Public Debt Decompositions in Emerging Economies

Methodology and Introduction of a Public Access Dashboard

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Abstract

In the context of rising public debt ratios and tightening financial conditions and spaces, especially in developing economies, studying the drivers of public debt accumulation is more important than ever. The successive Covid-19 and Russia-Ukraine war have pressured public finances and paved the way for further debt accumulation, thus accelerating a trend initiated in the 2010s.

This note investigates the challenges associated with public debt decompositions and proposes a methodology relying on publicly available data from the IMF and World Bank. In particular, it addresses core questions such as stock-flow adjustments generated by non-expenditure flows, hidden debt and the definition and valuation of external debt.

FDL's new public access debt decomposition tool is also introduced, providing a user-friendly interface for public debt decomposition, at the country and various aggregate levels. It uses the developed methodology and aims to address some of the challenges faced when working with debt statistics. We hope this transparent tool can serve as a public good and make debt decompositions more easily accessible to analysts.

1. Introduction

Two decades after the HIPC and MDRI, developing economies are facing a rapid accumulation of public debt. This trend has successively been worsened by the Covid-19 pandemic and the war in Ukraine, which have pushed debt ratios even further. As the IMF (2023) recently pointed out, the global public debt ratio is expected to reach 100% of the world's GDP in the coming years. Fiscal consolidations have had limited success in containing debt ratios, whereas below the line operations have significantly contributed to their rise. Troubled exchange rate periods and higher refinancing condition, together with lower growth outcomes in many economies, are all contributing to challenging debt accumulations.

With tightening international financial conditions and various policy challenges, including climate change, the outlook has become even bleaker for many emerging economies. As often cited, the number of (PRGT-eligible) countries at high risk of -or already in- debt distress has more than doubled over a few years, a trend which should continue in the years to come, with peaking debt service in 2024-2025 (see FDL, 2022).

This paper proposes a debt decomposition methodology and aims to identify the key drivers of public debt accumulation, based on publicly available data from the IMF and the World Bank. The fiscal and public accounting challenges associated with these decompositions are investigated, on stock-flow adjustments, external debt definition and currency compositions. Indeed, a decomposition of debt accumulation helps formulate a diagnostic and policy recommendations: a country where public deficits accumulate would need a different approach than a country where exchange rates variations explain most of the debt accumulation.

Based on this methodology, FDL developed an online public-access tool. To our knowledge, it is the only one available so far and it aims to provide analysts with a user-friendly and inclusive solution to study public debt accumulation. The decomposition also has its weaknesses: in many cases, the residual, which we call, following the literature, "stock-flow adjustment', is large. How to interpret those residuals is discussed in section 2.

2. Debt decomposition challenges in existing literature

The drivers of public debt dynamics have been widely studied in academic and institutional literatures. If IMF Debt Sustainability Analyses (DSAs) can reliably conduct such exercise at country-level with granular and quality information, their implementation come with many methodological challenges when using publicly available data from global debt databases.

Public debt accumulation equations aim to identify the respective contributions of six features on the change in the debt-to-GDP ratio: the primary balance, real growth, exchange rate, interest payments, inflation and Stock Flow Adjustments (SFAs). If this is quite straightforward to do from a theoretical perspective, debt statistics and scopes are the key challenges to these methodologies.

Debt scope and stock-flow adjustments

Public debt has been rising across most economies in the world, and its scope is increasingly complex. The quantity that we try to explain is the rise in general government debt, which is the one used in the World Economic Outlook (WEO). Its components have changed, with increased domestic debt, levels of government, etc. (see IMF, 2011)**.** Correspondingly, we use general government debt in the International Debt Statistics (IDS) to measure external debt.

According to IMF definitions, gross public debt refers to all liabilities that require future payment of interest and/or principal by the debtor to the creditor. This includes debt liabilities in the form of special drawing rights, currency, deposits, debt securities, loans, insurance, pension, standardized guarantee programs and other accounts payable.

Public debt dynamics can be studied at the gross or net level[1]. If net debt is interesting from a balance sheet perspective, and is thus studied in the IMF (2021) tool for public debt projection, we chose to focus on gross debt. **First, because the WEO's country coverage for net debt is much lower than the one for gross debt, and second, because the IDS external debt statistics are only available in gross terms.** As a consequence, residuals in the decompositions are large, i.e., the share of the change in the debt ratio is not explained by our main metrics. Indeed, for instance, if a large long-term bond is issued, which only part of the proceeds is used to finance deficit, the remainder would not appear in a net debt equation, but would in a gross debt one.

Another way to understand these SFAs is to consider them as below the line operations, namely fiscal flows generating additional liabilities and not directly generated by public expenditures, as opposed to above the line operations. Their large contributions are detailed in IMF (2023), under the form of transfers to struggling SOEs or materialization of guarantees, often off-setting fiscal consolidations. Generally positive, SFAs can be increased by other flows such as nationalizations, materialization of contingent liabilities (e.g., guarantees, bail-outs) and reduced by debt cancellations or privatizations.

Indeed, especially in developing countries, major negative SFAs can occur with events of sovereign debt restructuring. Events of defaults are very well documented by the literature, but the absence of a global and harmonized database on domestic and external debt restructurings prevents for the moment from being able to disentangle these events in the data.

The literature has pointed the existence of these large residuals and sometimes unexplained changes in debt statistics. Campos, Jaimovich and Panizza (2006) show that SFAs have on average a positive (and large) contribution to the debt ratio and occur in times of crises, when contingent liabilities materialize. Afonso and Tovar Jalles (2019) also study these large flows, which by definition often escape fiscal rule since not being due to public revenue or expenditure effects[2], pointing their increasing role in debt dynamics and limiting the ability of fiscal consolidation to contain debt ratios.

[1] Net debt refers to gross debt minus financial assets corresponding to debt instruments.
[2] See also Abbas et al. (2011) and Weber (2012) for discussions on the role and contribution SFAs.

External debt, exchange rates and hidden debt

The main data source for external debt is the World Bank's International Debt Statistics (IDS)[3]. Despite its large coverage and number of variables, the use of IDS raises a number challenges. The main ones are associated with the definition of external debt (from a residency or currency basis), its currency composition, and crossing it with IMF data on total debt.

First, as we are interested in exchange rate effects on public debt dynamics, this requires to focus on countries for which this differentiation is relevant, namely developing economies issuing international debt denominated mostly in US dollars (USD) and in euros (EUR). The IDS thus provides a wide range of external debt statistics at different institutional levels for 135 developing economies.

As detailed in the World Bank Debt Reporting System's manual, the IDS includes all debt with a maturity greater than one year, owed by the government to non-resident creditors (private, bilateral and multilateral). Bearing in mind that countries can owe debt denominated in local currency to foreign agents, and on the opposite FX debt to domestic ones, the IDS therefore does not enable to keep track of debt issued to residents in foreign currency, which could lead to misestimate exchange rate effects. The IDS provides a currency breakdown of external debt denomination for USD, EUR, Swiss Franc (CHF), British Pound (GBP), Japanese Yen (JPY), the remainder being classified in "other currencies of denomination". As identified by Eichengreen, Hausmann & Panizza (2023), this last category should include local currency debt, but also probably a growing share of other currencies, for example Chinese renminbi-denominated loans, and more secondarily South African rand or Russian ruble, for some specific geographical areas. Following these authors, we assume that all the "other currencies" category corresponds to local currency, sometimes thus leading to an underestimate of exchange rate effects. In addition, if the residency criterion works fine for official loans, it is yet more subject to debate for tradable bonds which by definition can change hands with limited trackability in the data.

Exchange rate effects are important contributors to changes in debt ratio, since they affect the valuation of the stock of debt denominated in a foreign currency, as well as the interest payments on this debt. By definition, there is no such effect when the local currency has a fixed parity with the currency of denomination. In general, debt decomposition methodologies look at the change in the end-of-year exchange rates, which we also do.

Some more in-depth methodologies also look at intra-year exchange rates. For instance, a sharp and momentaneous intra-year exchange rate depreciation could increase debt service and not be captured by using only end-of-year exchange rate. This is done in the methodology by Santiago Acosta (2020), by taking into account the spread between the average and end-of-year exchange rate. These intra-year exchange rate effects yet have quite limited quantitative contributions to debt dynamics and are not included in the present analysis.

Public debt discoveries, of sometimes so-called hidden debt, have been a major topic over the past few years[4]. They can arise for both domestic or external debt, generally taking the form of non-transparent loans, and can generate jumps in total debt (when they are not retropolated, otherwise contributing to large SFAs) and eventually explain a mismatch between public debt databases. The hidden debt issue is not new (see Esfahan and Kim, 2002), but has received greater attention with contributions following Horn et al. (2020) which extensively discuss debt discoveries in bilateral lending

[3] https://www.worldbank.org/en/programs/debt-statistics/ids
[4] See for instance the 2016 USD 2bn hidden debt scandal in Mozambique.

from China, with sometimes a voluntary lack of transparency, and challenging debt sustainability. Debt discoveries can also play a role, from a debt database to another, in mismatches for instance between total and external debt statistics. Horn et al. (2023) asked more generally how reliable debt statistics are by looking at ex-post revision of past public debt and show that hidden debt is common in all types of countries, and mostly arises in bilateral and non-bond private debt contracted during high states of the economy.

With general government gross debt given at the total level by the WEO and external level by the IDS, domestic debt and debt service thus have to be inferred as a differential. Unfortunately, these two definitions sometimes differ on a case-by-case basis, and in some cases external general government debt from IDS is larger than total public debt in the WEO. This well-known problem has not been solved yet by other authors and we take it as given, and remove non-coherent observations.

4. Methodology and data

This section describes the methodology of the debt decomposition equation, sources the variables used, and introduces FDL's online tool. It also validates the decomposition by comparing the results for a few countries between IMF DSAs and our own.

The debt accumulation equation

FDL's debt decomposition methodology is built in order to adapt to existing statistics on sovereign debt. It is mostly inspired by the IMF (2021) methodology previously mentioned, which relates to the IMF Debt Sustainability Analyses[5]. It starts with the standard decomposition of the debt dynamic in nominal terms. Total general government gross debt (D_t) is split between domestic (D^d_t) and external debt (D^f_t). The total debt at time t, as displayed in the equation below, is standardly increased by total interest payments and decreased by the primary balance (B_t).

$$D_t = e_t D^f_{t-1} + D^d_{t-1} + i_t D_{t-1} - B_t + SFA_t$$

The stock-flow adjustment (SFA_t) captures all flows which are not directly generated by fiscal flows. As previously discussed, they are positive on average and correspond for instance to unused bond and loan proceeds, nationalization or materialization of contingent liabilities for positive flows, and debt cancellations or privatisations for the negative ones.

Expressing from the previous equation the change in debt-to-GDP ratio, by dividing by GDP and thus accounting for real growth (g_t) and change in the GDP deflator (π_t), yields the equation below. Variables relative to GDP are in lower cases, and α_t refers to the share of external debt in total debt.

$$d_t - d_{t-1} = \frac{i_t}{(1+g_t)(1+\pi_t)} d_{t-1} - \frac{\pi_t}{1+\pi_t} d_{t-1}$$

[5] DSA analyses by the IMF at the country-level yet rely on much more precise data which enable greater accuracy in the evaluation of the different contributors.

$$+\frac{\Delta e_t(1+i_t^f)}{(1+g_t)(1+\pi_t)}\alpha_{t-1}d_{t-1}-\frac{g_t}{(1+g_t)(1+\pi_t)}d_{t-1}-b_t+sfa_t$$

The equation above decomposes changes in debt-to-GDP ratios into six components of interests. The first member on the right-hand side is the interest payment effect, the second the inflation one[6], the third is the exchange rate effect, the fourth captures the effect of the real GDP growth, the fifth being the fiscal balance effect, and finally the stock-flow adjustment.

Δe(t) represents the weighted change in the exchange rate. Weights are based on the share ($\omega_{i,t}$) of each of the k currencies of denomination for external debt given in the IDS. While the IMF methodology assumes all external debt to be denominated in USD, we use the currency composition breakdown in external debt given by the IDS to differentiate between debt in USD, EUR, JPY, CHF, GBP, assuming the whole remainder to be in LCU, following Eichengreen, Hausmann & Panizza (2023).

We thus have: $\Delta e_t = e_t/e_{t-1} - 1$

With: $e_t = \Sigma_{i=1}^{k}\omega_{i,t-1}e_{i,t}$

Sourcing and computing variables

Shifting from the theoretical formulation to the empirical implementation of these equations is not straightforward. The table below details how variables are sourced and computed.

Variable	Name	Source	Computation
d_t	Debt-to-GDP ratio	WEO	-
g_t	Real GDP growth	WEO	-
π_t	GDP deflator growth rate	WEO	-
b_t	Primary balance to GDP	WEO	-
d^f_t	External debt-to-GDP	WEO & IDS	*External debt stocks, general government sector (PPG)(DOD, current US$)*, divided by the WEO GDP in current USD
d^d_t	Domestic debt-to-GDP	WEO & IDS	Difference between d_t and d^f_t
i_t	implicit interest rate on total debt	WEO	Difference between the primary balance and the overall balance, divided by total debt at time t-1, all using WEO variables.
i^f_t	implicit interest rate on external debt	IDS	Ratio of *Interest payments on external debt, general government sector (PPG) (INT, current US$)*, divided by external debt from IDS at time t-1
$\omega_{i,t}$	Currency composition of external debt	IDS	-
$e_{i,t}$	Bilateral exchange rate (eoy)	IFS[7]	-

[6] We prefer to split interest payment and inflation and not gather them into one category named real interest rate, in order to enable greater breakdown.

[7] https://data.imf.org/?sk=388DFA60-1D26-4ADE-B505-A05A558D9A42&sId=1479329334655
All exchange rates are given with respect to the USD, such that exchange rates from LCU to EUR for instance can be inferred from the EUR-USD and LCU-USD exchange rate. The weighted exchange rate change on external debt is hence inferred from the weighted change in individual bilateral exchange rates.

Implementation challenges

Confronting theory and data raises some challenges which we address here. First, despite both covering general government gross debt, WEO and IDS debt variables sometimes do not match. To account for that, we remove these observations in the database. Over the 135 IDS countries, from 1990 to 2021, we have a total 2,464 years of debt decomposition, after removing 104 cases of alpha being greater than one. These cases mostly relate to less developed economies with specific economic and statistical challenges, such as Afghanistan. In an unrelated manner, Myanmar and Zimbabwe are also excluded due to explosive changes in some contributors, biasing averages.

Some other challenges are not yet accounted for but will probably be in the next version of the tool. The current version of the tool does not use the SDR share of denomination of external debt given by the IDS due to the absence of SDR-USD bilateral exchange rate in the IFS database. Regarding the question of the valuation of RMB-denominated debt, while China has grown as a major creditor in many EMs, there is a need for better estimation. The next update of the IDS could provide information on the RMB-denominated debt, and otherwise, one could estimate this share from Chinese-lending databases at the country level from sources such as Horn, Reinhart & Trebesch (2020) or by crossing data with China's bilateral lending in the IDS.

Exploring the sometimes-large residuals in the methodology still remains a key direction for future updates of the tool. These residuals arising from non-fiscally generated flows make them difficult to track. One which could be included are the negative debt restructuring flows, on which databases exist, but which crossing with the tool's database can be complicated.

It is also assumed that the debt service on external debt follows the same currency breakdown as the one the external debt stock. This assumption is made since the IDS currency breakdown is only available for the debt stock and not for the debt service. Moreover, missing exchange rates in the IFS database are managed such that we assume no change in the exchange rate for these years.

The FDL online tool

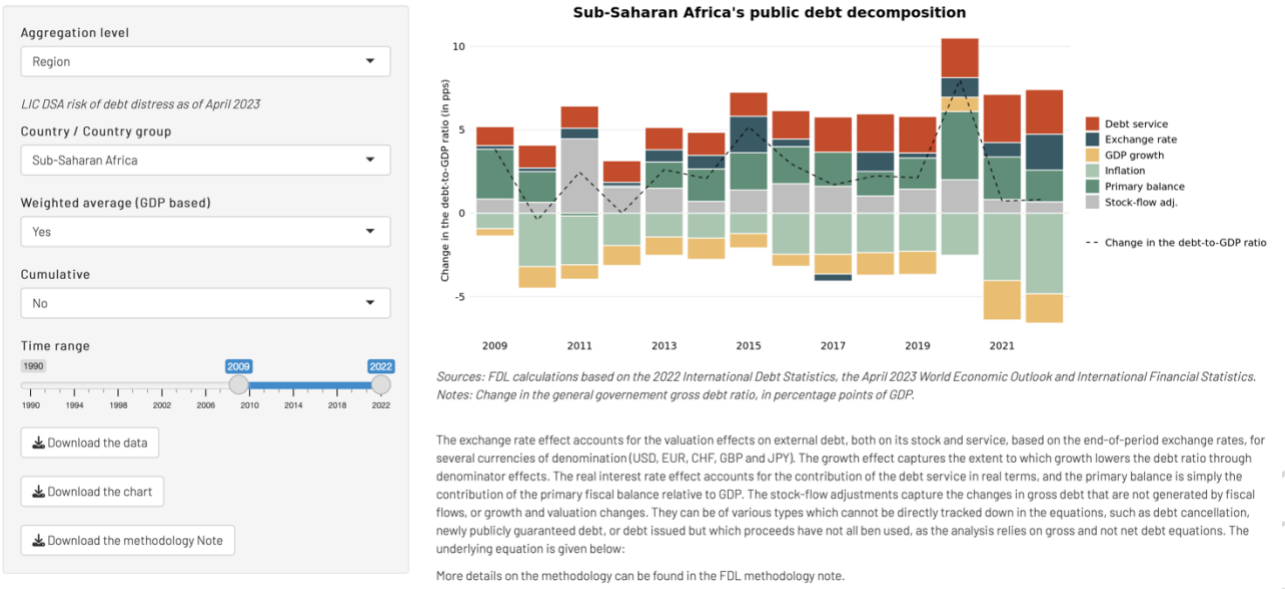
By definition of the methodology and design of the public databases, decompositions are done over the 135 low- and middle-income countries of the IDS database, from 1990 to 2021, as the IDS does not yet provide debt statistics for 2022. Outliers with total general government gross debt from the WEO lower than general government external debt from the IDS are excluded. Averages are computed over the list available countries only. The decomposition can be done at different levels: regional, income class, HIPC or non-HIPC countries, depending on the IMF DSA risk of debt distress classification[8], and finally at the country and global levels. Averages can be computed based on simple or GDP-weighted averages. The debt decompositions can also be displayed in a cumulative manner, to limit volatility in contributors and better show the long-term contributions of the different effects.

This tool is developed using R. Shiny and is accessible on FDL's website. The first released version of the tool relies on the latest available databases, namely the April 2023 WEO and the 2022 IFS and IDS. It will be augmented in the future based on newly available databases and variables, and to account for

[8] Based on the LIC DSA risk of debt distress as of April 2023

some of the challenges mentioned in section 2. The tool also enables to download the chart and its underlying data for replication. We hope that analysts can use it and comment on the results.

Figure 1. Extract from the FDL tool interface



Source: FDL website

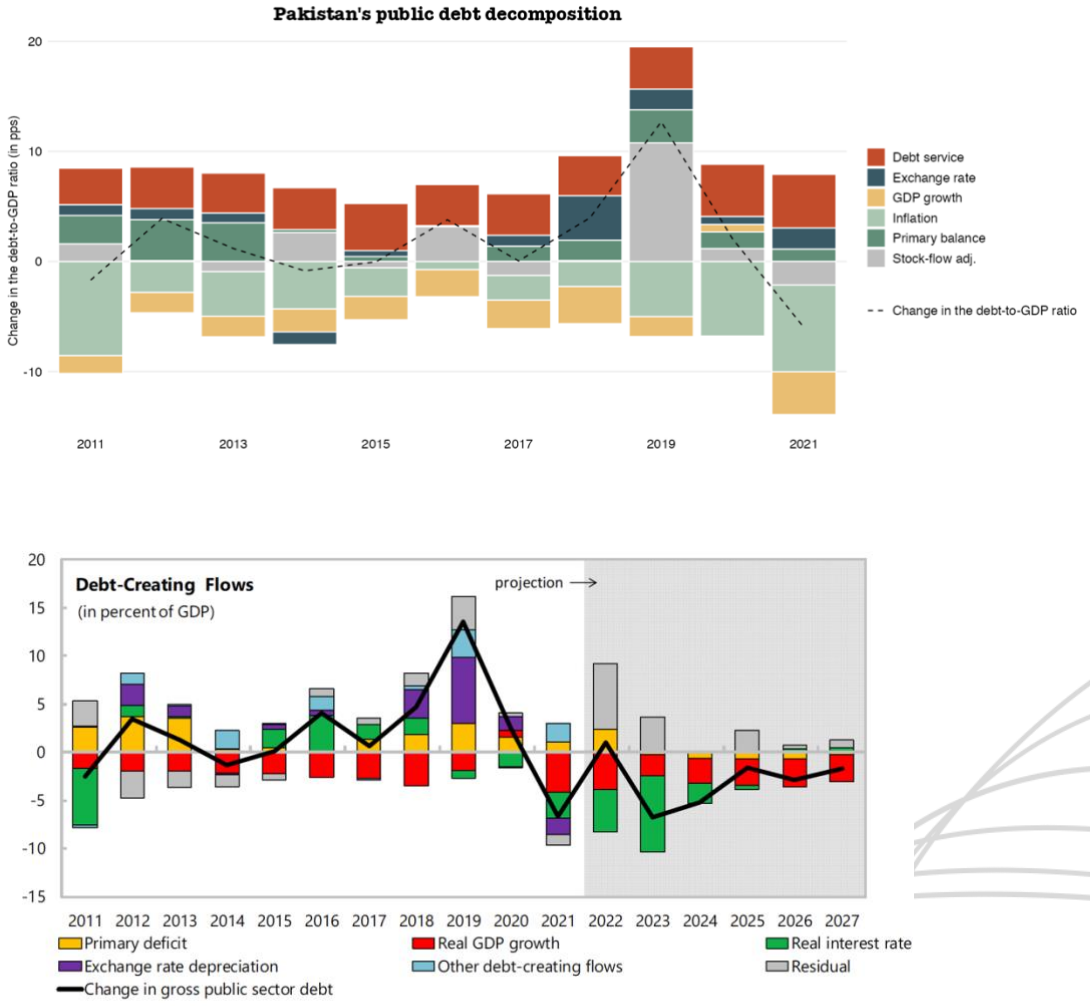
Country-comparisons of IMF and FDL debt decompositions

The FDL and IMF methodologies differ mostly on the data used, and slightly on the decomposition performed. The IMF uses internal data, with better granularity, for instance enabling to separate country-specific debt creating flows from the rest of the residual. Primary balance and growth effects should be of the same magnitudes in the two methodologies.

The IMF methodology gathers the interest rate and inflation into the real interest rate effects whereas we split the two for better granularity. Comparisons performed below show that the difference between our two categories matches the IMF real interest rate category.

Figures 2 and 3 below show the comparison of IMF and FDL public debt decomposition charts, using the examples of Pakistan and Côte d'Ivoire. Pakistan is considered as a Market Access Country, and Côte d'Ivoire a Low-Income Country, with different Debt Sustainability Frameworks for each. For both, we used the latest DSA performed (dating from 2022). The Pakistan case displays the evolution of drivers of debt in a non-cumulative manner, and in a cumulative manner for Côte d'Ivoire. Comparisons are very conclusive for Côte d'Ivoire, with apparently similar breakdowns. They are also quite close for Pakistan, with differences in magnitudes which cannot really be tracked, but probably generated by the imperfect match between the WEO and IDS, as well in much more granular data available to the IMF during country reviews.

Figure 2. FDL vs IMF Pakistan debt decomposition charts



Source: IMF staff.
1/ Public sector is defined as general government and includes public guarantees, defined as guarantees to PSEs.

Source: FDL calculations, IMF Pakistan Review (2022)[9]

A more accurate comparison is performed below using directly the data tables given in the IMF DSA and the FDL decomposition (based on the data downloaded through the tool for Pakistan). Depending on the vintage of the various statistics used, and based on the fact that IMF estimates are likely to be more accurate, some differences still arise.

[9] https://www.imf.org/en/Publications/CR/Issues/2022/09/01/Pakistan-Seventh-and-Eighth-Reviews-of-the-Extended-Arrangement-under-the-Extended-Fund-522800

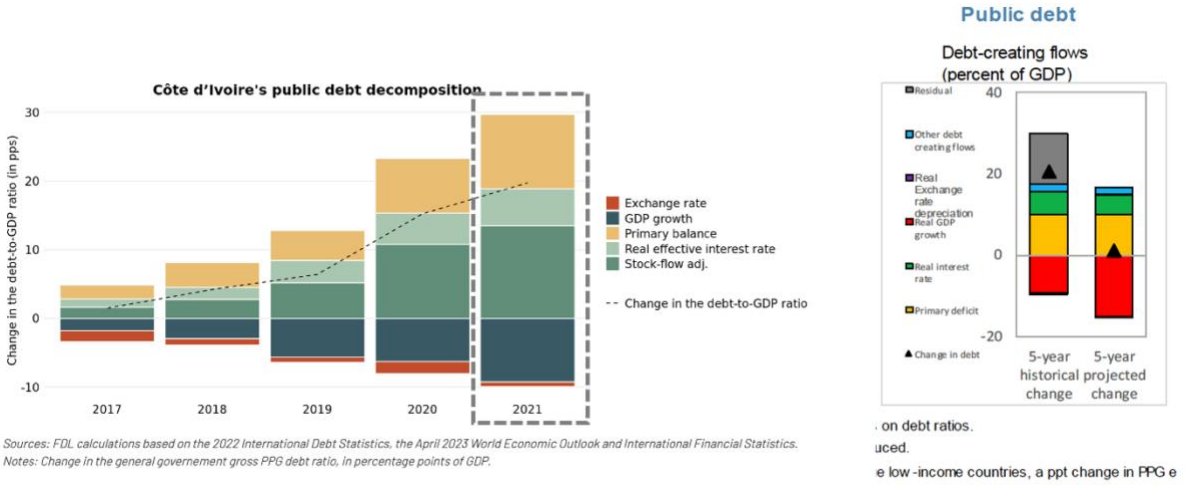
Period	2011-2019			2020			2021		
Indicator	FDL	IMF	*Diff.*	FDL	IMF	*Diff.*	FDL	IMF	*Diff.*
Change in the debt-to-GDP ratio	2,6	2,7	*0,1*	2,1	2,5	*0,4*	-6,0	-6,6	*0,6*
Debt service	3,8	-	-	4,8	-	-	4,9	-	-
Inflation	-3,6	-	-	-6,8	-	-	-7,9	-	-
Real interest rate	0,1	0,4	*0,3*	-2,0	-1,6	*0,4*	-3,0	-2,7	*0,3*
Exchange rate	1,0	1,6	*0,6*	0,7	1,5	*0,8*	1,9	-1,8	*3,7*
GDP growth	-2,2	-2,3	*0,1*	0,7	0,7	*0,0*	-3,9	-4,2	*0,3*
Primary balance	1,9	1,9	*0,0*	1,5	1,5	*0,0*	1,1	1,1	*0,0*
Stock-flow adj.	1,7	1,1	*0,6*	1,2	0,3	*0,9*	-2,1	0,9	*3,0*

Notes:

Differences are in absolute terms.

The FDL real interest rate is inferred as the difference between the debt service and inflation components

Figure 3. FDL vs IMF Côte d'Ivoire debt decomposition charts



Source: FDL calculations, IMF Côte d'Ivoire Art. IV (2022)[10]

7. Insights and policy recommendations

This exercise and its results remind once again the importance of a number of key elements:

(i) **Despite significantly improvements in publicly available database, there is still a need for better availability and quality of data on public debt.** This has been demonstrated by the mismatch in IDS and WEO debt variables, the need to offer greater granularity on currency composition in the IDS statistics.

(ii) **Reassuringly, we reproduce the IMF's analyses in the few cases we checked**. Despite possible differences in available data, the decomposition we perform is in line with existing DSAs. In addition, we improve the way exchange rates are usually taken into account by considering all existing denominations of the debt stock.

[10] https://www.imf.org/en/Publications/CR/Issues/2022/07/01/Cte-dIvoire-2022-Article-IV-Consultation-Press-Release-and-Staff-Report-520258

(iii) **We hope that with this tool they can be easily available for analysts and used widely.** Augmented with knowledge of the local context, they can be a powerful tool to understand debt dynamics for any given country and compare across countries. These decompositions play an important role in assessing the relative role of various factors.

(iv) A key insight is that on average debt distress and residuals are associated, underlying the importance of statistical capacity and transparency. Debt increases and residuals are associated, and especially for the lower income countries. This could limit the ability of fiscal consolidation to control debt dynamics, and warrants increased attention on contingent liabilities.

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