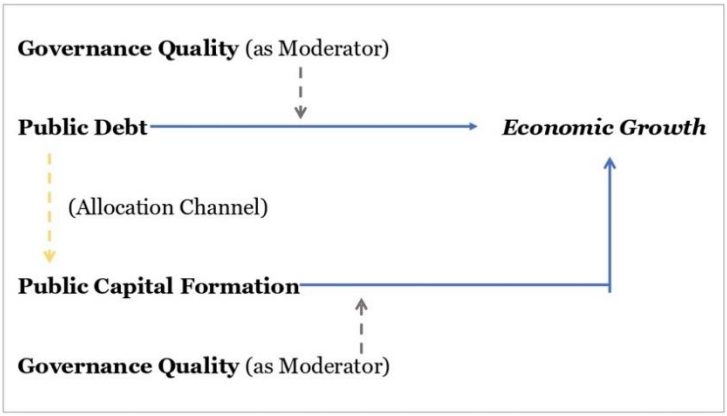

Figure 1. Conceptual Framework

The framework reflects an extended neoclassical perspective in which public debt influences growth through two mechanisms. First, debt directly affects growth by shaping macroeconomic stability and fiscal space, thereby influencing aggregate growth. Second, its effect increases when directed to public capital formation, as infrastructure and productive investment expand long-term economic capacity. Governance quality moderates both mechanisms by improving fiscal discipline, reducing inefficiencies, and ensuring that borrowed funds are invested in projects that yield sustainable returns. Thus, the growth effect of public debt depends on institutional capacity to convert borrowing into productive outcomes.

Building on this framework, three hypotheses are proposed. First, public debt is expected to negatively affect growth in the baseline model. Second, the effect should become positive when governance quality improves, reflecting institutions' role in enhancing debt productivity. Third, the growth impact of debt is expected to strengthen when allocated to public capital, particularly under strong governance. This study contributes in two ways. First, it employs a non-overlapping panel aggregation strategy, yielding more stable and policy-relevant estimates than models that use annual or full-period data. Second, it examines how debt is transmitted through public capital formation. A three-way interaction between debt, governance quality, and public capital evaluates whether debt more strongly promotes growth when directed to productive sectors under effective institutions. Together, these contributions emphasize that the growth effect of debt depends not only on the quantity of borrowing but also on institutional quality and fiscal allocation.

Empirical analysis is conducted using panel data from 188 countries for 1996–2023. To reflect the intergenerational nature of debt and reduce short-term volatility, the data are aggregated into non-overlapping five- and ten-year periods (Abbas et al., 2021; Mankiw, 2016). All six WGI dimensions are included simultaneously to avoid omitted variable bias and reflect institutional diversity. The study uses instrumental variable estimation to address endogeneity concerns (Panizza & Presbitero, 2014), evaluate marginal effects across governance levels, and explore differential effects across income groups.

RESEARCH METHOD

Theoretical Framework and Empirical Model

This study builds on the neoclassical growth model in which output (Y) depends on the accumulation of capital (K) and labor (L). While the traditional Solow–Swan model predicts absolute convergence toward a common steady state, empirical evidence supports conditional convergence, where countries converge to distinct steady states shaped by their structural characteristics, including institutions and fiscal policy.

Public debt influences the steady state by affecting productivity and investment efficiency (Assoum & Alinsato, 2023). Budget deficits financed through debt provide additional resources that can serve as capital, especially when allocated to productive activities or investment (Barro, 1990). Cross-country income disparities can also be attributed to governance, which enhances productivity through improved public investment efficiency, effective budget management, and efficient resource allocation. The Solow growth model is extended as follows:

$$Y = G\, f(K_D, L) \qquad \text{..... (1)}$$

where K_D includes both private and public capital. Public capital functions as a production factor partly financed through debt, while G represents governance quality, which proportionally enhances the productivity of capital and labor. To complement this formulation, Figure 2 illustrates an extended neoclassical framework that integrates governance quality and debt allocation, highlighting how institutional factors also fiscal choices jointly influence long-run economic outcomes.

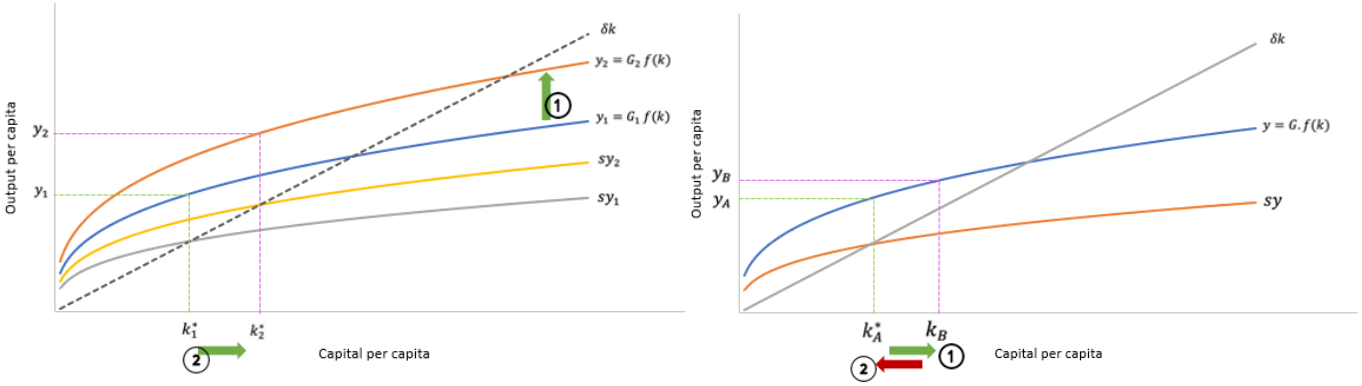

Figure 2. Extended Neoclassical Steady-State Framework

Figure 2 graphs on the left, presents the long-run equilibrium in an extended neoclassical model that incorporates governance quality. A country with a governance level G_1 achieves output $y_1 = G_1 f(k)$ and investment sy_1 at steady state (k_1^*, y_1). When governance improves to G_2, both output and investment increase $(y_2 = G_2 f(k), sy_2)$, leading to a higher steady state (k_2^*, y_2). This shows that stronger governance improves efficiency and long-term growth potential. Figure 2 on the right, illustrates how greater debt allocation to public capital can temporarily raise output y_B by increasing capital stock k_B. Without governance improvements, however, the effect is unsustainable and equilibrium returns to its initial state (k_A^*, y_A), since investment remains below the breakeven rate, δk. This pattern often occurs in debt-financed infrastructure projects lacking institutional readiness (e.g., digitalization programs in public services that fail to gain adoption).

Building on this foundation, and consistent with the view that fiscal outcomes depend on

institutional settings, the empirical model introduces two-way interactions between debt and governance indicators also a three-way interaction with public capital. This design tests whether stronger institutions and more efficient fiscal allocation enhance the growth effect of debt, aligning with the view that governance moderates fiscal effectiveness (Abiad et al., 2016). By incorporating these interactions, the model captures not only the debt's direct effect but also its conditional impact under differing governance quality. Grounded in this theory, the empirical model incorporates debt, governance, and their interaction terms. It is specified as:

$$\bar{y}_{i,t}^{(k)} = \beta_0 y_{i,0} + \beta_1 debt_{i,t} + \beta_2 gov_{i,t} + \beta_3 (debt_{i,t}\, x\, govt_{i,t}) + \beta_4 (debt_{i,t}\, x\, govt_{i,t} x\, fcfpub_{i,t}) + \gamma \chi_{i,t} + \alpha_i + \rho_t + \varepsilon_{i,t}. \quad \ldots\ldots\ldots\ldots (2)$$

Here, i denotes the country and t the period. The variable k represents the aggregation window, which is either five or ten years. The study applies non-overlapping averages for all variables to provide stable long-term estimates, reduce volatility from cycles and shocks, also limit autocorrelation (Woo & Kumar, 2015).

Accordingly, $\bar{y}_{it}^{(k)}$ is the average growth rate over the period k, while $Log\, y_{i,t}$ is the logarithm of initial GDP per capita at the start of the k-year period. A negative coefficient. β_0. indicates conditional convergence. Variable $debt_{i,t}$ measures public debt, while $gov_{i,t}$ represents governance quality indicators. All governance measures are included simultaneously to capture institutional dimensions. $\chi_{i,t}$ is the set of controls (capital and labor). The parameter α_i is a country-specific effect, ρ_t a time effect, and $\varepsilon_{i,t}$ the error term. To assess how governance and capital allocation shape debt's effect, the marginal effect of debt on growth is derived as Formula 3.

$$\frac{\partial \bar{y}_{i,t}^{(k)}}{\partial debt_{i,t}} = \beta_1 + \beta_3 . gov_{i,t} + \beta_4 . gov_{i,t}. fcfpub_{i,t}. \quad \ldots\ldots\ldots\ldots (3)$$

This expression shows that debt contributes positively to growth when governance quality is sufficient and borrowing is directed toward public capital formation. Weak governance or unproductive allocation produces neutral or negative effects.

Data and Variable Construction

The study covers 188 countries from 1996–2023, grouped by World Bank income classifications: 64 high-income, 52 upper-middle, 49 lower-middle, and 23 low-income economies (see Appendix 1). Data are sourced from the World Bank's World Development Indicators (WDI) and Worldwide Governance Indicators (WGI), also from the IMF for debt statistics. In this study, economic growth serves as the dependent variable, measured as the average annual growth rate of real GDP per capita in constant local currency. The primary independent variable, public debt, is proxied by the ratio of general government gross debt to GDP, which captures the total stock of liabilities, including loans, securities, and other debt instruments (Mbaye et al., 2018).

Governance quality is represented by all six dimensions of the Worldwide Governance Indicators—voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, also control of corruption. These indicators range from −2.5 to +2.5, where zero reflects the global average. Including all six dimensions simultaneously minimizes omitted variable bias and reflects the multifaceted nature of institutional quality (Kaufmann & Kraay, 2024).

The model also incorporates variables representing capital allocation. Total gross fixed capital formation, expressed as a percentage of GDP, is used as a proxy for overall capital accumulation and is lagged one period to reflect investment adjustments. To distinguish between public and private investment, public capital is calculated as the difference between total capital formation and private capital formation, both expressed as a share of GDP. Additional controls account for core growth determinants. The logarithm of initial GDP per capita captures convergence dynamics, where countries with lower starting income are expected to grow faster in the medium and long run. Labor input is represented by the labor force participation rate. Country- and time-fixed effects are included to control for unobserved heterogeneity and global shocks that may influence growth independently of fiscal and institutional factors. Appendix 2 provides definitions and sources for all variables.

Estimation Approach

The study develops four model specifications across two horizons: five-year averages (medium term) and ten-year averages (long term). Each model builds sequentially, showing how governance alters the debt–growth relationship, consistent with theory. The first specification estimates the baseline link between debt and growth, while the second specification incorporates governance as a moderator. Both are estimated using a fixed-effects (FE) estimator, which controls for unobserved, time-invariant country characteristics that may bias the results—an important concern in macroeconomic panels where structural attributes differ substantially across economies.

Diagnostic tests confirm this choice. The Breusch–Pagan Lagrange Multiplier test shows individual effects are present, making pooled OLS inappropriate. The Hausman test strongly supports FE, with $\chi^2 = 64.00$ ($p < 0.0001$) for the five-year horizon and $\chi^2 = 41.90$ ($p < 0.0001$) for the ten-year horizon, confirming correlation between country effects and regressors. To check if Specification 2 addresses omitted variable bias, Wald tests are run between Specifications 1 and 2. Results confirm that adding governance and higher-order interactions improves model fit, with $\chi^2 = 3.46$ ($p = 0.0002$) for the five-year horizon and $\chi^2 = 3.90$ ($p < 0.0001$) for the ten-year horizon.

A third specification addresses the potential endogeneity of public debt, which may arise if governance affects both growth and debt accumulation. An instrumental variables approach is adopted within a Fixed Effects–Instrumental Variables (FE–IV) framework, estimated using two-stage least squares (2SLS). This retains the within transformation and provides consistent estimates under country heterogeneity (Wooldridge, 2016; Panizza & Presbitero, 2014). The one-period lag of debt serves as an instrument for current debt. Past debt influences borrowing decisions but does not directly affect growth or governance within the period. Indirect channels, such as effects through public capital formation, are controlled for in the model, preserving the exclusion restriction both theoretically and empirically.

The fourth and most comprehensive specification incorporates a three-way interaction among debt, governance, also public capital. Using the same IV approach with lagged debt as the instrument, this specification distinguishes public from private capital formation to assess whether debt-driven growth operates specifically through public investment. To explore heterogeneity in fiscal capacity and institutional quality, the analysis also estimates all models separately for income-group subsamples. This allows the results to show whether the debt–governance–growth nexus differs across high-, middle-, and low-income countries, where debt burdens, investment efficiency, also institutional maturity vary substantially.

RESULT AND DISCUSSION

Descriptive Statistics

Before presenting regression results, the descriptive statistics of the key variables are reviewed. The average growth rate across the sample is 2.18%, with a large standard deviation and an extreme minimum value of –55.23%. This wide dispersion illustrates substantial heterogeneity in economic performance across countries and over time. Public debt averages 55.22% of GDP, ranging from 0% to 600%, indicating a sharp variation in fiscal conditions and potential sustainability risks. On average, public capital formation is 5.67% of GDP, while private capital formation is roughly three times larger at 17.22%, confirming the dominance of private investment in total capital.

All governance indicators exhibit negative average values, suggesting that most countries face institutional weaknesses. The broad spread in these indicators also reflects heterogeneity in state capacity, regulatory quality, and corruption control. Such variation reinforces the importance of governance in moderating the debt–growth relationship. Detailed descriptive statistics are presented in Table 1.

Table 1. Descriptive Statistics

Variable	Mean	Median	Std. Dev	Minimum	Maximum	Observation
y	2.18	2.17	5.95	–55.23	140.49	5,226
$debt$	55.22	45.85	44.21	0.00	600.10	4,896
va	–0.01	0.03	0.97	–2.26	1.80	4,694
pv	–0.03	0.05	0.97	–3.18	1.76	4,654
ge	–0.03	–0.18	0.97	–2.36	2.47	4,615
rq	–0.01	–0.15	0.96	–2.39	2.31	4,618
rl	–0.03	–0.17	0.97	–2.33	2.12	4,694
cc	–0.03	–0.27	0.99	–1.80	2.46	4,633
fcf	22.71	21.99	7.66	–2.42	78.00	4,356
lf	66.30	67.45	10.58	32.74	89.62	4,724
fcf_pub	5.67	4.71	4.34	–6.89	61,96	1,772
fcf_priv	17.22	16.44	7.85	0.00	59.38	1,772
$ln\_y_0\_fix_5$	8.49	8.42	1.44	5.40	11.61	1,118
$ln\_y_0\_fix_{10}$	8.45	8.38	1.45	5.40	11.59	558

All variables are based on annual data from 1996 to 2023, apart from log GDP per capita (initial), which is calculated from the initial years of each 5- and 10-year period.

Main Regression Results

Table 2 summarizes the estimation results across model specifications and horizons. In the baseline model (Specification 1), public debt is negatively associated with growth in both 5- and 10-year approaches. In the five-year model, a 1% rise in the debt-to-GDP ratio corresponds to an average annual growth decline of 0.019%. In the 10-year model, the decline is 0.0352 %. These results align with the crowding-out hypothesis, in which non-productive debt financing suppresses private investment and lowers long-term growth potential (Reinhart et al., 2012).

When governance indicators are included in Specification 2, the debt coefficient becomes

statistically insignificant in both horizons, suggesting the negative effect in the baseline model stems largely from omitted governance quality. In this specification, interaction terms between debt and governance—particularly government effectiveness—become positive and statistically significant in most models. These results indicate that stronger bureaucratic capacity and more effective public service delivery amplify the productivity of borrowing, consistent with findings from Abbas et al. (2021).

Table 2. Summary of Estimation Results

Variable	Five-Year Horizon				Ten-Year Horizon	
	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 1	Spec. 2
Debt	–0.019***	–0.00893	0.0238*	0.0659	–0.035***	–0.026***
	(0.00649)	(0.00570)	(0.01363)	(0.0415)	(0.00947)	(0.00870)
lag_fcf	0.0126	0.00467	0.0250		–0.00167	0.00846
	(0.0410)	(0.0399)	(0.02497)		(0.0477)	(0.0407)
lag_fcf_pub				0.2207**		
				(0.0964)		
debt_va		0.0100	0.0205**	0.0375		0.0157*
		(0.00784)	(0.00877)	(0.0297)		(0.00907)
debt_ge		0.0528***	0.0506***	0.1009***		0.0666***
		(0.0199)	(0.01643)	(0.0370)		(0.0213)
debt_ge_lag_fcfpub				–0.0054		
				(0.0050)		
Observations	766	765	747	316	310	310
R^2	0.243	0.292			0.320	0.464
No. Countries	161	161	161	88	161	161

*Note: Standard errors are reported in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. All estimations include time fixed effects. The R2 values for specifications using the IV approach are not reported, as they are not relevant in this context. The complete list of control variables and their estimated coefficients is provided in Appendix 3.*

To address endogeneity bias in debt estimation, Specification 3 applies an IV approach, using lagged debt as the instrument. This is justified because past debt strongly predicts current borrowing while exerting no direct effect on contemporaneous growth beyond its influence through current debt. The first-stage regression confirms instrument strength in the five-year model: lagged debt significantly predicts current debt (coefficient = 0.392, standard error = 0.038, $p < 0.01$), with an F-statistic of 27.41. As expected in macro panels, instrument strength is weaker for ten-year aggregates due to the reduced number of observations, so IV estimation is not applied for the longer horizon.

After applying IV–FE, the coefficient on debt becomes positive and statistically significant at the 10% level. This reversal suggests that, once endogeneity and governance quality are taken into account, debt can actually support growth rather than hinder it. Moreover, interaction terms between debt and both government effectiveness and voice also accountability remain positive and statistically significant, reinforcing the argument that institutional capacity converts borrowed resources into productive outcomes.

Specification 4 explores the contribution channel of public debt through public capital and the moderating role of governance. Estimated only for the five-year horizon, it uses lagged debt as an instrument, which passes the relevance and exclusion tests (coefficient = 0.286, standard error = 0.058, $p < 0.01$, F-statistic = 22.76). Due to limited observations, this IV approach is not applied to the ten-year data. Results show the three-way interaction remains insignificant even after correcting for endogeneity, suggesting the insignificance reflects short-term limits rather than estimation bias. However, the coefficient on *lag_fcf_pub* becomes significant, indicating that public capital's contribution to growth is clearer once debt endogeneity is addressed. This supports the view that debt-financed growth effects emerge when resources are directed to productive investment and efficient capital formation (Hilton, 2021).

Marginal Effect Analysis

To illustrate the conditional nature of the debt–growth relationship, marginal effects are calculated at different levels of government effectiveness. Five benchmarks are evaluated: the minimum, first quartile (Q1), median, third quartile (Q3), and maximum values of government effectiveness. The results show that debt's marginal effect is negative at very low and low levels of institutional quality. In weak bureaucratic environments, additional borrowing is likely channeled toward unproductive or inefficient spending, yielding little or no return.

As government effectiveness improves, the negative marginal effect diminishes and eventually turns positive. At the highest observed level of effectiveness, debt makes a significant contribution to growth. These results confirm that governance conditions shape whether borrowing becomes a fiscal burden or a catalyst for development, consistent with earlier findings by Abbas et al. (2021). Marginal estimates are presented in Table 3.

Table 3. Marginal Effects of Public Debt at Various Levels of Government Effectiveness

Government Level	Specification 3	Specification 4
Very Low (Min)	–0.0957	–0.238
Low (Q1)	–0.0148	–0.077
Median (Q2)	0.0147	–0.018
High (Q3)	0.0557	0.064
Very High (Max)	0.1488	0.249

To explore institutional heterogeneity, results are estimated separately for higher-income (high and upper-middle) also lower-income (low and lower-middle) economies using the IV–FE specification with five-year data. The result is shown in Table 4. Results show the interaction between debt and regulatory quality (*rq*) is negative also significant for higher-income economies. This suggests that stronger regulatory frameworks heighten market reactions to debt, triggering crowding-out effects that offset growth gains. In contrast, the interaction is not significant for lower-income economies, where institutional and financial market responses to debt tend to be weaker due to less developed financial systems also regulatory enforcement. Other interactions with governance indicators are positive but insignificant in both groups, although magnitudes are smaller than in the full-sample estimates. These findings confirm that the governance–debt–growth nexus is context-dependent. The same level of debt may have different implications depending on institutional maturity, financial depth, and policy credibility.

Table 4. Summary of Estimation Results: Further Analysis by Income Group

Variables	Specification 3	
	Higher Income	Lower Income
$debt\_va$	0.00791	0.0212
	(0.0102)	(0.0193)
$debt\_pv$	0.00769	–0.00187
	(0.0152)	(0.0129)
$debt\_ge$	0.00350	0.0176
	(0.0299)	(0.0261)
xx_debt_rq	–0.0480**	0.0363
	(0.0219)	(0.0431)
$debt\_rl$	0.0201	0.00347
	(0.0329)	(0.0336)
$debt\_cc$	0.00413	–0.0304
	(0.0252)	(0.0267)

Note: *Standard errors are reported in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level.*

Overall, the results demonstrate that the growth consequences of public debt are not uniform. In baseline estimates, debt is negatively associated with growth, consistent with concerns about fiscal crowding-out. However, once governance and endogeneity are accounted for, the relationship becomes neutral or even positive. This reinforces the theoretical expectation that institutions determine whether borrowed resources are used productively (Acemoglu et al., 2005; Barro, 1990).

The marginal effect analysis highlights that debt contributes to growth only in environments with strong bureaucratic capacity. Similarly, public capital becomes a meaningful channel of debt effectiveness only after addressing endogeneity, underscoring the importance of fiscal efficiency. Finally, sub-sample analysis reveals that institutional maturity and financial depth influence the balance between growth-enhancing and growth-constraining effects of debt. Taken together, the findings suggest that the key policy question is not whether countries should borrow, but whether they possess the institutional capability to manage and allocate debt productively. Countries with stronger governance structures appear more capable of converting debt into productive capital, while countries with weak governance remain vulnerable to overhang and instability.

This study has several limitations. The use of non-overlapping five- and ten-year averages improves long-term stability but reduces the number of observations, especially for IV estimation in the ten-year horizon where lagged debt becomes a weak instrument. The analysis also relies on broad measures of public debt and public capital that do not distinguish between productive also non-productive spending. In addition, structural shocks, such as financial crises or commodity price swings, may affect debt dynamics differently across countries but are not explicitly modelled. These limitations highlight the need for future research using sector-specific public investment data, alternative instruments, and richer institutional indicators.

CONCLUSION

The findings reveal that the impact of public debt on growth is conditional on governance quality and allocation. In the baseline, debt has a negative effect on growth, but once governance and endogeneity are taken into account, debt can have a positive effect on growth. Interactions with governance—particularly with government effectiveness, also voice and accountability—are significant, and marginal effect analysis confirms that debt productivity improves as institutional quality rises. Although public capital's contribution strengthens after correcting for endogeneity, the three-way interaction between debt, governance, and capital remains insignificant in the medium term, implying this channel may require a longer horizon or stronger institutional alignment.

The results underscore governance reform as a prerequisite for productive debt management. Governments must strengthen bureaucratic capacity and transparency to ensure borrowing supports long-term investment. Enhancing effectiveness through better project planning, stronger coordination, and rigorous monitoring is vital in maximizing growth from debt-financed spending. Debt management should be embedded in a fiscal framework that emphasizes efficient allocation, forward planning, and safeguards against misuse. With effective governance, public debt can shift from a fiscal burden to a productive instrument for inclusive and sustainable growth.

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APPENDICES

Appendix 1. Complete Country List

Low-Income Countries

No	Country	No	Country	No	Country
1	Afghanistan	8	Ethiopia	16	Niger
2	Burkina Faso	9	Gambia, The	17	Rwanda
3	Burundi	10	Guinea–Bissau	18	Sierra Leone
4	Central African Republic	11	Liberia	19	Sudan
5	Chad	12	Madagascar	20	Syrian Arab Republic
6	Congo, Dem. Rep.	13	Malawi	21	Togo
7	Eritrea	14	Mali	22	Uganda
		15	Mozambique	23	Yemen, Rep.

Lower-Middle Income Countries

No	Country	No	Country	No	Country
1	Angola	17	Honduras	33	Pakistan
2	Bangladesh	18	India	34	Papua New Guinea
3	Benin	19	Jordan	35	Philippines
4	Bhutan	20	Kenya	36	Samoa
5	Bolivia	21	Kiribati	37	Sao Tome and Principe
6	Cabo Verde	22	Kyrgyz Republic	38	Senegal
7	Cambodia	23	Lao PDR	39	Solomon Islands
8	Cameroon	24	Lebanon	40	Tajikistan
9	Comoros	25	Lesotho	41	Tanzania
10	Congo, Rep.	26	Mauritania	42	Timor–Leste
11	Cote d'Ivoire	27	Micronesia, Fed. Sts.	43	Tunisia
12	Egypt, Arab Rep.	28	Morocco	44	Uzbekistan
13	Eswatini	29	Myanmar	45	Vanuatu
14	Ghana	30	Nepal	46	Viet Nam
15	Guinea	31	Nicaragua	47	West Bank and Gaza
16	Haiti	32	Nigeria	48	Zambia
				49	Zimbabwe

Upper-Middle Income Countries

No	Country	No	Country	No	Country
1	Albania	18	Equatorial Guinea	35	Mongolia
2	Algeria	19	Fiji	36	Montenegro
3	Argentina	20	Gabon	37	Namibia
4	Armenia	21	Georgia	38	North Macedonia
5	Azerbaijan	22	Grenada	39	Paraguay
6	Belarus	23	Guatemala	40	Peru
7	Belize	24	Indonesia	41	Serbia
8	Bosnia and Herzegovina	25	Iran, Islamic Rep.	42	South Africa
9	Botswana	26	Iraq	43	St. Lucia
10	Brazil	27	Jamaica	44	St. Vincent and the Grenadines
11	China	28	Kazakhstan	45	Suriname
12	Colombia	29	Malaysia	46	Thailand
13	Costa Rica	30	Maldives	47	Tonga
14	Dominica	31	Marshall Islands	48	Turkiye
15	Dominican Republic	32	Mauritius	49	Turkmenistan
16	Ecuador	33	Mexico	50	Tuvalu
17	El Salvador	34	Moldova	51	Ukraine
				52	Venezuela, RB

High-Income Countries

No	Country	No	Country	No	Country
1	Andorra	22	Greece	43	Palau
2	Antigua and Barbuda	23	Guyana	44	Panama
3	Aruba	24	Hong Kong SAR, China	45	Poland
4	Australia	25	Hungary	46	Portugal
5	Austria	26	Iceland	47	Puerto Rico
6	Bahamas, The	27	Ireland	48	Qatar
7	Bahrain	28	Israel	49	Romania
8	Barbados	29	Italy	50	Russian Federation
9	Belgium	30	Japan	51	Saudi Arabia
10	Brunei Darussalam	31	Korea, Rep.	52	Seychelles
11	Bulgaria	32	Kuwait	53	Singapore
12	Canada	33	Latvia	54	Slovak Republic
13	Chile	34	Lithuania	55	Slovenia
14	Croatia	35	Luxembourg	56	Spain
15	Cyprus	36	Macao SAR, China	57	St. Kitts and Nevis
16	Czechia	37	Malta	58	Sweden
17	Denmark	38	Nauru	59	Switzerland
18	Estonia	39	The Netherlands	60	Trinidad and Tobago
19	Finland	40	New Zealand	61	United Arab Emirates
20	France	41	Norway	62	The United Kingdom
21	Germany	42	Oman	63	The United States
				64	Uruguay

Note: *The panel data is unbalanced. Estimations are based on observations with complete data for each model specification*.

Appendix 2. Data, Sources, and Measurements

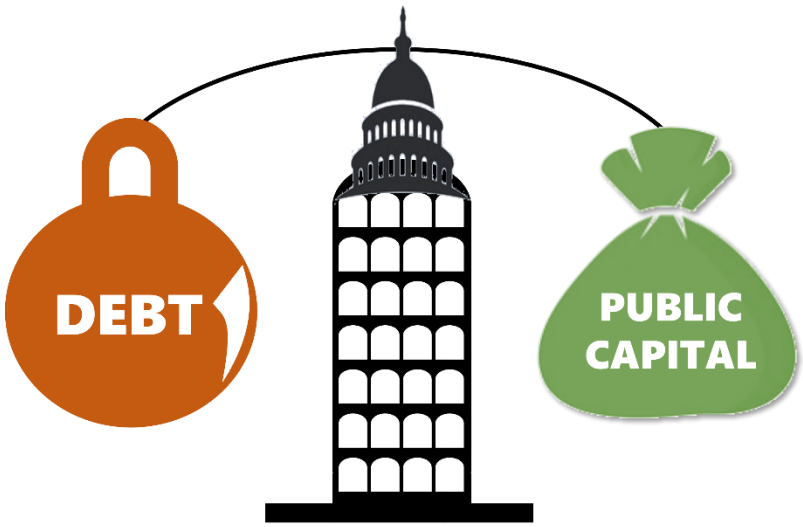
Variable	Measurement	Data Source	Description
$y_{i,t}$	Annual gross domestic product (GDP) per capita growth	WDI	Annual growth rate of real GDP per capita in constant local currency (%), capturing changes in average productive capacity and welfare
y_{i0}	Log of GDP per capita at the initial year of each period	WDI	Initial GDP per capita in logarithm, capturing the initial income level and testing convergence hypothesis whereby lower initial income is expected to be associated with faster economic growth
$debt$	Debt to GDP ratio	IMF	Proxied by ratio of general government gross debt (%), reflecting the total stock of public liabilities including loans, securities, and other debt instrument
va	Voice and accountability	WGI	Governance indicator that captured citizens ability to participate in the selection of government and the extent of freedom of expression, association, and media
ps	Political stability and absence of violence	WGI	Governance indicator measuring the likelihood of political instability or violence, including terrorism and politically motivated unrest
ge	Government effectiveness	WGI	Governance indicator measuring the government's ability to deliver quality public services and implement effective policies
rq	Regulatory quality	WGI	Governance indicator assessing the ability of the government to design and implement policies and regulations conducive to development
rl	Rule of law	WGI	Governance indicator measuring compliance with laws and the effectiveness of contract enforcement, property rights protection, policing, and the judicial system
cc	Control of corruption	WGI	Governance indicator capturing perceptions of corruption
lf	Labor force participation rate	WDI	Population aged 15–64 participating in the labor market to produce goods and services (% of total population)
lag_fcf	Gross fixed capital formation (FCF)	WDI	Proxy for capital formation (% of GDP), lagged one period, reflecting fixed investment in infrastructure, buildings, machinery, and equipment used in the production process
lag_fcf_priv	Private capital formation	WDI	Capital formation originating from the private sector (% of GDP) lagged one period
llg_fcf_pub	Public capital formation	WDI	Capital formation from the public sector (% of GDP), calculated as the difference between total FCF and private FCF, lagged one period

Appendix 3. Full Estimation Results

Variable	Five-Year Horizon				Ten-Year Horizon	
	Spec. 1	Spec. 2	Spec. 3	Spec. 4	Spec. 1	Spec. 2
Log initial GDP per capita	–5.024***	–5.647***	–4.914***	–7.750***	–3.989***	–4.440***
	(1.252)	(1.307)	(0.767)	(1.287)	(0.990)	(0.781)
debt	–0.019***	–0.00893	0.0238*	0.0659	–0.035***	–0.026***
	(0.00649)	(0.00570)	(0.01363)	(0.0415)	(0.00947)	(0.00870)
lf	0.0854*	0.0868*	0.0905*	0.0731	0.0986*	0.106**
	(0.0500)	(0.0503)	(0.04232)	(0.0829)	(0.0551)	(0.0493)
lag_fcf	0.0126	0.00467	0.0250		–0.00167	0.00846
	(0.0410)	(0.0399)	(0.02497)		(0.0477)	(0.0407)
lag_fcf_pub				0.2207**		
				(0.0964)		
lag_fcf_priv				0.0660		
				(0.0547)		
va		–0.126	–0.434	–2.483		–0.584
		(0.759)	(0.754)	(1.555)		(0.925)
pv		1.652***	0.940	1.400		1.558**
		(0.559)	(0.546)	(0.982)		(0.704)
ge		–1.537	–1.152	–1.863		–2.563
		(1.416)	(1.151)	(2.204)		(1.753)
rq		1.346	1.443	1.313		0.563
		(1.097)	(1.053)	(1.999)		(1.359)
rl		–0.773	–2.215	–4.833		–1.276
		(1.525)	(1.530)	(2.982)		(1.942)
cc		0.703	1.544	5.058**		2.327*
		(1.412)	(1.191)	(2.331)		(1.355)
$debt\_va$		0.0100	0.0205**	0.0375		0.0157*
		(0.00784)	(0.00877)	(0.0297)		(0.00907)
$debt\_pv$		–0.0106	0.0059	0.0110		–0.0307**
		(0.00955)	(0.00878)	(0.0203)		(0.0128)
$debt\_ge$		0.0528***	0.0506***	0.1009***		0.0666***
		(0.0199)	(0.01643)	(0.0370)		(0.0213)
$debt\_rq$		–0.0232	–0.0195	–0.0578		–0.0132
		(0.0188)	(0.01599)	(0.0439)		(0.0194)
$debt\_rl$		–0.0133	–0.0031	0.0546		–0.00627
		(0.0238)	(0.02159)	(0.0595)		(0.0261)
$debt\_cc$		–0.00580	–0.0254	–0.1097**		–0.0133
		(0.0235)	(0.01734)	(0.0527)		(0.0206)
$debt\_va\_lag\_fcfpub$				0.0003		
				(0.0023)		
$debt\_pv\_lag\_fcfpub$				–0.0034		
				(0.0025)		
$debt\_ge\_lag\_fcfpub$				–0.0054		
				(0.0050)		
$debt\_rq\_lag\_fcfpub$				0.0053		
				(0.0048)		
$debt\_rl\_lag\_fcfpub$				0.0009		
				(0.0058)		
$debt\_cc\_lag\_fcfpub$				0.0054		

Variable	Five-Year Horizon				Ten-Year Horizon	
	Spec. 1	**Spec. 2**	**Spec. 3**	**Spec. 4**	**Spec. 1**	**Spec. 2**
				(0.0040)		
Constant	39.96***	44.70***	36.30***	54.33***	31.23***	33.61***
	(10.41)	(10.73)	(6.889)	(11.72)	(10.04)	(7.628)
Observations	766	765	747	316	310	310
R^2	0.243	0.292			0.320	0.464
No. of Countries	161	161	161	88	161	161

Note: *Standard errors are reported in parentheses. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. All estimations include time fixed effects. Specifications 3 and 4 employs an IV approach using lagged debt as the instrument. Specification 3 and 4 are not estimated under the ten-year aggregation due to a limited number of observations. The R^2 value for Specification using the IV approach is not reported, as they are not relevant in his context.*


DEBT
PUBLIC
CAPITAL