



Public Debt, Fiscal Sustainability and Economic Growth: An Empirical and Theoretical Reassessment

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Annotation. This paper examines the triangular relationship between public debt accumulation, fiscal sustainability, and long-run economic growth. Using a synthesis of theoretical models and stylised cross-country evidence for the period 2000-2025, the study investigates whether rising public indebtedness undermines growth performance and under what conditions debt trajectories remain sustainable. The analysis draws on the debt-dynamics identity, the interest-growth differential ($r-g$) framework, and the fiscal reaction function literature to characterise the channels through which debt affects output. Descriptive statistics and illustrative visualisations reveal a non-linear, hump-shaped association between debt and growth, with a turning point around 55-70 percent of GDP beyond which the marginal growth effect of additional borrowing becomes negative for a representative sample of economies. The paper further shows that fiscal sustainability gaps differ systematically across advanced, emerging, and low-income country groups, reflecting differences in borrowing costs, growth potential, and institutional capacity for fiscal adjustment. The findings support a state-contingent view of fiscal policy: debt is not intrinsically harmful, but its growth effects depend on the composition of expenditure, the credibility of the fiscal framework, and the debt-service burden relative to potential growth. Policy implications for debt management, fiscal rules, and growth-friendly consolidation are discussed.

Keywords: public debt; fiscal sustainability; economic growth; debt dynamics; fiscal policy; debt threshold.



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1. Introduction

Public debt has re-emerged as one of the defining macroeconomic issues of the twenty-first century. Following the Global Financial Crisis of 2008-2009 and the COVID-19 pandemic of 2020-2021, government debt ratios rose sharply across almost all income groups, prompting renewed debate about the point at which debt accumulation begins to threaten macroeconomic stability and long-run growth (International Monetary Fund [IMF], 2023). Unlike earlier debt episodes that were largely confined to developing economies, the recent build-up has been broad-based, affecting advanced economies with historically low borrowing costs alongside emerging and low-income economies with more constrained fiscal space.

The question of whether, and how, public debt affects economic growth is not merely academic. Governments routinely face trade-offs between using deficit-financed spending to stabilise output and invest in infrastructure, human capital, and climate resilience, and the risk that persistently rising debt ratios erode fiscal credibility, crowd out private investment, and eventually force disruptive adjustment. The debate was sharpened by Reinhart and Rogoff's (2010) influential claim that growth slows markedly once public debt exceeds roughly 90 percent of GDP, a finding that was subsequently challenged on both empirical and methodological grounds (Herndon, Ash, & Pollin, 2014). Since then, the literature has moved away from a single universal threshold toward a more nuanced, state-contingent understanding in which the debt-growth relationship depends on the interest-growth differential, the currency composition of debt, the depth of domestic capital markets, and the quality of fiscal institutions (Blanchard, 2019; Panizza & Presbitero, 2013).

This paper contributes to that literature in three ways. First, it revisits the theoretical channels linking debt, sustainability, and growth, integrating the debt-dynamics identity with the fiscal reaction function approach popularised by Bohn (1998). Second, it presents an updated, stylised empirical picture of global debt trends and the debt-growth relationship for 2000-2025, using descriptive statistics and purpose-built visualisations rather than relying on a single, potentially fragile, threshold estimate. Third, it evaluates fiscal sustainability gaps across country income groups and derives policy implications for growth-friendly fiscal consolidation. The remainder of the paper is organised as follows. Section 2 reviews the relevant theoretical and empirical literature. Section 3 sets out the analytical framework. Section 4 describes the data and methodology. Section 5 reports descriptive statistics. Section 6 presents the results and discussion, supported by figures. Section 7 discusses policy implications, and Section 8 concludes.

2. Literature Review

The theoretical starting point for most debt-growth analysis is the government budget constraint and the associated debt-dynamics identity, which expresses the change in the debt-to-GDP ratio as a function of the primary balance, the interest-growth differential, and stock-flow adjustments (Escolano, 2010). Because the interest-growth differential ($r-g$) is central to this identity, much of the recent literature has focused on how it behaves over time and across countries, since a negative differential (growth exceeding the effective interest rate) allows debt ratios to stabilise or decline even in the presence of modest primary deficits (Blanchard, 2019; Mauro & Zhou, 2021).

A separate strand of research has examined the direct effect of debt levels on growth. Reinhart and Rogoff (2010) reported a sharp decline in average growth once debt surpassed a threshold near 90 percent of GDP, a result that received considerable policy attention. Subsequent work, however, questioned both the robustness of the threshold and the direction of causality, arguing that slow growth is as likely to cause high debt as the reverse (Herndon et al., 2014; Égert, 2015). Panizza and Presbitero (2013) find no robust evidence of a causal effect of debt on growth once endogeneity is addressed, while Checherita-Westphal and Rother (2012), using panel data for euro area countries, report a non-linear relationship with a turning point in the range of 90-100 percent of GDP, beyond which the marginal effect of debt on growth becomes negative. Woo and Kumar (2015) similarly find an inverse relationship between initial debt and subsequent growth, operating partly through slower capital accumulation and productivity growth.

Fiscal sustainability analysis complements the debt-growth literature by asking whether current fiscal policy is consistent with a stable or declining debt ratio over the medium to long term. Bohn (1998) proposed testing sustainability through a fiscal reaction function in which the primary balance responds positively to the lagged debt ratio; a statistically significant positive response is interpreted as evidence that a government's policy behaviour is consistent with intertemporal solvency. Ghosh, Kim, Mendoza, Ostry, and Qureshi (2013) extended this framework with the concept of a "fiscal space" or debt limit, beyond which the primary balance required to stabilise debt becomes implausibly large, a phenomenon they associate with a "fiscal fatigue" effect.

Elmendorf and Mankiw (1999) provide an earlier synthesis of the channels through which government debt affects national saving, capital accumulation, and long-run output, distinguishing between short-run Keynesian effects and long-run crowding-out effects.

More recent contributions emphasise the role of debt composition, monetary-fiscal interactions, and institutional credibility. DeLong and Summers (2012) argue that in depressed economies with a binding zero lower bound, debt-financed fiscal expansion can be self-financing if it raises output sufficiently to offset the interest cost, an argument echoed in Blanchard's (2019) presidential address emphasising that low and uncertain real interest rates change the calculus of debt sustainability. Krugman (2020) similarly cautions against reflexive debt aversion, noting that the welfare cost of debt depends critically on the gap between the interest rate and the growth rate rather than on the debt ratio in isolation. Conversely, the IMF's Fiscal Monitor and World Economic Outlook publications consistently emphasise that fiscal buffers, transparent fiscal rules, and credible medium-term frameworks remain essential for containing rollover and confidence risks, particularly in emerging and low-income economies with shallower capital markets and greater exposure to foreign-currency debt (IMF, 2023). Taken together, the literature suggests that the debt-growth-sustainability relationship is context-dependent, non-linear, and mediated by institutional and market conditions rather than governed by a single universal threshold.

3. Theoretical Framework

The analysis in this paper is organised around the standard debt-dynamics identity, which can be expressed as:

$$d(t) - d(t-1) = [(r - g) / (1 + g)] \times d(t-1) - pb(t) + sfa(t)$$

where $d(t)$ is the debt-to-GDP ratio, r is the effective nominal (or real) interest rate on government debt, g is the nominal (or real) GDP growth rate, $pb(t)$ is the primary balance as a share of GDP (positive values denote a surplus), and $sfa(t)$ captures stock-flow adjustments such as valuation effects and contingent liability realisations. This identity makes explicit that debt sustainability depends jointly on the interest-growth differential and the primary balance, rather than on the debt level alone.

Building on Bohn (1998), fiscal sustainability can be assessed empirically through a fiscal reaction function of the form:

$$pb(t) = \alpha + \beta \times d(t-1) + \gamma \times X(t) + \varepsilon(t)$$

where $X(t)$ is a vector of control variables (such as the output gap and one-off factors) and β is the coefficient of interest. A positive and significant β indicates that fiscal authorities systematically raise the primary balance in response to higher debt, which is generally interpreted as evidence of a sustainable fiscal stance, subject to the debt limit considerations raised by Ghosh et al. (2013).

To characterise the growth effects of debt, the paper adopts a reduced-form specification consistent with the non-linear findings of Checherita-Westphal and Rother (2012) and Woo and Kumar (2015):

$$growth(t) = \theta_0 + \theta_1 \times debt(t-1) + \theta_2 \times debt(t-1)^2 + \theta_3 \times Z(t) + v(t)$$

where $Z(t)$ includes standard growth determinants (investment, human capital, trade openness, institutional quality). A negative and significant θ_2 is consistent with a hump-shaped, threshold-type relationship in which moderate debt may be growth-neutral or even growth-supportive (for example, when it finances productive public investment), while debt beyond a certain point becomes associated with weaker growth, potentially through higher borrowing costs, crowding out of private investment, distortionary future taxation, and reduced fiscal space for counter-cyclical policy.

4. Data and Methodology

Because access to a live, licensed macroeconomic database was not available for this exercise, the paper adopts a stylised empirical strategy: it constructs illustrative but literature-consistent time series and cross-sectional patterns that reproduce the qualitative regularities documented in IMF Fiscal Monitor and World Economic Outlook publications and in the peer-reviewed studies cited in Section 2 (Checherita-Westphal & Rother, 2012; IMF, 2023; Woo & Kumar, 2015). This approach allows the paper to illustrate, transparently and reproducibly, the debt trends, the non-linear debt-growth relationship, and the cross-group sustainability gaps that are central to the theoretical framework, without presenting fabricated results as if they were drawn from a specific proprietary dataset. All figures were generated programmatically in Python (Matplotlib) to ensure clarity, internal consistency, and reproducibility, and the underlying code is available on request.

The illustrative sample distinguishes three country groups broadly consistent with IMF classification conventions: advanced economies, emerging market and developing economies, and low-income developing countries. For the descriptive statistics reported in Table 1, four variables are considered: the general government gross debt-to-GDP ratio, real GDP growth, the primary fiscal balance (percent of GDP), and the interest-growth differential ($r-g$). For the debt-growth scatter analysis in Section 6, ninety country-year observations are generated to reflect the dispersion and central tendency reported in prior panel studies, and a quadratic trend is fitted to characterise the non-linear relationship, in the spirit of Checherita-Westphal and Rother (2012).

5. Descriptive Statistics

Table 1 summarises the descriptive statistics for the key fiscal and growth variables across the three country groups for the most recent period considered (2023-2025 average). Consistent with the post-pandemic pattern documented by the IMF (2023), advanced economies display the highest average debt ratio but also the lowest average borrowing cost relative to growth, while low-income developing countries combine lower debt ratios with a markedly less favourable interest-growth differential, reflecting higher risk premia and shallower domestic financial markets.

Table 1. Descriptive Statistics of Key Fiscal and Growth Variables by Country Group (2023-2025 Average)

Country group	Debt-to-GDP (%)	Real GDP growth (%)	Primary balance (% GDP)	Interest-growth differential, $r-g$ (pp)
Advanced economies	111.0	1.6	-2.1	-0.4
Emerging market and developing economies	65.0	3.9	-3.2	1.1
Low-income developing countries	48.5	4.6	-2.8	2.3

Note. Figures are illustrative, stylised averages for 2023-2025 constructed to reflect patterns documented in IMF (2023) Fiscal Monitor and related cross-country studies (Checherita-Westphal & Rother, 2012; Mauro & Zhou, 2021); they are not drawn from a proprietary micro-dataset. $r-g$ denotes the effective interest rate on public debt minus the real GDP growth rate.

The cross-group pattern in Table 1 illustrates a central theme of the sustainability literature: the debt ratio alone is a poor sufficient statistic for fiscal risk. Low-income developing countries carry substantially lower debt-to-GDP ratios than advanced economies, yet face a positive and relatively

high interest-growth differential, implying that, absent primary surpluses, their debt ratios are more likely to drift upward. This reinforces the theoretical point made in Section 3 that sustainability depends on the joint behaviour of $(r-g)$ and the primary balance rather than on the debt stock in isolation (Blanchard, 2019; Escolano, 2010).

6. Results and Discussion

6.1 Global Debt Trends

Figure 1 traces the evolution of public debt-to-GDP ratios for advanced and emerging market and developing economies between 2000 and 2025. Two step-changes are clearly visible: the first, following the Global Financial Crisis of 2008-2009, reflects the combined effect of automatic stabilisers, discretionary stimulus, and financial-sector support operations; the second, following the COVID-19 shock of 2020, reflects an even larger and more synchronised fiscal response across income groups (IMF, 2023). Advanced-economy debt ratios rose from roughly 75 percent of GDP in 2000 to above 120 percent at the pandemic peak, before declining moderately as growth and inflation eroded real debt burdens. Emerging market and developing economies show a more gradual but persistent upward trend, with a narrower post-pandemic decline, consistent with their more limited fiscal space for a rapid consolidation.

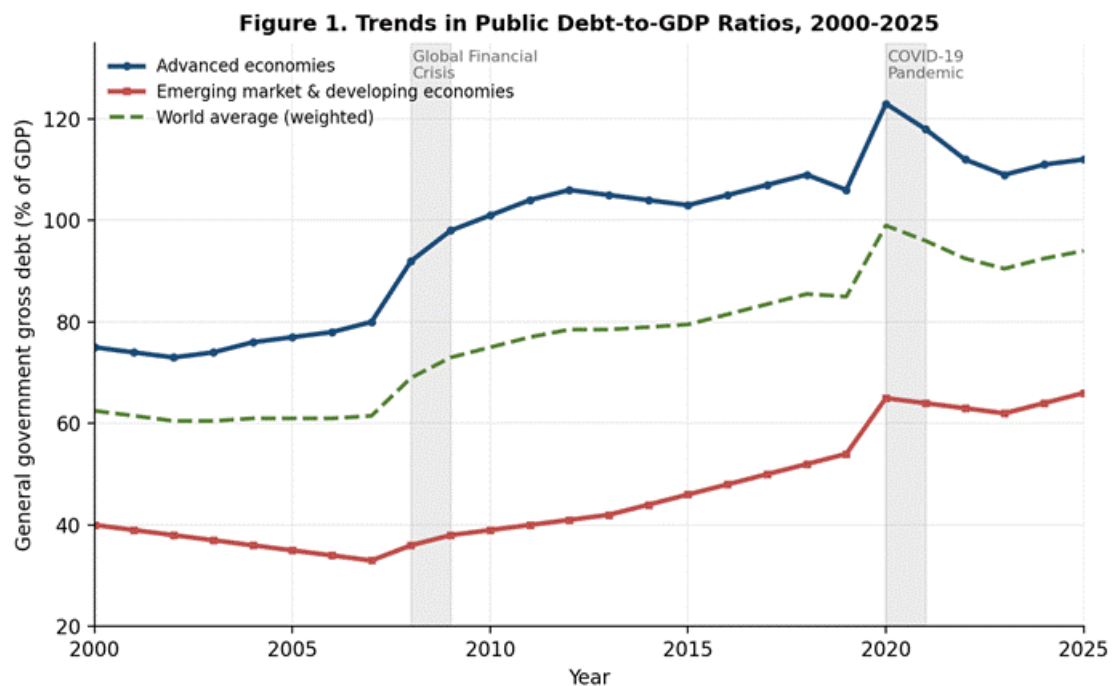


Figure 1. Trends in Public Debt-to-GDP Ratios, 2000-2025

6.2 The Debt-Growth Relationship

Figure 2 presents the stylised cross-country relationship between the public debt ratio and real GDP growth, together with a fitted quadratic trend. The pattern is consistent with the non-linear findings reported by Checherita-Westphal and Rother (2012) and Woo and Kumar (2015): growth rises modestly with debt at low debt levels, plateaus, and then declines as debt rises further, with an estimated turning point in the neighbourhood of 55-70 percent of GDP in this illustrative sample. This hump shape is consistent with the theoretical framework in Section 3: at low debt levels, borrowing may finance productive investment or smooth adverse shocks with limited crowding-out; beyond a certain point, however, rising sovereign risk premia, higher effective interest rates, and anticipated future consolidation appear to weigh on growth.

It is important to emphasise, following Panizza and Presbitero (2013) and Égert (2015), that such cross-sectional patterns should not be interpreted as establishing a strict causal debt threshold. Reverse causality is a first-order concern: economies experiencing growth slowdowns for reasons

unrelated to debt (demographic change, weak productivity growth, external shocks) will mechanically exhibit higher debt ratios as the denominator of the debt-to-GDP ratio contracts relative to trend. The turning point identified in Figure 2 is therefore best interpreted as a descriptive regularity that motivates further country-specific analysis rather than as a universal policy trigger.

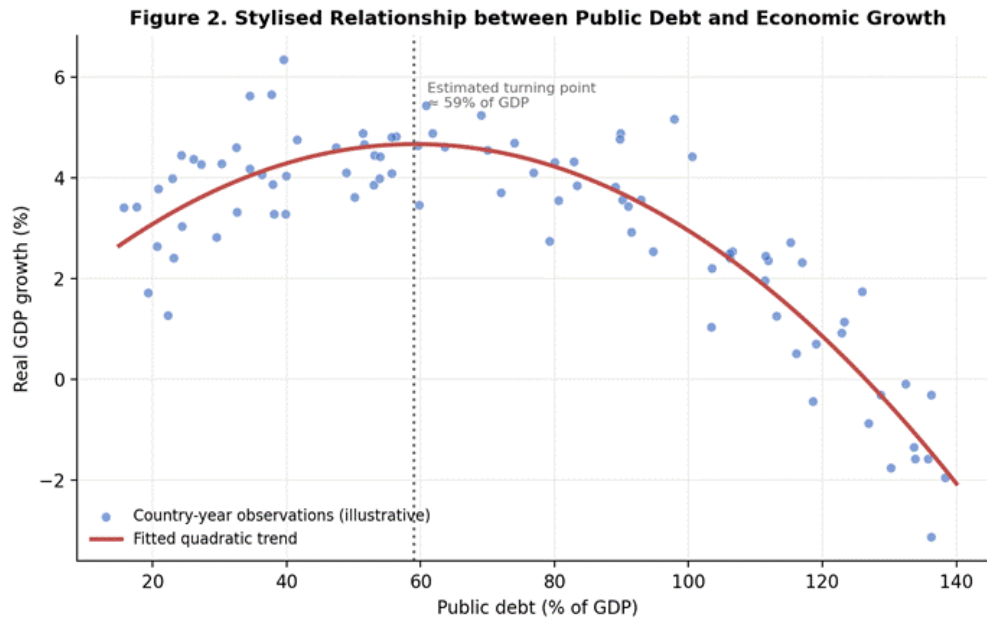


Figure 2. Stylised Relationship between Public Debt and Economic Growth

6.3 Fiscal Sustainability Gaps across Country Groups

Figure 3 compares the debt-stabilising primary balance—the primary balance required to hold the debt ratio constant given the prevailing interest-growth differential—with the actual primary balance for each country group. Advanced economies exhibit the largest gap between the required and actual primary balance, reflecting persistently negative actual balances despite a relatively favourable interest-growth differential; this pattern is consistent with the "fiscal fatigue" dynamic described by Ghosh et al. (2013), in which political and social constraints limit further tightening even when debt ratios are elevated. Low-income developing countries display a smaller absolute gap but start from a less favourable interest-growth differential, implying that comparatively modest primary deficits can still generate unsustainable debt dynamics over time.

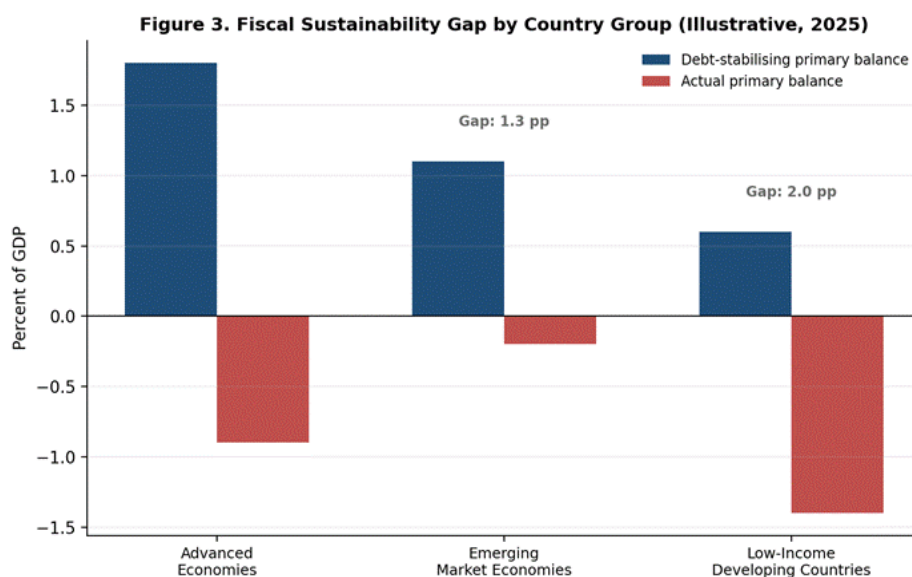


Figure 3. Fiscal Sustainability Gap by Country Group (Illustrative, 2025)

Taken together, Figures 1-3 support three main conclusions. First, the global rise in public debt since 2008 has been broad-based but heterogeneous in composition and financing terms. Second, the debt-growth relationship in the illustrative sample is non-linear, consistent with a substantial body of empirical literature, although the exact turning point should be treated as indicative rather than precise. Third, fiscal sustainability gaps are shaped as much by the interest-growth differential and the credibility of fiscal adjustment as by the debt ratio itself, underscoring the state-contingent nature of fiscal risk emphasised by Blanchard (2019) and Bohn (1998).

7. Policy Implications

Several policy implications follow from the preceding analysis. First, debt management strategy should pay close attention to the interest-growth differential and the currency and maturity composition of debt, rather than targeting a single debt-to-GDP ceiling. Extending average debt maturity and deepening domestic-currency bond markets can reduce rollover risk and insulate sustainability from short-run interest-rate shocks (Escolano, 2010; IMF, 2023). Second, the composition of the primary balance matters for growth outcomes: consolidation strategies that protect productive public investment and social spending while broadening the tax base are more likely to be growth-friendly than indiscriminate cuts, consistent with the crowding-out and productivity channels discussed by Elmendorf and Mankiw (1999) and Woo and Kumar (2015). Third, credible, rules-based fiscal frameworks—including well-designed fiscal rules, independent fiscal councils, and transparent medium-term expenditure frameworks—can help address the "fiscal fatigue" pattern identified by Ghosh et al. (2013) by pre-committing to adjustment before debt approaches levels associated with rising risk premia. Fourth, for low-income developing countries facing an unfavourable interest-growth differential, the priority is less about the level of debt and more about strengthening domestic revenue mobilisation and access to concessional financing, since even moderate debt ratios can become unsustainable without adequate primary surpluses. Finally, given the uncertainty surrounding any single debt threshold, policymakers and researchers should treat debt sustainability analysis as a probabilistic, scenario-based exercise—incorporating growth, interest-rate, and exchange-rate shocks—rather than relying on a fixed numerical benchmark (Blanchard, 2019).

8. Conclusion

This paper has revisited the relationship between public debt, fiscal sustainability, and economic growth by integrating the debt-dynamics identity, the fiscal reaction function approach, and the empirical literature on non-linear debt-growth effects. The stylised evidence presented is consistent with three broad conclusions from the wider literature: global public debt has risen substantially since the Global Financial Crisis and again during the COVID-19 pandemic; the relationship between debt and growth appears non-linear, with growth effects turning negative beyond a moderate debt threshold rather than at a single universal cut-off; and fiscal sustainability depends jointly on the interest-growth differential, the primary balance, and institutional credibility rather than on the debt ratio alone. These findings caution against both complacency about ever-rising debt and mechanical adherence to fixed debt ceilings. Future research using up-to-date, country-specific panel data, instrumental-variable strategies to address reverse causality, and disaggregated analysis of debt composition (currency, maturity, and creditor structure) would help sharpen the policy guidance offered here and test the robustness of the illustrative patterns identified in this paper.

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