

How Do Debt Forecasts Get Wrong?

Insights and Takeaways for Future Reforms

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Executive summary

In the context of the ongoing review of the Debt Sustainability Analysis (DSA) for Low-Income Countries (LICs), this paper seeks to help shed light on IMF and World Bank macroeconomic projections. DSAs are central to the financial architecture of developing countries. Yet, the ways the projections are performed are rarely accessible to outside researchers.

The first contribution of this paper is to provide a newly constructed database of 605 DSAs conducted from 2013 to 2024. It contains all the information of all published DSAs for LICs in Tables 1 (macro-economic and fiscal) and 2 (external debt dynamics), as well as the shock scenarios. It will be updated regularly.

The second contribution of the paper is to analyze forecast errors concerning public and external debt, as well as the main macroeconomic components. It highlights results on large optimistic biases, with a 10 percentage point underestimation of the trajectory of the debt-to-GDP ratio on average after 5 years. Decomposing this result, it finds that:

1. **Larger countries tend to be more affected by significant positive biases.** Small Island Developing States (SIDS) and vulnerable countries tend to be more accurately forecasted. We interpret this finding as showing the integration of past shocks in the baseline.
2. **It's mostly fiscal:** The main driver of forecast errors is the underestimation of primary deficits, followed by overestimated GDP growth. In particular, forecasting errors on primary deficits stem from overestimated fiscal revenues.
3. **Mixed results post-2017 reform:** While the 2017 reform introduced tools aimed at enhancing forecast realism, biases have persisted. This is evidence of some limited (non-statistically significant) improvements by reducing the optimism bias. This pleads for further disclosure of assumptions. However, given that they were rolled out in 2018, and that COVID-19 made projections difficult, we also caution against too broad interpretation of those results.
4. **DSAs designed in the context of programs perform better on public debt, but worse on deficits:** This tends to show that the IMF tends to overestimate the political feasibility of a program. We find some support for the idea that in LICs, the multipliers are still underestimated.
5. **Influence of country-specific factors:** The study identifies institutional, structural, and cyclical factors influencing these biases, including governance quality, economic diversification, and global economic conditions. Countries reliant on commodity exports tend to have significant forecast biases, particularly optimistic projections for both public and external debt ratios. Countries with fragile governance or in conflict display more pessimistic forecasts for primary deficits and external debt, but overly optimistic growth projections. Countries that have had market access and have build-up debt stocks toward defending market access.
6. **Recession conditions:** DSAs conducted during recessions are associated with strong optimism in public and external debt ratios as well as real GDP growth. This suggests both a tendency to overplay rebound effects and a misconception of the way macroeconomic effects transmit over various phases of the business cycle.

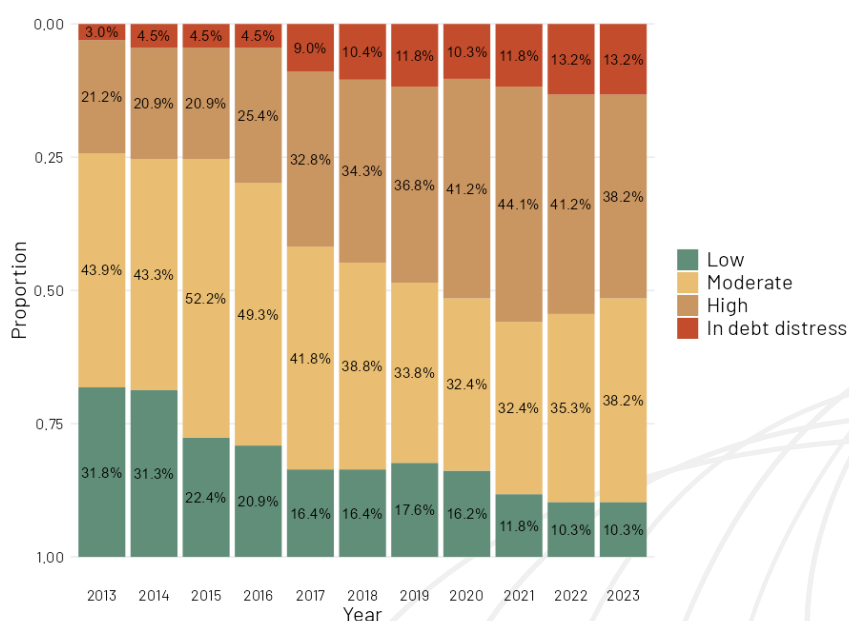
Optimism bias is very hard to control, but it can have large policy consequences on the IMF and its members. By publishing more information on its DSAs, the IMF and the World Bank have allowed

outside scrutiny. The database we are publishing hopefully provides the tools to outside researchers to help this scrutiny, and we hope that this paper is a first example of such exploration.

Introduction

The World Bank-IMF Debt Sustainability Framework for Low-Income Countries (LIC-DSF) is an essential tool to assess debt risks for about 70 poor countries with access to multilateral concessional finance. Between 2013 and 2021, the proportion of LICs deemed at high risk of debt distress by International Financial Institutions (IFIs) rose sharply, from one in four to one in two (Figure 1). The COVID-19 pandemic and subsequent economic shocks weakened debt sustainability in those vulnerable countries. In this new environment, updating the tools to assess distress risk is essential.

Figure 1: Evolution of LIC DSA ratings between 2013 and 2023



DSAs play a crucial role in shaping the risk perceptions of various stakeholders. They also are a key determinant of a country's access to concessional financing from IFIs. For instance, the IMF cannot lend to countries with unsustainable debt, and the concessionality of World Bank loans from its concessional fund, the International Development Association (IDA), is tied to DSA outcomes. Furthermore, DSAs guide debt restructuring efforts by helping set haircut levels. Given the rising concerns and likely increase in requests for support, evaluating the effectiveness and reliability of the LIC-DSF is essential.

In 2023, the World Bank and the IMF launched a review of the framework, which had last been reformed in 2017. The latest LIC-DSF reform was introduced to address some of the challenges of the previous version of the framework established in 2013. The main objectives were to enhance the realism and transparency of DSA projections. The review launched in 2023 should conclude in 2025 and raise a number of points: revised risk-rating methodology (Graf von Luckner 2024), inclusion of climate and nature risks, enhanced accounting of domestic debt dynamics, along with other dimensions.

This paper seeks to contribute to the reform by focusing on one central aspect of the reform: **To what extent have DSA forecasts for LICs improved in accuracy post-2017, and what factors contribute to**

any persisting biases? To answer this question, we have created a new database aggregating the projections made for public and external debt ratios in 605 DSAs conducted for 68 LICs between 2013 and 2023. Using this data, we evaluate forecast errors for public debt, PPG external debt, primary deficits, and real GDP growth across a broad sample of LICs. The analysis covers a range of periods before and after the 2017 reform, allowing for a comparative assessment of forecast accuracy over time. One of the contributions of this project is to publish the dataset available [here](#), allowing a broader engagement of the research community with projections.

We find four major stylized facts in the way DSAs are conducted:

- **Persistent optimistic bias on debt and growth:** DSA forecasts tend to underestimate debt accumulation while overestimating real GDP growth. The degree of over-optimism increases with time. External debt is better forecasted than domestic debt.
- **Projections for Small Islands Developing States (SIDS) are different:** The group of SIDS (as defined by the United Nations) is heterogeneous. It makes up half of the countries covered by the LIC-DSF, representing a substantial share of our sample. A key result is that forecasts often reflect a more pessimistic outlook compared to larger countries, likely driven by anticipated economic impacts of potential natural disasters.
- **Mixed results from the 2017 reform:** While the reform introduced valuable tools for improving forecast realism, the results suggest that significant biases remain for overall debt, especially regarding domestic debt projections.
- **DSAs in the context of IMF programs show optimism about the ability of countries to consolidate.** DSAs for IMF programs are different, as projections stem from an agreement with authorities rather than relying on the “most likely policies” assessed by the IMF and the World Bank. Additionally, they often involve greater scrutiny of data, especially related to domestic debt. The results seem to show that the IMF may have over-emphasized the ability of countries to conduct consolidations.

This paper is structured in five sections: Section 1 reviews the literature explaining persistent forecast errors. In addition to data uncertainty, over-optimism is general and tends to have negative policy consequences for developing countries. Section 2 provides an overview of the data sources and methodology used in the analysis. Section 3 describes the main headline results: large optimism bias for larger economies and limited or no bias for small development states. Section 4 tries to explain these findings by linking them to structural factors (governance and economic structure), policy decisions (IMF programs), and economic cycles. Section 5 summarizes the results, finding that despite difficulties in forecasting, half of the forecast error could be reduced by taking the “known unknowns” into account.

1. Why debt sustainability analyses matter

Debt sustainability analyses and their projections have a direct impact on the policies of the IMF and the World Bank. For low-income countries, they matter because the risk of debt distress will change the terms of financial support provided by the World Bank and also how access is determined in IMF policies. The risk of debt distress is also tracked by private investors. In short, the DSA is also a tool for surveillance and policy advice: countries seek to lower their assessed risk. For all of this, projections of growth and economic policies are central. They are only one part of the DSF; another important component is a risk model to compute the probability of distress given these projections (Graf von Luckner 2024).

Researchers from within these institutions and independent scholars alike have tried to quantify and propose reforms to attenuate forecast errors. The existence of an “optimistic bias” is well documented, including from IFIs themselves and their evaluation offices. Methodologies differ but there is a consensus on the fact that IMF and WB projections are optimistic and tend to be more biased as the horizon lengthens¹. Recently, Estefania-Flores, Furceri, Kothari & Ostry (2023) studied medium-term public debt forecasts for an unbalanced panel of 174 countries between 1995 and 2020. Their findings confirm that the IMF’s projections suffer from optimistic biases increasing in magnitude with the horizon and find that, on average, actual debt ratios are higher than 5-year projections by around 10%. On average, there are no differences in the size of biases between advanced and developing countries, but optimism is a recurring pattern in developing countries, while it follows solely from unpredicted recessions in advanced economies. Finally, they also note that optimism biases on the debt-to-GDP ratio are only partly driven by optimism on real GDP growth and fiscal balances. The literature also documents such patterns for projections from private actors and other public institutions.²

Over-optimism can lead to policy mistakes. Civil society organizations contend that IMF over-optimism is symptomatic of the institution’s reluctance to advise for pre-emptive restructuring. Rehbein (2020, 2022, 2023) argues that the IMF tends to advocate for fiscal consolidation as a solution underpinned by optimistic macroeconomic outlooks or over-confidence in the ability of governments to reduce primary deficits. Raga (2024) uses the World Economic Outlook and finds an average debt-to-GDP underestimation of about 10 to 15 percentage points, depending on the period. Looking across individual restructuring cases, she identifies instances of optimism about the ability of countries to consolidate. Over-optimism can also reduce debt relief, for instance, in Zambia and Sri Lanka³. Beaudry

¹ Baduel and Price (2012), IEO (2014), Ho and Mauro (2014), Panizza (2015), Mooney and de Soyres (2017), IEO (2021) and IEO (2023)

² Forecasts made by private actors and other public actors suffer from similar limitations as can be observed in Timmermann (2007), An, Jalles & Loungani (2018) and Estefania-Flores et al (2023) who find that forecasts from the official and the private sectors perform similarly. Gatti et al (2024) show that data quality can be responsible for growth forecast errors in predictions made by both IFIs and the private sector, even after controlling for country’s institutional and conjunctural state. Forecast errors are large (around 1.5%) and subject to regional biases, especially Middle East and North Africa. Countries with the largest biases largely stem from MENA or Sub-Saharan African and are small for fragile states. Overall, forecast errors remain for all predictors even though WB projections display less optimism than those performed by the IMF.

³ The observation had already been put forward in the IMF 2018 Review of Program Design and Conditionality, 2022 Management Implementation Program and the 2024 Operational Guidance Note on Program Design and Conditionality. Beyond the need to rethink policy recommendations, the IMF supported the argument that baseline projections were biased and that evaluations should improve the inclusion of more prominent risks.

and Willems (2022) show that over-optimism of IMF mission chiefs can lead to lower growth outcomes and more public and private debt accumulation. These results confirm Ley & Misch (2014)'s conclusion that over-optimism has greater consequences for LICs given that social safety nets are largely absent. Debrun et al. (2019) also document how optimism can lead to too much borrowing and pave the way for harmful market reactions.

But if this is the case, why are IFIs unable to better discipline their debt forecasts? First and foremost, because, as Yogi Berra knew better than anybody else, "it is tough to make predictions, especially about the future". Assessing Debt Sustainability remains a "mission impossible" in Wyplosz's (2011) words because debt projections are very sensitive to assumptions about growth, budget outcomes and interest rates, which, if difficult to predict per se also prove to be endogenous to debt projections themselves. The timing of economic crises is almost impossible to predict, and interactions between policymaker's choices, economic cycles, and markets are poorly understood. Fiscal multipliers, which lead to underestimating the contractionary effect of consolidations⁴, can vary across the cycle.

Beyond economic models, poor data quality, whether due to a lack of statistical capacity, or due to "hidden debt", is a major constraint. While the World Bank has documented recent progress in data coverage of debt, transparency remains a major issue in LICs (WB 2021, Rivetti 2022). In LICs, projections are inherently more complicated due to poor statistical quality and other data-related factors. Horn, Mihalyi, Nichol & Sosa-Padilla (2023) document, for 140 countries over the last 50 years, the pattern of hidden debt revelations. These are large and frequent, with an average revision of 1% of GDP. They tend to be contracted during economic booms and reveal themselves amid crises, often through debt reconciliation under a restructuring process or an IMF program. Ley & Misch (2014) identify three compounding factors related to output data revisions: (i) worse data quality given informal and hidden economic activity; (ii) more frequent revisions to output growth and GDP levels; and (iii) a greater vulnerability to shocks.

2. Data and methodology

1. New database on recent DSAs (2013–2024)

We construct a new database including key quantitative elements from DSAs published between 2013 and February 2024⁵ for an unbalanced panel of 68 countries⁶. We extract information from a set of standardized and commonly available tables: (i) the two tables detailing the baseline projections for Public Sector Debt Sustainability and for External Debt Sustainability, which document macroeconomic and fiscal projections in the baseline, and (ii) the sensitivity analysis for Public Sector and PPG External Debt which indicates how Debt Burden Indicators respond to the stress tests scenarios analysis.

DSAs are produced at least once a year as part of the IMF Article IV surveillance procedure and of the WB IDA credit-grant allocation procedure⁷. They can also be produced outside of these regular cycles when countries request IMF financing or WB non-concessional borrowing. Under IMF programs,

⁴ Raga (2024)

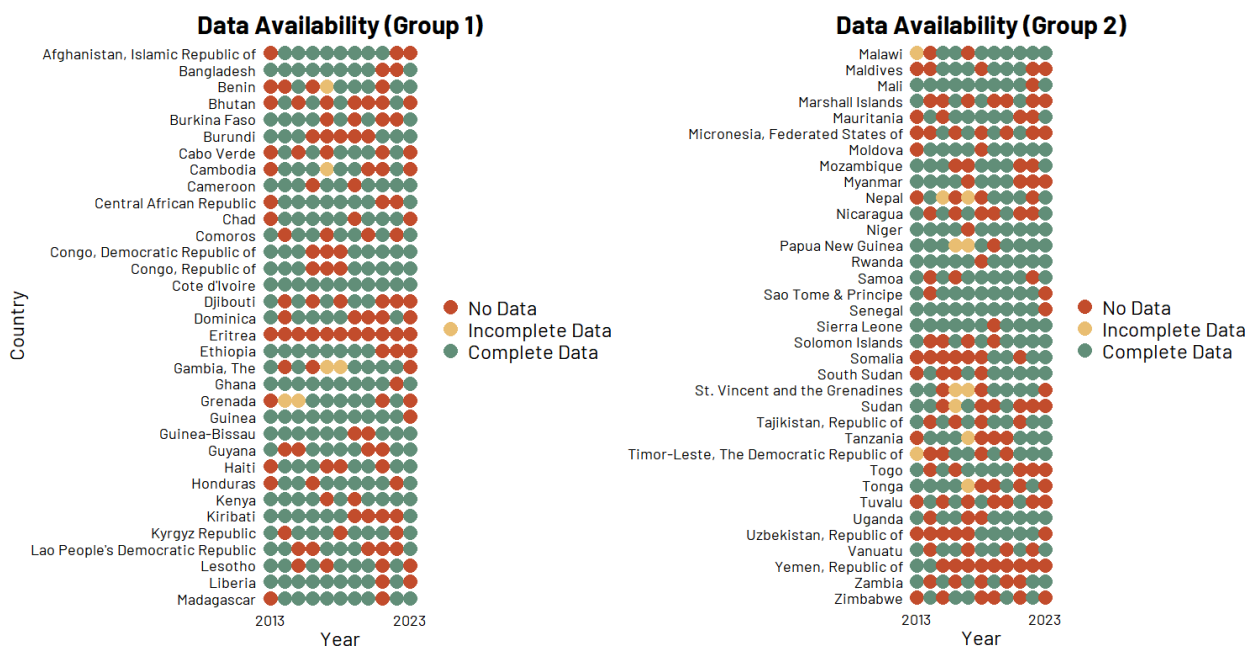
⁵ The last DSA in our database was published in February 2024 for Timor Leste.

⁶ In practice, the LIC-DSF applies to 69 countries, but no data was available for Eritrea.

⁷ With some exceptions: in some cases, DSAs are not published; while some DSAs can be published less frequently than one year for SIDS.

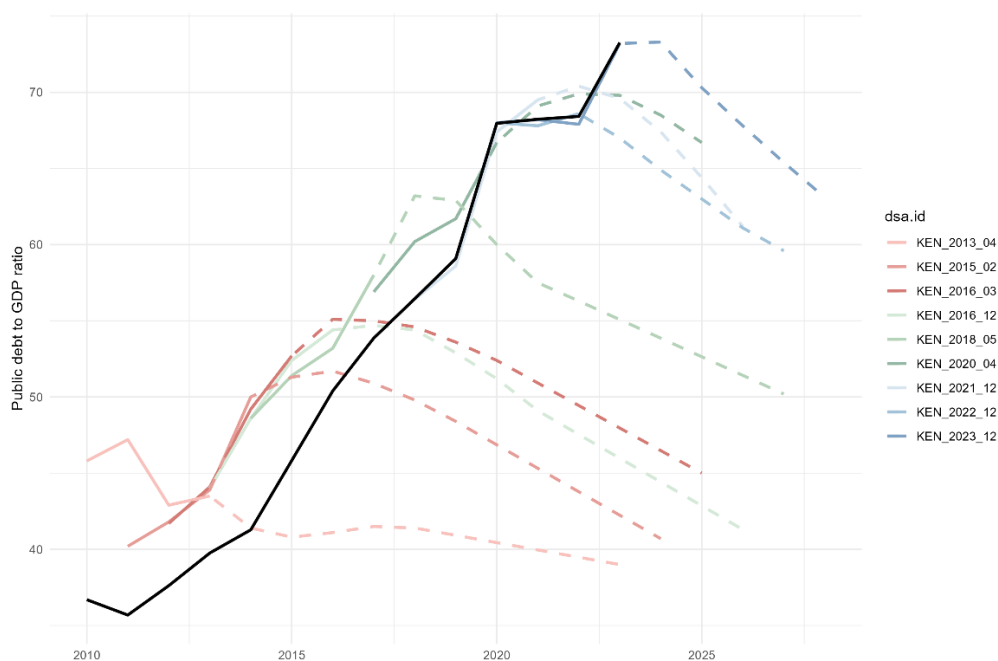
DSAs are also produced at every program review. The database, therefore, covers 605 DSAs, with a median and an average of 7 DSAs per country. Yemen displays the fewest available DSAs (only 2 in 2013 and 2014) and Côte d'Ivoire has the highest (11 in total). Overall, data availability is limited for Small Islands and Developing States as well as for conflict-afflicted countries. Figure 2 below details data availability by country-year. For countries that report multiple DSAs each year, we focus on the most recent information available per year, so as not to bias our results based on countries with greater representation. This leads us to focus on 504 DSAs.

Figure 2: Data availability

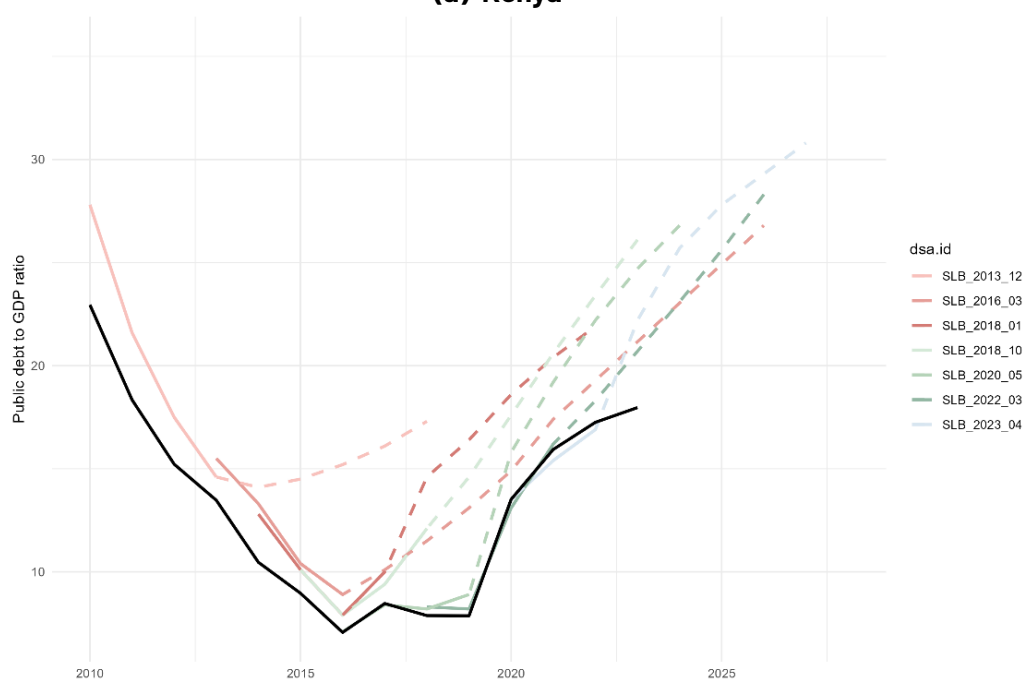


By collecting the most quantitative data on key macroeconomic and debt variables across DSAs, we can evaluate them against actual outcomes. Figure 3 below illustrates two distinct scenarios, which set the foundation for the remainder of our research. In the case of Kenya, DSAs systematically underestimated debt accumulation. Following the GDP rebasing in 2019, the black line falls below the plain lines representing the actual evolution. Nevertheless, despite this adjustment, the dynamics of debt accumulation were largely missed by projections (the dotted lines). The case of the Solomon Islands shows the reverse tendency to pessimism: projections tend to rise faster than actual results. These two illustrations underline our overall findings: large and persistent over-optimism for “large” LICs and weak pessimism for SIDS.

Figure 3: Realized (black) and projections (colors) of debt to GDP ratio by DSA vintage



(a) Kenya



(b) Solomon Islands

2. Estimating forecast errors: methodological challenges

Reconstructing forecast error time series is a tedious task. National statistics undergo regular changes and revisions, such as GDP rebasing; changes in the definition and scope of public sector debt, or the materialization of contingent liabilities that directly affect debt stocks. For example, Figure 3 highlights a mismatch between realized and historical debt-to-GDP ratios for Kenya before 2019, which resulted from a GDP rebasing. Consequently, significant and persistent variations can arise between

the time series taken from official sources today and the historical and projection times series used in the DSA. These data inconsistencies make direct comparisons between the datasets extremely challenging.

To overcome these challenges, we follow the methodology outlined in Mooney and de Soyres (2017)⁸.

Take a DSA in a given vintage v . Typically, the last actually observed year by the IMF/WB is the previous one, $v - 1$ ⁹. We call this last observed year of data the “reference” and are going to be interested in how much a given variable is going to evolve from the reference to various horizons. Because later revisions of series can change both the variable as projected and the reference, our variable of interest is the difference between the projection at horizon h and the reference. We compare this to “actual” outcomes of this difference, using the latest published World Economic Outlook (April 2024) or International Debt Statistics (December 2023) as the realized value.

The forecast error of variable y , $FE^{v,i}(y_{t+h})$, for country i , in vintage v , at horizon h writes:

$$FE^{v,i}(y_{t+h}) = (R^i(y_{t+h}) - R^i(y_t)) - (P^{v,i}(y_{t+h}) - P^{v,i}(y_t))$$

where $R^i(y_{t+h})$ is the actual realized value of the variable y in year $t + h$ reported in the WEO/IDS¹⁰, $P^{v,i}(y_{t+h})$ is the projected value of y in year $t + h$ reported in vintage v . Here t represents the last year with known values (i.e. not projected) in the DSA, typically one or two years prior to the publication year.

For instance, consider a DSA published in 2015. If the observed debt / GDP ratio in 2014 was **60** and the projection for 2017 is **70**, the forecasted evolution is **10**. We compare this forecasted evolution to the actual evolution, which we take from the IMF World Economic Outlook. But for a given country, it is frequently the case that the value of debt-to-GDP for 2014 reported in 2024 is different from the one which was reported in 2015. These pervasive data revisions require to correct the measure both of the initial value and the forecasted value. For instance, if GDP was rebased upwards in 2022, as occurs about every 10 years in developing countries, all GDP series will be revised, and thus debt / GDP will be revised downwards retrospectively, even for 2014. Suppose that with revised GDP series, debt / GDP in 2014 is now considered to be **40**, and that debt / GDP in 2017 was actually **60**, the rise was actually **20**. The forecast error will then be:

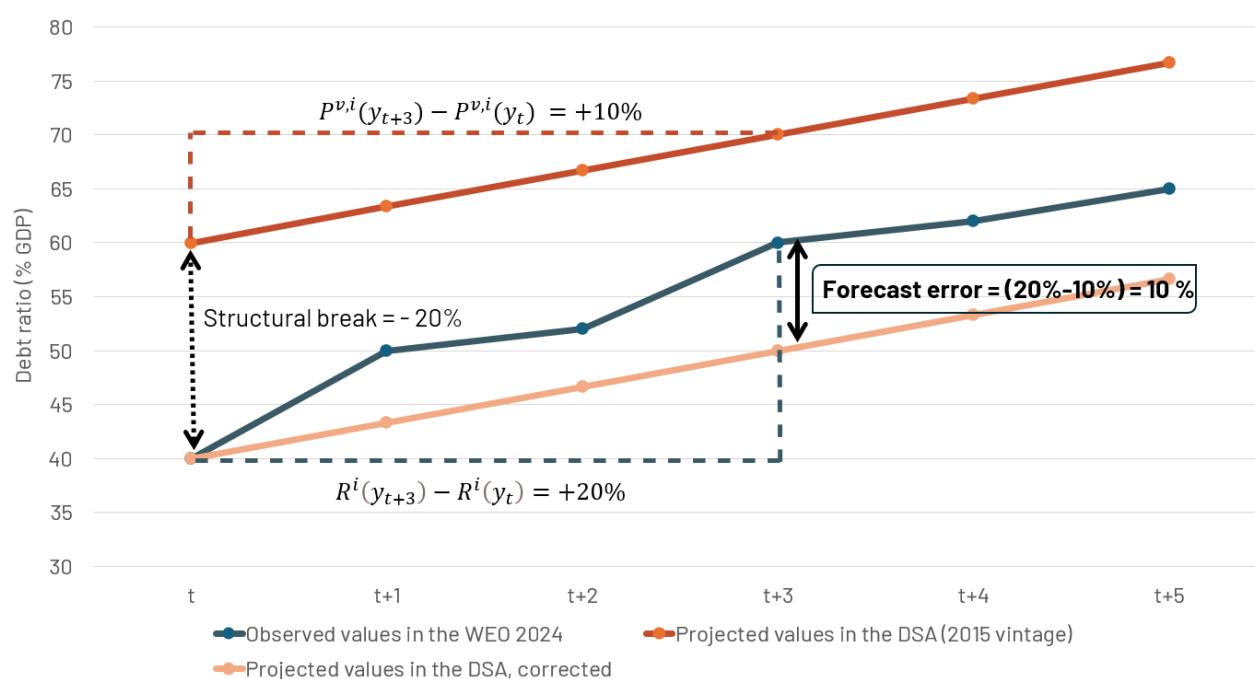
$$FE^{v,i}(y_{t+3}) = (60\% - 40\%) - (70\% - 60\%) = 20\% - 10\% = 10\%$$

⁸ In their paper, this is their second measures or error.

⁹ In some cases, especially when the DSA is published early in the year, the last observed year of data (as opposed to estimated) is $v - 2$. We then consider forecast errors starting from that reference point.

¹⁰ Realized values for the public sector are sourced from the World Economic Outlook (April 2024) and from the International Debt Statistics (IDS) published in November 2023 for the external sector.

Figure 4: Illustration of the error measurement



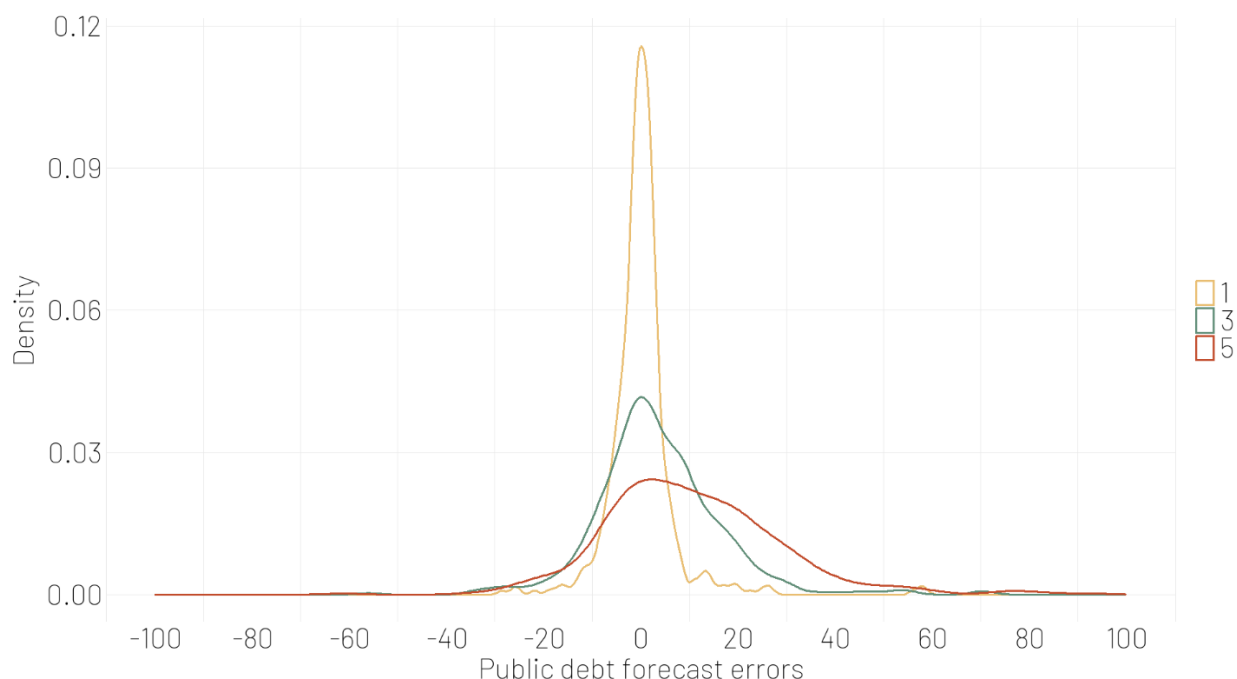
Positive errors indicate the extent to which a variable’s actual value exceeds expectations, signifying an error of “underestimation”. For some variables, an underestimation can convey “optimism”. This is the case for a debt ratio, where a positive error suggests that projections were overly optimistic. Conversely, for real GDP growth, a positive error indicates pessimism, as it reveals a higher growth rate than anticipated, reflecting pessimistic expectations.

3. Projections of public debt: an exercise in managing uncertainty

1. Projections errors can become large at 3 years horizon

An initial notable finding is that significant errors can occur even over short timeframes. Figure 5 below presents the distribution of forecast errors for the public debt to GDP ratio based on various projection horizons (1, 3, and up to 5 years). One visually striking result is that errors are large on both sides. They are centered around 0 in year 1, but tails are already large: errors of more than 10 percentage points of GDP the year after the projection are infrequent, but not exceptional: they represent about 8.3% of the sample. The error distribution is skewed to the right, indicating that realizations exceed initial forecasts. As horizons widen, errors become larger (tails are fatter) and move to the right: optimism creeps more in the medium run. The proportion of deviations exceeding 10 percentage points of GDP in absolute terms rises from 8.3% after 1 year to 33% after 3 years, and further to 54.6% at a 5-year horizon (47% “highly optimistic” with more than 10 percentage points above forecasts, and 7.6% below 10 percentage points of GDP below forecast). This initial observation is congruent with the existing literature on past DSA reforms.

Figure 5: Errors distribution of public debt-to-GDP ratio by projection year
(Negative = pessimism; Positive = optimism)



The magnitude of errors varies across countries and types of variables. On average, errors are actually close to accurate in the short run but tend to shift towards optimism over longer periods. When considering the debt to GDP ratio, along with external debt to GDP, real GDP growth, and primary balance to GDP, the overall point remains consistent. Table 1 shows the mean and median errors by horizon for these four variables. On average, there is a small (and statistically insignificant) pessimistic bias at horizons 1 and 2, which then turns into (high and significant) optimism after horizon 3.

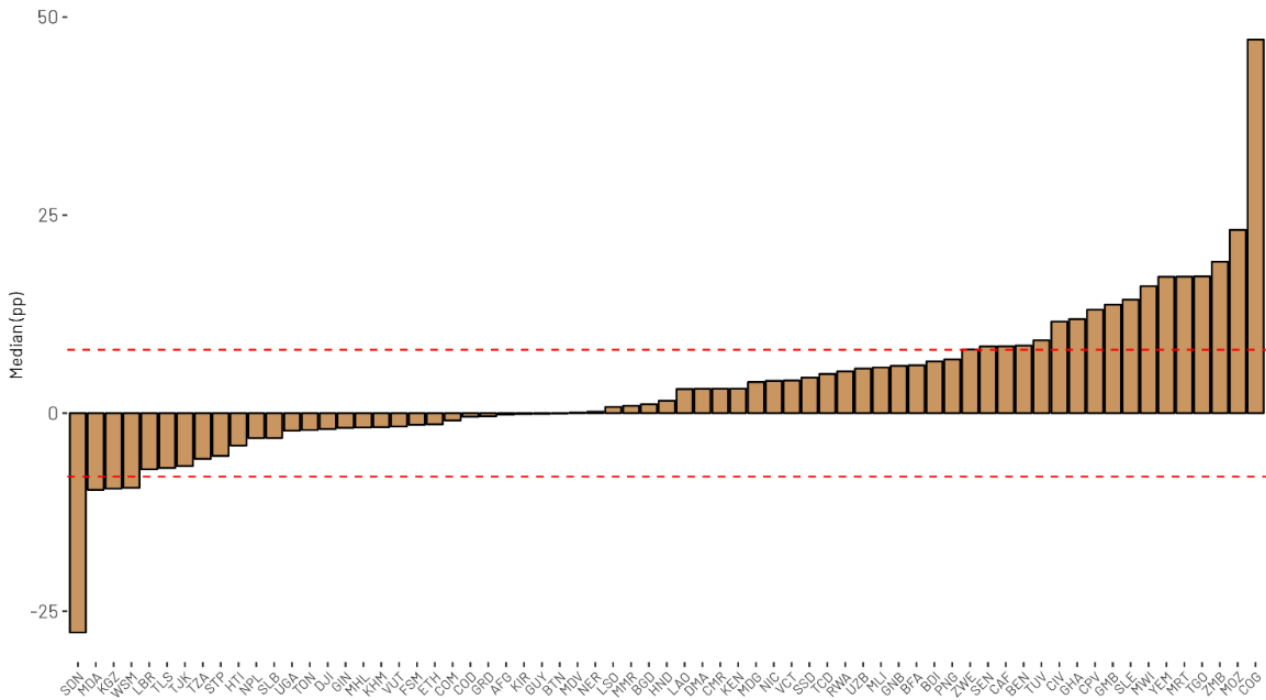
Table 1: Overview of Forecast Error Statistics

Variable	Statistic	Horizon 1	Horizon 2	Horizon 3	Horizon 4	Horizon 5
Public debt to GDP	Mean	0.23	1.98	4.37	8.12	11.34
	Median	-0.05	0.74	2.26	5.31	8.80
External PPG debt to GDP	Mean	-0.61	-0.43	0.53	1.86	3.60
	Median	-0.57	-0.66	0.37	1.06	2.53
Primary deficit to GDP	Mean	-0.72	-0.49	0.13	0.81	0.99
	Median	-0.28	-0.06	0.60	1.27	1.49
Real GDP growth	Mean	0.20	-1.20	-1.70	-2.10	-1.74
	Median	0.07	-0.50	-0.84	-1.25	-1.22

Are errors affecting specific countries differently? We start with errors in the public debt ratio (to GDP, as will be the case throughout). By taking the median over the years, we can assess how countries, in general, are assessed. On the right side of figure 6 are countries where optimism has been most striking, with Congo and Mozambique figuring as the highest, indicating that hidden debt likely plays an important role. Other countries, and especially SIDS, tend to have smaller, or even negative median errors in their public debt projections¹¹.

¹¹ See the appendix for figures 5 and 6 with other key variables.

Figure 6: Median 3-year forecast errors of public-debt-to-GDP ratio by country
(Negative = pessimism; Positive = optimism)



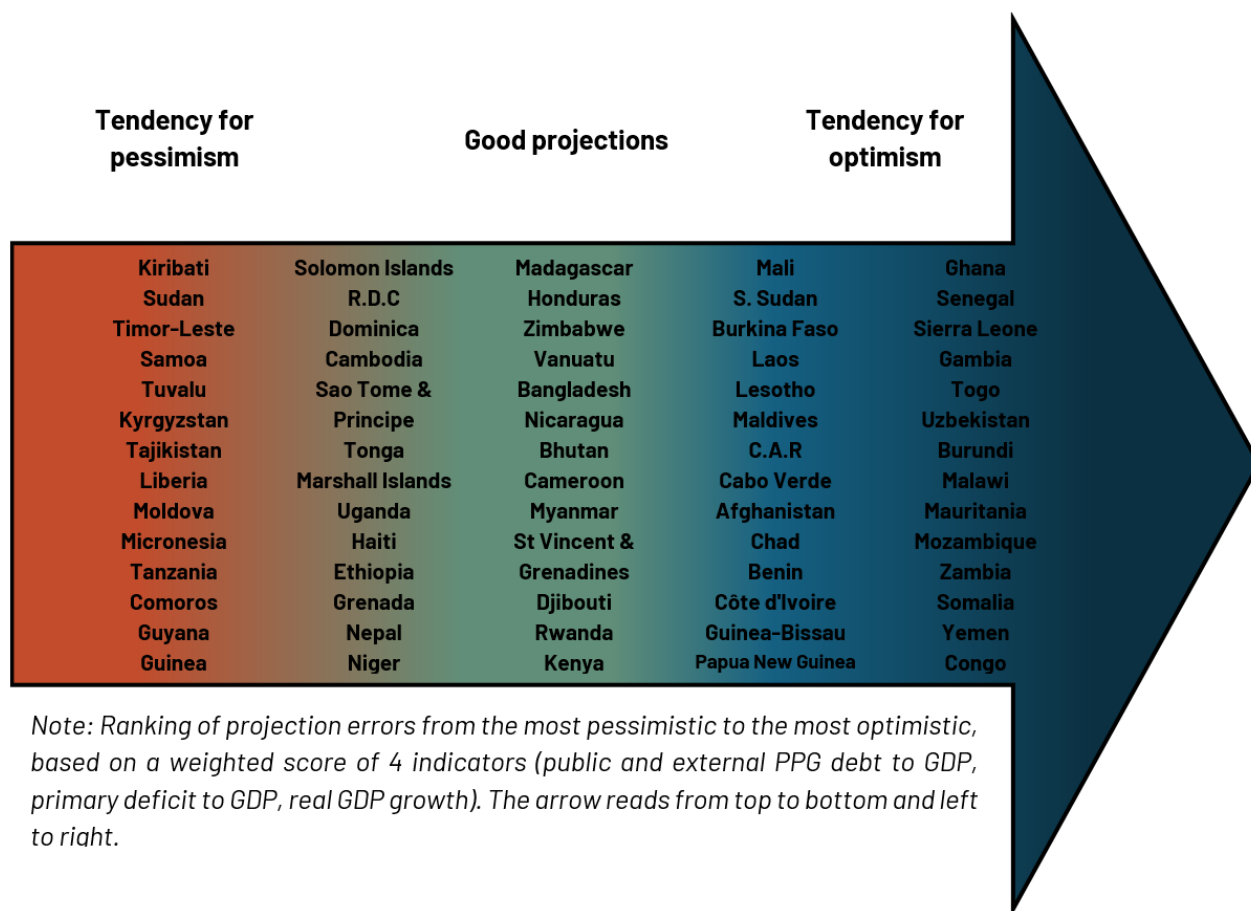
We repeat the same exercise for the main variables driving DSA results and find systematic differences across countries. We further aggregate the information from the four indicators into a composite indicator¹². Figure 7 classifies countries according to this score, with the most pessimistic projections located in the top-left corner and the most optimistic projections in the bottom-right. This arrangement follows a reading order from left to right and top to bottom.

¹² To aggregate this data and differentiate between optimistic, pessimistic, and accurate projections, we build a composite score calculated as follows:

$$SCORE_i = \frac{1}{4} \left(\frac{x_{pub,i} - \bar{x}_{pub}}{\sigma_{pub}} + \frac{x_{ext,i} - \bar{x}_{ext}}{\sigma_{ext}} + \frac{x_{pdef,i} - \bar{x}_{pdef}}{\sigma_{pdef}} - \frac{x_{gwth,i} - \bar{x}_{gwth}}{\sigma_{gwth}} \right)$$

where $x_{k,i}$ is the median 3-year forecast error of country i for indicator k , \bar{x}_k the mean of the medians for indicator k and σ_k the standard deviation of the medians for indicator k .

Figure 7: Classification of country projections according to our composite indicator



Small Island Developing States (SIDS) are overrepresented among countries with pessimistic projections. Out of 20 SIDS, 7 fall into this group, with another 7 closely bordering it. Notably, none of these countries are classified as having optimistic projections. Conversely, countries in the Sub-Saharan Africa region tend to be assessed with more optimism.

2. Public debt and deficits tend to see the largest deviations

To account for the broad heterogeneity in projection results, we ask how errors evolve on a 5-year horizon. We run the following panel regression model on our unbalanced sample of country-year-DSA units of observation for each variable in the DSA¹³:

$$FE^{v,i}(y_{t+h}) = \sum_{k=0}^5 \beta_k \cdot I(k = h) + \gamma \cdot D_{covid}^{v,t+h} + \epsilon_{t+h}^{v,i}$$

where $FE^{v,i}(y_{t+h})$ is the forecast error for variable y in year $t + h$, country i for DSA vintage v . The set of β_k coefficients captures the average error, for each projection year. Since we aim to capture country-specific effects, we consider that a global shock such as the COVID-19 recession would add noise to the results. In all regressions, we therefore control for COVID's impact with a specific dummy $D_{covid}^{v,t+h}$, which equals 1 if the DSA vintage is pre- 2020 and if $t + h$ is larger or equal to 2020.

¹³ To tackle heteroskedasticity and ensure robust standard errors, we use the Huber-White estimator.

Forecast errors grow with time and become large at 3-to-5-year horizons, but more so for public debt than external debt. Figures 8- a and b present point estimates and margins of error for average forecast errors over 1- to 5-year horizons for debt stock ratios. The results confirm earlier observations: DSAs underestimate the rate of public debt accumulation, with this optimistic bias increasing as the forecast horizon lengthens. SIDS are clearly distinct in the way their debt is forecasted. Public debt tends to be slightly – but not significantly underestimated.

External public debt projections are less optimistic, suggesting that the overall optimism is primarily driven by domestic debt stocks. Up to two years, external debt tends to be slightly underestimated for non-SIDS, but this reverses at later horizons, reaching 4 percentage points of GDP after year 5. SIDS display a pattern like public debt ratios.

Figure 8-a: Forecast errors of public debt to GDP

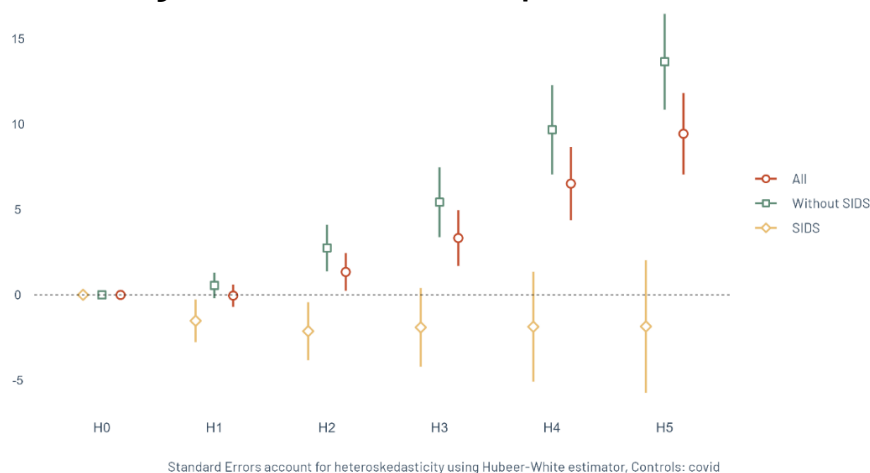
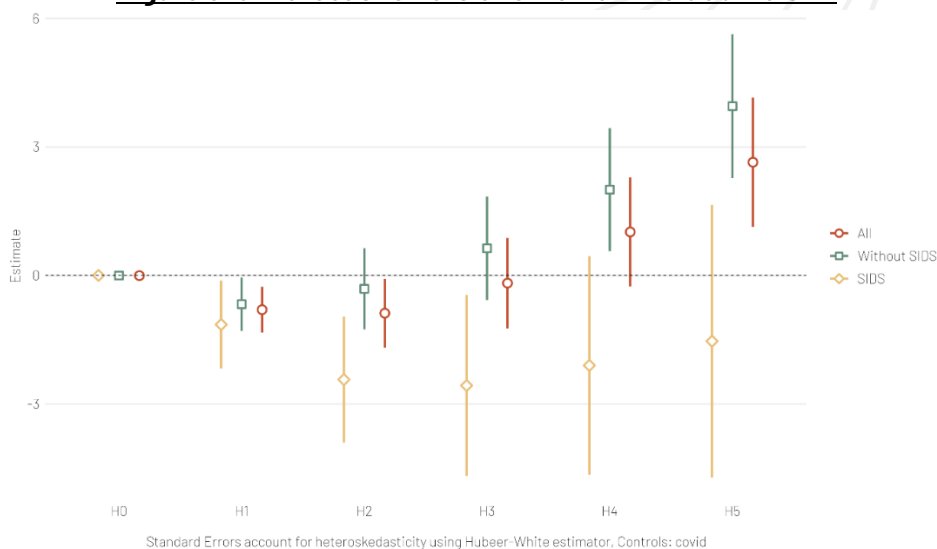


Figure 8-b: Forecast errors of external PPG debt to GDP



Where do these errors come from? It is important for the reform to understand whether assessments by the IMF and the World Bank on debt stem from over-confidence on growth, or from over-confidence on the ability of countries to maintain fiscal discipline. With similar regressions as before, we find that results differ for SIDS and non-SIDS, especially with respect to fiscal policy. Primary deficit projections

for non-SIDS are optimistic, underestimating by over 1 percentage point of GDP after four years. Cumulated, this would explain about 4.5 percentage points in public debt increase. The underestimation of the primary deficit is primarily driven by an overestimation of revenues, typically by about 1 to 2 percentage points of GDP. This is important because fiscal revenues are not only important as a factor behind debt dynamics, but also express the ability of governments to repay: a key indicator in the LIC-DSF is the external debt to revenues ratio. On average, assessments overestimate revenue generation by 1.5 percent of GDP after 5 years (we include grants in this concept of revenues but excluding them does not affect results). It seems that, on average, the ability to forecast public expenditures is more accurate. As a result, actual deficits end up being substantially higher than forecasted.

For SIDS, revenues tend to be consistently underestimated, much more than they are for expenditure. As a result, there is a significant overestimation of the primary deficit. It is important to note that the uncertainty bands are also higher, due to the diversity among these countries. Their insular and vulnerable nature makes the forecasting exercise different, with specific guidelines developed by the IMF and World Bank economists to account for the possibility of natural disasters (box 1). Those guidelines can, in part, explain why, on average, SIDS seem to be assessed with large errors in the other direction than non-SIDS.

Figure 9-a: Forecast errors of primary deficits to GDP and its components (non-SIDS)

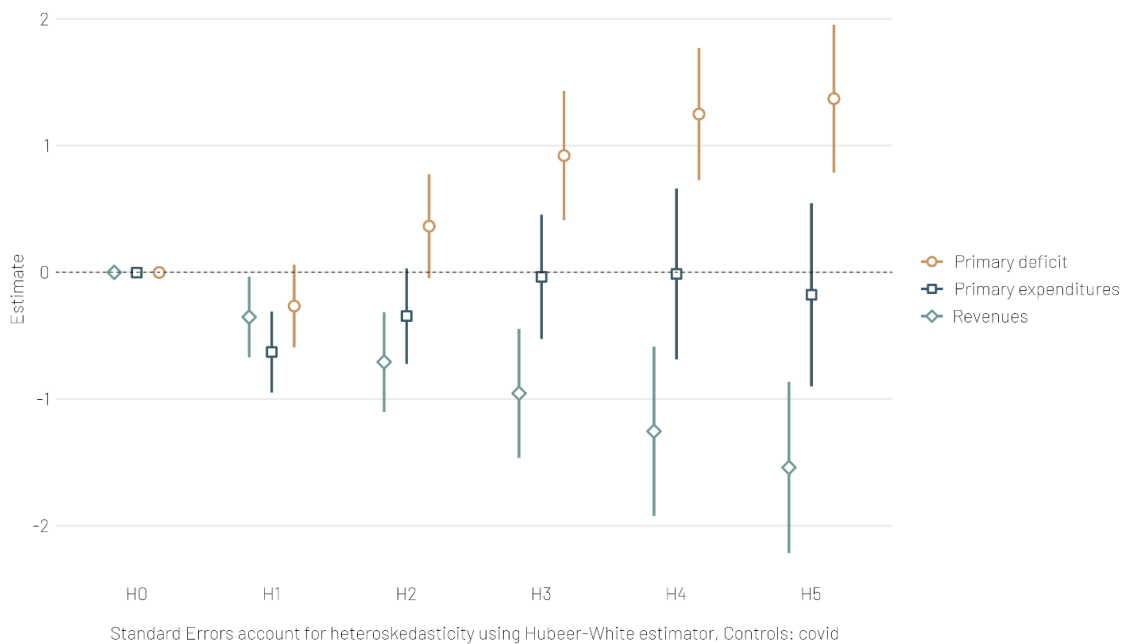
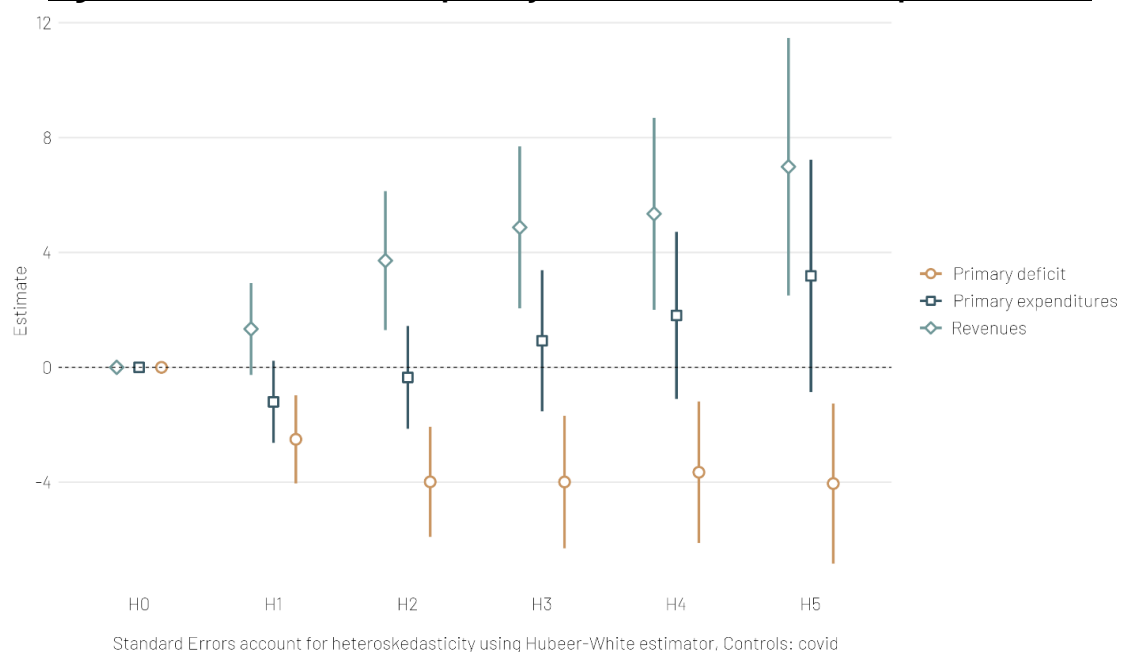
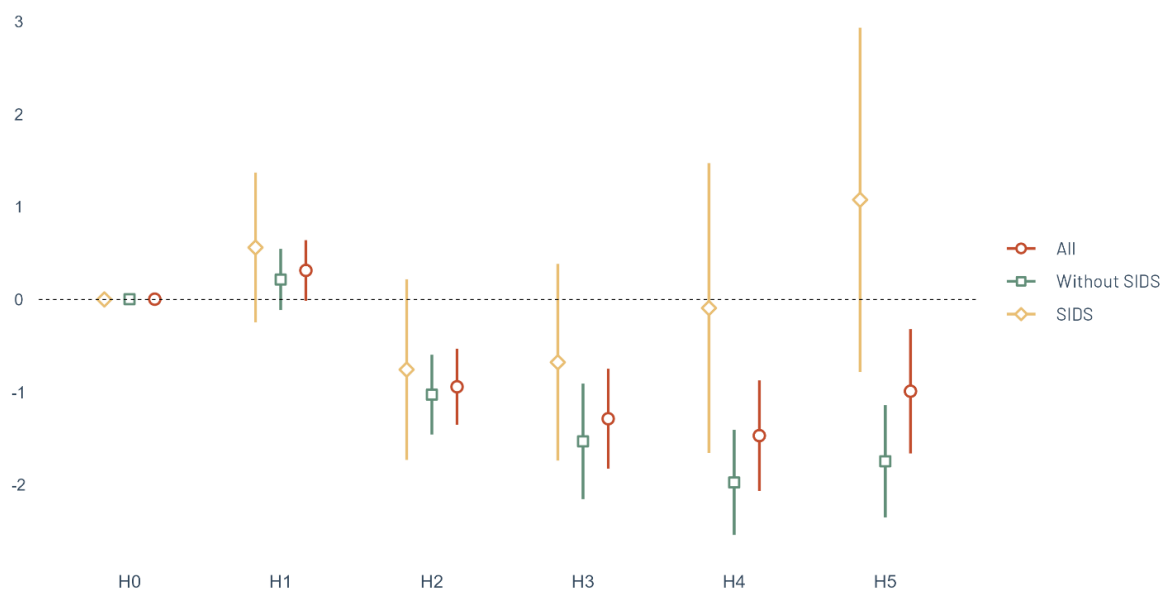


Figure 9-b: Forecast errors of primary deficits to GDP and its components (SIDS)



Growth also plays an important role in explaining debt slippages. For the year ahead, projections for GDP growth are generally accurate for both groups (figure 10). They become increasingly optimistic for non-SIDS countries as growth projections are overestimated by 1 to 2 percentage point by year, resulting in a total average slippage of 6% in real GDP compared to initial projections. SIDS' projections are not statistically different from realizations at the various horizons. Nevertheless, they display interesting dynamics as they also tend to be optimistic at a 2-year horizon but become less optimistic over the long term. At a 5-year horizon, they even become pessimistic, with growth underestimated by 1 percent.

Figure 10: Forecast errors of real GDP growth



Standard Errors account for heteroskedasticity using Hubeer-White estimator, Controls: covid

Box 1: Why are Small Islands and Developing States assessed in a “pessimistic” manner?

Small Islands and Developing States (SIDS) are disproportionately vulnerable to natural disasters relative to the size of their economies. These climate-related disasters are not only more frequent but also more devastating in terms of cost impact. For instance, the impact of Cyclone Evan in 2012 resulted in damages of 28% of Samoa’s GDP, while, in 2017, Hurricane Maria’s economic devastation represented more than 200% of Dominica’s GDP. Generally, these countries are more susceptible to climate shocks such as rising sea levels, rising temperatures, and changing rainfall patterns. This heightened vulnerability affects macroeconomic performance. It reduces real growth due to lost production and worsens fiscal balances through reduced tax revenues and increased expenditures. This situation often leads to increased borrowing, which usually comes at higher costs¹⁴.

This creates complications for modelers: how to account for uncertain but probable large shocks over the medium run? In practice, the IMF/WB operational guidance has evolved: in August 2024, it asked country teams to reflect the risk of disasters in the baseline. The World Bank evaluation office notes that “climate change considerations were incorporated in almost three-quarters of baseline projections and in over four-fifths of tailored stress tests” of SIDS’ DSAs (IEG 2023). Nevertheless, the official guidance was to only incorporate climate change or natural disasters in their baseline beyond 5 years by factoring in the average annual expected impact of such events. For instance, if, on average, a hurricane occurs once every five years and reduces growth by 2.5 percentage points, projected growth will be reduced by 0.5 percentage points per year. For projection horizons up to five years (medium-term projections), the guidance on forecasts excluded shocks, except through tailored stress tests. Our results suggest that prior to the official guidance, a degree of such accounting for possible shocks was already happening in practice.

¹⁴ Cevik and Jalles (2021) suggests that an increase of 10 percentage points in climate change vulnerability is associated with an increase of over 150 basis points in long-term government bond spreads for emerging markets and developing economies

This has several consequences: on average, projections exhibit a pessimistic bias. Public debt is slightly overestimated (around 1.8 percentage points of GDP), whereas, for other countries, the ratio is underestimated and reaches 13.7 percentage points of GDP at horizon 5. This is mostly due to pessimism on the primary balance, about-right GDP projections, and pessimistic projections on financing options (countries obtain better terms than initially expected by the projections). A possibility, often raised by SIDS, is that this pessimism reduces their access to credit.

4. Explaining forecast errors: IMF programs, crises and governance

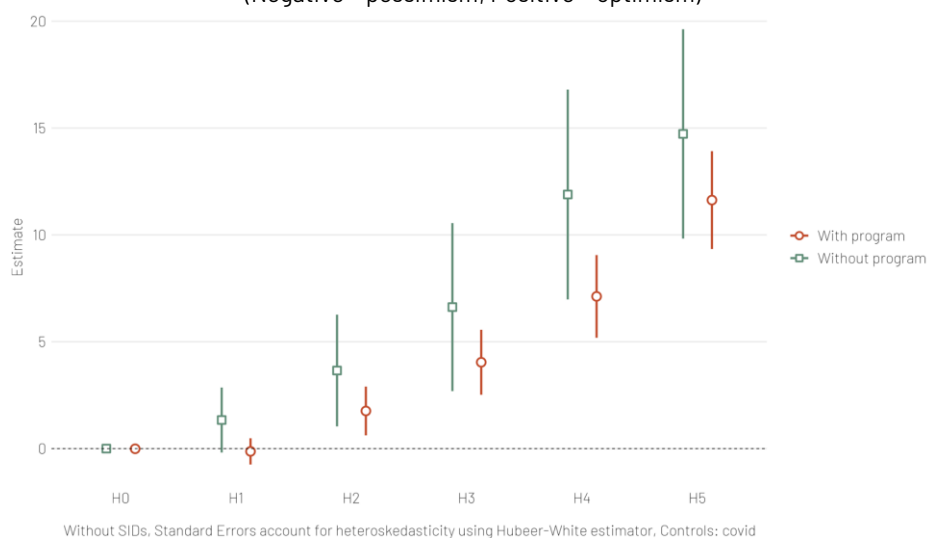
What causes these systematic optimistic errors? The academic literature has identified several factors that might explain these trends. Forecast errors can be explained by factors such as difficult modelling environments: data quality and availability, inaccurate prediction models, hard-to-predict macroeconomic conditions, and shocks. A second set of explanations relates to the political or bureaucratic biases of international institutions: Presbitero and Lang (2018) show that countries aligned with major shareholders tend to receive better treatment in the risk assessment (although they do not look at the biases in underlying projections, but in the application of judgment). As documented above, Beaudry and Willems (2022) highlight bureaucratic factors. It is also important to note that data quality may be a product of political dynamics (Mosley and Rosendorff 2024).

In this section, we mainly identify variables linked to governance, economic conditions and the existence of an IMF program. We investigate whether the conduct of IMF programs is associated with fewer errors, and how projections have performed considering countries' institutional, conjunctural and structural features. Finally, we discuss whether the recent trends in debt portfolio diversification (creditor diversification and domestic debt markets development) have been associated with larger projection errors. A key goal of the 2017 reform was to reduce over-optimism but, on average (after accounting for the COVID-19 crisis), we do not observe any major impact.

1. Do IMF programs improve projections?

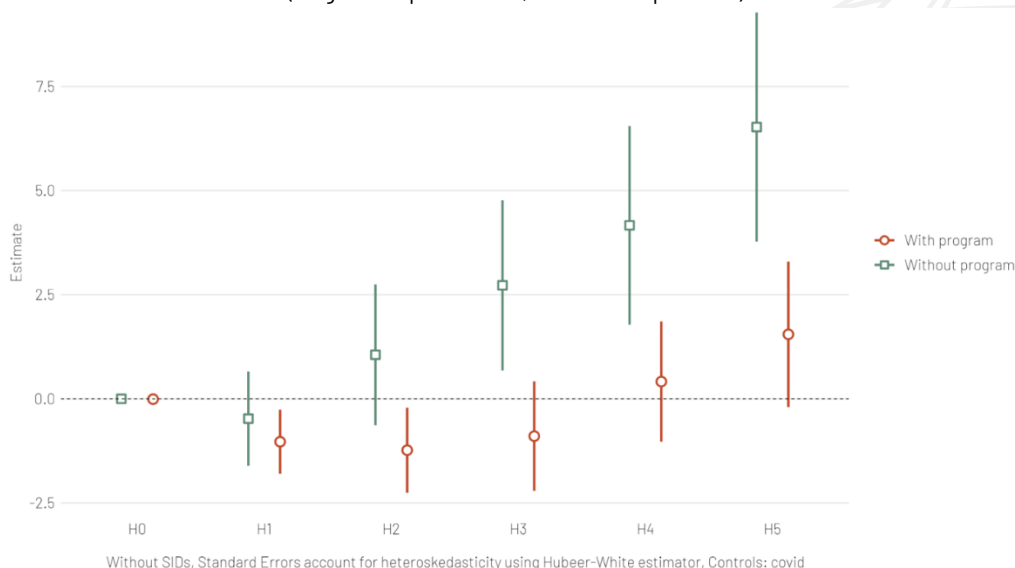
IMF programs come with additional scrutiny on fiscal and debt data. As a result, comprehensive fiscal and financial information sharing is a pre-condition to reach Staff-Level Agreements, which precede any program. Horn et al. (2024) have shown that debt revelations tend to coincide with IMF programs. Once the program has started, what happens? Our results show that debt slippages tend to be smaller under IMF scrutiny, especially at medium horizons. For instance, at a 5-year horizon, the public debt-to-GDP ratio of countries with a program is 12 pp of GDP higher than projected, against 15 pp for countries without a program (Figure 11).

Figure 11: Forecast errors of public debt to GDP under IMF-supported programs
(Negative = pessimism; Positive = optimism)



The LIC-DSF differs from the MAC-DSF in that it focuses much more on external debt. The rationale, set out in the mid-2010s, was that domestic debt markets were less developed and that low-income countries can suffer more frequently from external shocks. As a result, most criteria rely on external debt stock (in present value) or debt service. Therefore, we anticipate that greater attention will be paid to fulfilling external debt targets. In fact, projections of external public debt for countries participating in a program closely match actual outcomes (Figure 12).

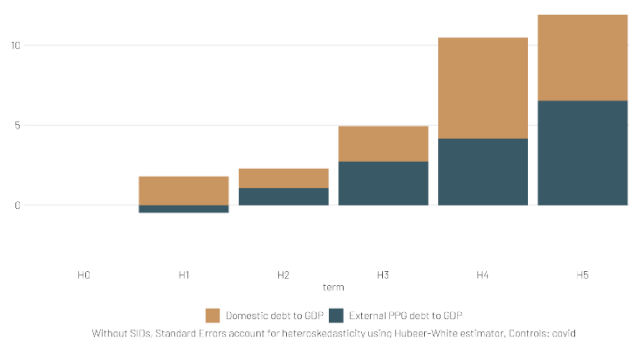
Figure 12: Forecast errors of external PPG debt to GDP under IMF-supported programs
(Negative = pessimism; Positive = optimism)



IMF programs trade greater scrutiny on external debt against looser scrutiny on domestic debt. The flip side of relatively accurate predictions on external debt and only slightly better predictions on total debt is that domestic debt control is weaker in IMF programs (Figures 13-a and -b). A possible interpretation is that it is easier for governments under such programs to “hide” financing from the domestic system. Another is that external financing options are limited under these programs, and that countries rely on domestic debt. A conclusion is that the LIC-DSF reform should come with additional scrutiny and measures for domestic debt.

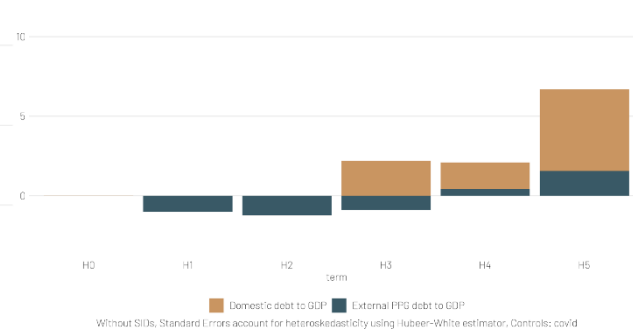
13.a: Domestic and external PPG debt-to-GDP ratio (WITHOUT program)

(Negative = pessimism; Positive = optimism)



13.b: Domestic and external PPG debt-to-GDP ratio (WITH program)

(Negative = pessimism; Positive = optimism)



Beyond external and domestic debt financing, what are the underlying economic factors that contribute to the evolution of programs? The IMF's definition of debt sustainability is underpinned by the predication that agreed policies under the program should be economically and politically feasible. This could provide incentives to be too optimistic about growth. Indeed, since sharp adjustments are unlikely to be politically feasible, IMF staff might be tempted to show optimism on growth and reduce the actual fiscal effort. Ho and Mauro (2014) document that forecasts made prior to a country entering a program display a more pronounced optimistic bias. Guzman (2016) also points out that the IMF might overestimate what is economically feasible, for instance, believing that a sharp policy adjustment can co-exist with high growth.

However, prediction mistakes might also come from too much confidence in restrictive fiscal programs. Indeed, while DSAs play a role in shaping fiscal policies during surveillance, their effect on program design is more central. Typically, the IMF will request adjustment policies in the form of conditionalities to restore sustainability. If they are not sufficient, debt restructuring might be necessary to obtain an IMF loan. This provides incentives to be too optimistic on debt, whether through growth or fiscal policy. Indeed, while the IMF's policy is to leave the decision to restructure to countries, its decision to lend or not, and to request more or less difficult conditionalities, is crucial. Critics point out that the IMF is generally reluctant to push for restructuring (Rehbein 2023), which might translate into optimistic biases. Comparing normal access and exceptional access programs, Montiel, Cohen-Setton and Li (2024) provide further evidence for this theory, as it shows that optimistic biases on primary deficits dominate in the case of exceptional access, possibly to avoid or delay debt restructuring. By comparing DSAs in program and non-program contexts, we deepen this literature by comparing DSAs under programs vs. non-programs.

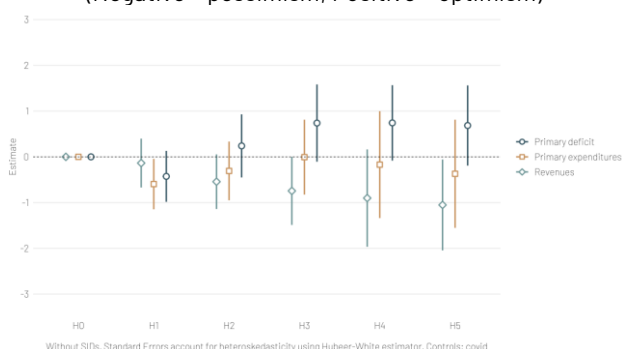
The IMF could be biased in another direction, to encourage ambitious targets in its bargaining with countries. If governments are reluctant to conduct policies to restore debt sustainability, the IMF might provide harder-to-reach targets in its programs than its predictions in a surveillance context. Considering 94 IMF programs conducted for Emerging Markets and Developing Countries between 1989 and 2002, Baqir, Ramcharan & Sahay (2005) document that both policy targets (fiscal performance) and outcomes (growth) fall short of expectations, but that programs with more ambitious fiscal targets obtain better growth performance.

Our results provide support to the idea that IMF programs tend to put too much trust in the ability of governments to consolidate, especially on the revenues side. Indeed, our most striking result is that

primary deficit projections display stronger optimistic biases for DSAs in programs (fig. 14.b). In both cases, projections on the expenditure side (net of interests) tend to be rather accurate. Revenues are often overestimated, and to a very large extent, cumulating at more than 2 percentage point of GDP at a horizon of 5 years, on average. Tax policy is often the most targeted – and difficult for governments to implement – and the slippages tend to correspond to more constraining programs. There is no obvious difference in the level of additional optimism regarding growth (figure 15). As a result, what differentiates IMF programs are their fiscal rigor, rather than beliefs in the growth perspectives.

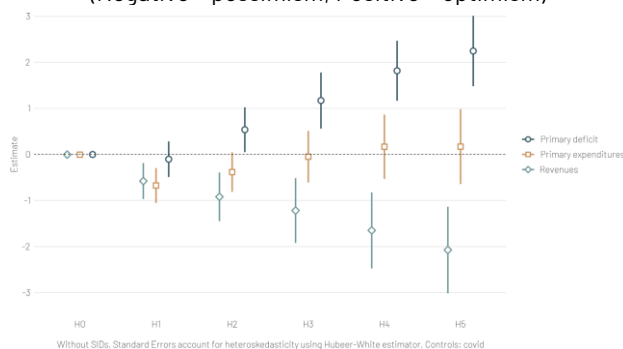
14.a: Primary deficit to GDP and its components (WITHOUT program)

(Negative = pessimism; Positive = optimism)



14.b: Primary deficit to GDP and its components (WITH program)

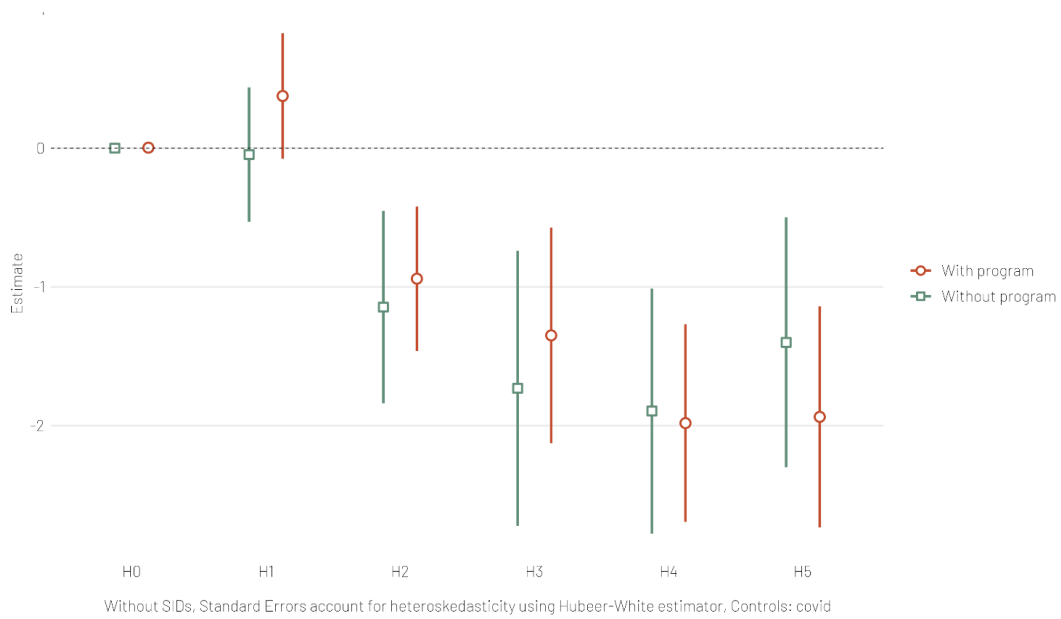
(Negative = pessimism; Positive = optimism)



Comparing the contributions to debt stock forecast errors build-up, it is noteworthy that DSA conducted under a program displays much smaller residual errors than otherwise. Similarly, except for Balance of Payment (BoP)-contributions to external debt accumulation, the determinants of debt accumulation biases are much less sizable under a program. These results are coherent with the literature. IEO (2021) finds that under IMF programs, growth outcomes have systemically fallen short of projections and shows that this over-optimism can mainly be attributed to poor assumptions regarding the macro-modelling of fiscal multipliers. We find some evidence of the deficits/growth link at horizons 3 and 5: the more stringent programs with no fiscal conditions tend to lead to worse growth errors.

To conclude on the role of DSAs in program design, our findings indicate that: data quality improves and allows a better control of debt dynamics, especially external debt. However, IMF targets as set out in programs are rarely met, with large slippages on deficit reduction. More ambitious programs see larger slippages, and lower growth at medium-term horizon (3 to 5 years), although the results remain fragile to outliers removal. Overall, this indicates that more scrutiny is necessary to assess whether fiscal plans under a program are realistic.

Figure 15: Forecast errors of real GDP growth under IMF programs
(Negative = optimism; Positive = pessimism)

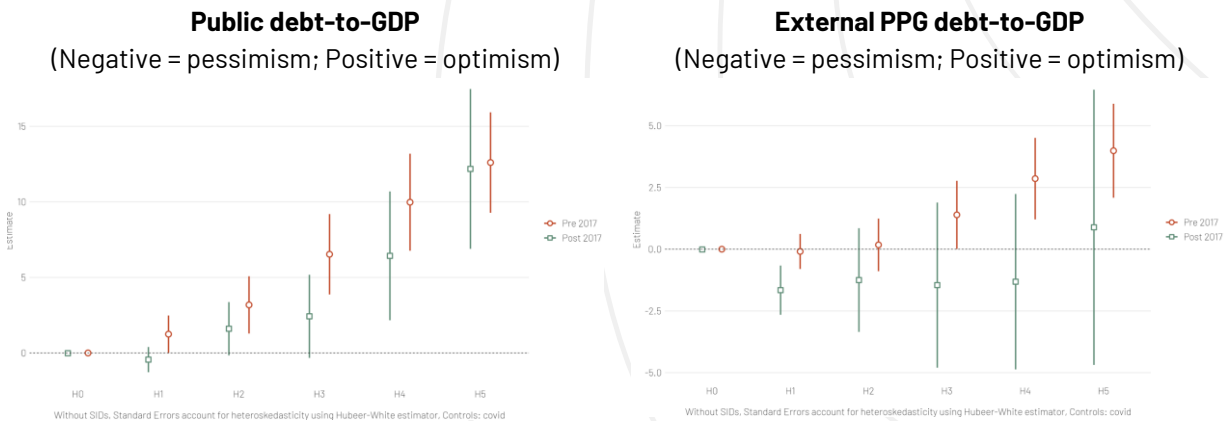


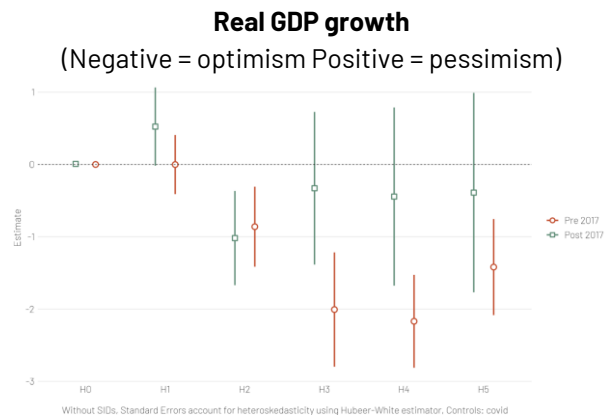
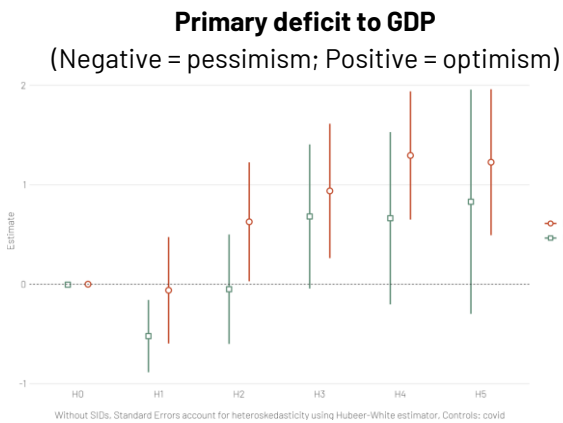
2. Moderate improvements in forecasting with the 2017 reform

An important rationale for the introduction of the reforms in the DSA methodology was to reduce errors. In particular, the 2017 reform implemented the publication of “realism tools” to assess if growth projections, changes in primary deficits, and fiscal multipliers were in line with historical realizations. By publishing these graphs, it was hoped that civil society would be able to challenge assumptions underlying programs. Our results show that this is the case only to a very limited extent.

Forecast errors have fallen, but the error margins remain wide. This is especially true for external debt and real GDP growth, at horizon 3 (Figure 16). Note that statistical power is limited as we are only able to assess DSAs published with the new methodology for the years 2018 and 2019 (since we have “actuals” until 2024). We caution against making too much of these results but see them as indicating a mildly positive impact of the 2017 reform.

Fig.16: Forecast errors before and after the 2017 methodological change



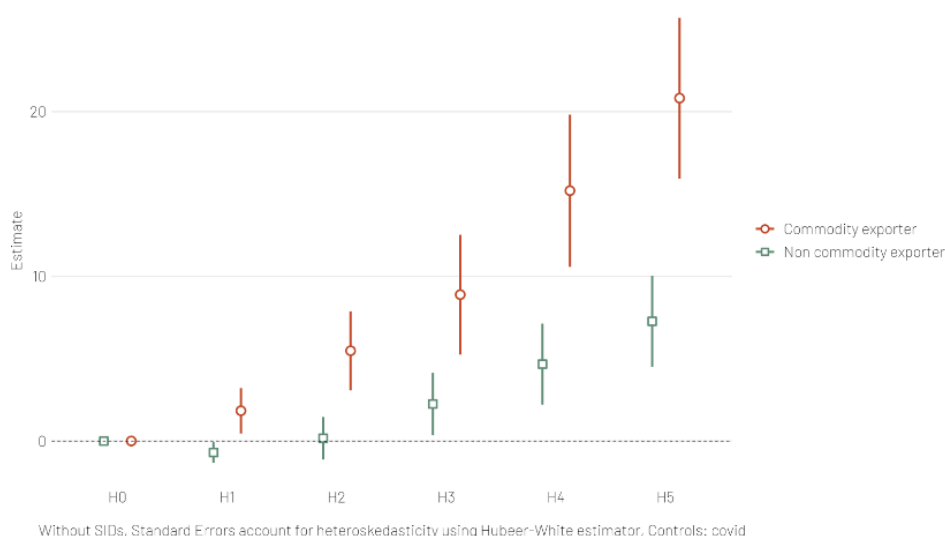


3. Structural factors matter for prediction performance

Different countries can be more or less difficult to assess. Economic and governance instability, in particular, can lead to persistent biases. In this section, we look at several types of structural differences across countries. Many of the LIC-DSF countries are heavily dependent on commodities, and depend on their prices for exports and fiscal revenues. In addition, governance and climate vulnerability will affect fiscal performance and debt management. We also account for other structural conditions: creditor composition will affect the ability to respond to shock, as well as governments' incentives.

Countries with higher exposure to commodity markets are associated with larger forecast errors. Indeed, the volatile nature of commodity prices often leads to overly positive expectations during price booms. Commodity-exporting countries consistently exhibit more optimistic DSAs compared to non-commodity exporters (Figure 17). This is quantitatively significant, with a 20-percentage point difference for public debt to GDP actual evolution compared to predictions. Those are mainly explained by higher-than-planned deficits. These optimistic projections can result in insufficient preparation for potential downturns, as policymakers might underestimate fiscal risks and overestimate growth prospects based on temporary commodity price increases.

Figure 17: Public debt-to-GDP ratio by commodity exporter status
(Negative = pessimism; Positive = optimism)



Governance and climate vulnerabilities are also important predictors of unexpected debt slippages.

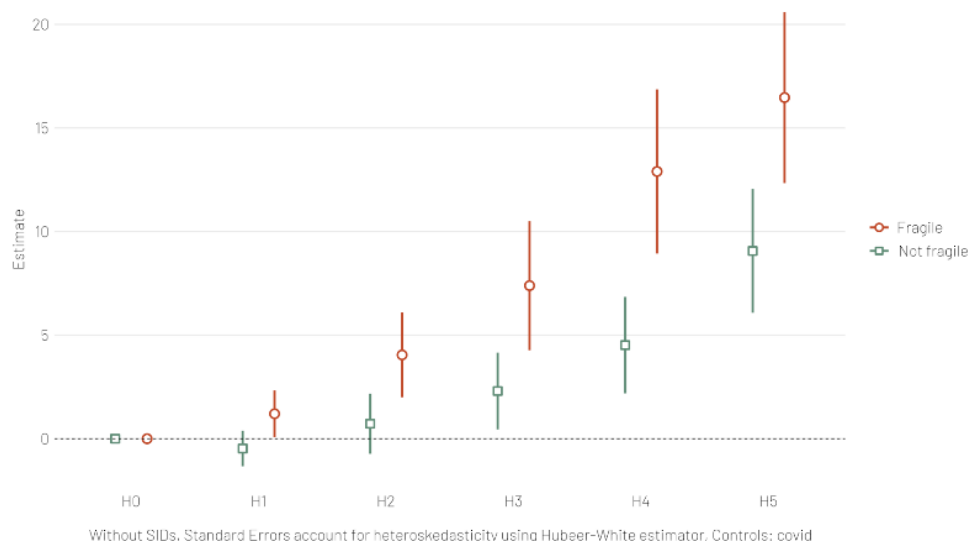
Fragile and conflict-affected countries¹⁵ display more optimistic projections, with external and public debt-to-GDP ratios, suffering from 3 to 7 percent of GDP, and larger errors for fragile countries (Figure 18). DSAs tend to underestimate debt dynamics in fragile countries, signaling the need for the framework to better account for institutional limitations and the risks posed by conflicts and social unrest on macroeconomic development. Policy rules are often considered by the economic literature as a potential vector for stability and policy coherence, thus limiting the effect of institutional vulnerabilities. We do not find that countries with policy rules¹⁶ display any better projections. This suggests that the framework does not sufficiently internalize the macroeconomic stabilizing features of policy rules.

¹⁵ <https://www.worldbank.org/en/topic/fragilityconflictviolence/brief/harmonized-list-of-fragile-situations>.

Fragile situations are defined as those: (i) With 1 or more of the following situations: (a) the weakest institutional and policy environment, based on a revised CPIA for IDA countries that is below 3.0; or (b) the presence of a UN Department of Peace Operation; or (c) flight across borders of 2,000 or more per 100,000 population, who are internationally regarded as refugees; (ii) And that are not in medium- or high-intensity conflict.

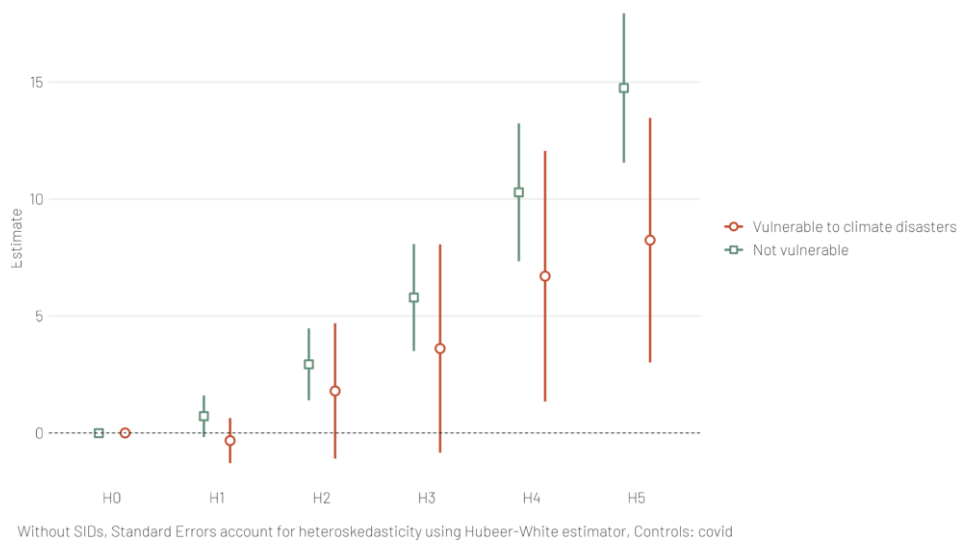
¹⁶ The policy rules we consider are either: (i) fiscal as provided in the IMF Fiscal Rules Database and (ii) exchange rate regimes.

Figure 18: Public debt-to-GDP ratio by governance fragility
(Negative = pessimism; Positive = optimism)



Using a different measure of climate vulnerability, we confirm, as was the case for SIDS, that climate vulnerability leads to slightly smaller forecast errors on public debt. There is a 1 percentage point difference in the primary deficit ratio between vulnerable and non-vulnerable countries, and a 1 to 2 percentage point difference in real GDP growth. This confirms that analysts are more conservative in their forecasts for countries prone to natural disasters.

Figure 19: Public debt-to-GDP ratio by climate vulnerability
(Negative = pessimism; Positive = optimism)

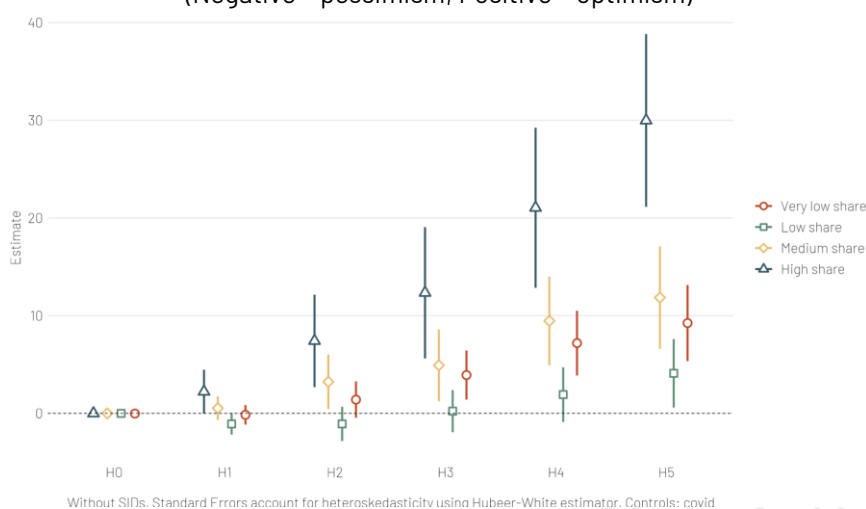


Finally, as the debt portfolio has diversified over the last decade, the ability to accurately project debt stocks might have complexified and supported projection errors. Recent literature (e.g., Cohen, Harnoys-Vannier 2023) shows that the share of China and private creditors has significantly increased in recent years, as has the proportion of domestic debt in the portfolios of LICs. This shift in creditor composition complicates debt forecasting and management, as private and non-traditional creditors may not follow the same patterns or transparency as official lenders. As these private and Chinese creditors become more prominent, the variability and uncertainty in debt servicing and repayment rise.

Additionally, the increasing share of domestic debt in LICs' portfolios introduces new dynamics and risks, further impacting the accuracy of forecasts.

Figure 20 compares countries based on their share of External PPG debt owed to private creditors. The results show that the higher the exposure to private creditors, the higher the optimism. Specifically, at a five-year horizon, WB-IMF teams overestimate the public debt ratio for countries with the highest exposure by approximately 25 GDP points against 4 % for the less exposed ones. For growth and the primary deficit, the difference between the categories is not significant, but we keep the same intensity order of optimism. Interestingly, the fact that LICs' debt portfolios have higher shares owed to Chinese (public and private) creditors or emitted domestically is not associated with significant differences in terms of forecast errors.

Figure 20: Public debt-to-GDP ratio by share of markets in external debt
(Negative = pessimism; Positive = optimism)



4. Projections made during recessions are overly optimistic

In addition, DSAs performed during uncertain times could also build on assumptions of a fast recovery. Indeed, when DSAs are published amidst a recession¹⁷, projections display significant biases. At a 5-year horizon, public debt stocks are projected to be 35 percentage points lower than realized, while real GDP growth is projected to be 10% higher than reality. These errors are, respectively, three and eight times those of DSAs published during periods of economic expansion. When analyzing primary deficit projections, optimistic biases are also noted, being twice as large as during recessions, yet statistically not different from DSAs published during expansions. In both cases, revenues are underestimated but for DSAs published during recessions, expenditures are also underestimated, while they are well predicted when countries are in expansion. These observations suggest that the IMF/WB teams underplay the full extent of economic contractions. Projections outweigh growth rebounds, leading to an understatement of debt stocks and an underestimation of primary spending.

¹⁷ To determine if DSAs were published during a recession or expansion, we categorized them by whether the country's growth rate was negative or positive. While we attempted to use the HP filter, the procedure failed to converge for several countries.

Fig. 21.a: Public debt-to-GDP ratio by recession status
(Negative = pessimism; Positive = optimism)

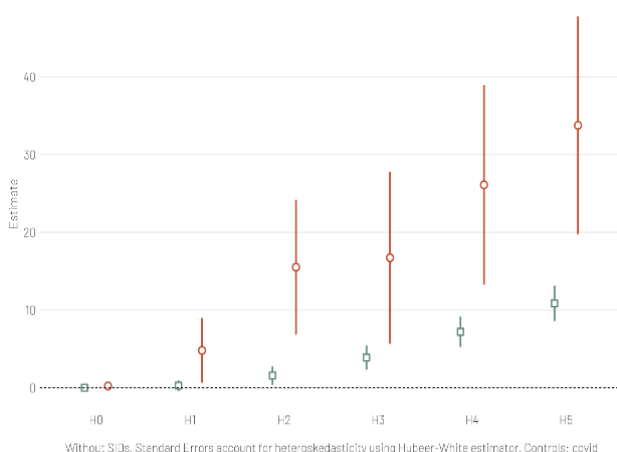
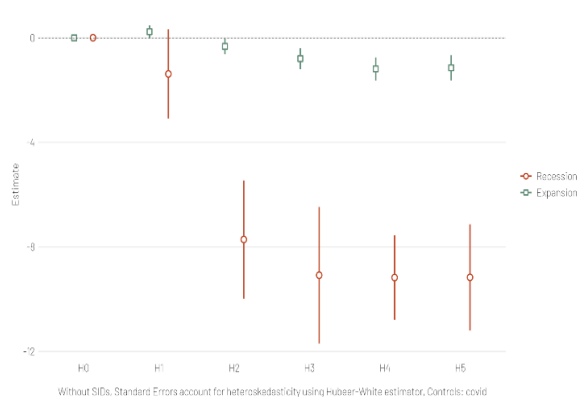


Fig 21.b: Real GDP growth by recession status
(Negative = optimism Positive = pessimism)



5. Synthesis: identifying key influencing factors for projections

To ensure the robustness of the various effects we discussed in the previous sub-sections, we estimate a regression in which we regress 5-year forecast errors on the different explanatory factors. Table 2 presents the results for all variables of interest. Most results remain robust to the inclusion of all factors.

- Countries for which DSAs are conducted, while under an IMF program, display more optimistic forecasts on debt ratios and higher optimism on primary deficit, with no statistically significant difference in real growth.
- DSAs published during recessions are associated with strong optimism for public and external debt ratios as well as real growth.
- Countries known to have historically high debt stocks display more optimistic forecasts on debt ratio and primary deficits, showing that history is not adequately taken into account.
- Countries in peg currency regimes display more optimistic forecasts for primary deficits, which supports the view that when the currency regime is, by essence, more stable, primary deficits are wrongly considered more stable.
- SIDS display significantly fewer optimistic forecast errors on the public debt ratio and on real GDP growth, supporting the view that forecasters adequately internalize their intrinsic fragilities. In contrast to individual effects regression, the coefficient of the variable vulnerability to climate change is no longer significant when all variables are included. The effect is notably captured by the SIDS variable.
- Countries with fragile governance or in conflict keep significant statistical differences; they display more pessimistic forecasts on primary deficits and external PPG debt but more optimistic growth forecasts.
- Commodity exporters are also associated with significantly stronger forecast biases on both public and external debt ratios.
- There is no significant statistical difference on the quality of forecasts between pre-2017 and post-2017 periods.

Table 2: Determinants of forecast errors in major fiscal variables over 5-year horizon

	Public debt	Primary deficit	Real GDP growth	External PPG debt
Constant	-2.84 (4.14)	-0.43 (1.59)	-1.24 (1.19)	3.71 (2.50)
In program	-6.08** (2.59)	2.12** (0.99)	-0.52 (0.74)	-5.12*** (1.56)
In recession	11.78*** (3.06)	0.22 (1.18)	-8.59*** (0.88)	6.19*** (1.86)
Growth volatility	-0.35 (0.40)	-0.06 (0.15)	0.47*** (0.12)	-0.58** (0.24)
Average gov. debt level	0.27*** (0.04)	0.04*** (0.02)	-0.01 (0.01)	0.06** (0.02)
WGI	4.65 (2.84)	0.16 (1.09)	-0.57 (0.82)	2.11 (1.86)
In fiscal rule	2.49 (2.72)	-1.20 (1.05)	-0.30 (0.78)	3.35** (1.62)
In PEG currency regime	3.43 (2.75)	1.83* (1.06)	-0.35 (0.79)	2.17 (1.64)
Small Island	-14.33*** (4.02)	-1.79 (1.54)	2.33** (1.16)	-3.21 (2.38)
Vulnerable	-1.29 (3.38)	-1.35 (1.30)	-0.35 (0.97)	-2.43 (2.08)
Fragile or in conflict	-1.69 (3.06)	-2.41** (1.18)	-1.94** (0.88)	-4.18** (1.93)
Commodity Exporter	9.23*** (3.00)	-0.48 (1.15)	0.59 (0.86)	4.95*** (1.87)
Post 17 method	5.99 (4.05)	2.98* (1.56)	0.40 (1.17)	0.41 (2.42)
R ²	0.27	0.10	0.32	0.18
Adj. R ²	0.24	0.06	0.30	0.14
Num. obs.	287	284	287	271

***p < 0.01; **p < 0.05; *p < 0.1

5. The accumulation of public debt forecast errors

The Debt Sustainability Framework relies upon one core debt dynamic equation that relates changes in the debt stock to endogenous debt dynamics (i.e., the relative driving forces of real interest and growth rates), to the government's primary deficits, and to other debt flows (e.g., valuation effects and below-the-line operations). Optimistic forecasts can thus be linked to these various build-up sources.

1. Decomposing the forecast errors build-up

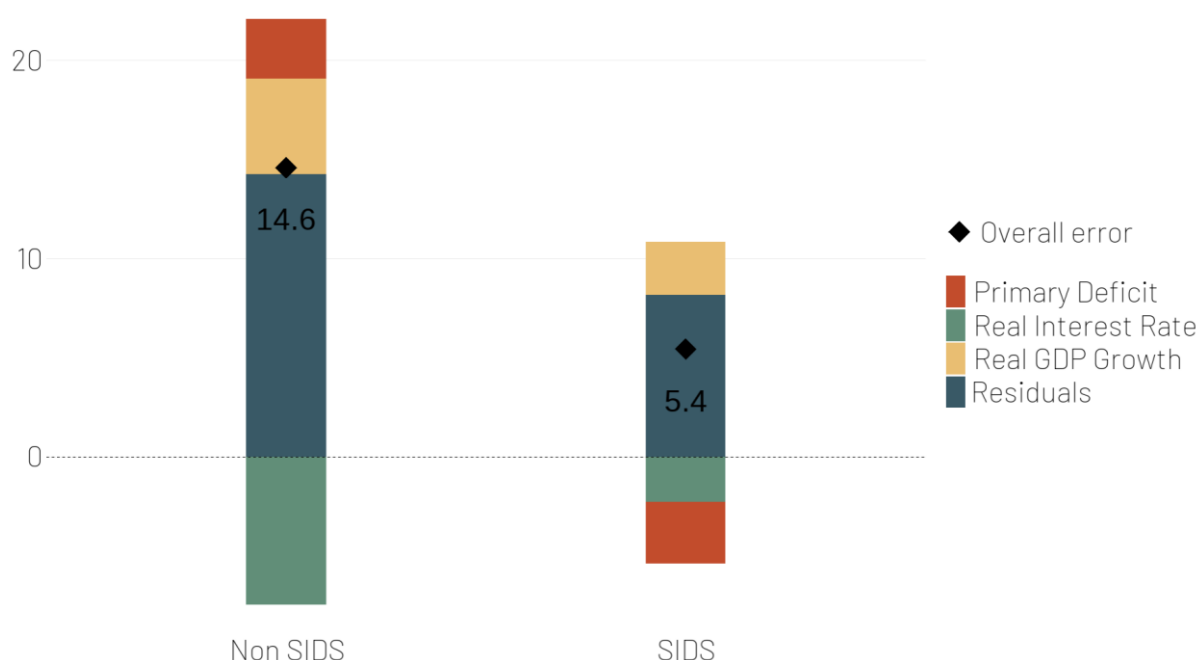
Public sector debt dynamics result from three factors: primary deficits, endogenous debt dynamics (commonly referred to as the "r-g" term), and residual components¹⁸. Endogenous debt dynamics are further broken down into four contributions that identify the relative impact of the nominal interest rate, price level changes (inflation), real GDP growth, and finally, the exchange rate. Overall public debt dynamics

$$\Delta d_t = pd_t + contrib(i_t) + contrib(\pi_t) + contrib(g_t) + contrib(\Delta e_t) + sfa_t$$

where i_t represents the nominal effective interest rate on the overall debt portfolio, g_t the real GDP growth, π_t the change in the GDP deflator and Δe_t the nominal exchange rate depreciation. As the IMF-WB DSAs do not provide details on the real exchange rate depreciation contribution, we are forced to follow their approach and include it in the residual¹⁹.

At a five-year horizon, the stock of public debt in non-SIDS countries is erroneously forecasted as 14.6 percentage points of GDP smaller than realized. Despite overestimating how much real rates contributed to automatic debt accumulations (-7.5pp of GDP), the forecasters underestimate the automatic contribution of real GDP growth and the primary deficits in compensating amounts (4.8 and 3.0pp of GDP, respectively). The residual remains high, both because it contains exchange rate movements (which are an important part of debt dynamics) and because other "below-the-line" transactions (assumption of contingent debt, etc.).

Figure 22: Public debt 5-year forecast error: Decomposition by projection component for SIDS and non-SIDS countries



¹⁸ See annex C for further details.

¹⁹ Appendix F provides a detailed discussion of the challenges related to real effective interest rate data availability and the solutions we implemented to address them.

In contrast, the forecast error for the public debt stock in SIDS countries is significantly smaller: the IMF-WB tend, on average, to underestimate 5-year public debt stock changes by 5.4 percentage points of GDP over 5 years. This can be decomposed between overestimations of the contributions of primary deficits and real interest rates, by respectively **-3.1** and **-2.3** pp of GDP, and the underestimation, by **2.7** pp of real growth contributions. Residual errors remain an important contributor, with a notable **8.2** pp for residual errors.

2. The drivers of public debt-to-GDP forecast errors

A second approach to assess the relative importance of factors is to synthesize them in a regression framework.

We find that there is a high correlation at all horizons between forecast errors on real growth and debt, of about -0.85 : if GDP growth is 1 percentage point lower than initial forecast, debt-to-GDP will be 0.85 percentage point higher. Since errors in growth forecasting compound, the role of growth optimism is an important overall contributor

The influence of forecast errors on inflation and nominal interest rates are also significant. The coefficient on inflation is 0.257^{***} , but moderates depending on horizon. Higher than planned financing conditions under the form of higher interest rates will also lead to surprises, but does not seem a major factor.

Forecast errors of fiscal policy at various horizons have high impact. The primary deficit forecast errors show a significant effect on debt forecast errors, particularly at the third-year horizon (H3) with a value of 0.699^{***} , indicating that underestimating the primary deficit leads to higher-than-expected debt accumulation. This result is intuitive, but the influence of primary deficit forecast errors diminishes considerably at shorter horizons (H2 & H1), with the coefficient becoming insignificant and even changing signs. Decomposing into revenue and expenditures forecast errors, one finds that correlations between both revenues and expenditures forecast errors with debt are high, about -0.4 to -0.5 for revenues (negative, since an overestimation of revenues leads to an underestimation of debt dynamics) and 0.7 for expenditure.

Table 3.1: Drivers of debt forecast errors at the third-year horizon, full sample

	<i>Dependent variable: Public debt-to-GDP forecast errors (Horizon 3)</i>				
	(1)	(2)	(3)	(4)	(5)
Growth FE.H3		-0.850*** (0.137)			
Growth FE.H2		-0.521*** (0.151)			
Growth FE.H1		-0.247 (0.198)			
Inflation FE.H3			0.257** (0.094)		
Inflation FE.H2			-0.297*** (0.092)		
Inflation FE.H1			-0.032 (0.109)		
Eff. nominal rate FE.H3			0.029*** (0.006)		
Eff. nominal rate FE.H2			-0.082*** (0.016)		
Eff. nominal rate FE.H1			0.057*** (0.012)		
Primary deficit FE.H3				0.699*** (0.170)	
Primary deficit FE.H2				0.186 (0.190)	
Primary deficit FE.H1				-0.207 (0.182)	
Revenue FE.H3					-0.395* (0.203)
Revenue FE.H2					-0.480** (0.223)
Revenue FE.H1					0.342* (0.196)
Primary expenditure FE.H3					0.762*** (0.188)
Primary expenditure FE.H2					0.384 (0.236)
Primary expenditure FE.H1					0.022 (0.220)
Constant	4.372*** (0.777)	2.346*** (0.779)	4.179*** (0.764)	4.460*** (0.754)	4.593*** (0.751)
Observations	420	419	366	413	413
R ²	0.000	0.144	0.101	0.116	0.152
Adjusted R ²	0.000	0.138	0.086	0.110	0.140
Residual Std. Error	15.929 (df = 419)	14.809 (df = 415)	14.165 (df = 359)	14.989 (df = 409)	14.733 (df = 406)
F Statistic		23.243*** (df = 3; 415)	6.693*** (df = 6; 359)	17.917*** (df = 3; 409)	12.162*** (df = 6; 406)

Note:

*p<0.10 **p<0.05 ***p<0.01

Conclusion

The article examines the accuracy and reliability of Debt Sustainability Analysis (DSA) forecasts for Low-Income Countries (LICs). It utilizes a newly constructed database, that aggregates forecasts for public and external debt ratios across 605 DSAs conducted between 2013 and 2023, identifying and analyzing forecast errors in debt, primary deficits, and GDP growth. The research addresses the core question of whether these DSA forecasts have improved in accuracy following the 2017 reforms and explores the factors contributing to any remaining biases.

The analysis reveals several key findings regarding the accuracy of DSA forecasts. Notably, there is a persistent optimistic bias in these forecasts, with consistent underestimation of debt accumulation and overestimation of GDP growth, particularly over longer time horizons. This bias is less pronounced in Small Island Developing States (SIDS), where the forecasts often tend to account for the economic impacts of climate-related events. Despite the reforms introduced in 2017, which aimed to enhance the realism of these projections, significant inaccuracies remain. This suggests that while there has been some improvement in the forecasting process, critical gaps persist, particularly in the projection of domestic debt, where forecast errors continue to be substantial.

Of particular interest, DSAs run along an IMF program display specific forecasting biases. IMF programs trade greater scrutiny on external debt against looser scrutiny on domestic debt. What differentiates IMF programs are their fiscal over-ambition, not beliefs on the growth perspectives. This tends to support the view that DSAs made along IMF programs are overly ambitious to buy in political support. This can have important consequences as countries that do not meet the fiscal ambitions set in the programs will tend to restructure too late. A lot more attention must be paid as part of programs and in the macro-economic framework on the “political sustainability” aspects.

The analysis also identifies several determinants that drive these forecast errors. Growth forecast errors emerge as the most significant factor, with overly optimistic projections of GDP growth leading to larger-than-expected public debt ratios. Several factors compound the difficulties in achieving accurate and reliable DSA forecasts, notably the dependence on commodities and weak governance. Forecasts made for LICs that have had access to international capital markets display more optimism, suggesting a bias in favor of maintaining market access. Finally, DSAs published in recessionary years are overly optimistic, suggesting that IMF-WB team overplay rebound effects and that the forecasting model underplays non-linearities along business cycle phases.

Given these findings, the paper suggests several policy recommendations. Enhancing the accuracy of DSA forecasts requires continued refinement of the tools and methodologies used, particularly in adapting forecasts to the specific economic and environmental contexts of LICs and SIDS. This includes improving the integration of climate risks and external shocks into the forecasting models. Additionally, strengthening the capacity of LICs to manage their debt sustainably through improved governance and more diversified economies is essential. Finally, international financial institutions must enhance their support for LICs by providing more tailored assistance and by ensuring that DSAs are both realistic and reflective of the unique challenges faced by these countries. These steps will be critical in helping LICs and SIDS navigate their debt challenges and achieve sustainable development.

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Appendix

A. The concept of debt sustainability: a primer

In theory, debt sustainability is synonymous with the solvency of the public sector (Debrun et al 2019). Solvency directly relates to the ability of a government to support a more or less large stock of debt without facing debt overhang (i.e. a situation in which an important debt stock impairs refinancing, new investments and growth perspectives). In turn, a country's sovereign debt can be unsustainable because the government might turn out incapable of finding the required money to meet upcoming payments, due to liquidity shortages and/or the inability to roll-over its debt. As presented, debt sustainability relates to a government's ability to meet its financial obligations, but national authorities can also reveal themselves as unwilling to repay owed amounts: because of pure political interplay or because it would be associated with cutting too much into necessary spending²⁰. In IMF (2002), Debt Sustainability is defined based on "whether a country's debt can be serviced without an unrealistically large future correction in the balance of income and expenditure". The challenges of defining debt sustainability stem first from the variety of situations that lead to countries entering debt distress areas.

Debt Sustainability is even more complex to assess because of its forward-looking nature, something coined a "mission impossible" by Wyplosz (2011). The fact that a country's sovereign debt (stock and associated debt service) might prove sustainable rests on the fact that, in the future, given the country's growth path, upcoming payments, and its expected capacity to generate liquidity, payments will be met. All these rely entirely on the capacity of accurately projecting a country's growth and debt path, its upcoming revenues, spending and access to new financing. Moreover, these elements cannot be identified strictly by themselves as they depend strongly on the evolution of the country's environment (macro-financial but not only as rising climatic risks exemplify). Assessing Debt Sustainability is thus by essence a probabilistic exercise, the quality of which depends on the ability to appropriately capture and predict future country evolutions against the most likely global developments. This uncertain nature also complicates the prediction of distress episodes as with debt sold (and traded) on financial markets, investors' beliefs play a great role in determining the price at which sovereigns will emit financial obligations. Default probabilities are priced by market agents in the premium charged above risk-free rates. Hence, multiple equilibria and self-fulfilling prophecies can turn transitory financial troubles and pure liquidity crises into heightened distress episodes for otherwise solvent governments.

Debt Sustainability has thus been at the forefront of many debates throughout academic and policy spheres. In 2005 amid the HIPC/MDRI initiatives, the IMF and the WB drew and publicized their first methodology that soon became a – though debated – reference worldwide. Debt Sustainability as

²⁰ This latter aspect echoes the opposition drawn by Arnone, Bandiera and Presbitero (2007) between financial and economic sustainability, the latter considering in underlying projections the needs for investment in the Sustainable Development Goals or following today's framing the needs for the sustainable transition and the fight against climate change.

assessed by the IMF and the WB is indeed a primordial tool. As part of the IMF surveillance exercises²¹, DSA enlighten countries' evaluations on fiscal and external matters. They therefore contribute importantly to the signals captured and analyzed by public and private policy makers worldwide. Scrutinized by market participants they are often considered as exogenous evaluations that help determine lending and borrowing decisions. Importantly, given that the IMF's program can only be accessed by countries that display sustainable debt stocks, DSAs condition countries' access to IMF's lending. DSAs also matter, for Low Income Countries, as they determine the terms at which they will be able to borrow from the World Bank International Development Agency given the "traffic light" system. When deemed at high risk of debt distress, countries benefit from liquidity lines in the form of pure grants. On the opposite, countries deemed at low risk of debt distress can borrow at concessional terms. When deemed at moderate risks, countries have access to a mix of grants and concessional loans. Finally, the IMF/WB LIC-DSF steps in as an essential policy tool during Debt Restructuring episodes. They help delimitate the scope of the haircut that needs to be introduced to bring countries back on a sustainable path (and to enable countries to access IMF's liquidity lines).

As important as the IMF-WB DSF can be, given the complexity of its underlying concept, they do not fall short of limitations and areas for improvement. In the next section we address the rationale and methodology behind them and how projections take a central place in their conclusion.

B. Overview of the WB-IMF Debt Sustainability Framework

The initial DSF was established around 2005. The 2013 reform sought "modest improvements", given the observation that the LIC-DSF had "performed relatively well and fulfilled its main objectives" (IMF & WB 2013). The revision simplified the computation of Present Value indicators by using a common discount factor. It also simplified the use of remittances when considering countries' access to foreign exchange revenues.

The subsequent 2017 reform included a "wide ranging set of reforms" (IMF 2017), though some criticized its approach (Pinto 2019; Pinto & Gill 2024). In practice, the 2017 revision had several targets. It introduced "realism tools" to reduce country teams discretion, by comparing key variables of the DSA (e.g. fiscal adjustment requirements or investment-to-growth transmission) against historical experience. It also added macro-financial determinants (reserves to GDP, country growth, world growth) to the pre-existing CPIA variables to determine debt carrying capacity. It added considerations of the evolution of total public debt. Finally, the DSF also refined the methodology to adapt it to country characteristics. It re-calibrated and -designed the set of generic stress-tests applied to all countries and developed a procedure to design tailored stress-tests. The methodology also included specific guidance to account for the application of judgment.

Throughout the various waves of reforms, the LIC-DSF has always relied upon 5 steps:

- **Define the country's debt coverage:** The DSA defines what the public sector should include (central/general government, other agencies...), how external debt is characterized (residency/currency based) and whether specific liabilities should be considered (e.g. State-Owned Enterprises).
- **Project country's debt and macroeconomic situation according to a baseline scenario:** To form a country's baseline scenario at a 20-year horizon, the IMF and WB country desks work

²¹ As part of its mandate, the IMF is required to dress every year or two years a review of member countries' economic and financial health.

together with country officials. Macroeconomic and financial assumptions are made on the short- and long-run²² to derive growth and BoP flows using external inputs (e.g. WEO growth projections) and long-run constraints (e.g. REER mean reversion). They are completed with projections on government's policy perspectives (e.g. primary expenditures, revenues and grants).

- **Define the country's Debt Carrying Capacity:** The DSA computes a composite indicator that aggregates the CPIA, country-specific macro characteristics (real GDP growth, remittances to GDP, reserves to import) and world growth. For each variable, the DSA considers the average of 5 years of historical data and 5 years of baseline projections²³. Depending on the final score, the country is then ranked at low/moderate/strong Debt Carrying Capacity (DCC) which determines the thresholds that indicate, for each Debt Burden Indicator, the levels above which the countries enter distress zones.
- **Identify when the country's Debt Burden Indicators enter distress zones under baseline projections and stress-tests:** The DSA first assesses whether, under the baseline projection, the various DBI overcome at a 10-year horizon the thresholds determined by the DCC. The projections are then redrawn under a set of standardized stress tests meant to encompass LIC's most frequent shocks. Tailored stress tests can also be introduced to consider country-specific vulnerabilities – natural disasters, contingent liabilities, commodity price shock and market pressures. For each DBI, the stress test that leads to the worst performance is then selected and used to identify if the projections breach the threshold and enter the distress area.
- **Assess the country's risk:** Two assessments are given: one on external debt and one on overall public debt. For the former, if a country is ongoing debt restructuring negotiations or if they are impending a country is classified "in debt distress". This category also applies for countries having important outstanding arrears or with a high probability of debt distress (large near-term breaches for flow DBIs or significant and sustained breaches). If any country's external DBI breach its threshold under the baseline, the country is ranked at "high risk" of debt distress. If a country's external DBI breach their threshold under the most extreme stress-test but not under the baseline they are ranked at "moderate risk", whereas if there are no breaches under both the baseline and the stress tests, risks are "low". Overall risk of debt distress follows a similar pattern, but the moderate risk category is applied when the external risk assessment is low but the public DBI breaches under the stress-test. Judgment can also change categories under a set of situations (e.g. based on market access tools or depending on the duration and intensity of the breaches).

C. Debt Dynamics

When debt is expressed in various currencies the debt dynamic in nominal terms writes:

$$D_t^d + e_t D_t^f = (1 + i_t^d) D_{t-1}^d + (1 + i_t^f) e_t D_{t-1}^f + P D_t + SFA_t$$

²² In theory, the IMF is supposed to handle short-term projections while the WB handles medium to long-run projections. In practice, IEG (2023) documents that the WB's teams are rarely leading the projections on long-term projections and the investment-growth nexus that is essential to quantifying how public debt financed investment might boost future growth and relax debt dynamics constraints.

²³ For the CPIA, the indicator is assumed to remain constant over the projection horizon.

where D_t^d and D_t^f the stock of domestic and foreign currency denominated debt, i_t^d and i_t^f the nominal interest rate on domestic and foreign debt, e_t the nominal exchange rate (domestic currency per \$).

Using the definition of domestic and foreign currency denominated debt,

$$\begin{aligned} D_t^d &\equiv (1 - \alpha_t)D_t \\ e_t D_t^f &\equiv \alpha_t D_t \end{aligned}$$

we get:

$$D_t = (1 + i_t^d)(1 - \alpha_{t-1})D_{t-1} + (1 + i_t^f)e_t \frac{\alpha_{t-1}D_{t-1}}{e_{t-1}} + PD_t + SFA_t$$

Using lower cases letters to denote shares of GDP and the definition of real GDP growth rate g_t , $P_t Y_t = (1 + \pi_t)(1 + g_t)P_{t-1}Y_{t-1}$, with π_t the inflation rate, we obtain:

$$d_t = \frac{d_{t-1}}{(1 + g_t)(1 + \pi_t)} [1 - \alpha_{t-1} + i_t^d(1 - \alpha_{t-1}) + \alpha_{t-1} + \alpha_{t-1}\Delta e_t(1 + i_t^f) + i_t^f \alpha_{t-1}] + pd_t + sfa_t$$

Using the definition of the effective nominal interest rate,

$$i_t^w \equiv i_t^f \alpha_{t-1} + i_t^d(1 - \alpha_{t-1})$$

we get:

$$d_t = \frac{[1 + i_t^w + \alpha_{t-1}\Delta e_t(1 + i_t^f)]}{(1 + g_t)(1 + \pi_t)} d_{t-1} + pd_t + sfa_t$$

The change in debt-to-GDP ratio is therefore given by:

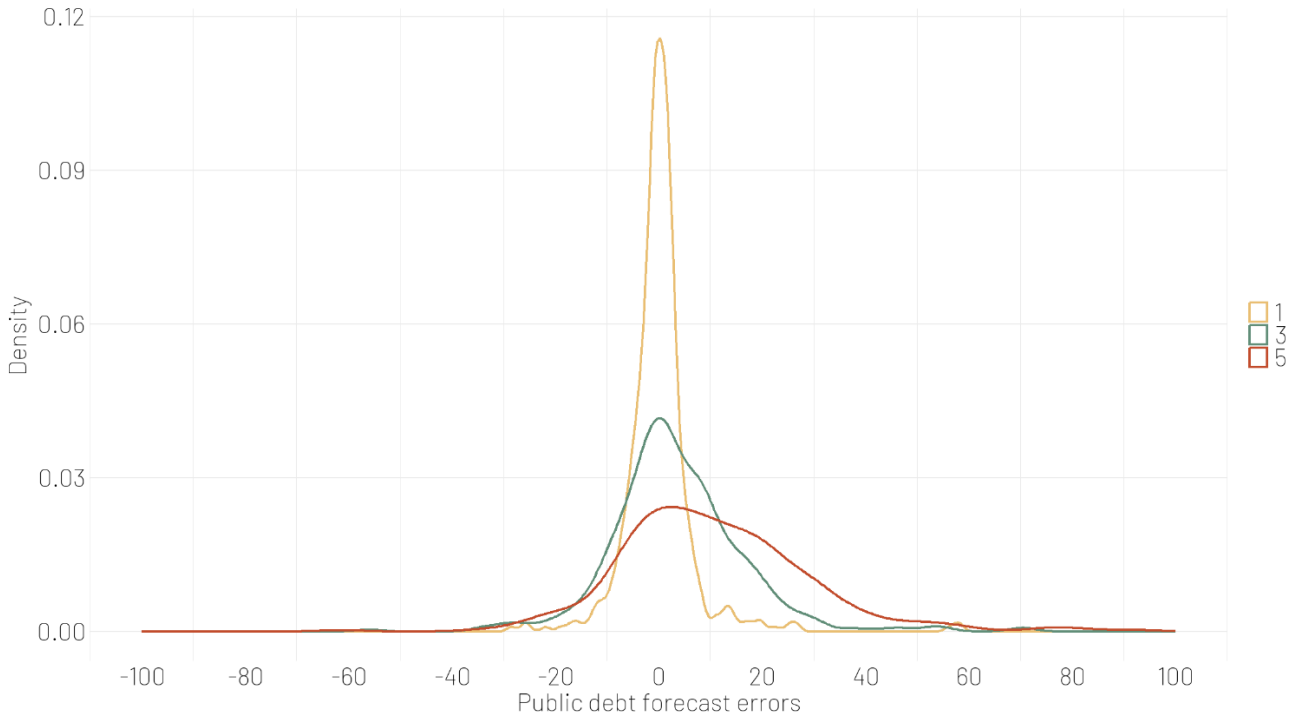
$$\begin{aligned} \Delta d_t &= \left(\frac{i_t^w}{(1 + g_t)(1 + \pi_t)} - \frac{g_t}{(1 + g_t)(1 + \pi_t)} - \frac{\pi_t}{1 + \pi_t} + \alpha_{t-1} \frac{\Delta e_t(1 + i_t^f)}{(1 + g_t)(1 + \pi_t)} \right) d_{t-1} + pd_t + sfa_t \\ \Delta d_t &\equiv \text{ctrb}(i_t^w) + \text{ctrb}(g_t) + \text{ctrb}(\pi_t) + \text{ctrb}(\Delta e_t) + pd_t + sfa_t \end{aligned}$$

D. Additional Figures and Tables

a) Errors distribution by projection year

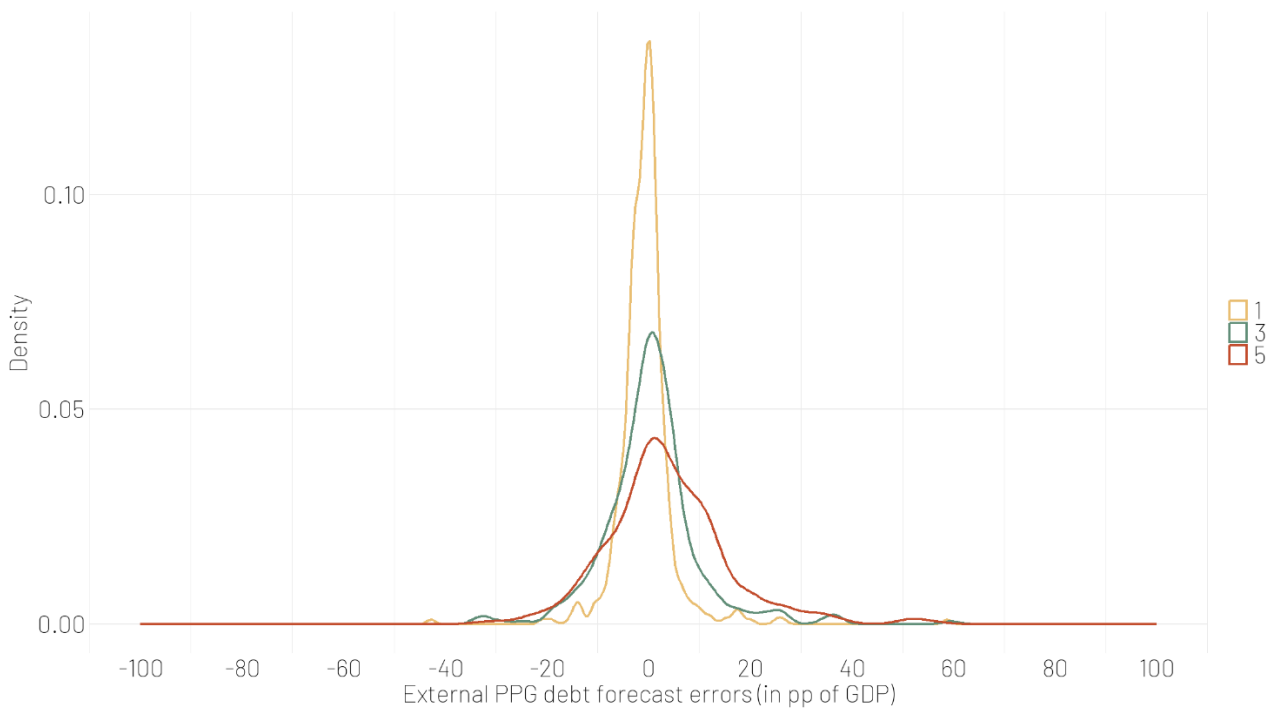
a) Public debt-to-GDP ratio

(Negative = pessimism; Positive = optimism)

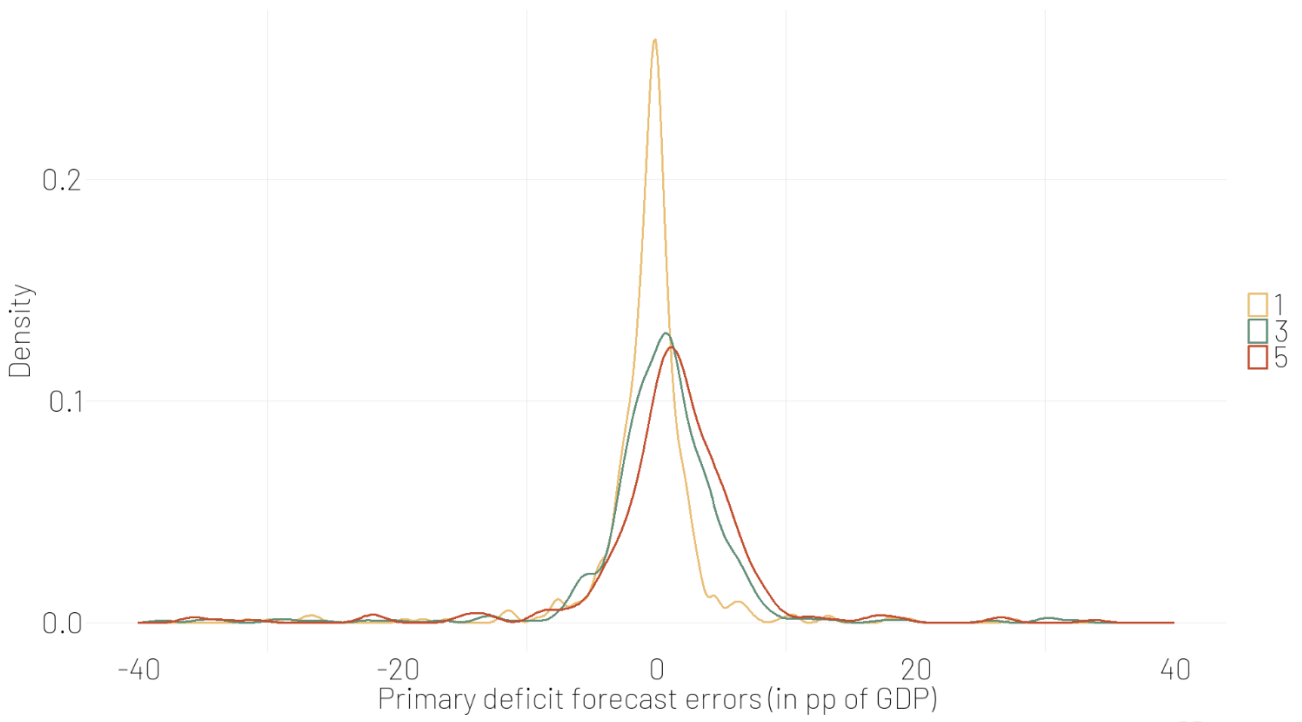


b) PPG debt-to-GDP ratio

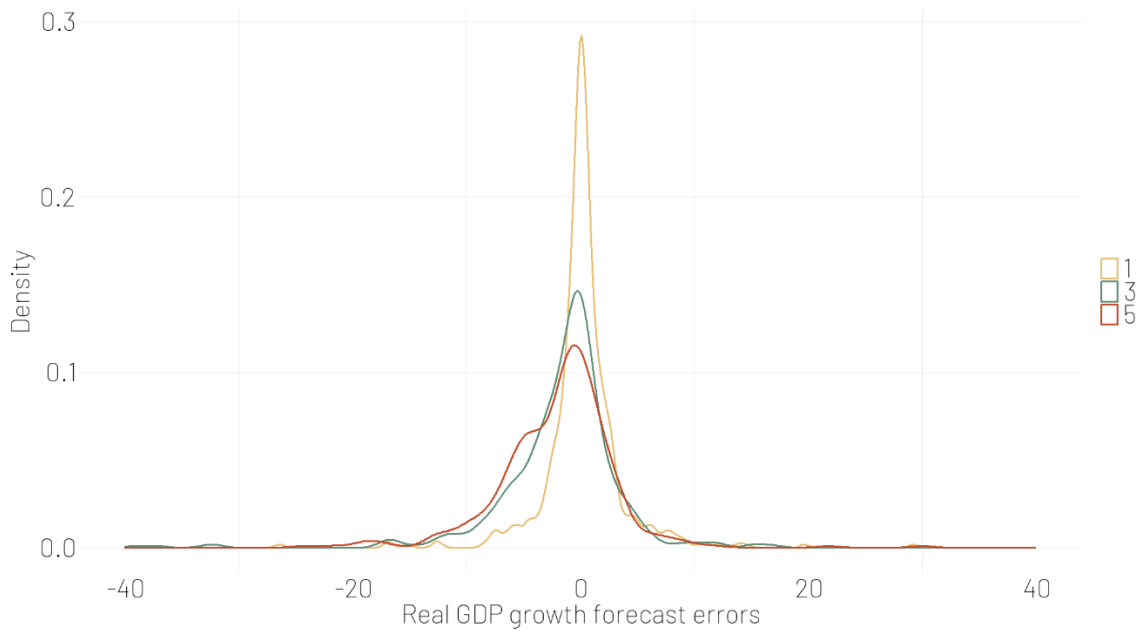
(Negative = pessimism; Positive = optimism)



c) Primary deficit-to-GDP
(Negative = pessimism; Positive = optimism)

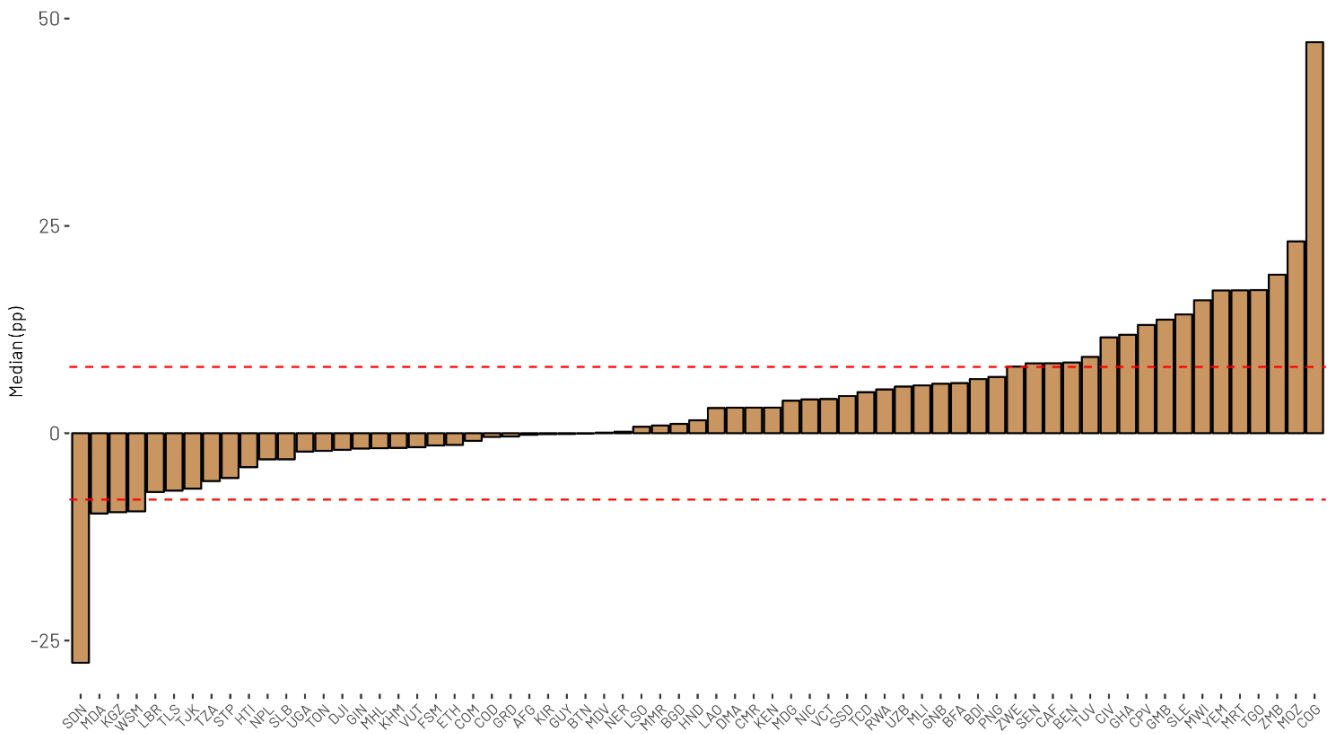


d) Real GDP growth
(Negative = optimism; Positive = pessimism)

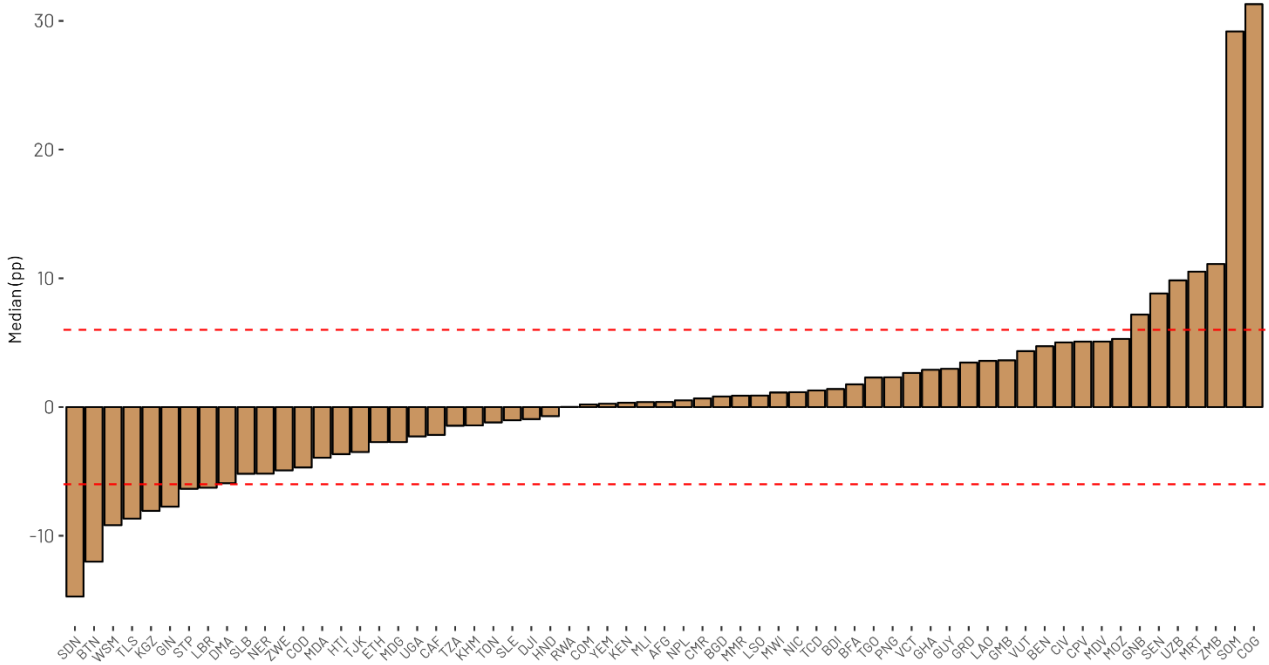


b) Median 3-year forecast errors by country

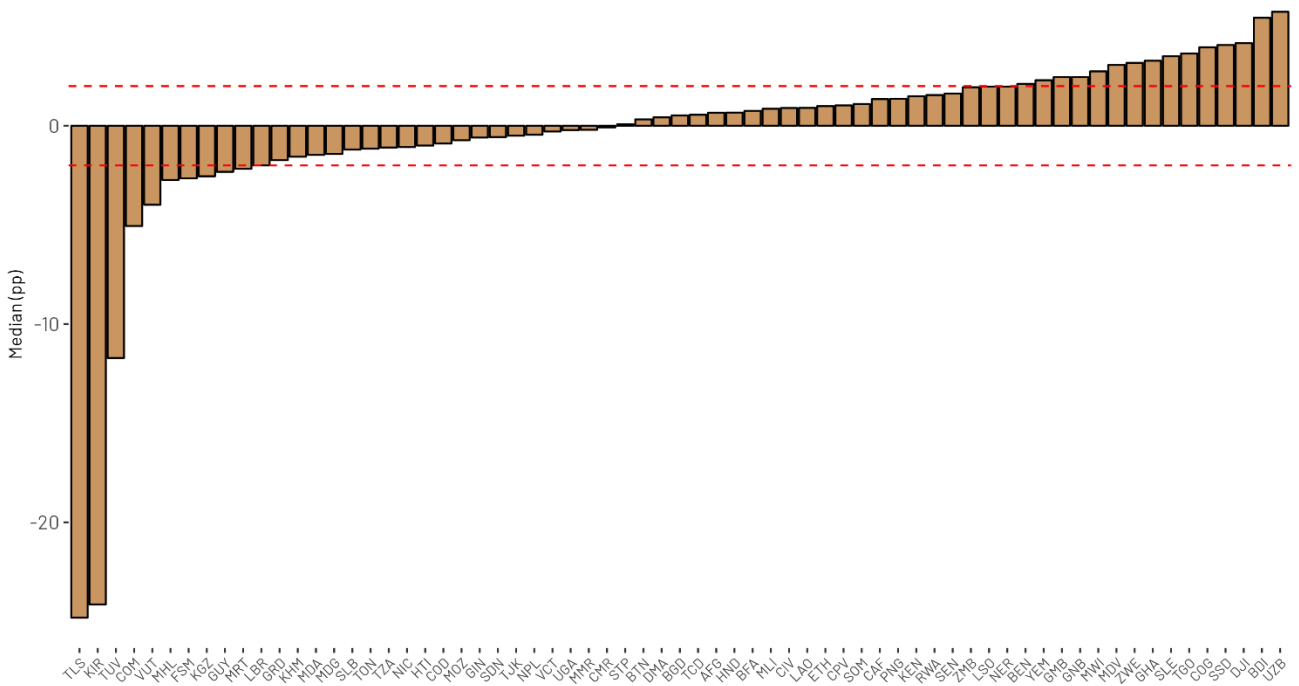
a) Public debt-to-GDP
(Negative = pessimism; Positive = optimism)



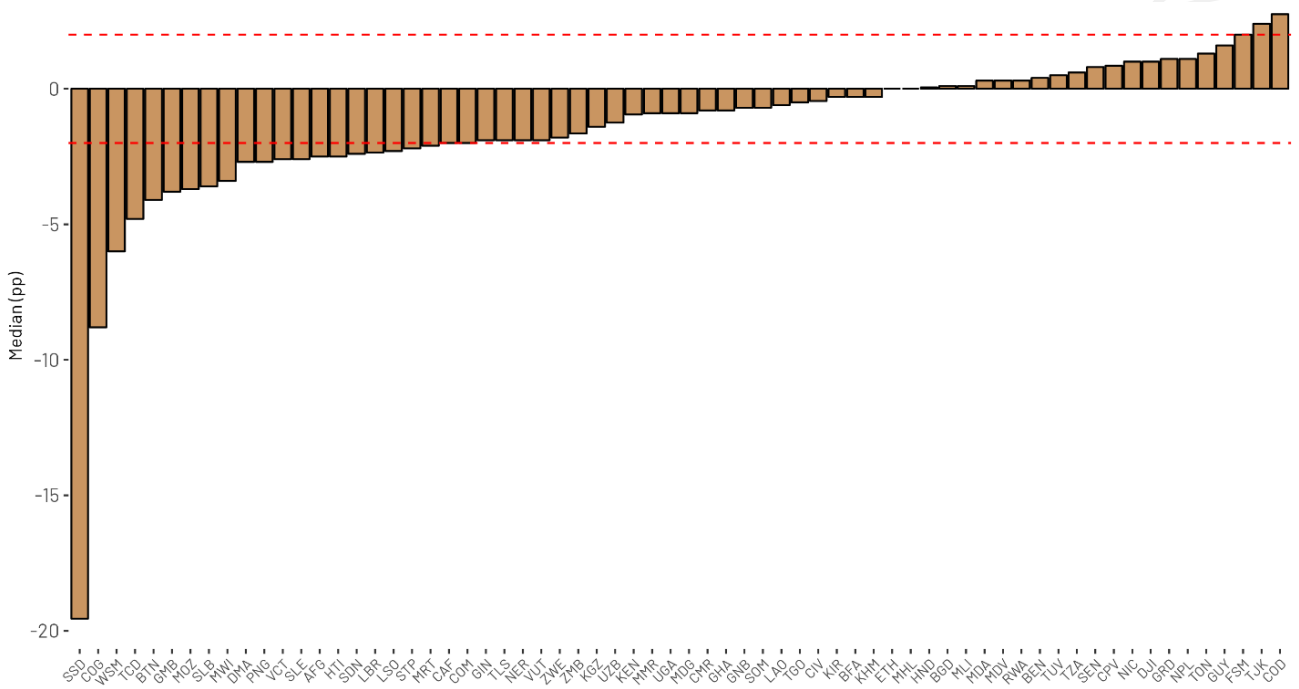
b) External PPG debt-to-GDP
 (Negative = pessimism; Positive = optimism)



c) Primary deficit-to-GDP
 (Negative = pessimism; Positive = optimism)



d) Real GDP growth
 (Negative = optimism; Positive = pessimism)

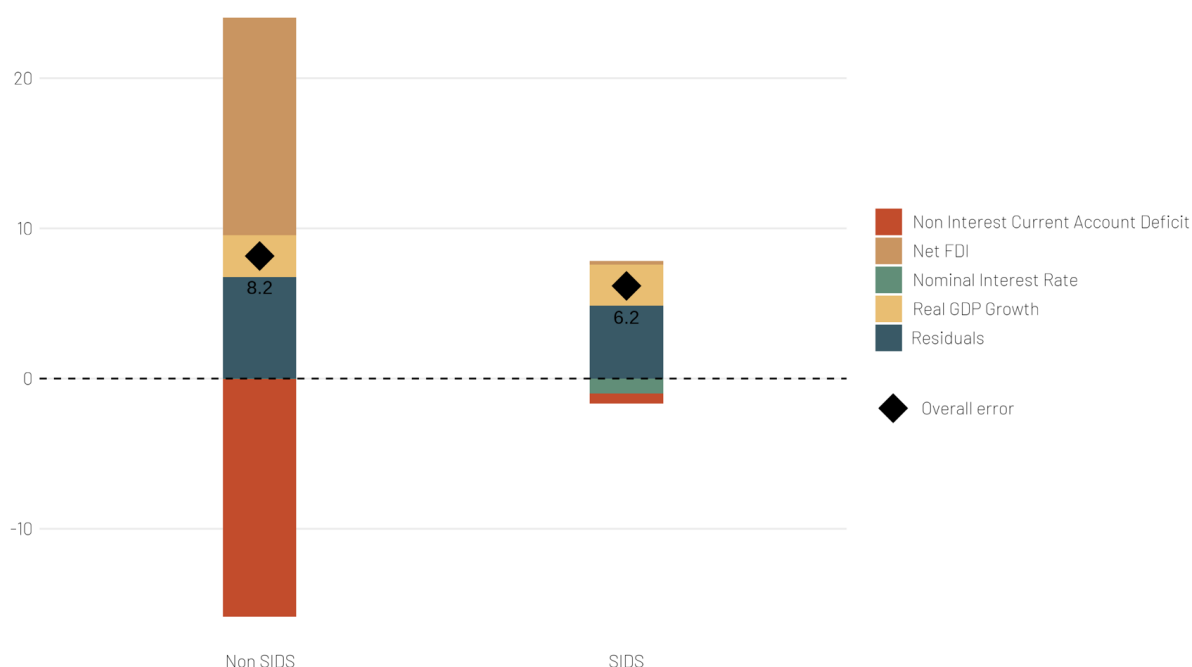


Note: In the graphs above, countries whose median lies between the two dashed lines are considered to have good predictions. Outside this range, projection errors are considered to be either optimistic or pessimistic, depending on the case. The thresholds have been chosen by studying the deciles of the errors. For Public Debt and PPG External Debt to GDP ratios they are fixed at, respectively, ± 8 and ± 6 percents while for the primary deficit ratio and real GDP growth they are fixed at ± 2 percent.

c) Decomposition error forecast buildup

Figure 12 illustrates similar decompositions for the stock of external debt²⁴. In non-SIDS countries, at a 5-year horizon, the forecast error/optimism bias for external debt amounts to **8.2** percentage points of GDP. This bias can be broken down into biased views on BoP projections, “r-g” endogenous debt dynamics and exceptional and stock-flow adjustment. Biased BoP projections display the larger magnitudes. Over 5 years, they amount to overestimated deficits – **-15.8 %** of GDP – and underestimated net FDI – **14.5 %**. Interestingly, this suggests that the IMF-WB teams consistently (and importantly) overpredict country’s excess saving’s potential and underpredict capital outflows. The mirror effect is no miraculous artefact and results from the fact that top-of-the BoP entries are met by an opposite entry in the bottom). Nominal Interest Rate Contributions related forecast errors are negligible, contributing 400 times less than the largest factor (**-0.04 %**). Real growth contributions’ related errors are optimistic biases that account for **2.8 %** among the total, whereas residual forecast errors amount to **6.7 %**²⁵. The large contributions of Forecast Errors on the NICAD and net FDI, which offset each other on average, are particularly important for non-SIDS. For SIDS countries, the forecast error for the stock of external debt is slightly smaller, at **6.2 %** of GDP. The breakdown reveals a contribution of **-0.66 %** for NICAD, **0.26 %** for net FDI, **-1 %** for the nominal interest rate, **2.7 %** for real GDP growth, and **4.9 %** for residual errors. Unlike public debt, the overall difference in external debt forecast errors between SIDS and non-SIDS countries is less pronounced, with overall magnitudes smaller for both groups. Interestingly, BoP flows-related forecast errors are negligible – both NICAD and net FDI– suggesting good practices for projecting country’s external financial needs for SIDS.

Figure 12: External debt 5-year forecast error: Decomposition by projection component for SIDS and non-SIDS countries



²⁴ As a reminder, the change in external debt stocks is explained by non-interest current account deficit (//primary deficits), net FDI inflows, endogenous debt dynamics – further decomposed between nominal interest rate, real growth, and prices contributions along a residual that includes exceptional financing (debt relief, changes in arrears), changes in foreign assets and valuation adjustments.

²⁵ These residual errors include factors such as exceptional financing (e.g., changes in arrears), gross foreign assets, valuation adjustments, and the contributions of price and exchange rate changes.

Regarding net FDI, DSAs defines inflows as negative values. Therefore, the positive forecast error for net FDI reflects underestimated outflows or weaker-than-anticipated inflows of foreign direct investment. This underestimation of debt-mitigating FDI flows results in an overprojection of external debt. The negative NICAD contribution in the forecast errors indicates that the actual current account deficit was smaller than expected, reducing the need for external borrowing to finance the gap. This implies a more favorable external balance than foreseen during the forecasting process, partially offsetting the adverse effects of neglecting the amount of FDI relative outflows.

In summary, our analysis reveals significant differences in the magnitude and composition of forecast errors for public and external debt between non-/SIDS countries. Non-SIDS countries experience larger public debt forecast errors, driven primarily by residual factors, overestimated real GDP growth, and underestimated primary deficits. In contrast, SIDS countries exhibit smaller errors across all components, with a unique negative contribution from primary deficits reflecting stricter fiscal constraints or stronger fiscal discipline. On external debt, SIDS tend to perform better as their BoP-related contributions appear well forecasted.

Public debt 5-year forecast error: Decomposition by projection component for non-SIDS countries

Variable	H1	H2	H3	H4	H5	Cumul.
Public Debt - $FE_2^{v,i}$	0.72	3.88	6.60	10.80	14.75	
Change in Public Debt- $FE_1^{v,i}$	0.74	3.13	2.72	4.17	3.83	14.59
Primary Deficit - $FE_1^{v,i}$	-0.52	0.28	0.68	1.25	1.33	3.01
Real Interest Rate- $FE_1^{v,i}$	-0,52	-0,96	-1,56	-1,87	-2,57	-7,48
Real GDP Growth - $FE_1^{v,i}$	0.31	1.02	1.14	1.24	1.09	4.80
Residuals - $FE_1^{v,i}$	1,48	2,79	2,46	3,55	3,98	14,26

External debt 5-year FE: Decomposition by projection component for non-SIDS countries

Variable	H1	H2	H3	H4	H5	Cumul.
External Debt- $FE_2^{v,i}$	0.59	2.75	4.92	6.51	8.90	
Change in External Debt- $FE_1^{v,i}$	0.57	2.13	2.18	1.66	1.62	8.16
NICAD- $FE_1^{v,i}$	-2.02	-3.06	-3.17	-3.63	-3.94	-15.82
Net FDI- $FE_1^{v,i}$	2.31	2.77	3.03	3.01	3.35	14.48
Nominal Interest Rate- $FE_1^{v,i}$	-0.06	-0.06	-0.07	0.01	0.15	-0.04
Real GDP Growth- $FE_1^{v,i}$	-0.06	0.51	0.70	0.83	0.82	2.80
Residuals- $FE_1^{v,i}$	0.41	1.98	1.69	1.44	1.23	6.74

Public debt 5-year forecast error: Decomposition by projection component for SIDS countries

Variable	H1	H2	H3	H4	H5	Cumul.
Public Debt - $FE_2^{v,i}$	-1.03	-0.25	2.25	3.76	5.12	
Change in Public Debt- $FE_1^{v,i}$	-1.03	0.78	2.50	1.52	1.66	5.43
Primary Deficit - $FE_1^{v,i}$	-1.11	-1.67	-0.95	-0.08	0.70	-3.11
Real Interest Rate- $FE_1^{v,i}$	-0,23	-0,15	-0,29	-0,68	-0,95	-2,29
Real GDP Growth - $FE_1^{v,i}$	-0.32	0.96	1.09	0.95	-0.01	2.67
Residuals - $FE_1^{v,i}$	0,63	1,64	2,65	1,32	1,93	8,16

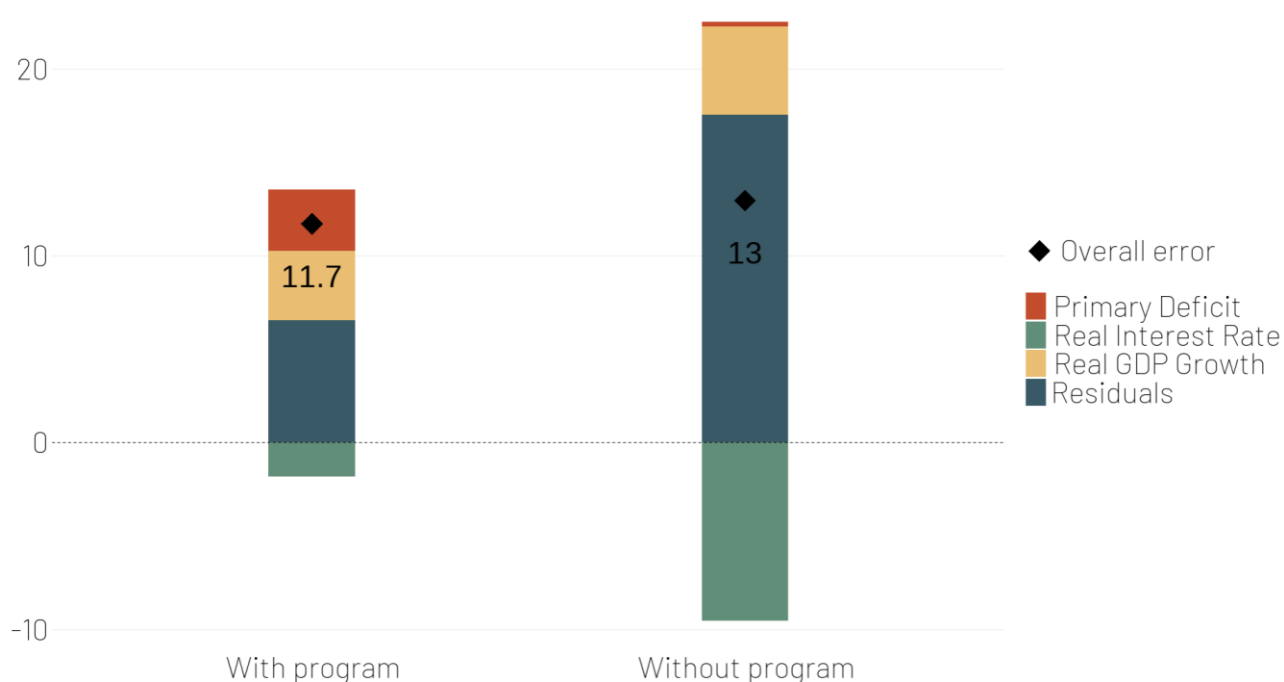
External debt 5-year forecast error: Decomposition by projection component for SIDS countries

Variable	H1	H2	H3	H4	H5	Cumul.
External Debt- $FE_2^{v.i}$	0.12	0.63	2.13	3.73	5.94	
Change in External Debt- $FE_1^{v.i}$	0.12	0.65	1.70	1.62	2.09	6.17
NICAD- $FE_1^{v.i}$	-0.50	0.07	0.29	-0.14	-0.38	-0.66
Net FDI- $FE_1^{v.i}$	0.83	0.53	-0.08	-0.42	-0.60	0.26
Nominal Interest Rate- $FE_1^{v.i}$	-0.20	-0.20	-0.22	-0.20	-0.19	-1.00
Real GDP Growth- $FE_1^{v.i}$	-0.13	0.82	0.97	0.79	0.28	2.72
Residuals- $FE_1^{v.i}$	0.12	-0.56	0.73	1.59	2.99	4.86

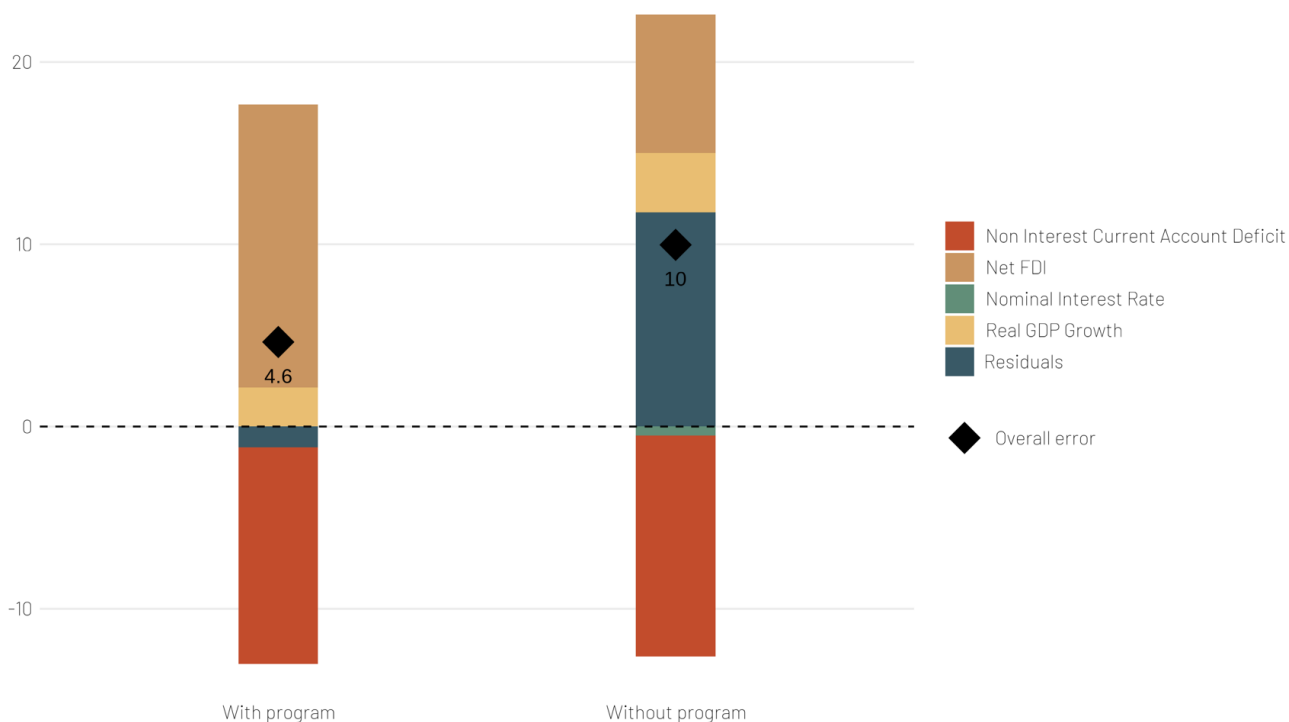
Note: Within each table, the bolded values should ideally be equal. However, slight differences persist because achieving perfect equality would require using only DSAs that include projections for all forecast years. To avoid significant data loss, we have also included DSAs published after 2018. It should be noted that the sum of cumulated factors are equal to the cumulative debt change.

d) Decomposition error forecast buildup for program and non-program countries

Public debt 5-year forecast error: Decomposition by projection component for program and non-program countries



External debt 5-year forecast error: Decomposition by projection component for program and non-program countries



e) Drivers of forecasting bias: insights on conjunctural, institutional and structural

We now delve deeper into understanding which factors correlate the most with larger forecasting biases and what drive the latter. Versions of Table 2 below present the results for public debt-to-GDP forecast errors using one explanatory variable at a time.

Conjunctural factors:

Projections made within a program display slightly lower pessimism than those without for debt ratios, yet these differences are statistically different only for the external PPG debt ratio. Real growth doesn't display significant difference between the two subsamples. On the contrary, there is a significant difference for primary deficits, as countries under program face underestimated forecasts. Primary deficit is predicted at a five-year horizon with 0.1 pp of GDP of optimistic bias without program against 2.2pp in the contrary case. This result indicates that the tendency of debt stocks to be underestimated during programs does not come from the primary deficit or growth, but rather from another source such as interest rates.

For DSAs conducted in a recessionary year (with negative growth), errors on public debt are 10.6 pp of GDP higher than they are when the DSA is conducted in an expansionary year, for which they already remain high at 9.6 pp of GDP. Forecast errors on real GDP growth are 8.1% more optimistic at a five-year horizon than they are if there is no recession at the time of forecasting (without a recession, forecasts are optimistic by 0.4% at horizon five on average). External debt ratio is also more underestimated for DSA conducted in a recessionary year. Primary deficit forecasts are not statistically different depending on the occurrence of a recession in the forecasting year.

Countries that have higher growth volatility (measured by the standard deviation of real GDP growth over 2011-2022) do not display significant larger forecast error, except naturally for real GDP growth. This implies that growth erraticness and the higher uncertainty it imposes on macroeconomic

developments are not associated with more difficult prediction capacities. This appears as a different result from Estefania-Flores et al (2023), which might be due to our study focusing solely on LICs against a sample of advanced economies, emerging markets and developing countries in their article.

Finally, we have ranked the countries according to their debt-to-GDP ratio over the 2011-2023 period. Countries below the median of this indicator are considered to have historically low levels of debt stock, and vice versa. Countries with the highest public debt-to-GDP ratios tend to have more optimistic public debt ratio forecasts than those with historically lower ratios. This observation does not extend to the other three variables, where the difference between the two samples is not significant.

Table 2.1: Individual Effects of Conjunctural factors on Forecast Errors on Public Debt-to-GDP Over a 5-Year Horizon

	<i>Dependent variable:</i>			
	Public debt-to-GDP			
	(1)	(2)	(3)	(4)
In program	-0.557 (2.413)			
In recession		10.625*** (3.163)		
Growth volatility			0.151 (0.322)	
Average gob. debt level				0.238*** (0.037)
Constant	11.565*** (1.537)	9.627*** (1.276)	10.697*** (1.811)	-2.569 (2.408)
Observations	335	332	335	335
R ²	0.0002	0.033	0.001	0.113
Residual Std. Error	21.685 (df = 333)	21.268 (df = 330)	21.680 (df = 333)	20.424 (df = 333)
F Statistic	0.053 (df = 1; 333)	11.285*** (df = 1; 330)	0.219 (df = 1; 333)	42.454*** (df = 1; 333)

Note:

* p ** p*** p<0.01

Institutional & Policy factors:

A higher level of institutional quality (captured here with the yearly average of the World Governance Indicators) is associated with a lower level of optimism bias for the public debt-to-GDP ratio and the real GDP growth. As an illustration, the median country faces forecast errors of 11.8 pp of GDP on public debt ratio and -1.95% on real GDP growth. The country at the third quartile of the institutional quality distribution (higher quality) displays forecast errors of, respectively, 9.4pp of GDP and -1.4% for GDP growth while a country at the first quartile of institutional quality faces higher biases of 14.2 pp of GDP and -2.49% for real growth.

Considering fiscal rules, it is first important to note that all countries in our sample that display at least one fiscal rule include one targeting the debt level and in a vast majority (20 out of 26 cases) have one

on the government budget balance. The results indicate no significant effect of fiscal rule on average forecast errors for public debt-to-GDP ratios, the primary deficit and real GDP growth. Yet, if a DSA is conducted for a country with a fiscal rule, the forecast error on external debt will be higher by 3.6pp of GDP at a five-year horizon. This observation suggests that forecasters give too much attention to the existence of a rule when projecting governments' policy decisions and tend to be also overoptimistic on the external debt dynamics. The fact that the presence of a fiscal rule is not associated with a significant difference on public debt ratios suggests that while forecasters underestimate external debt stocks in the presence of a rule, they overestimate the stock of domestic debt.

Different exchange rate regimes do not imply statistical differences between forecast errors for the main variables.

Table 2.2 : Individual Effects of Institutional & Policy factors on Forecast Errors on Public Debt-to-GDP Over a 5-Year Horizon

	<i>Dependent variable:</i>		
	Public Debt-to-GDP		
	(1)	(2)	(3)
WGI	-5.509*** (2.110)		
In fiscal rule		3.569 (2.414)	
In PEG currency regime			-0.416 (2.568)
Constant	8.260*** (1.771)	9.921*** (1.521)	11.627*** (2.137)
Observations	289	335	335
R ²	0.023	0.007	0.0001
Adjusted R ²	0.020	0.004	-0.003
Residual Std. Error	21.998 (df = 287)	21.616 (df = 333)	21.686 (df = 333)
F Statistic	6.819*** (df = 1; 287)	2.187 (df = 1; 333)	0.026 (df = 1; 333)

Note:

* p ** p *** p<0.01

Structural factors:

The regressions confirm the observations made earlier on SIDS. For all variables of interest, SIDS display significantly less optimistic biases. Non-SIDS' forecasts are strongly optimistic with errors at 14.5 pp of GDP on public debt, 4.5 pp of GDP on external debt and 1.7 pp of GDP on primary deficits. As for real GDP growth, it is overestimated by 2.3%. Conversely, the SIDS have lower errors of the order of 11 pp of GDP for public debt, 2.8 pp of GDP for external debt and 2.7 pp of GDP for primary deficits. The overestimation of growth is reduced to 0.3%.

In a similar vein and because many SIDS are vulnerable to natural disasters, the group of vulnerable countries display significantly less optimistic biases for forecasts on public and external debt-to-GDP ratios, primary deficits and real GDP growth.

Finally, countries that are commodity exporters do not display significantly different errors on real GDP growth and primary deficits forecasts. Commodity exporters are nevertheless associated with stronger optimism biases on public debt ratio. While public debt-to-GDP forecasts underestimate the realized level by 7.5 pp of GDP for non-dependent countries, commodity exporters display 15.9 pp of GDP underestimated forecasts.

Table 2.3 : Individual Effects of Structural Factors on Forecast Errors on Public Debt-to-GDP Over a 5-Year Horizon

	<i>Dependent variable:</i>			
	Public Debt-to-GDP			
	(1)	(2)	(3)	(4)
Small Island	-11.323*** (2.572)			
Vulnerable		-12.074*** (2.447)		
Fragile/Conflict			1.801 (2.420)	
Commodity Exporter				8.363*** (2.335)
Constant	14.482*** (1.355)	15.231*** (1.390)	10.252*** (1.879)	7.544*** (1.573)
Observations	335	335	335	335
R ²	0.055	0.068	0.002	0.037
Adjusted R ²	0.052	0.065	-0.001	0.034
Residual Std. Error (df = 333)	21.082	20.935	21.669	21.281
F Statistic (df = 1; 333)	19.380***	24.341***	0.554	12.822***

Note:

* p < 0.1
** p < 0.05
*** p < 0.01

Forecast errors in primary deficit-to-GDP over a five-year horizon

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	0.14 (0.51)	1.08 (0.44)**	1.23 (0.61)**	-0.32 (0.86)	0.59 (0.63)	0.82 (0.51)	0.64 (0.71)	1.72 (0.46)***	1.66 (0.48)***	1.95 (0.64)***	1.06 (0.54)*	0.74 (0.45)
In program	2.08 (0.80)***											
In recession		-0.58 (1.09)										
Growth volatility			-0.06 (0.11)									
Average gov. debt level				0.02 (0.01)*								
WGI					-0.72 (0.75)							
In fiscal rule						0.44 (0.81)						
In PEG currency regime							0.51 (0.86)					
Small Island								-2.71 (0.89)***				
Vulnerable									-2.13 (0.85)**			
Fragile or in conflict										-1.56 (0.81)*		
Commodity Exporter											-0.16 (0.80)	
Post 17 method												1.16 (0.96)
R ²	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.03	0.02	0.01	0.00	0.00
Adj. R ²	0.02	-0.00	-0.00	0.01	-0.00	-0.00	-0.00	0.02	0.02	0.01	-0.00	0.00
Num. obs.	332	329	332	331	286	332	332	332	332	332	332	332

***p < 0.01; **p < 0.05; *p < 0.1

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Forecast errors in real GDP growth over a five-year horizon

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	-1.28 (0.45)***	-0.41 (0.34)	-3.22 (0.52)***	-0.97 (0.75)	-1.17 (0.53)**	-1.92 (0.45)***	-1.78 (0.63)***	-2.28 (0.41)***	-1.91 (0.42)***	-0.71 (0.55)	-1.74 (0.47)***	-1.98 (0.39)***
In program	-1.12 (0.71)											
In recession		-8.12 (0.84)***										
Growth volatility			0.35 (0.09)***									
Average gov. debt level				-0.01 (0.01)								
WGI					1.22 (0.64)*							
In fiscal rule						0.47 (0.71)						
In PEG currency regime							0.08 (0.76)					
Small Island								2.00 (0.77)**				
Vulnerable									0.55 (0.75)			
Fragile or in conflict										-1.69 (0.71)**		
Commodity Exporter											0.02 (0.70)	
Post 17 method												1.12 (0.84)
R ²	0.01	0.22	0.04	0.00	0.01	0.00	0.00	0.02	0.00	0.02	0.00	0.01
Adj. R ²	0.00	0.22	0.04	0.00	0.01	-0.00	-0.00	0.02	-0.00	0.01	-0.00	0.00
Num. obs.	336	333	336	335	289	336	336	336	336	336	336	336

*** p < 0.01; ** p < 0.05; * p < 0.1

Forecast errors in external PPG debt-to-GDP over a five-year horizon

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Constant	4.88 (0.96) ^{***}	2.87 (0.81) ^{***}	4.85 (1.19) ^{***}	1.66 (1.68)	4.29 (1.09) ^{***}	2.22 (0.97) ^{**}	2.17 (1.29) [*]	4.48 (0.86) ^{***}	5.23 (0.87) ^{***}	5.70 (1.15) ^{***}	2.78 (0.99) ^{***}	3.82 (0.78) ^{***}
In program	-2.72 (1.51) [*]											
In recession		5.14 (1.93) ^{***}										
Growth volatility			-0.26 (0.22)									
Average gov. debt level				0.03 (0.02)								
WGI					0.84 (1.30)							
In fiscal rule						3.66 (1.49) ^{**}						
In PEG currency regime							2.40 (1.58)					
Small Island								-2.77 (1.70)				
Vulnerable									-4.94 (1.61) ^{***}			
Fragile or in conflict										-3.28 (1.50) ^{**}		
Commodity Exporter											2.31 (1.50)	
Post 17 method												-0.51 (2.58)
R ²	0.01	0.03	0.00	0.01	0.00	0.02	0.01	0.01	0.03	0.02	0.01	0.00
Adj. R ²	0.01	0.02	0.00	0.00	-0.00	0.02	0.00	0.01	0.03	0.01	0.01	-0.00
Num. obs.	271	271	271	271	271	271	271	271	271	271	271	271

*** p < 0.01; ** p < 0.05; * p < 0.1

E. Proof: Decomposition debt stock to GDP forecast errors formula

For all h . $\Delta d_{t+h} = pd_{t+h} + add_{t+h} + res_{t+h}$. Summing over h and telescoping:

$$\sum_{h=1...5} \Delta d_{t+h} = \sum_{h=1...5} (pd_{t+h} + add_{t+h} + res_{t+h})$$

$$d_{t+5} - d_t = \sum_{h=1...5} (pd_{t+h} + add_{t+h} + res_{t+h})$$

Evaluating the equation for both the realized and projected side:

$$R^i(d_{t+5}) - R^i(d_t) = \sum_{h=1...5} (R^i(pd_{t+h}) + R^i(add_{t+h}) + R^i(res_{t+h}))$$

$$P^{v,i}(d_{t+5}) - P^{v,i}(d_t) = \sum_{h=1...5} (P^{v,i}(pd_{t+h}) + P^{v,i}(add_{t+h}) + P^{v,i}(res_{t+h}))$$

Subtracting both equations:

$$R^i(d_{t+5}) - R^i(d_t) - (P^{v,i}(d_{t+5}) - P^{v,i}(d_t))$$

$$= \sum_{h=1...5} ((R^i(pd_{t+h}) - P^{v,i}(pd_{t+h})) + (R^i(add_{t+h}) - P^{v,i}(add_{t+h})))$$

$$+ (R^i(res_{t+h}) - P^{v,i}(res_{t+h}))$$

$$FE_2^{v,i}(d_{t+5}) = \sum_{h=1}^5 FE_1^{v,i}(pd_{t+h} + add_{t+h} + res_{t+h})$$

With:

- $FE_2^{v,i}(y_{t+h}) = FE^{v,i}(y_{t+h}) = R^i(y_{t+h}) - R^i(y_t) - (P^{v,i}(y_{t+h}) - P^{v,i}(y_t))$ our usual error measure
- $FE_1^{v,i}(y_{t+h}) = R_t^i(y_{t+h}) - P_t^{i,v}(y_{t+h})$ the simple difference between actual and projected values
- d_t , pd_t , add_t and res_t refers respectively to the public debt to GDP ratio, primary deficit to GDP ratio, the automatic debt dynamics and the residual.

F. Data limitation to decompose forecast errors buildup

We encountered four main challenges in breaking down debt dynamics.

- 1) The first challenge was addressed in the previous section, where we achieved an accurate debt dynamics decomposition augmented by the error dimension.
- 2) Discrepancies arise when comparing t+5 debt stock forecast errors with cumulative flow errors from t+1 to t+5. These differences stem from approximations, distribution effects, and the definition of measurement errors. To ensure a consistent decomposition, the COVID dummy was excluded, and a balanced sample applied across all variables in each table
- 3) In DSA documents, the projections for the contribution of the exchange rate changes are included in the residual elements, then we can't disentangle the contribution from this part in the analysis. Same for the contribution from price change in the external debt sustainability framework part of the DSA.

- 4) The real effective interest rate on public debt is a weighted average of the real interest rate on domestic debt and the real interest rate on external debt. While real effective rates on public and domestic debt are derived from nominal effective interest rates and the inflation computed using the GDP deflator in local currency, the real effective rate on external debt can be computed in two different ways. Using the standard decomposition, the real rate on external debt is derived from the nominal rate on external debt and the inflation computed using the GDP deflator in USD. Yet, the LIC DSF defines the real rate on external debt by considering the deflator of the US GDP. Doing so allows us to extract directly the effects of the real depreciation. Following computations detail the procedure to match the standard debt dynamic equation with the one practiced by the IMF-WB teams.

For the realized values (WEO), the real effective interest rate can be calculated as follows:

$$1 + r_t^w = \frac{1 + i_t^w}{1 + \pi_t^{LCU}} \quad (1)$$

Nevertheless, in the DSA:

$$1 + r_t^w = \alpha_{t-1} \frac{(1 + i_t^f)}{1 + \pi_t^f} + (1 - \alpha_{t-1}) \frac{(1 + i_t^d)}{1 + \pi_t^{LCU}} \quad (2)$$

where r_t^w and i_t^w are the real and nominal effective interest rate, i_t^f and i_t^d the nominal interest rate on the debt denominated in foreign currency and the domestic debt, α_{t-1} the share of total debt denominated in foreign currency in $t-1$, π_f the growth of the deflator in the US, π_t^{LCU} the growth of the deflator using GDP in LCU.

To reconcile the two, it is essential to return to the basics. Total interest payments I_t are equal to foreign interest payments evaluated in LCU using the exchange rate e_t , and domestic interest payments:

$$I_t = e_t I_t^f + I_t^d$$

Dividing by total debt at the previous year D_{t-1} , we get:

$$\frac{I_t}{D_{t-1}} = \frac{e_t I_t^f}{e_{t-1} D_{t-1}^f} \frac{e_{t-1} D_{t-1}^f}{D_{t-1}} + \frac{I_t^d}{D_{t-1}^d} \frac{D_{t-1}^d}{D_{t-1}}$$

$$i_t^w = (1 + \Delta e_t) i_t^f \alpha_{t-1} + i_t^d (1 - \alpha_{t-1})$$

where Δe_t represents the rate of exchange rate depreciation and α_{t-1} the share of total debt denominated in foreign currency at the previous year.

Rearranging,

$$1 + i_t^w = \alpha_{t-1} (1 + (1 + \Delta e_t) i_t^f) + (1 - \alpha_{t-1}) (1 + i_t^d)$$

$$1 + i_t^w = \alpha_{t-1} \left((1 + \Delta e_t) (1 + i_t^f) - \Delta e_t \right) + (1 - \alpha_{t-1}) (1 + i_t^d)$$

Then, dividing by $1 + \pi_t^{LCU}$,

$$1 + r^w = \alpha_{t-1} \frac{1 + \Delta e_t}{1 + \pi_t^{LCU}} (1 + i_t^f) - \frac{\alpha_{t-1} \Delta e_t}{1 + \pi_t^{LCU}} + (1 - \alpha_{t-1}) (1 + r_t^d) \quad (3)$$

Subtracting (2) and (3):

$$\Delta = \alpha_{t-1}(1 + i_t^f) \left(\frac{1 + \Delta e_t}{1 + \pi_t^{LCU}} - \frac{1}{1 + \pi_t^f} \right) - \frac{\alpha_{t-1} \Delta e_t}{1 + \pi_t^{LCU}} \quad (4)^{26}$$

All variables in (4) can be found in the WEO, then simply subtract Δ from (1) to get a real effective interest rate comparable with the one in the DSA.

²⁶ In fact, $\Delta = \alpha_{t-1}(1 + r_t^f)q - \frac{\alpha_{t-1} \Delta e_t}{1 + \pi_t^{LCU}}$ with q the real depreciation rate.



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