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Abstract

Debt in most developing countries is growing, marking the beginning of a new debt crisis and highlighting the need for the global financial system to be transformed to address global inequalities. Despite the importance of debt sustainability analysis (DSA) in assessing debt vulnerability, overoptimistic predictions of economic recovery and unfair treatment of debtors and creditors have weakened its effectiveness. Thus, simple measures that allow regular debt monitoring could complement DSAs. This article suggests that an independently measured safe debt threshold could be used as a complementary measure alongside DSAs. Analysing the public debt-growth nexus in developing countries, this article shows that the debt threshold of Latin America and the Caribbean is 25% of debt-to-GDP. Further, average debt thresholds of countries with the lowest income levels and lowest quality of governance are 37% and 38% of debt-to-GDP, respectively. Debt thresholds of developing countries are much lower than those of advanced economies. Thus, the global financial system should facilitate access to non-debt creating alternative financial options, such as improved taxation and increased flow of official development assistance, to replace the need for new borrowing in developing countries. This article contributes to the indebtedness literature by providing an update on regional debt thresholds, and insights into alternative financing tools to ameliorate the debt problem in Global South.

Keywords

Debt sustainability; Global South; debt threshold; global financial system; alternative financial options

Evidence for decision-making

1. Overly optimistic debt sustainability assessments and unfair debt burden distribution amongst debtors and creditors increase debt vulnerabilities in the Global South.

2. Maintaining debt at safe thresholds could be considered a complementary measure to the IMF's debt sustainability analysis (DSA) for developing countries.

3. The global financial system needs modifying to ensure debt sustainability and increased availability of alternative financial options for developing economies.

4. Improved taxation and increased flow of official development assistance would replace the need for new borrowing in the Global South.

5. The global financial system needs modification to ensure financial sustainability and inclusivity, taking into account social, economic, and political dimensions, and human rights.

Introduction

Increasing indebtedness in developing countries is marking the beginning of a new debt crisis (Gaspar et al., 2023), reigniting the long-standing debate on the fairness of global financial governance. High levels of debt reduce economic growth and increase risk of default, where governments fail to repay debt, as occurred for example in Sri Lanka and Zambia, among others (Rehbein, 2023; Adrian et al., 2024). Debt is sustainable if a country can finance its policy objectives and repay debt. Otherwise, debt restructuring is needed to avoid default risk that leads to losses in international capital market access and output.

Global public debt reached USD 97 trillion in 2023 (United Nations Trade and Development [UNCTAD], 2024). Developing economies accounted for 30% of this debt, and spent USD 443.5 billion on debt servicing in 2022 (World Bank, 2023). Asia is the most indebted region in the Global South, although Africa is the worst affected as its debt is growing faster than gross domestic product (GDP) (UNCTAD, 2024). The majority of the 54 countries in default risk are in the Global South (United Nations [UN], 2023a; 2023b). Levels of high indebtedness have recently increased in developing countries, driven by the impacts of the pandemic and rising inflation and energy prices, and exacerbated by debt surcharges, traditional lender policies linked to conditionalities, and poor access to finance (Toussaint, 2023; Romeu, 2024). Unsustainable debts trigger fiscal adjustments, reducing a government's capacity to guarantee human rights (Munevar, 2021). Also, limited access to development finance pushes developing countries to borrow from more expensive sources (Bretton Woods Project, 2024). As a result, debt servicing costs increase substantially, making it even more challenging to resolve the debt crisis. Globally, the impacts of colonialism and ongoing imperialism are linked to high indebtedness, while poor governance affects it domestically.

Injustice in the global financial architecture threatens debt sustainability in the Global South (Essl et al., 2019; Sial et al., 2023). In 1996, the World Bank and the International Monetary Fund (IMF) launched the Heavily Indebted Poor Countries (HIPC) initiative to reduce unsustainable debt in poorer countries. The IMF's debt sustainability analysis (DSA) is a tool used to resolve potential debt crises (Rehbein, 2023). Yet, overly optimistic post-pandemic economic recovery projections for the Global South, unfair burden sharing among debtors and creditors, and the neglect of political-economic factors have undermined its effectiveness. Further, developing countries often face higher borrowing costs and receive limited financial assistance in times of crisis. For instance in 2021, while the IMF allocated USD 160 billion (1% of total debt

burden) in emergency assistance for the European Union, Africa received only USD 34 billion (4% of total debt burden) (UN, 2023a). Thus, equality in global financial governance is a fundamental requirement for sustainable debt management in the Global South, and would enable further improvements in financial systems at the national level.

In terms of the impact of the debt-growth nexus, managing debt within a safe threshold is preferred, since debt beyond this limit could reduce growth (Chudik et al., 2017). These debt thresholds vary across countries and over time (Herndon et al., 2014). Relatively, developed countries have larger debt thresholds of around 90-100% of debt-to-GDP than developing countries (Reinhart & Rogoff, 2011; Checherita-Westphal & Rother, 2012). Growth impacts of debt vary based on both level and composition of debt, which is not covered in the DSAs (Matsuoka, 2020; Rehbein, 2023). As DSAs have several limitations (Flassbeck & Panizza, 2008), debt thresholds could be used as a complementary tool alongside DSAs to prevent unsustainable debt accumulation.

In this context, this article aims to answer the following question: how should the global financial system be modified to enable debt sustainability in the Global South? The article objectives are threefold: to estimate debt thresholds, to propose modifications to the global financial architecture, and to explore alternative financing modalities. Despite extensive research on indebtedness, heterogeneity in debt thresholds across developing countries remains relatively under-explored. This study makes an important contribution to the indebtedness literature by providing an update on debt thresholds against heterogeneity factors (geographic location, income and governance quality) that can be used as a complementary measure to DSA. Debt threshold is a simple measure that keeps debt in check, prevents unsustainable debt accumulation, and detects inaccuracies in DSA estimations. Further, this study provides useful insights for the 'Summit of the Future' and the 'Fourth International Conference on Financing for Sustainable Development'. In this regard, the article argues for the creation of an unbiased global financial architecture that facilitates increased availability of non-debt creating alternative financial options, such as improved taxation and increased flow of official development assistance (ODA) to developing economies. This would ameliorate the debt problem in the Global South by replacing the need for new borrowing.

The remainder of the article is structured as follows: section two presents the methods used, section three contains the research findings, and section four presents the conclusions of the study.

Methods

This study investigates the public debt-growth nexus by identifying debt thresholds and various heterogeneities in developing countries using dynamic panel threshold regression (DPTR). Debt thresholds are sensitive to estimation techniques (Ndoricimpa, 2017). This article uses DPTR because it is considered a superior technique for the estimation of non-linear functions, allowing simultaneous estimation of threshold level and coefficients of different regimes and their significance (Hansen, 1999; Caner & Hansen, 2004; Kremer et al., 2013; Fernando, 2021). Also, DPTR addresses endogeneity and serial correlation issues in a dynamic setting. DPTR is used extensively to analyse debt thresholds of developed countries, but is seldom used in developing countries. In line with the external debt-growth nexus literature, this article adopts a Solow-growth specification, since this neoclassical model clearly describes the long-term relationship between growth and production factors (Siddique et al., 2016).

Equality in global financial governance is a fundamental requirement for sustainable debt management in the Global South.

This article uses a panel of 111 developing countries covering three regions as follows: Africa (47), Asia (38), and Latin America and the Caribbean (26), for the period 1993-2022. Heterogeneity estimations are limited to relevant subsamples.

The study uses the following model:

$$\Delta gdp_{it} = \chi \Delta gdp_{it-1} + \beta_1 d_{it} I(d_{it} \leq \gamma) + \beta_2 d_{it} I(d_{it} > \gamma) + \alpha' X_{it} + \eta_t + \mu_i + e_{it} \text{ ---- (1)}$$

The outcome variable is real GDP growth rate (Δgdp_{it}). Public debt (d_{it}) is both the threshold variable and the regime dependent regressor, and has two coefficients (β_1 and β_2). The threshold variable splits the sample into two 'regimes' based on whether the threshold variable is lower or higher than the threshold level (γ). β_1 is the marginal impact of the threshold variable when the threshold variable is less than or equal to the threshold value (low-debt regime), and β_2 is the marginal impact of a threshold variable when the threshold variable is greater than the threshold value (high-debt regime).

This specification contains a set of standard Solow growth determinants (X_{it}): trade openness, public investment, population growth, and secondary school enrolment; its coefficient vector, α, estimates the effect of a change in each variable on real GDP growth rate. The unobserved heterogeneity is controlled by using year- (η_t) and country-specific (μ_i) fixed effects.[1]

Public debt data are taken from the IMF's global debt database (IMF, 2024), and all other explanatory variables from the World Bank (World Bank, 2024). Based on Kourtellos et al. (2013), governance quality data is obtained from the 'Freedom in the World Survey'. Governance quality, represented by political rights and civil liberties, is measured on a scale from 1 (highest) to 7 (lowest) (Freedom House, 2024). Countries are categorised into three groups based on governance quality (i.e. the combined average ratings of political rights and civil liberties): free (1-3); partly free (3-5.5); and not free (5.5-7).

Results

Debt sustainability is not an isolated technicality, but rather represents a historical continuum, rooted in colonialism, and linked to the challenges of neoliberalism and ongoing imperialism (Sial et al., 2023). Interpreting the Global South's debt crisis as a technical issue, and highlighting the incompetencies of debtor governments, often distracts from the need to understand the role of colonialism and extractive imperialism, with powerful governments and institutions still now exercising control over the Global South. Thus, addressing unsustainable debt requires recognition of multifaceted factors, including political economic factors and the protection of human rights (Munevar, 2021; Bretton Woods Project, 2024). The debt burden impedes access to development finance, limiting the capacity of Global South governments to respond to the needs of their citizens. To improve this, DSAs need to go beyond financial sustainability and promote inclusivity in terms of human rights, and social and environmental dimensions. In this regard, this study proposes an independently-measured debt threshold that can be used as an effective complementary measure to DSAs in avoiding unsustainable debt in developing countries.

Another factor which points to the importance of a simple, independently-assessed debt threshold is the cost associated with delays in DSAs (Rehbein, 2023). There are several factors that may cause delays, including that a DSA will be implemented only after an IMF program is approved in a debtor

1. Please see the technical supplement in the Appendix for more details.

country (and delays in IMF program approval would mean irreversible economic impacts). In addition, when a DSA needs national government approval, it becomes a public document and this affects negotiations with creditors. Moreover, pooling local and foreign currency debts in DSAs is erroneous as capacity to rollover different debts is different. Debt un sustainability is costlier for debtors and creditors alike, thus alternative approaches that protect social, political, and economic objectives are encouraged (Munevar, 2021). In this context, the use of independently-measured debt thresholds is useful to monitor debt levels and to prevent unsustainable debt build-ups.

Table 1 shows the DPTR debt-growth nexus estimates in developing countries. The threshold estimates ($\hat{\gamma}$) of debt-to-GDP for all Global South regions, Asia, Africa, and Latin America and the Caribbean are 38%, 32%, 40% and 25% respectively. Yet, threshold effect is significant only in Latin America and the Caribbean (p-value=0.01). As such, this region can enjoy a maximum of 25% debt-to-GDP without compromising its growth, while in the other regions no threshold effect is observed.

Table 1. **DPTR debt-growth nexus estimates**

	Developing economies	Asia region	Africa region	Latin America and the Caribbean region
	(1)	(2)	(3)	(4)
Threshold estimates $\hat{\gamma}$	37.549	31.690	39.552	25.160
95% confidence interval	[37.07 37.70]	[30.82 31.95]	[36.09 39.56]	[24.75 25.19]
Threshold effect test: p-value	0.157	0.331	0.675	0.010
Threshold effect	No	No	No	Yes
Impact of debt on growth				
$\hat{\beta_1}$	-0.007	-0.021**	0.002	-0.050***
	(0.005)	(0.010)	(0.008)	(0.010)
$\hat{\beta_2}$	0.010***	0.011***	0.021***	0.001
	(0.001)	(0.002)	(0.004)	(0.002)
Regime independent controls	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Countries	111	47	38	26
Observations	2,886	1,222	988	676

Note. ***, ** and * indicate significant p values at 1%, 5% and 10% level. Data from the IMF's global debt database and the World Bank's World Development Indicators from 1993-2022 World Bank. (2024).

Impact of debt on growth is shown by β_1 (low-debt regime) and β_2 (high-debt regime). The main focus is on β_2 which represents the high-debt regime or the debt above the safe debt threshold of 25% of debt-to-GDP. Though not significant, the regime-dependent coefficient at high-debt regime is positive for Latin America and the Caribbean region (0.001). Hence, as the public debt level exceeds the threshold value of 25% debt-to-GDP, a 100% increase in public debt leads to a 0.1% increase in economic growth. This means although debt exceeds the threshold level of 25% debt-to-GDP, it does not negatively impact on growth. So, accumulating debts around this threshold is still growth-enhancing. This could be because the debt threshold of 25% is well below the region's average debt level of 65% of debt-to-GDP, or due to the presence of more than one debt threshold. The estimations for multiple thresholds however, show no significant threshold effect. Second and third thresholds are at 54% and 76% debt-to-GDP, but none are significant. In comparison to the HIPC initiative, current debt of developing countries is largely held by private creditors. In this article, debt threshold estimation does not consider variations in debt composition. Due to this limitation, results need to be interpreted with caution. Future studies considering variations in debt composition would provide more precise debt threshold estimations.

Heterogeneity analyses of income and governance quality were limited to sub samples to avoid the generalisation of results across a varied group of countries, and to accurately reflect individual country dynamics. This helps to identify specific country-level factors and glean more precise policy implications.

The income-based heterogeneity analysis categorised countries into four groups: low-, lower middle-, upper middle- and high-income. The threshold effect of 37% of debt-to-GDP is observed only for low-income countries. Marginal impact of debt in the high-debt regime (β_2) is significant and positive for this group. With increasing income, however, the debt threshold effect disappears. Low-income economies accumulated substantially larger debt stocks, and 95% of countries in the low-income group are from Africa. As production structures vary significantly across levels of development, the presence of debt thresholds may have been impacted by existing structural differences. Further, debt in most developing countries is either non-concessional or sourced from private creditors, and thus involves high debt repayments (Essl et al., 2019). High interest payments absorb more revenue while reducing fiscal space for public spending, leading to macroeconomic instabilities. Debt repayments are more manageable for higher-income countries. Hence, with increased income, countries accumulate high debt levels that are still not growth-reducing, such that their debt thresholds are

insignificant. Therefore, reducing debt vulnerability through strengthened DSAs and improved public financial management practices are critical.

The debt-growth nexus depends on country characteristics such as institutional quality and governance quality (Kourtellos et al., 2013). Countries with better governance quality enjoy higher debt thresholds, while countries with poor quality governance have comparatively lower debt thresholds (Cordella, 2010). In terms of governance quality, countries are categorised into three groups: free, partly free and not free. A debt threshold effect of 38% of debt-to-GDP exists for countries with the lowest quality governance ('not free'). Beyond this, a 100% increase in debt leads to 1% growth increase. Further, investment inflow is also unrelated to the quality of governance in developing countries. This could contribute to there being no observed growth-reducing effect in poor governance quality countries. Future research could usefully explore other possible relationships between debt and growth.

The article found that the debt-growth nexus depends on a multitude of factors, which supports the argument that DSAs should go beyond simple technical analysis to include other social, political and economic factors like institutional and political frameworks (Guzmán & Stiglitz, 2024). Failure to restructure unsustainable debts can cause recessions in economic activity and efficiency loss (Rehbein, 2023). In severe cases, debt relief would be essential for both debtor and creditor to minimise further output losses. Overoptimism in DSAs leads to greater IMF lending and reduced debt write-off by private creditors, leading to more benefits for creditors and increased risk of debt crisis for the debtor country. Thus, it is crucial to address politics and power in order to minimise negative economic and distributional effects. DSAs are forward-looking and based on the evolution of the economy. Differences in opinion are common during debt negotiations, with creditors often arguing that debtor countries have better repayment capacities than they actually do. Developing countries often delay debt restructuring for political economic reasons, meaning the crisis becomes long-lasting as recovery is costlier. The debtors prefer to pass the problem to the next government and the creditors expect a possible positive shock for better deals in debt negotiation. Thus, DSA efficiency relies heavily on the degree to which all these are addressed in coordination with all relevant stakeholders in a timely manner.

Discussion and actionable recommendations

Ensuring debt sustainability

Debt sustainability is crucial for economic growth and stability. This article argues for creating a robust global financial architecture that enables debt sustainability in developing countries. The existing global financial system, built in the aftermath of World War II to address political economic power dynamics of the time, is now outdated and heavily favours developed nations (UN, 2023a). In this regard, the study proposes that debt be maintained at an independently-measured safe threshold as a complementary measure to DSA, and that global financial systems facilitate the increased availability of non-debt creating alternative financial resources to avoid the need for new borrowing.

Debt in developing countries was the lowest during 2008-2012, but has increased continuously thereafter.

It is argued that the debt threshold is not common to all developing countries (Pescatori et al., 2014, Chudik et al., 2017 & Bentour, 2021). Similarly, this article finds a debt threshold of 25% of debt-to-GDP only for Latin America and the Caribbean. Heterogeneity analyses suggest average debt thresholds of 37% and 38% debt-to-GDP for countries classed as low-income and as having poor governance, respectively, with most countries in these two groups being in Africa. Poor governance, historical imbalances and the extractive nature of imperialism lead to high indebtedness (Fosu & Gafa, 2023; Sial et al., 2023). In 2022, Africa had the highest average debt of 66% of debt-to-GDP. Also, beyond debt thresholds, high debt is not growth-reducing for these two groups. However, this does not necessarily negate the need to reduce debt or improve income and governance quality, since the Global South's debt vulnerability is a multifaceted issue. Hence, it is critical to understand how debt is being used to maintain power, and what changes are required in the global financial system to ensure debt sustainability in the Global South.

Country characteristics play a significant role in the debt-growth nexus (Kourtellos et al., 2013). Despite short-term benefits, long-term high debt is growth-reducing due to the crowding out of private investment, increased interest rates, and by the need for future tax increases or spending cuts to

accommodate future interest payments (Reinhart & Rogoff, 2010; Fan et al., 2024). Further, increasing debt is growth-enhancing when countries have low initial debts, but growth-reducing when initial debts are high or show increasing debt trends (Soyres et al., 2022). This study reveals that debt in developing countries was the lowest during 2008-2012, but has increased continuously thereafter (see Appendix, Figure A1). Therefore, high debt levels are considered sustainable as long as there is a decreasing trend.

Developed countries account for most global debt (see Appendix, Figure A1). The debt threshold for France (1862-2008) is 80% debt-to-GDP, and beyond this level debt is still growth enhancing. For Greece (1914-2008), the United Kingdom (1862-2008), and the United States (1871-2008), the 99% debt threshold is growth reducing (Lechtenberg, 2017). Countries with decreasing debt trends, such as France, show positive growth effects. Therefore, the debt-growth nexus is impacted by debt trajectory, and debt sustainability is supported by a decreasing debt trend. The HIPC initiative reduced debt in developing countries. Yet, this declining trend reversed in 2012, and by 2022 overall debt had increased by 55%, with debt in Africa (66%) and Latin America and the Caribbean (65%) exceeding the Global South average in 2022. Low-income countries recorded the highest average debt from 2019-2022 at 73%. Drivers of recent debt in developing countries are linked to a combination of factors, including the impact of the pandemic, rising inflation, and rising energy prices rooted in recent wars and conflict. This is exacerbated by debt surcharges, traditional lender policies linked to conditionalities, and problems faced by developing countries in relation to access to finance. Therefore, global financial governance should coordinate and provide early debt resolutions to ensure efficient debt restructuring and continuous debt sustainability assessments.

Continuous debt monitoring improves growth prospects. Therefore, debt portfolios should involve careful review of the development needs and priorities of each country. Also, there are many factors a country should examine in terms of debt financing, namely: the interest rate of the debt instrument, currency mix, the share of fixed versus floating interest rates in the portfolio, the maturity profile, the choice of domestic versus external debt, and the share of nominal versus inflation-indexed instruments (World Bank, 2023). With increasing debt vulnerabilities in developing countries, active debt portfolio management is essential to ease debt service burdens. Such management includes repurchases, swaps, and cancellations. Also, properly managed portfolios can provide financial incentives such as debt buybacks (a risk management tool that can reduce the debt stock when traded at deep discount), debt exchanges (swapping outstanding

debt for new debt) or debt-for-nature swaps (partial debt relief in exchange for green investments in debtor countries) (Chamon et al., 2022). These tools are more beneficial than issuing new debt. Hence, the global financial system should create a conducive environment for developing countries to implement hem. Yet, unsustainable debt is also partly due to a lack of awareness, accountability, and political commitment. National governments therefore also have a crucial role to play in improving debt management, including through continuous capacity development in sustainable debt management.

In addition, DSA is a vital tool that helps restore stability in countries which have defaulted on their debt (Spiegel et al., 2024). Yet, its success is ensured only when it goes beyond mechanical/technical analysis and follows a holistic approach considering the political and economic realities of a given country. Developing countries are highly vulnerable during crises. Thus, the global financial system can facilitate 'state contingent debt instruments', incorporate beneficial alterations to debt contracts, and establish impartial institutions to manage crises (Griffiths, 2019). This article also highlights the role of alternative financial instruments in avoiding the need for new borrowing. Strengthening domestic resource mobilisation or taxation is a key tool for improved state performance (European Network on Debt and Development [Eurodad], 2024). Inefficiencies in international and national tax systems have led to a global revenue loss of USD 480 billion. Financial globalisation threatens national tax policies, especially in developing economies. As a result, unlike in developed countries, increased per capita income does not necessarily ensure increased tax collection in developing countries. Creating better global tax governance that improves national revenue collection and prevents illicit financial flows helps address this issue.

The role of private creditors has gained much attention since the last debt crisis. Creditors and borrower countries' behaviour is critical for debt sustainability. Private lenders reduced lending to developing countries by 23% to USD 371 billion in 2022, yet collected USD 556 billion in repayments (Committee for the Abolition of Illegitimate Debt, 2023). Thus, repayments are now exceeding lending to developing countries. This ought to be addressed through reform of the economic model and systems followed by lenders. Further, increased accountability improves the behaviour of both borrower and lender. Debt transparency can be improved by disclosing the real debt stocks and debt risks. This avoids 'hidden debts' such as contingent liabilities and direct borrowings of state owned enterprises. Also, creating a public borrowing registry and sharing lending contracts with the public

increases accountability and transparency. Therefore, all parties should be encouraged to follow principles promoting responsible sovereign lending and borrowing (UNCTAD, 2012).

Despite its economic importance for countries in the Global South, disbursement of ODA has reduced over recent years. In 2022, only USD 213.2 billion was disbursed, which is not sufficient to cover financial needs in developing countries. Also, ODA is now increasingly given as concessional loans rather than grants. Between 2021 and 2022, ODA grants to developing regions fell by 8% to USD 109 billion, while loans increased by 11% to USD 61 billion. Further, high-income countries failed to meet the annual USD 100 billion climate finance budget for low- and middle-income countries during 2009-2020 (Oxfam, 2023). These trends have collectively contributed to increased debt vulnerability in developing countries. Therefore, donor countries are well-positioned to enable developing economies to use financial aid to leverage economic growth and secure other financing resources, through revising the conditions of ODA and ensuring they adhere to climate financing commitments.

Conclusions

History shows that unsustainable debts trigger financial crises, and yet public debt in developing countries is again rising at an alarming rate. Debt sustainability is crucial for growth and development, yet sustainable debt management is challenging, as it goes beyond a simple technical exercise, involving broader social, political, and economic dimensions and human rights. However, the global financial system is rooted in historical inequalities, and neglects the needs of the Global South. Reduction of the Global South's debt burden requires significant transformation of the global financial system, including debt restructuring through reliable debt sustainability assessments. This study proposes that governments consider keeping debt at an independently-measured safe threshold level to keep debt in check. This simple measure could be used as complementary to the DSA, to avoid erroneous estimations and for effective monitoring. In addition, the global financial system should facilitate increased availability of non-debt creating alternative financial options such as improved taxation and increased flow of ODA grants to developing economies. This would replace the need for new borrowing, and encourage improvements in national financial systems and processes.

Private creditors play a significant role in current debt accumulation in developing countries. However, the DPTR estimation used in this study does

not account for the variations in debt composition. Thus, future research on debt threshold effects could usefully examine variations in debt composition of developing countries to address this limitation.

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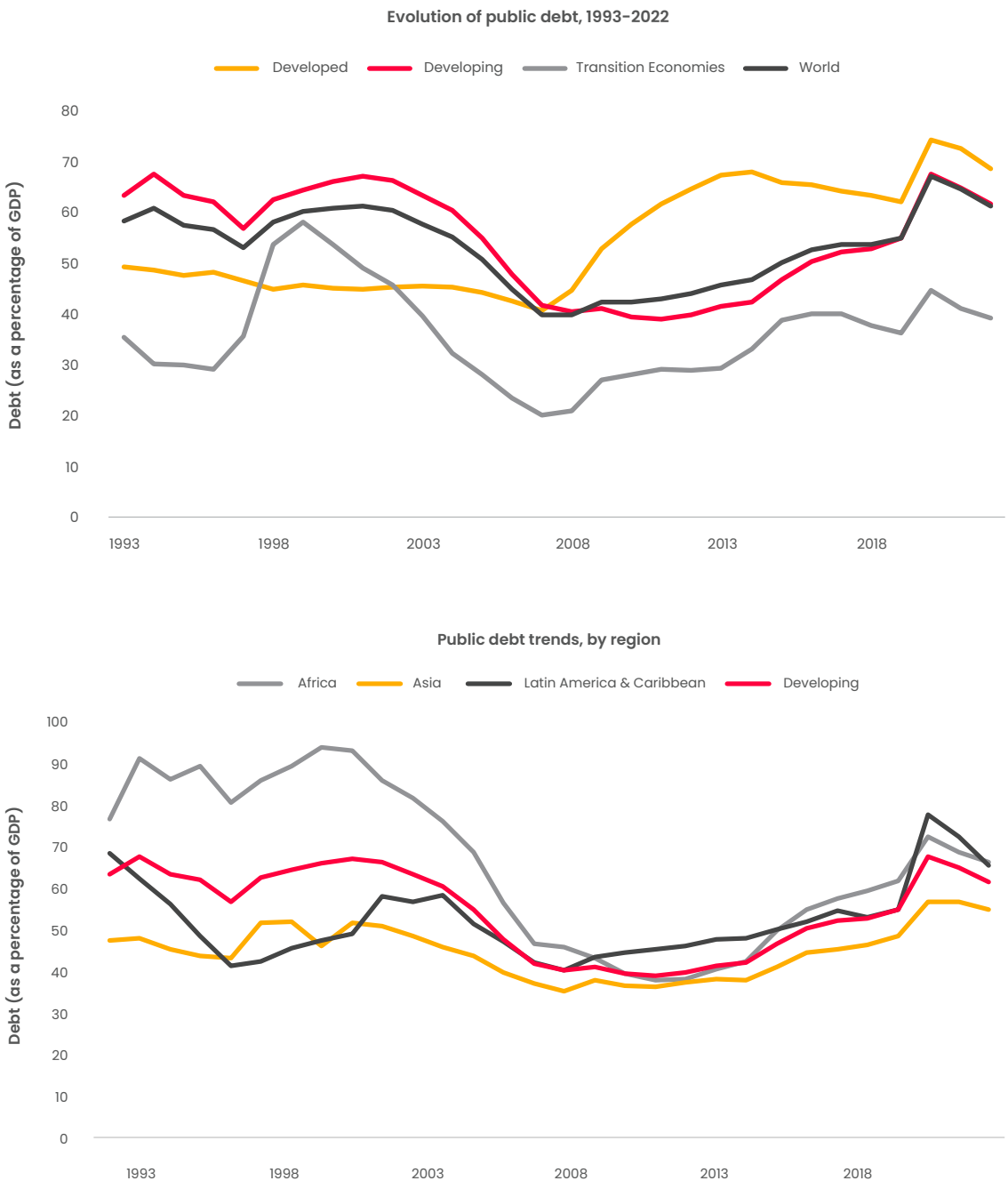
Appendix 1

Figure A1. **Public debt trends, 1993-2022**



Note. Data from **Global Debt Database** (1993–2022) by the International Monetary Fund (1993-2022)

Methods – Technical supplement

The DPTR technique is an advancement of the static panel threshold estimation model of Hansen (1999) and the dynamic cross-sectional threshold model of Caner and Hansen (2004), and captures the dynamic impact of debt on GDP growth. The model considers potential dynamic feedback effects by incorporating lagged dependent variables to understand how past GDP growth influences current public debt levels. This helps understand the full impact of debt on economic growth. The general specification in equation (1) allows only one threshold, but the estimation procedure in Hansen (1999) allows a number of thresholds. Future analysis allowing more thresholds would improve the findings.

The potential endogeneity between public debt and GDP growth is another concern. To deal with endogeneity, equation (1) includes a set of instruments: T-1 moment conditions (lags of dependent variable) as instruments (Caner & Hansen, 2004). Also, high debt levels might not only affect growth but could also be a result of low growth. This reverse causality could lead to biased results. The model explicitly assessed causality considering time variation in debt-growth nexus. This includes contemporaneous growth (indicates causality is ambiguous), five-year forward (leading) average growth (indicates causality running from debt to growth), and five-year past (lagging) average growth (indicates reverse causality from growth to debt). Autocorrelation in the error term for growth means negative shocks to growth are persistent and the shock is passed to the debt process, increasing the level of debt in the long run. Therefore, in a contemporaneous regression, autocorrelation in the growth equation will erroneously lead to the conclusion that public debt is bad for growth. Averaging growth into the future over several years reduces this bias. Therefore, this study focuses mainly on the forward five-year average growth to mitigate bias in the estimates. The model includes year- and country-specific fixed effects to control for unobserved heterogeneity. However, there can still be other time-varying factors at the country level that are not captured. These could influence the relationship between public debt and GDP growth, leading to biased estimates. Therefore, a linear-time trend is included as a robustness check, yet the significance and direction of the results remain the same.