
# TECHNICAL

## NOTES & MANUALS

# A Guide and Tool for Projecting Public Gross Financing Needs

Santiago Acosta-Ormaechea, Leonardo Martinez, and Jorge Restrepo

TNM/2025/01

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# A Guide and Tool for Projecting Public Gross Financing Needs

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Authorized for distribution by Dominique Desruelle

**This technical note and manual addresses the following questions:**

- How can we obtain public gross financing needs (GFN) projections consistent with the public debt projections presented in the Public Debt Dynamics Tool (DDT; Acosta-Ormaechea and Martinez 2021)?
- How can we compute fiscal adjustment paths to meet any user-specified GFN-to-GDP ratio target after any user-specified adjustment period?
- How can we use the simple Excel-based Public Debt Dynamics Tool with Gross Financing Needs (DDT_GFN) to produce consistent projections of public debt and GFN under the baseline and alternative scenarios, including fan charts for both public debt and GFN?

The authors thank Marie Pierre Aquino Coste, and Priscila Stisman for their contributions and for helping build the adjustment scenarios with a gross financing needs ratio target in the DDT_GFN. The authors also thank all colleagues who provided helpful comments during the internal review process. María Sofía Anastacio and Juan Pablo Angel Mojica provided excellent assistance to improve the DDT_GFN. Any errors are the responsibility of the authors.

Cover Design: IMF Creative Solutions

**Cataloging-in-Publication Data**
**IMF Library**

Names: Acosta-Ormaechea, Santiago Leonardo Enrique, author. | Martinez, Leonardo, author. | Restrepo, Jorge, author. | International Monetary Fund, publisher.
Title: A Guide and Tool for Projecting Public Gross Financing Needs / Santiago Acosta-Ormaechea, Leonardo Martinez and Jorge Restrepo
Other titles: Technical notes and manuals. | International Monetary Fund. Institute for Capacity Development.
Description: Washington, DC : International Monetary Fund, 2025. | Jan. 2025 | Includes bibliographical references.
Identifiers: ISBN:
9798400289446 (paper)
9798400289996 (ePub)
9798400289651 (web PDF)
Subjects: LCSH: Finance, Public—Accounting. | Fiscal Policy.
Classification: LCC HJ9733.A26 2025



Recommended citation:
Acosta-Ormaechea, Santiago, Leonardo Martinez, and Jorge Restrepo. 2025. "A Guide and Tool for Projecting Public Gross Financing Needs." IMF Technical Notes and Manuals 2025/01. International Monetary Fund, Washington, DC.

Please send orders to:
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# Contents

# I. Overview

**This guide presents the analytical underpinnings and a user manual for the Public Debt Dynamics Tool with gross financing needs (DDT_GFN).** The Excel-based DDT_GFN is an extension of the Public Debt Dynamics Tool (DDT), which projects public debt as percent of GDP under the baseline and alternative scenarios. The DDT_GFN presents debt-to-GDP projections and the corresponding public gross financing needs (GFN)-to-GDP projections for all DDT scenarios, including GFN fan charts. The DDT_GFN also computes fiscal adjustment paths to achieve a user-defined GFN target after a user-specified adjustment period. As the DDT, the DDT_GFN was developed by the IMF Institute for Capacity Development (ICD) to be used for its training and technical assistance work on macroeconomic frameworks for forecasting and policy analysis (as the DDT, the DDT_GFN can be easily linked to a country's macroeconomic framework). Only 12 macro-fiscal variables, which are often publicly available, are needed to perform a rich analysis of public debt and GFN dynamics with the DDT_GFN. Among them, those associated with debt amortizations and interest expense can be obtained from other debt projection tools that compute detailed debt cash flows, thus complementing the DDT_GFN, including the Debt Sustainability Framework for Low-Income Countries (LIC DSF), the Sovereign Risk and Debt Sustainability Framework for Market Access Countries (MAC SRDSF), and the Medium-Term Debt Management Strategy tool (MTDS).

# II. Introduction

**Acosta-Ormaechea and Martinez (2021) discuss how to project the public debt-to-GDP ratio with local and foreign currency debt under the baseline and alternative scenarios and how to compute fiscal adjustment paths to achieve a user-defined debt target after a user-specified adjustment period.** They also explain how these calculations can be implemented using the Excel-based DDT. The DDT only needs 10 often-publicly-available macro-fiscal variables to perform a rich analysis of public debt dynamics.[1]

This guide extends the analysis of Acosta-Ormaechea and Martinez (2021) to also include the projection of public GFN. The DDT focuses on public debt projections, whereas the DDT_GFN calculates consistent projections for both public debt and GFN-to-GDP ratios. This guide shows that in addition to the 10 macro-fiscal variables used for the DDT, GFN calculations require data for only two additional variables (the effective amortization rates for local and foreign currency debt).

The Excel-based DDT_GFN, which incorporates GFN for every DDT scenario (including fan charts), also computes fiscal adjustment paths to achieve a user-defined GFN target. The analysis of GFN is often at the center of policy debates because of the use of GFN (and other liquidity indicators, also calculated in the DDT_GFN) to gauge the risk of debt distress. As the DDT, the DDT_GFN presents key results in standardized tables and figures.

Both the DDT and the DDT_GFN were developed by the IMF Institute for Capacity Development (ICD). Because of their simplicity, these tools have been useful for ICD's training and technical assistance work on macroeconomic frameworks for forecasting and policy analysis. As the DDT, the DDT_GFN has been easily linked to macroeconomic frameworks.

The rest of this guide is organized as follows: Section III discusses how to project the GFN-to-GDP ratio with local and foreign currency debt. Section IV presents the data needed for projecting the GFN ratio. Section V details the inputs needed to use the DDT_GFN. Section VI explains how to build fiscal consolidation scenarios, including for achieving a user-defined GFN target after a user-specified adjustment period. Section VII discusses how the DDT_GFN can be used to build alternative scenarios, including standardized stress tests, customized scenarios, and fan charts. Section VIII details the standardized outputs produced by the DDT_GFN. Finally, the appendix presents the derivation of key formulas discussed in this guide.

[1] The DDTx is a 5-hour online course that discusses the Public Debt Dynamics Tool (DDT) in detail and presents practical examples. DDTx videos are available on YouTube.

# III. Public Gross Financing Needs

**Following IMF (2013) and Acosta-Ormaechea and Martinez (2021) (and this video), let's define GFN as the government's debt amortization payment obligations in local and foreign currency debt that are not covered by the overall fiscal balance.**[2] Equivalently, GFN are given by the public sector's debt-service obligations (amortizations plus interest expense in local and foreign currency debt) that are not covered by the primary fiscal balance (equal to the overall balance plus the interest expense):

$$GFN_t \equiv Amortizations_t - Overall\ Balance_t$$

$$= e_t^{avg} am_t^f D_{t-1}^f + am_t^d D_{t-1}^d + e_t^{avg} i_t^f D_{t-1}^f + i_t^d D_{t-1}^d - PB_t, \quad (1)$$

where

- $e_t^{avg}$ is the average nominal exchange rate for period $t$ (local currency per unit of foreign currency),
- $D_t^f$ and $D_t^d$ are the stocks of gross public debt denominated and expressed in foreign and local (or domestic) currency, respectively,
- $am_t^f \equiv \frac{Amort_t^f}{D_{t-1}^f}$ and $am_t^d \equiv \frac{Amort_t^d}{D_{t-1}^d}$ are the period-$t$ nominal effective amortization rates for foreign and local currency debt, where $Amort_t^f$ ($Amort_t^d$) denotes the amortization payments for foreign currency (local currency) debt denominated in foreign (local) currency,
- $i_t^f \equiv \frac{I_t^f}{D_{t-1}^f}$ and $i_t^d \equiv \frac{I_t^d}{D_{t-1}^d}$ are the period-$t$ nominal effective interest rates for foreign and local currency debt, where $I_t^f$ ($I_t^d$) denotes the foreign currency (local currency) interest expense denominated in foreign (local) currency, and
- $PB_t$ is the primary fiscal balance (that is, primary government revenues minus primary government expenditures).[3]

Policy discussions of GFN are often centered around the GFN-to-GDP ratio, because it is considered that a country's GDP is an indicator of its capacity to service its debt. Dividing all terms in equation (1) by nominal GDP, we can express the GFN-to-GDP ratio as follows:

$$gfn_t = \frac{\alpha_{t-1}(1+\varepsilon_t^{eop})\frac{e_t^{avg}}{e_t^{eop}}(am_t^f + i_t^f) + (1-\alpha_{t-1})(am_t^d + i_t^d)}{(1+g_t)(1+\pi_t)} d_{t-1} - pb_t, \quad (2)$$

where lower-case variables represent ratios to GDP for GFN, debt, and the primary balance, and $g_t$, $\pi_t$, $\varepsilon_t^{eop} = \frac{e_t^{eop}}{e_{t-1}^{eop}} - 1$, and $\alpha_{t-1}$, are the real GDP growth rate, the inflation rate measured by the GDP deflator, the end-of-period nominal exchange rate depreciation (local currency per unit of foreign currency), and

[2] This definition of public gross financing needs (GFN) is consistent with that of the Sovereign Risk and Debt Sustainability Framework for Market Access Countries (IMF 2022). In the Debt Sustainability Framework for Low-Income Countries, the definition of GFN includes "other net debt-creating flows" (IMF 2018).

[3] The primary and overall balance concepts are those considered in the debt sustainability literature (for example, Escolano 2010; IMF 2013, 2018) and belong to the "older" Government Finance Statistics Manual (IMF 1986). For simplicity, this guide assumes that all foreign-currency debt and its flow payments are in the same foreign currency. Observe that there is a link between effective nominal amortization rates and the average debt maturity (expressed in years): the average debt maturity in local and foreign currencies can be approximated with the average of $1/am_t^d$ and $1/am_t^f$, respectively.

the share of foreign currency debt in total debt in the previous period, respectively (Appendix 1 presents a derivation of equation 2).

Equation (2), similar to equation (1), presents GFN (Percent of GDP) generated by the debt service (that is, debt amortization plus interest) not covered by the primary balance. In addition, both equations (1) and (2) present amortizations and interest expense as the product of the effective rates and the stock of debt.

Note from equation (2) that without foreign currency debt ($\alpha_{t-1} = 0$), exchange rate fluctuations do not affect the GFN-to-GDP ratio. However, with foreign currency debt ($\alpha_{t-1} > 0$), a higher depreciation rate $\varepsilon_t^{eop}$ and a larger gap between the average and end-of-period exchange rates (a higher $\frac{e_t^{avg}}{e_t^{eop}}$) increase the GFN ratio. Also, note that the GFN ratio is affected by current policy decisions and economic conditions as well as by past policy decisions reflected in pre-existing debt contracts and subsumed in the effective amortization and interest rates and the stock of debt.[4]

[4] In general, the contribution of new debt issuances to the effective amortization and interest rates (given by debt and coupon payments generated by new issuances within the period) is less significant than the contribution to these effective rates of pre-existing debt contracts.

# IV. Required Data

**The DDT projects the public debt ratio using the following equation:**

$$d_t = \frac{1 + \hat{r}_t^w}{1 + g_t} d_{t-1} - \mu_t pb_t + \mu_t of_t, \tag{3}$$

where

$$1 + \hat{r}_t^w = \frac{\alpha_{t-1}\left(1 + i_t^f\right)\left(1 + \varepsilon_t^{eop}\right) e_t^{avg}/e_t^{eop} + \left(1 - \alpha_{t-1}\right)\left(1 + i_t^d\right)}{1 + \pi_t} \mu_t \tag{4}$$

represents the real cost of debt, $\mu_t = \left[1 - \alpha_t\left(1 - e_t^{avg}/e_t^{eop}\right)\right]^{-1}$ is the coefficient for the stock-flow adjustment because of intra-year exchange rate fluctuations, and $of_t$ is the ratio of other debt-creating flows to GDP (Acosta-Ormaechea and Martinez 2021). Thus, to project the public debt-to-GDP ratio using equation (3), one needs:

1. *Debt-related data:*
   A. Stock of total gross public debt as percent of GDP, for the last period before the projection.
   B. Share of public debt in foreign currency as percent of total debt (excluding uncalled guarantees).
2. *Macro-fiscal indicators:*
   A. Average and end-of-period nominal exchange rates.
   B. Effective nominal interest rates on local and foreign currency debt.
   C. GDP deflator inflation.
   D. Real GDP growth.
   E. Primary balance as percent of GDP.
   F. Other net debt-creating flows as percent of GDP.

To project the GFN ratio using equation (2), one needs the data necessary for projecting debt (which is an input of equation 2) plus two additional variables:

3. *Effective amortization rates:*
   A. Nominal effective amortization rate of local currency debt.
   B. Nominal effective amortization rate of foreign currency debt.

How can historical data and projections for the effective amortization rates be obtained? As indicated earlier, for local and foreign currency debt, effective amortization rates are defined as the ratio of amortizations over the previous-period debt stock. Thus, for computing effective amortization rates, one needs data on amortizations and debt by currency. For projections of amortizations, one needs detailed information on the amortization schedule of existing debt, which is added to the projection of amortizations of new debt issuances. For the latter, one needs detailed assumptions about the government's debt management strategy. Observe that, for computing effective interest rates, the user similarly needs information on the interest expense for existing debt by currency and detailed assumptions on the interest expense implied by new debt issuances for each currency, consistent with the government's debt management strategy. Detailed information about the government's debt management strategy is typically included in macroeconomic frameworks, in debt projection tools used in debt management offices, and in the LIC DSF, MAC SRDSF, and Medium-Term Debt Management Strategy tool (Balibek and others 2019). Equation (2) shows

that for computing the GFN ratio, detailed information on amortizations can be summarized in effective amortization rates. As discussed in the following section, using effective amortization rates to compute the GFN ratio facilitates the analysis of the evolution of GFN under the baseline and alternative scenarios, including all scenarios presented in the DDT.[5]

[5] Note also that if users have data and baseline projections for the GFN ratio (for example, from IMF reports), they can use equation (2) to derive the effective amortization rates consistent with these data and projections (although without distinguishing the amortization rate for each currency). This would allow users to reproduce these data and baseline GFN projections and to create alternative scenarios consistent with such data and projections with the DDT_GFN. The currency composition of GFN could be approximated using the currency composition of the total debt stock, which is often publicly available (for example, in IMF reports).

# V. Inputs for the Public Debt Dynamics Tool with Gross Financing Needs

**As with the DDT, the first step for using the DDT_GFN is to populate it with country-specific information and macro-fiscal data.** The DDT_GFN follows the formatting and color codes of the DDT. Users should enter information and relevant data only in *yellow-shaded* cells, which are only in *yellow* worksheets. In *light-yellow-shaded* cells, users can select the input from a drop-down menu. *White*-shaded cells contain formulas that users should not override. The following sections describe the four "blocks" of inputs of the DDT_GFN (which follow the structure of those in the DDT).

## A. Basic Inputs

Basic inputs are exactly as in the DDT. The user needs to go through the drop-down menus in the Readme worksheet under the "Basic Inputs" header to select the country of interest, the first year of projection, the year for medium-term indicators (to be discussed later), the definition of the public sector, and whether uncalled guarantees are included in the definition of public debt (Acosta-Ormaechea and Martinez 2021). If guarantees are relevant, the user can specify what are these guarantees (Figure 1).

The remainder inputs of the Readme worksheet are for fiscal adjustment paths and stress tests. Before completing these inputs, the user should populate the Input – Data worksheet. After the user populates the Input – Data worksheet, the DDT_GFN automatically produces the baseline projections for the debt and GFN ratios. These baseline projections and the historical data inputted in the Input – Data worksheet can be a reference to define fiscal adjustment and stress test scenarios.

**Figure 1. Basic Inputs (Readme)**

| Basic Inputs | |
|---|---|
| **Select country** | Macondo |
| **First year of projection** | 2021 |
| **Year for medium-term indicators** | 2026 |
| **Definition of the public sector** | Central government |
| Includes public guarantees? | Yes |
| Specify or define the guarantees | Outstanding amount of loans guaranteed by the Central government |

Source: IMF staff.

## B. Data Inputs

The Input – Data worksheet provides the DDT_GFN with (10 years of) historical annual data and (15 years of) projections for the macro-fiscal inputs described in the previous section as necessary for projecting the debt and GFN ratios.[6] In addition, as the DDT, the DDT_GFN allows users to input historical data and projections for uncalled guarantees as percent of GDP in local and foreign currency (this is only needed if guarantees

[6] The 10 years of historical data are needed for building alternative scenarios including fan charts but are not necessary for other key DDT_GFN functions (such as for calculating baseline projections and adjustment scenarios).

**Figure 2. Variables in Input – Data**

**Year/Variable**

$d_t$ *(debt including uncalled guarantees)*: Stock of total gross public debt, percent of GDP

*o/w stock of local-currency guarantees (uncalled)*: Stock of uncalled guarantees in local currency included in total debt, percent of GDP

*o/w stock of foreign currency guarantees (uncalled)*: Stock of uncalled guarantees in foreign currency included in total debt, percent of GDP

$\alpha_t$ *(share excl. guarantees)*: Share of foreign-currency-denominated debt in total debt, percent of total debt

$e_t$ *(LCU/FCU, avg)*: Nominal average exchange rate, local currency per unit of foreign currency

$e_t$ *(LCU/FCU, eop)*: Nominal end of period exchange rate, local currency per unit of foreign currency

$i_t^d$: Nominal effective interest rate on local-currency-denominated debt, percent

$i_t^f$: Nominal effective interest rate on foreign-currency-denominated debt, percent

$\pi_t$: GDP deflator inflation, percent

$g_t$: Real GDP growth, percent

$pb_t$: Primary balance, percent of GDP

$of_t$ *(other net debt-creating flows)*: Other net debt-creating flows, percent of GDP

$am_t^d$: Nominal effective amortization rate of local-currency-denominated debt, percent

$am_t^f$: Nominal effective amortization rate of foreign-currency-denominated debt, percent

$\pi^f_t$: Foreign GDP deflator inflation, percent

Source: IMF staff.

Note: o/w = of which; excl. = excluding; LCU = local currency units; FCU = foreign currency unit; avg = average; eop = end of period.

are included in the definition of debt, as described by Acosta-Ormaechea and Martinez (2021) and the online DDT course). Furthermore, as in the DDT, the DDT_GFN user can input data on foreign GDP deflator inflation (for example, that of the United States). As noted later, foreign inflation is used for computing the real exchange rate, which is used for calculating contributions to debt changes and for creating debt fan charts (Figure 2). With these data and projections, the DDT_GFN generates projections 15 years ahead for the public debt and GFN ratios under the baseline and alternative scenarios.

## C. Adjustment Paths Inputs

As the DDT, the DDT_GFN can be used to calculate fiscal balance paths consistent with a user-defined debt ratio target. In addition to reproducing all adjustment scenarios with a debt target in the DDT, the DDT_GFN presents fiscal adjustment scenarios with a GFN ratio target.

To build fiscal adjustment scenarios, under the "Adjustment Paths Data Inputs" header in Readme, the user can specify the "Public debt-to-GDP target" that would be achieved after the fiscal adjustment is implemented, the year in which the "Adjustment path starts," and the year in which the "Adjustment path ends." In addition, the DDT_GFN user can input the "GFN-to-GDP target." For example, as shown in Figure 3, the DDT_GFN could compute adjustment paths to achieve a debt ratio of 50 percent of GDP and a GFN ratio of 9 percent of GDP by 2028, with fiscal adjustments starting in 2022 (the second year of projections for the example used throughout this note).

As in the DDT, under the "Values of Key Variables for Adjustment Paths" header in Readme, for the fiscal adjustment years, DDT_GFN users can choose values of key macro-fiscal inputs that are different from the

### Figure 3. Adjustment Path Inputs (Readme)

**Adjustment Paths Inputs**

**Debt target and adjustment period**

**To be completed after "Input - Data" Sheet is populated**

| | |
|---|---|
| Public debt-to-GDP target (for example, for 60 percent of GDP write 60) | 50.0 |
| Adjustment path starts | 2022 |
| Adjustment path ends | 2028 |
| Public gross financing needs-to-GDP target (for example, for 20 percent of GDP write 20) | 9.0 |

Source: IMF staff.

### Figure 4. Value of Key Variables for Adjustment Paths (Readme)

**Values of Key Variables for Adjustment Paths (for time-varying values please review cells F30:S41)**

| | | Manually-set constant values | Drop-down menu constant values |
|---|---|---|---|
| $\alpha$ = Share of foreign currency debt | Time-varying values | | |
| $\varepsilon$ = Depreciation rate | Time-varying values | | |
| $i^d$ = Local-currency effective interest rate | Time-varying values | | |
| $i^f$ = Foreign-currency effective interest rate | Time-varying values | | |
| $\pi$ = Inflation rate | Time-varying values | | |
| g = Real GDP growth rate | Time-varying values | | |
| of = Other net debt-creating flows | Time-varying values | | |
| $am^d$ = Local-currency effective amortization rate | Time-varying values | | |
| $am^f$ = Foreign-currency effective amortization rate | Time-varying values | | |

Source: IMF staff.

baseline values introduced in Input – Data. In the DDT_GFN, this includes values for the two new variables used to project the GFN ratio: the local and foreign currency effective amortization rates.

As the DDT, the DDT_GFN presents options for setting the values of key variables during the adjustment period. First, users can assume these values are constant. The user can choose the 10- or 5-year averages for the historical or projection periods and the value in the latest year before projections start as the constant values for these variables. These options may be a reference for users to find their preferred assumptions. Users can also choose the option to "Set constant value manually," which they can do in the *yellow-shaded* cells under "Manually-set constant values." If users choose any of these alternatives for constant values, the relevant value for each variable is reproduced in the *white-shaded* cells in the column "Drop-down menu constant values".

Second, as shown in Figure 4, users can instead choose "time-varying values" for these variables. Under this option, the DDT_GFN automatically computes fiscal adjustment paths using the baseline assumptions included in Input – Data plus the "Additions to Baseline Assumptions for Fiscal Adjustment Paths" chosen by the user, as illustrated in Figure 5. For example, if the user believes that the adjustment scenario required to meet the GFN or the debt target would imply a GDP growth rate that is one percentage point lower than that assumed in the baseline scenario, they must enter "–1" for the corresponding years. For the user's convenience, the resulting values of key variables throughout the adjustment path are presented with such "Additions" (see Figure 5). Note that choosing "Additions" equal to zero implies that the DDT_GFN computes fiscal adjustments using the baseline values for the relevant variables.

**Figure 5. Assumptions for Adjustment Paths (Readme)**

| Baseline Assumptions From "Input - Data" Sheet, Plus "Additions to Baseline" | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 |
|---|---|---|---|---|---|---|---|---|---|
| $\alpha_t$ *(share excl. guarantees)*: Share of foreign currency denominated debt in total debt, percent of total debt | 60.45 | 63.47 | 63.47 | 60.30 | 57.28 | 57.28 | 57.28 | 60.15 | 57.14 |
| $e_t$ *(LCU/US$, avg)*: Nominal average exchange rate, local currency per unit of foreign currency | 24.58 | 24.21 | 24.38 | 24.71 | 25.21 | 25.71 | 26.23 | 26.75 | 27.29 |
| $e_t$ *(LCU/US$, eop)*: Nominal end of period exchange rate, local currency per unit of foreign currency | 24.11 | 24.30 | 24.47 | 24.96 | 25.46 | 25.97 | 26.49 | 27.02 | 27.56 |
| $i_t^d$: Nominal effective interest rate on local-currency-denominated debt, percent | 10.39 | 9.87 | 9.38 | 9.84 | 10.34 | 10.34 | 10.34 | 10.34 | 10.34 |
| $i_t^f$: Nominal effective interest rate on foreign-currency-denominated debt, percent | 3.60 | 3.78 | 3.78 | 3.59 | 3.41 | 3.41 | 3.41 | 3.58 | 3.40 |
| $\pi_t$: GDP deflator inflation, percent | 4.01 | 4.04 | 3.65 | 3.76 | 3.74 | 3.72 | 4.00 | 4.00 | 4.00 |
| $g_t$: Real GDP growth, percent | −8.99 | 4.23 | 2.75 | 2.41 | 2.66 | 2.84 | 2.84 | 2.84 | 2.84 |
| $of_t$ *(other net debt-creating flows)*: Other net debt-creating flows, percent of GDP | 0 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |
| $am_t^d$: Nominal effective amortization rate of local currency denominated debt, percent | 12.23 | 18.71 | 11.78 | 12.05 | 12.40 | 13.03 | 13.20 | 12.47 | 12.62 |
| $am_t^f$: Nominal effective amortization rate of foreign currency denominated debt, percent | 11.67 | 17.71 | 11.35 | 11.74 | 12.03 | 12.54 | 12.74 | 12.06 | 12.21 |
| **Additions to Baseline Assumptions for Fiscal Adjustment Paths (for time-varying values)** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** |
| $\alpha_t$ *(share excl. guarantees)*: Share of foreign currency denominated debt in total debt, percent of total debt | | | | | | | | | |
| $e_t$ *(LCU/US$, avg)*: Nominal average exchange rate, local currency per unit of foreign currency | | | | | | | | | |
| $e_t$ *(LCU/US$, eop)*: Nominal end of period exchange rate, local currency per unit of foreign currency | | | | | | | | | |
| $i_t^d$: Nominal effective interest rate on local-currency-denominated debt, percent | | | | | | | | | |
| $i_t^f$: Nominal effective interest rate on foreign-currency-denominated debt, percent | | | | | | | | | |
| $\pi_t$: GDP deflator inflation, percent | | | | | | | | | |
| $g_t$: Real GDP growth, percent | | | | −1 | −1 | −1 | −1 | −1 | −1 | −1 |
| $of_t$ *(other net debt-creating flows)*: Other net debt-creating flows, percent of GDP | | | | | | | | | |
| $am_t^d$: Nominal effective amortization rate of local currency denominated debt, percent | | | | | | | | | |
| $am_t^f$: Nominal effective amortization rate of foreign currency denominated debt, percent | | | | | | | | | |

Source: IMF staff.

## D. Stress Tests Inputs

The final set of inputs in the Readme worksheet are those used to build stress scenarios. The user can choose these inputs under the "Stress Tests Inputs" header. As the DDT, the DDT_GFN uses these inputs to shock four key debt drivers: the primary balance, GDP growth, the nominal interest rates, and the exchange rate depreciation. For each of these variables, the user can choose the following:

1. The "Size of the shocks" measured as a scalar factor that multiplies the historical standard deviation of the respective variable.[7] For instance, as illustrated in Figure 6, −1 indicates that the user selected shocks to the primary balance and GDP growth that will lead to a reduction of one historical standard deviation in the values of these two variables relative to the baseline.
2. The years in which each shock starts and ends.

[7] As the DDT, the DDT_GFN computes historical standard deviations using 10 years of data, except for the exchange rate depreciation, for which the DDT_GFN uses the 9 years of available data.

## Figure 6. Stress Tests Inputs (Readme)

**Stress Tests Inputs**

| Stress testing scenario design: size of shocks | Shock Size (number of historical standard deviations) |
|---|---|
| Primary balance shock | –1 |
| GDP growth shock | –1 |
| Interest rate shock | 1 |
| Exchange rate depreciation shock | 1 |
| **Stress testing scenario design: duration of shocks** | |
| Primary balance shock starts | 2022 |
| Primary balance shock ends | 2023 |
| GDP growth shock starts | 2022 |
| GDP growth shock ends | 2023 |
| Interest rate shock starts | 2022 |
| Interest rate shock ends | 2023 |
| Exchange rate depreciation shock starts | 2022 |
| Exchange rate depreciation shock ends | 2023 |

Source: IMF staff.

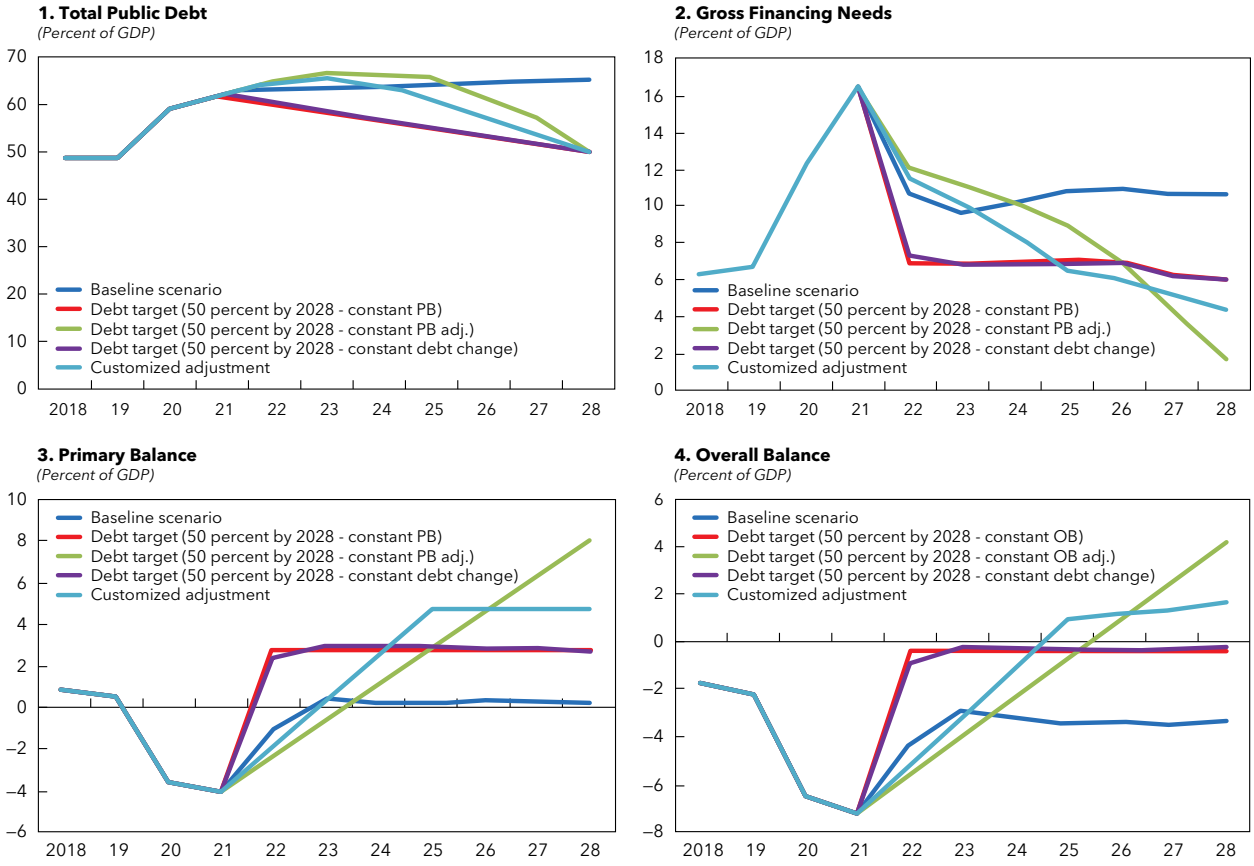
# VI. Fiscal Adjustment Scenarios

**The DDT_GFN presents the five DDT fiscal adjustment scenarios to reach a debt target (now presenting the implied GFN ratio for each of these scenarios).** We describe these scenarios in Subsections A to E. In addition, the DDT_GFN presents four fiscal adjustment scenarios to reach a target for the GFN ratio. We describe these scenarios in Subsection F. The DDT_GFN presents one debt-target customized scenario (as in the DDT) and one GFN-target customized scenario. For all other adjustment scenarios, as the DDT, the DDT_GFN presents each scenario (with the corresponding GFN ratio) in a green worksheet. Users do not need to revise these green worksheets unless they want to look at additional details of the scenario. As the DDT, the DDT_GFN does the calculations for each of the scenarios in the green worksheets automatically (for the parameters chosen by the user in Readme) and presents key results from fiscal adjustment scenarios in the Output – Baseline worksheet discussed in the following section. Furthermore, as illustrated in Figure 7, the DDT_GFN presents the behavior of key variables in fiscal adjustment scenarios in the worksheets Output – Debt Target and Output – GFN Target (the latest version of the DDT includes an Output – Debt Target worksheet).

## A. Debt-Stabilizing Primary and Overall Balance

The worksheets DebtStabPrimBalance and DebtStabOverallBalance automatically compute the primary and overall balance that would stabilize debt at the level of the previous year in either the first projection year

**Figure 7. Fiscal Adjustment Scenarios for Debt (Output – Debt Target)**




Source: IMF staff.

Note: adj. = adjustment; OB = overall balance; PB = primary balance.

or the "Year for medium-term indicators" defined in Readme. As the DDT, the DDT_GFN reports the debt-stabilizing primary balance in the blue table of the standardized outputs as in Figure 8 (see Section VIII).

**Figure 8. Debt-Stabilizing Primary Balance**

| Debt-stabilizing primary balance in 2021 and in 2026 | |
|---|---|
| 0 | 0.7 |

Source: IMF staff.

## B. Constant Primary and Overall Balance to Reach a Debt Target

The worksheets DebtTargetConstant_pb and DebtTargetConstant_ob automatically compute the primary and overall balance levels that, if implemented during every adjustment year, would achieve the debt target. The blue table presented in the DDT_GFN standardized outputs (Section VIII) and the Output – Debt Target worksheet (Figure 9) report the resulting primary balance, together with the primary balance adjustment described in the following section.

**Figure 9. Constant Primary Balance and Constant Adjustment to Reach a Debt Target**

| Level and yearly change in primary balance to yield 50 percent debt in 2028 | |
|---|---|
| 2.8 | 1.7 |

Source: IMF staff.

## C. Constant Yearly Adjustment of the Primary and Overall Balance to Reach a Debt Target

Note that the constant level of the fiscal balance consistent with the debt target typically implies a significant adjustment (fiscal balance increase) in the first adjustment year and no adjustment (a constant fiscal balance) after that (Figure 9). The user may also want to consider a smoother adjustment path that achieves the same debt target. The worksheets DebtTargetConstantAdjustment_pb and DebtTargetConstantAdjustment_ob present the constant fiscal yearly adjustment (change in the primary or overall balance) that would achieve the debt target. As Figure 9 illustrates, the DDT_GFN reports the "yearly change" in the primary balance necessary to yield a debt target in the blue table presented in the DDT_GFN standardized outputs (Section VIII) and in the Output – Debt Target worksheet.

## D. Primary and Overall Balance to Reach a Debt Target through Constant Yearly Debt Reductions

Alternatively, fiscal policy can aim at implementing constant annual debt ratio reductions until the debt target is reached. The worksheet DebtTargetConstantDebtChange presents the primary and overall balance paths that would achieve this objective. Because this exercise implies a different fiscal balance for each adjustment year, the DDT_GFN does not report any summary statistics for this scenario in the blue table presented in the DDT_GFN standardized outputs (Section VIII), but this scenario is included in the Output – Debt Target worksheet.

## E. Customized Adjustment Scenario

To illustrate the possibility of different adjustment modalities, the DDT_GFN also allows users to combine two of the adjustments discussed in the previous sections. To achieve that, the user must divide the adjustment period into two subperiods: a first subperiod with a constant yearly adjustment (as in Subsection C)

and a second subperiod with a constant primary balance (as in Subsection B). The debt target is reached at the end of the second subperiod. To implement this adjustment scenario, users must provide additional information about the adjustment they would like to consider in the worksheet CustomizedAdj. As Figure 10 illustrates, in the yellow cells of this worksheet, the user can set the years in which the "First adjustment subperiod starts" and "ends," the year in which the "Second adjustment subperiod ends" (and the debt target is reached), and the constant primary balance for the second subperiod. The debt target and the value of key variables are as set in Readme. As the DDT, the DDT_GFN only presents this customized adjustment scenario for the primary balance, but users could do a similar exercise for the overall balance. This scenario is also reported in the Output – Debt Target worksheet (Figure 7).

**Figure 10. Inputs for Customized Adjustment to Reach a Debt Target (CustomizedAdj)**

| **Debt Target** | | | |
|---|---|---|---|
| d to start adjustment | 59.63 | | |
| Sub-target d (by end of first adjustment subperiod) | 59.03 | Target d (end of adjustment) | 50.00 |
| First adjustment subperiod starts | 2022 | Second adjustment subperiod starts | 2026 |
| First adjustment subperiod ends | 2025 | Second adjustment subperiod ends | 2028 |
| Years of first adjustment subperiod | 4.00 | Years of first adjustment subperiod | 3.00 |
| pb for second adjustment subperiod | 4.69 | | |

Source: IMF staff.
Note: pb = primary balance.

## F. Public Gross Financing Needs Adjustment Scenarios

In addition to the adjustment scenarios with a debt target described in the previous section, the DDT_GFN presents similar adjustment scenarios that would allow users to achieve a target for the GFN ratio (defined by the user in Readme). As seen in equation (2), the GFN ratio in period *t* depends on the debt ratio in the previous period. Thus, to reach a target for the GFN ratio in period *t*, the government must reach a compatible debt ratio in the previous period (as for the debt target scenarios, the values of all other variables influencing the dynamics of the debt and GFN ratios are those set in Readme). Therefore, one can compute fiscal paths that would deliver a GFN ratio target in period *t* as the fiscal paths that would deliver an associated debt ratio target in the previous year.

Note that in these scenarios, to reach a GFN target in period *t* and the corresponding debt target in period *t-1*, the DDT_GFN computes paths of the fiscal balance until *t*-1. The user may want to also make the fiscal balance in period *t* part of the fiscal adjustment scenario. To do that in the DDT_GFN, the user could adjust the fiscal balance in *t* for the scenario under "Additions to Baseline Assumptions for Fiscal Adjustment Paths (for time-varying values)" in Readme. Alternatively, the user can use the customized adjustment scenario to reach a GFN target in CustomizedAdj – GFN. This scenario, as the customized adjustment scenario to reach a debt target, combines a first subperiod (with a constant yearly adjustment) with a second subperiod (with a constant primary balance), which also includes the last adjustment period (Figure 11).

The DDT_GFN presents adjustment paths with:

- A constant primary and overall fiscal balance (in worksheets gfnTargetConstant_pb and gfnTargetConstant_ob).
- A constant yearly adjustment for the primary and overall fiscal balance (gfnTargetConstantAdjustment_pb and gfnTargetConstantAdjustment_ob).
- A constant debt change (gfnTargetConstantDebtChange) and
- the customized adjustment scenario (CustomizedAdj – GFN).

As illustrated in Figures 12 and 13, some of these results are also reported in the blue table presented in the DDT_GFN standardized outputs (Section VIII) and in the Output – GFN Target worksheet.

## Figure 11. Inputs for Customized Adjustment to Reach a GFN Target (CustomizedAdj – GFN)

| GFN Target | | | |
|---|---|---|---|
| d to start adjustment | 59.63 | Target GFN (end of adjustment) | 9.00 |
| Sub-target d (by end of first adjustment subperiod) | 65.31 | Sub-target d (year before adjustment ends) | 64.97 |
| First adjustment subperiod starts | 2022 | Second adjustment subperiod starts | 2026 |
| First adjustment subperiod ends | 2025 | Year before adjustment ends | 2027 |
| Years of first adjustment subperiod | 4.00 | Years of second adjustment subperiod | 2.00 |
| pb for second adjustment subperiod | 2.21 | | |

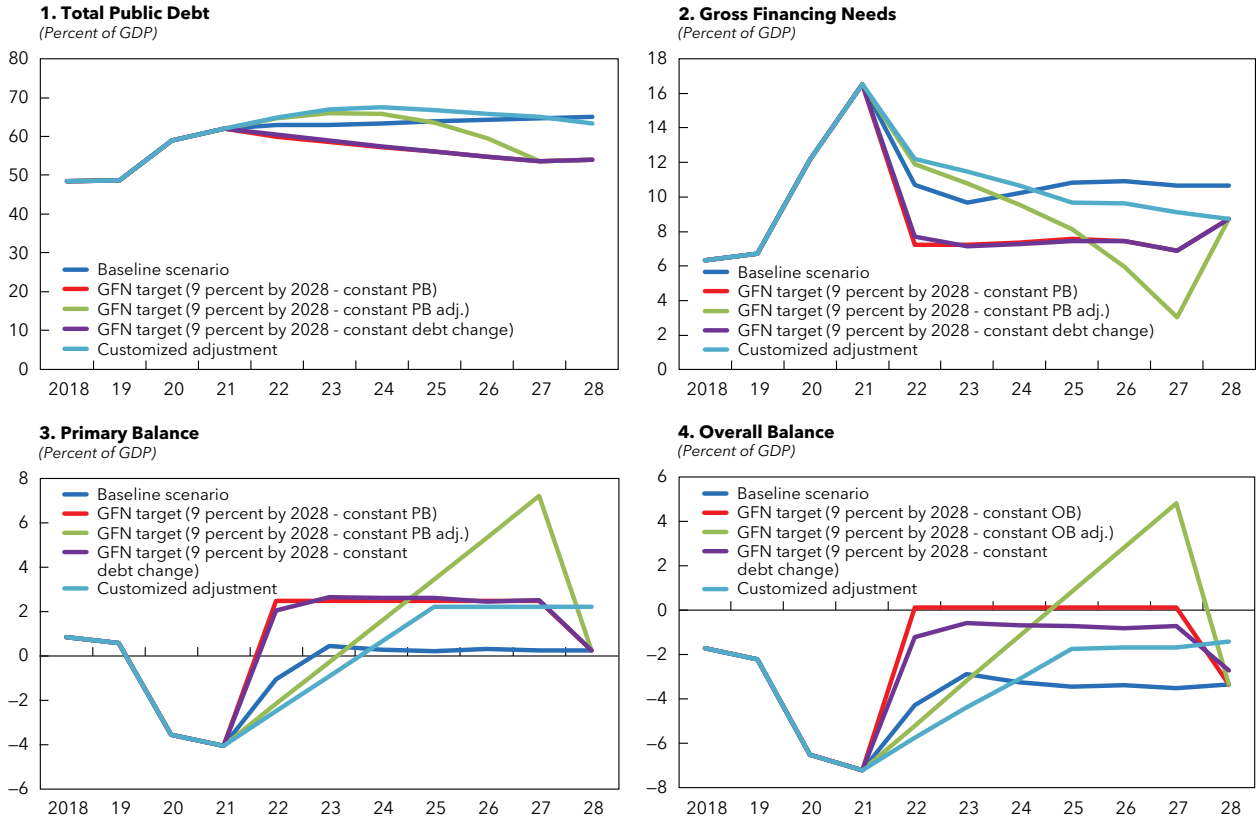
Source: IMF staff.
Note: GFN = gross financing needs.

## Figure 12. Constant Primary Balance and Constant Adjustment to Reach a Debt or GFN Target

| Level and yearly change in primary balance to yield 50 percent debt in 2028 | |
|---|---|
| 2.8 | 1.7 |
| to yield 9 percent GFN in 2028 | |
| 2.5 | 1.9 |

Source: IMF staff.
Note: GFN = gross financing needs.

## Figure 13. Fiscal Adjustment Scenarios for GFN (Output – GFN Target)




Source: IMF staff.
Note: adj. = adjustment; GFN = gross financing needs; OB = overall balance; PB = primary balance.

# VII. Realism, Stress Tests, and Fan Charts

## A. Alternative Scenarios and Shocks

**The DDT_GFN includes all alternative scenarios presented in the DDT (Acosta-Ormaechea and Martinez 2021).** For each of these scenarios, the DDT_GFN also presents the GFN ratio in the corresponding green worksheet.

As the DDT, the DDT_GFN presents the historical and constant-primary-balance scenarios in the worksheets HistoricalSc and ConstanPBSc. As illustrated in Figure 14, the top of the blue table presented in the DDT_GFN standardized outputs (Section VIII) reports the debt and GFN ratios for these scenarios for the year selected as "Year for medium-term indicators" in Readme.

The worksheets Sh-pb, Sh-g, Sh-int, and Sh-er present the stylized shock scenarios for the primary balance, GDP growth, the effective interest rates, and the rates of exchange rate depreciation, respectively. In each of these scenarios, only the variable of interest is shocked (according to the inputs chosen by the user in Readme). All other variables take the baseline values. This allows users to clearly identify the role of each of these variables in public debt and GFN dynamics. As the DDT, the DDT_GFN presents the debt ratios for these scenarios in the Output – Shocks worksheet. In addition, the DDT_GFN presents the GFN ratios for these scenarios in the Output – Shocks – GFN worksheet.

As in the DDT, in the DDT_GFN, users can build more realistic shock scenarios in the CustomizedSc worksheet. As illustrated in Figure 15, in this yellow worksheet, all inputs that are relevant to public debt and GFN dynamics are in yellow cells, inviting users to freely modify them. The CustomizedSc worksheet can be used to study more carefully the consequences of a shock to the key variables used for building stylized shock scenarios. For example, recall the DDT_GFN presents a stylized shock to the exchange rate (that does not include changes in any other variable). A customized shock to the exchange rate can also include the effects of the exchange rate depreciation on growth, inflation, the primary balance, and the interest rates. Customized scenarios can also help DDT_GFN users think about the effects of other commonly encountered situations (including realized contingent liabilities, for example, from the banking sector, climate policies, pension reforms, and so on). ICD is developing a complementary template, dubbed Natural Disasters for the DDT, that uses data from previous natural disasters (selected by the user) and standard methodologies for computing shocks (also selected by the user) and incorporates a natural disaster scenario into the CustomizedSc worksheet. The DDT_GFN presents debt and GFN ratios for the customized scenario in the Output – Shocks and Output – Shocks – GFN worksheets, respectively.

**Figure 14. Debt and GFN Levels for the Historical and Constant-Primary-Balance Scenarios**

| Historical and constant-primary-balance scenarios debt levels in 2026 | |
|---|---|
| 74.8 | 84.6 |
| GFN in 2026 | |
| 14.5 | 18.2 |

Source: IMF staff.
Note: GFN = gross financing needs.

**Figure 15. Inputs for the Customized Scenario (CustomizedSc)**

| Year | First Year of Projection 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|---|
| $d_t$ (debt including uncalled guarantees) | 61.91 | 62.91 | 63.04 | 63.37 | 63.90 | 64.25 |
| o/w stock of local-currency guarantees (uncalled) | 0.57 | 0.50 | 0.44 | 0.38 | 0.36 | 0.36 |
| o/w stock of foreign-currency guarantees (uncalled) | 1.71 | 1.50 | 1.32 | 1.15 | 1.08 | 1.08 |
| $1 - \alpha_t$ (share excl. guarantees) | 36.53 | 36.53 | 39.70 | 42.72 | 42.72 | 42.72 |
| $\alpha_t$ (share excl. guarantees) | 63.47 | 63.47 | 60.30 | 57.28 | 57.28 | 57.28 |
| $e_t$ (LCU/US$, avg) | 24.21 | 24.38 | 24.71 | 25.21 | 25.71 | 26.23 |
| $e_t$ (LCU/US$, eop) | 24.30 | 24.47 | 24.96 | 25.46 | 25.97 | 26.49 |
| $\varepsilon_t$ | 0.76 | 0.72 | 2.00 | 2.00 | 2.00 | 2.00 |
| $i_t^d$ | 9.87 | 9.38 | 9.84 | 10.34 | 10.34 | 10.34 |
| $i_t^f$ | 3.78 | 3.78 | 3.59 | 3.41 | 3.41 | 3.41 |
| $\pi_t$ | 4.04 | 3.65 | 3.76 | 3.74 | 3.72 | 4.00 |
| $\mu_t$ | 1.00 | 1.00 | 1.01 | 1.01 | 1.01 | 1.01 |
| $i^{\wedge}{}_t^w$ | 2.54 | 2.55 | 3.28 | 3.52 | 3.71 | 3.43 |
| $g_t$ | 4.23 | 3.75 | 3.41 | 3.66 | 3.84 | 3.84 |
| $\varphi^{\wedge}{}_t$ | 0.98 | 0.99 | 1.00 | 1.00 | 1.00 | 1.00 |
| $pb_t$ | –4.04 | –1.05 | 0.45 | 0.27 | 0.20 | 0.31 |
| $of_t$ (other net debt-creating flows) | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 | 0.90 |

Source: IMF staff.
Note: o/w = of which; excl. = excluding; LCU = local currency units; avg = average; eop = end of period.

## B. Fan Charts

The DDT_GFN builds consistent fan charts for both public debt (as in the DDT) and GFN ratios.[8] Fan charts summarize paths that these ratios can take in the future by incorporating shocks into relevant macro-fiscal variables. These shocks reflect the (joint) behavior of these variables in the past.

**Public debt fan charts.** As the DDT, the DDT_GFN builds debt fan charts using the following equation:

$$d_t = \frac{\alpha_{t-1}\left(1+\hat{r}_t^{f,aug}\right)+\left(1-\alpha_{t-1}\right)\left(1+\hat{r}_t^{d}\right)}{1+g_t} d_{t-1} - pb_t^{aug}, \quad (5)$$

where

- $\hat{r}_t^{f,aug} \equiv \left(1+\hat{r}_t^{f}\right)\left(1+z_t\right)-1$ is the augmented (with the real exchange rate depreciation) real foreign effective interest rate or the real effective cost of foreign currency debt,
- $\hat{r}_t^{f} \equiv \mu_t \frac{\left(1+i_t^f\right)e_t^{avg}}{\left(1+\pi_t^f\right)e_t^{eop}}-1$ is the real foreign effective interest rate, calculated with foreign inflation $\pi_t^f$ (measured by the foreign GDP deflator) and corrected by the stock-flow coefficient $\mu_t$,
- $z_t = \frac{\left(1+\pi_t^f\right)\left(1+\varepsilon_t^{eop}\right)}{1+\pi_t}-1$ is the rate of depreciation of the real exchange rate,
- $\hat{r}_t^{d} \equiv \mu_t \frac{1+i_t^d}{1+\pi_t}-1$ represents the real effective cost of local currency debt corrected by the stock-flow coefficient $\mu_t$, and
- $pb_t^{aug} \equiv \mu_t\left(pb_t - of_t\right) - res_t$ is the the augmented primary balance, which reflects other flows as well as the historical residual $res_t$, which is the result of the difference between observed historical debt changes and historical identified debt-creating flows.

[8] The debt fan chart tool is adapted from the IMF Debt Sustainability Analysis for Market Access Countries (IMF 2013). For further details about the construction of debt fan charts, see Celasun, Debrun, and Ostry (2006) and the online course DDUx.

Let $Y_t \equiv (g_t, \hat{r}_t^d, \hat{r}_t^{f,aug}, pb_t^{aug})$ be the vector of variables shocked for building the public debt fan charts. For each fan chart scenario, values of this vector are calculated as $Y_t = \theta_t + \epsilon_t$, where the vector $\theta_t$ contains the baseline mean value of the four variables, $\epsilon_t \sim N(0, \Omega)$ is a vector of jointly and normally distributed shocks, and Ω is the variance–covariance matrix that characterizes the joint statistical properties of the historical contemporaneous interrelations among the four variables in $Y_t$. Using 1,000 shocks for the $Y_t$ variables, the DDT_GFN computes 1,000 debt paths and orders the resulting debt levels in deciles to build confidence intervals summarized through fan charts.

**GFN fan charts.** Following an approach similar to the one used for building the debt fan charts, the DDT_GFN also builds fan charts for the GFN ratio, consistent with those for the debt ratios. First, note that we can calculate the GFN ratios as follows:

$$gfn_t = \left[\alpha_{t-1}\frac{r_t^{f,gfn}}{1+g_t} + (1-\alpha_{t-1})\frac{r_t^{d,gfn}}{1+g_t}\right] d_{t-1} - pb_t, \tag{6}$$

where

- $r_t^{f,gfn} = \dfrac{(1+\varepsilon_t^{eop})\frac{e_t^{avg}}{e_t^{eop}}(am_t^f + i_t^f)}{1+\pi_t}$ is the real rate at which foreign currency debt generates $gfn_t$,
- $r_t^{d,gfn} = \dfrac{am_t^d + i_t^d}{1+\pi_t}$ is the real rate at which local currency debt generates $gfn_t$.

The DDT_GFN builds fan charts for the GFN ratio using equation (6) to create 1,000 GFN ratio paths. To build these 1,000 paths, starting from the second projection year, the DDT_GFN takes 1,000 values for the previous-year debt ratio $d_{t-1}$ from the debt fan chart. Let $Y_t^{gfn} \equiv (g_t, r_t^{d,gfn}, r_t^{f,gfn}, pb_t)$ be the vector of variables shocked for building the GFN fan charts. For each fan chart path, the value of this vector is calculated as $Y_t^{gfn} = \theta_t^{gfn} + \epsilon_t^{gfn}$, where the vector $\theta_t^{gfn}$ contains the baseline mean value of the four variables in $Y_t^{gfn}$; $\epsilon_t^{gfn} \sim N(0, \Omega^{gfn})$ is a vector of jointly normally distributed shocks, and $\Omega^{gfn}$ is the variance–covariance matrix that characterizes the joint statistical properties of the historical contemporaneous interrelations among the four variables in $Y_t^{gfn}$.

**Generating fan charts with the DDT_GFN.** As the DDT, the DDT_GFN builds the fan charts and presents the inputs necessary for doing so in the worksheet Fan chart. The DDT_GFN uses nine years of historical data along with baseline projections for the four key variables contained in $Y_t$ and $Y_t^{gfn}$ to undertake all relevant computations. The user can include additional years of historical data in the corresponding yellow cells as seen in Figures 16 and 17.

**Figure 16. Variables for Debt Fan Charts (Fan Chart)**

| Fan Chart | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Series | Units | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
| Real GDP growth rate (g) | Percent | | | | | | | | |
| Real effective interest rate on local-currency debt | Percent | | | | | | | | |
| Primary balance (pb) augmented | Percent of GDP | | | | | | | | |
| Real effective interest rate on foreign-currency debt augmented by changes in real exchange rate | Percent | | | | | | | | |

Source: IMF staff.

**Figure 17. Variables for GFN Fan Charts (Fan Chart)**

| GFN Fan Chart | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Series | Units | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
| Real GDP growth rate (g) | Percent | | | | | | | | |
| Real rate at which local-currency debt generates gin | Percent | | | | | | | | |
| Primary balance (ph) | Percent of GDP | | | | | | | | |
| Real rate at which foreign-currency debt generates gfn (with exchange rate depreciation) | Percent | | | | | | | | |

Source: IMF staff.

The DDT_GFN uses these historical data to build the corresponding variance–covariance matrices. To generate the fan charts, users must first activate an embedded Excel macro by clicking the blue button in the Fan Chart worksheet (Figure 18).

**Figure 18. Button for Excel Macro to Generate Fan Charts (Fan Chart)**


Source: IMF staff.

In the Fan Chart worksheet, users can also choose to deactivate shocks to any of the four key variables used to create debt and GFN fan charts (Figure 19).

**Figure 19. Fan Charts Shocks On/Off Options (Fan Chart)**

| Turning Off Shocks for Fan Charts | | |
|---|---|---|
| | For debt | For GFN |
| g for debt and GFN | On | On |
| $r^{d}$ for debt and $r^{d,gfn}$ for GFN | On | On |
| $pb^{aug}$ for debt and pb for GFN | On | On |
| $r^{f,aug}$ for debt and $r^{f,gfn}$ for GFN | On | On |

Source: IMF staff.
Note: GFN = gross financing needs.

Note that without value restrictions, the symmetric distribution of shocks would imply symmetric fan charts (where debt and GFN ratio levels higher than in the baseline scenario are as likely as levels lower than in the baseline scenario). In case this is assessed as unrealistic, for example, if it is expected that negative shocks (that increase debt levels) are more likely than positive shocks (that reduce debt levels), users can instead build asymmetric fan charts by restricting the value of shocks.

As illustrated in Figure 20, the DDT_GFN users can input restrictions to both the value of shocks used for generating the debt fan chart (as in the DDT) and the values of shocks used for generating the GFN fan chart. Note that the previous-period debt ratio in the asymmetric debt fan chart is an input for the asymmetric GFN fan chart. Therefore, restricting the shocks used for generating the debt fan chart and thus creating an

**Figure 20. Fan Charts Shocks Restrictions (Fan Chart)**

| Restrictions on Good Shocks for Fan Charts | | |
|---|---|---|
| For debt | For GFN | |
| | | Is the max (+) g shock for debt (left) and for GFN (right) (percent) |
| | | Is the max (-) $r^{d}$ shock for debt (left) and $r^{d,gfn}$ for GFN (right) (percent) |
| 0 | 0 | Is the max (+) $pb^{aug}$ shock for debt (left) and pb shock for GFN (right) (percent GDP) |
| | | Is the max (-) $r^{f,aug}$ shock for debt (left) and $r^{f.gfn}$ shock for GFN (right) (percent) |

Source: IMF staff.
Note: GFN = gross financing needs; pb = primary balance.

asymmetric debt fan chart is sufficient to create an asymmetric GFN fan chart. Recall also that the debt and GFN fan charts have been created considering shocks to only four variables, which are not the same for each fan chart. However, there is a natural relation among the four variables used for the fan charts (growth, the primary balance, and local and foreign currency rates). Accordingly, the user should aim to have consistent restrictions on these variables when creating asymmetric debt and GFN fan charts.

# VIII. Standardized Outputs

**As the DDT, after the user populates all necessary inputs in the yellow worksheets, the DDT_GFN automatically produces projections for the baseline and alternative scenarios and summarizes these projections in standardized tables and charts.** These standardized outputs are presented in blue "Output" worksheets.

## A. Baseline Scenario and Contributions to Debt Changes

The DDT_GFN presents the evolution of the debt and GFN ratios and the contributors to changes in the debt-to-GDP ratio in the baseline scenario. To facilitate the comparison with IMF reports, the DDT_GFN presents these contributions following the formats used in the Debt Sustainability Analysis for Market Access Countries (MAC DSA; IMF 2013), the LIC DSF (IMF 2018), and the new MAC SRDSF (IMF 2022). The DDT_GFN presents an additional decomposition of the contributions to debt changes that incorporates the effects of intra-year exchange rate fluctuations into the contribution of the different flow variables. Specifically, following the MAC DSA, the DDT_GFN computes contributions to debt changes using the following equation:

$$d_t - d_{t-1} = \frac{i_t - (1+g_t)\pi_t}{(1+g_t)(1+\pi_t)} d_{t-1} + \frac{\varepsilon_t^{eop} + i_t^f \left[ \left(1+\varepsilon_t^{eop}\right) e_t^{avg}/e_t^{eop} - 1 \right]}{(1+g_t)(1+\pi_t)} \alpha_{t-1} d_{t-1} - \frac{g_t}{(1+g_t)(1+\pi_t)} d_{t-1} - pb_t + of_t + sf_t^{ier},$$

where the contribution to the change in public debt of the primary deficit is $-pb_t$, that of other identified debt-creating flows is $of_t$, and that of the stock-flow adjustment because of intra-year exchange rate fluctuations is $sf_t^{ier}$. Note that the first three terms in this equation represent the contributions of the interest rate (where $i_t = \alpha_{t-1}\left(1+i_t^f\right) + \left(1-\alpha_{t-1}\right)\left(1+i_t^d\right) - 1$ denotes the nominal average effective interest rate without exchange rate valuation effects), the nominal exchange rate, and GDP growth, respectively, and the sum of these three contributions is labeled as the contribution of automatic debt dynamics. Results obtained following this approach are presented in the Output – Baseline worksheet as shown in Figure 21.

**Figure 21. Contributions to Debt Changes as in Debt Sustainability Analysis for Market Access Countries (Output – Baseline)**

| Contribution to Changes in Public Debt | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Actual | | Est. | Projections | | | | | | |
| | 2012–18 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | Cumulative |
| Change in gross public sector debt | 2.4 | 0.1 | 10.2 | 3.0 | 1.0 | 0.1 | 0.3 | 0.5 | 0.4 | 5.4 |
| Identified debt-creating flows | 1.6 | 2.8 | 7.8 | 3.0 | 1.0 | 0.1 | 0.3 | 0.5 | 0.4 | 5.4 |
| Primary deficit | 1.6 | −0.6 | 3.5 | 4.0 | 1.1 | −0.5 | −0.3 | −0.2 | −0.3 | 3.9 |
| Automatic debt dynamics | −0.1 | 0 | 4.9 | −0.9 | −0.7 | −0.1 | −0.1 | −0.1 | −0.3 | −2.1 |
| Interest rate/growth differential | −1.0 | −0.3 | 5.5 | −1.2 | −0.9 | −0.8 | −0.8 | −0.8 | −0.9 | −5.4 |
| Of which: real interest rate | 0.5 | 0.9 | 1.2 | 1.0 | 1.1 | 1.1 | 1.3 | 1.4 | 1.3 | 7.3 |
| Of which: real GDP growth | −1.5 | −1.2 | 4.3 | −2.2 | −2.1 | −1.9 | −2.1 | −2.2 | −2.2 | −12.7 |
| Exchange rate depreciation | 0.9 | 0.3 | −0.6 | 0.2 | 0.3 | 0.7 | 0.7 | 0.7 | 0.7 | 3.3 |
| Other identified debt-creating flows | 0 | 0 | 0 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 5.4 |
| SFA because of intra-year exchange rate changes | 0 | 0 | −0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 01 |
| Change in guarantees (uncalled) | 0.1 | 3.4 | −0.5 | −1.0 | −0.3 | −0.2 | −0.2 | −0.1 | 0 | −1.8 |
| Residual | 0.8 | −2.7 | 2.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: IMF staff.

Note: SFA = Stock flow adjustment.

Following the MAC SRDSF, the DDT_GFN also calculates contributions to debt Changes, as in Figure 22, using the following equation:

$$d_t - d_{t-1} = \frac{r_t}{1+g_t} d_{t-1} + \frac{\pi_t - \pi_t^f}{(1+g_t)(1+\pi_t)(1+\pi_t^f)} \alpha_{t-1} d_{t-1} + \frac{z_t}{(1+g_t)(1+\pi_t^f)} \alpha_{t-1} d_{t-1} - \frac{g_t}{1+g_t} d_{t-1} - pb_t + of_t + sf_t^{fer},$$

where the first four terms represent the contributions of the real interest rate, relative inflation, the real exchange rate, and GDP growth, respectively, and the sum of these four contributions is labeled as the contribution of automatic debt dynamics.[9] Note that in this decomposition, $r_t = \frac{1+i_t^{fisc}}{1+\pi_t} - 1$ represents the real interest rate, where $i_t^{fisc} = \frac{Int_t}{D_{t-1}} = \alpha_{t-1} i_t^f (1+\varepsilon_t^{eop}) \frac{e_t^{avg}}{e_t^{eop}} + (1-\alpha_{t-1}) i_t^d$ denotes the nominal effective interest rate that can be derived from fiscal accounts, with $Int_t$ equal to the total interest expense in local and foreign currency debt converted into local currency. As in Output – Baseline, the contribution to the change in public debt of the primary deficit is $-pb_t$, that of other identified debt-creating flows is $of_t$, and that of the stock-flow adjustment because of intra-year exchange rate fluctuations is $sf_t^{fer}$. Results obtained following this approach are presented in the Output – Baseline_MAC SRDSF worksheet.

Following the LIC DSF, the DDT_GFN also calculates contributions to debt changes using the following equation:

$$d_t - d_{t-1} = \frac{\alpha_{t-1} r_t^f + (1-\alpha_{t-1}) r_t^d}{1+g_t} d_{t-1} + \frac{z_t (1+r_t^f)}{1+g_t} \alpha_{t-1} d_{t-1} - \frac{g_t}{1+g_t} d_{t-1} - pb_t + of_t + sf_t^{fer},$$

where the first three terms represent the contributions of the real interest rate, the real exchange rate, and GDP growth, respectively, and the sum of these three contributions is labeled as the contribution of

[9] One can interpret the sum of the contributions of the interest rate and relative inflation as being the total contribution of the interest rate.

**Figure 22. Contributions to Debt Changes as in Sovereign Risk and Debt Sustainability Framework for Market Access Countries (Output – Baseline_MAC SRDF)**

| Debt and Economic Indicators | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Actual | | | Medium-Term Projection | | | | | | | Extended Projection | | | | |
| | 2012–18 | 2019 | 2020[2] | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2033 | 2035 |
| Nominal gross public debt | 44.2 | 48.7 | 58.9 | 61.9 | 62.9 | 63.0 | 63.4 | 63.9 | 64.3 | 64.8 | 65.0 | 65.4 | 65.9 | 66.9 | 67.6 |
| Of which: guarantees (uncalled) | 0.3 | 3.8 | 3.3 | 2.3 | 2.0 | 1.8 | 1.5 | 1.4 | 1.4 | 1.5 | 1.4 | 1.4 | 1.5 | 1.5 | 1.4 |
| Change in gross public sector debt | 2.4 | 0.1 | 10.2 | 3.0 | 1.0 | 0.1 | 0.3 | 0.5 | 0.4 | 0.5 | 0.3 | 0.4 | 0.5 | 0.4 | 0.3 |
| Identified debt-creating flows | 1.6 | 2.8 | 7.8 | 3.0 | 1.0 | 0.1 | 0.3 | 0.5 | 0.4 | 0.5 | 0.3 | 0.4 | 0.5 | 0 | 0 |
| Primary deficit | 1.6 | −0.6 | 3.5 | 4.0 | 1.1 | −0.5 | −0.3 | −0.2 | −0.3 | −0.3 | −0.3 | −0.3 | −0.3 | −0.3 | −0.3 |
| Automatic debt dynamics | −0.1 | 0 | 4.9 | −0.9 | −0.7 | −0.1 | −0.1 | −0.1 | −0.3 | −0.2 | −0.4 | −0.3 | −0.2 | −0.3 | −0.3 |
| Real interest rate and relative inflation | 1.2 | 1.6 | 1.8 | 1.7 | 1.9 | 1.9 | 2.0 | 2.1 | 2.0 | 2.1 | 2.0 | 2.1 | 2.2 | 2.1 | 2.2 |
| Real interest rate | 0.6 | 0.9 | 1.1 | 1.1 | 1.2 | 1.2 | 1.4 | 1.5 | 1.4 | 1.4 | 1.3 | 1.4 | 1.5 | 1.4 | 1.5 |
| Relative inflation | 0.6 | 0.6 | 0.7 | 0.6 | 0.6 | 0.7 | 0.6 | 0.6 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |
| Real growth rate | −1.5 | −1.2 | 4.4 | −2.3 | −2.2 | −2.0 | −2.2 | −2.3 | −2.3 | −2.3 | −2.3 | −2.3 | −2.4 | −2.4 | −2.4 |
| Real exchange rate | 0.2 | −0.3 | −1.3 | −0.3 | −0.4 | 0 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | −0.1 |
| Other identified debt-creating flows | 0 | 0 | 0 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| SFA because of intra-year exchange rate changes | 0 | 0 | −0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Change in guarantees (uncalled) | 0.1 | 3.4 | −0.5 | −1.0 | −0.3 | −0.2 | −0.2 | −0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Residual | 0.8 | −2.7 | 2.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | | | | | | | | | | | | | | |
| Public gross financing needs | 8.4 | 6.7 | 12.1 | 16.5 | 10.7 | 9.7 | 10.2 | 10.8 | 10.9 | 10.7 | 10.7 | 10.9 | 11.1 | 11.7 | 13.1 |
| of which: debt service | 6.9 | 7.3 | 8.6 | 12.5 | 9.6 | 10.1 | 10.5 | 11.0 | 11.2 | 10.9 | 10.9 | 11.2 | 11.3 | 12.0 | 13.4 |
| Local currency | 3.0 | 3.5 | 4.2 | 5.8 | 4.3 | 4.5 | 5.1 | 5.7 | 5.8 | 5.7 | 5.4 | 5.8 | 5.9 | 6.2 | 6.9 |
| Foreign currency | 3.8 | 3.8 | 4.4 | 6.7 | 5.3 | 5.6 | 5.4 | 5.3 | 5.4 | 5.3 | 5.6 | 5.3 | 5.5 | 5.8 | 6.5 |
| Memo: | | | | | | | | | | | | | | | |
| Real GDP growth (Percent) | 3.8 | 2.7 | −9.0 | 4.2 | 3.7 | 3.4 | 3.7 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 |
| Inflation (GDP deflator, Percent) | 4.4 | 4.1 | 4.0 | 4.0 | 3.7 | 3.8 | 3.7 | 3.7 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Nominal GDP growth (Percent) | 8.3 | 6.9 | −5.3 | 8.4 | 7.5 | 7.3 | 7.5 | 7.7 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 0 | 0 |
| Effective interest rate (Percent) | 5.8 | 6.2 | 6.3 | 6.2 | 5.8 | 5.9 | 6.2 | 6.4 | 6.4 | 6.5 | 6.2 | 6.4 | 6.5 | 6.4 | 6.4 |

Source: IMF staff.

Note: SFA = stock flow adjustment.

automatic debt dynamics. As in Output – Baseline and Output – Baseline_MAC SRDSF, the contribution to the change in public debt of the primary deficit is $-pb_t$, that of other identified debt-creating flows is $of_t$, and that of the stock-flow adjustment because of intra-year exchange rate fluctuations is $sf_t^{ier}$. Results under this format are presented in the Output – Baseline_LIC DSF worksheet as illustrated in Figure 23, with a detailed definition of each term presented by Acosta-Ormaechea and Martinez (2021).

## Figure 23. Contributions to Debt Changes as in the Debt Sustainability Framework for Low-Income Countries (Output – Baseline_LIC DSF)

| Debt and Economic Indicators | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Actual | | | Projections | | | | | | | | | | | | Average | |
| | 2018 | 2019 | 20[2] | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 20 | 2033 | 2035 | Historical | Projections |
| Public sector debt | 48.5 | 48.7 | 58.9 | 61.9 | 62.9 | 63.0 | 63.4 | 63.9 | 64.3 | 64.8 | 65.0 | 65.4 | 65.9 | 66.9 | 67.6 | 46.3 | 65.0 |
| Of which: guarantees (uncalled)[3] | 0.5 | 3.8 | 3.3 | 2.3 | 2.0 | 1.8 | 1.5 | 1.4 | 1.4 | 1.5 | 1.4 | 1.4 | 1.5 | 1.5 | 1.4 | 1.1 | 1.6 |
| Of which: foreign-currency debt | 29.4 | 27.2 | 33.6 | 37.8 | 38.7 | 37.0 | 35.4 | 35.8 | 36.0 | 38.1 | 36.3 | 36.6 | 38.7 | 37.3 | 37.2 | 28.9 | 37.1 |
| Change in public sector debt | 1.1 | 0.1 | 10.2 | 3.0 | 1.0 | 0.1 | 0.3 | 0.5 | 0.4 | 0.5 | 0.3 | 0.4 | 0.5 | 0.4 | 0.3 | 3.0 | 0.6 |
| Identified debt-creating flows | −1.0 | 2.8 | 7.8 | 3.0 | 1.0 | 0.1 | 0.3 | 0.5 | 0.4 | 0.5 | 0.3 | 0.4 | 0.5 | 0 | 0.6 | 2.4 | 0.6 |
| Primary deficit | −0.9 | −0.6 | 3.5 | 4.0 | 1.1 | −0.5 | −0.3 | −0.2 | −0.3 | −0.3 | −0.3 | −0.3 | −0.3 | −0.3 | −0.3 | 1.6 | 0.1 |
| Automatic debt dynamics | −0.1 | 0 | 4.9 | −0.9 | −0.7 | −0.1 | −0.1 | −0.1 | −0.3 | −0.2 | −0.4 | −0.3 | −0.2 | 0 | −0.3 | 0.5 | −0.3 |
| Contribution from interest rate/ growth differential | −0.5 | 0.3 | 6.3 | −0.6 | −0.3 | −0.1 | −0.2 | −0.2 | −0.3 | −0.2 | −0.3 | −0.3 | −0.2 | 0 | −0.3 | 0.5 | −0.3 |
| of which: contribution from average real interest rate | 1.2 | 1.6 | 1.9 | 1.7 | 1.9 | 1.9 | 2.0 | 2.1 | 2.0 | 2.1 | 2.0 | 2.1 | 2.2 | 2.1 | 2.2 | 1.3 | 2.0 |
| of which: contribution from real GDP growth | −1.7 | −1.2 | 4.4 | −2.3 | −2.2 | −2.0 | −2.2 | −2.3 | −2.3 | −2.3 | −2.3 | −2.3 | −2.4 | −2.4 | −2.4 | −0.8 | −2.3 |
| Contribution from real exchange rate depreciation | 0.4 | −0.3 | −1.4 | −0.3 | −0.4 | 0 | 0.1 | 0.1 | 0 | 0 | 0 | 0 | 0 | 0 | −0.1 | 0 | 0 |
| Other identified debt-creating flows | 0 | 0 | 0 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0 | 0.9 |
| SFA because of intra-year exchange rate changes | 0 | 0 | −0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Change in guarantees (uncalled) | −0.1 | 3.4 | −0.5 | −1.0 | −0.3 | 0.2 | −0.2 | −0.1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.4 | −0.1 |
| Residual | 2.1 | −2.7 | 2.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.6 | 0 |
| Public gross financing needs | 6.3 | 6.7 | 12.1 | 16.5 | 10.7 | 9.7 | 10.2 | 10.8 | 10.9 | 10.7 | 10.7 | 10.9 | 11.1 | 11.7 | 13.1 | 8.7 | 11.4 |
| Memo: | | | | | | | | | | | | | | | | | |
| Real GDP growth (percent) | 3.8 | 2.7 | −9.0 | 4.2 | 3.7 | 3.4 | 3.7 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 2.2 | 3.8 |
| Average nominal interest rate on external debt (percent) | 3.6 | 3.6 | 3.6 | 3.8 | 3.8 | 3.6 | 3.4 | 3.4 | 3.4 | 3.6 | 3.4 | 3.4 | 3.6 | 3.4 | 3.4 | 3.3 | 3.5 |
| Average real interest rate on domestic debt (percent) | 5.7 | 5.9 | 6.1 | 5.6 | 5.5 | 5.9 | 6.4 | 6.4 | 6.1 | 6.1 | 6.1 | 6.1 | 6.1 | 6.1 | 6.1 | 5.7 | 6.0 |
| Real exchange rate depreciation (percent) | 1.4 | −1.0 | −4.6 | −1.0 | −1.1 | 0.1 | 0.2 | 0.3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.1 | −0.1 |
| Inflation (GDP deflator, percent) | 4.2 | 4.1 | 4.0 | 4.0 | 3.7 | 3.8 | 3.7 | 3.7 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.3 | 3.9 |
| Primary deficit that stabilizes the debt-to-GDP ratio | −2.0 | −0.7 | −6.6 | 1.0 | 0.1 | −0.6 | −0.6 | −0.7 | −0.7 | −0.8 | −0.5 | −0.7 | −0.7 | −0.6 | −0.6 | −1.5 | −0.5 |
| Effective interest rate (percent) | 6.0 | 6.2 | 6.3 | 6.2 | 5.8 | 5.9 | 6.2 | 6.4 | 6.4 | 6.5 | 6.2 | 6.4 | 6.5 | 6.4 | 6.4 | 5.9 | 6.3 |

Source: IMF staff.

Note: SFA = stock flow adjustment.

Finally, note that instead of presenting the contribution of the stock-flow adjustment because of intra-year exchange rate fluctuations in a separate term, $sf_t^{fier}$, the DDT_GFN also distributes this contribution to incorporate the effect of intra-year exchange rate fluctuations into each flow as follows:

$$d_t - d_{t-1} = \frac{\left(1 + i_t^{fisc}\right)\mu_t - 1}{(1 + g_t)(1 + \pi_t)} d_{t-1} - \frac{\pi_t}{(1 + g_t)(1 + \pi_t)} d_{t-1}$$

$$+ \frac{\left[\left(1 + \varepsilon_t^{eop}\right) e_t^{avg}/e_t^{eop} - 1\right]}{(1 + g_t)(1 + \pi_t)} \mu_t \alpha_{t-1} d_{t-1} - \frac{g_t}{1 + g_t} d_{t-1} - \mu_t pb_t + \mu_t of_t.$$

The first four terms in this equation represent the contributions of the interest rate, inflation, the nominal exchange rate, and real GDP growth, respectively, with corrections for $\mu_t$ incorporated in the relevant components. The sum of these four contributions is labeled as the contribution of automatic debt dynamics. Similarly, the contributions from the primary deficit, $-\mu_t pb_t$, and other identified debt-creating flows, $\mu_t of_t$, are also corrected with $\mu_t$. Results obtained following this approach are presented in the Output – Baseline_mu worksheet (Figure 24).

As illustrated in Figure 25, at the top of the Readme worksheet, under the heading "Contribution to Debt Changes in Baseline Output Table," users can select which of the baseline output worksheets they want to be displayed in the DDT_GFN.

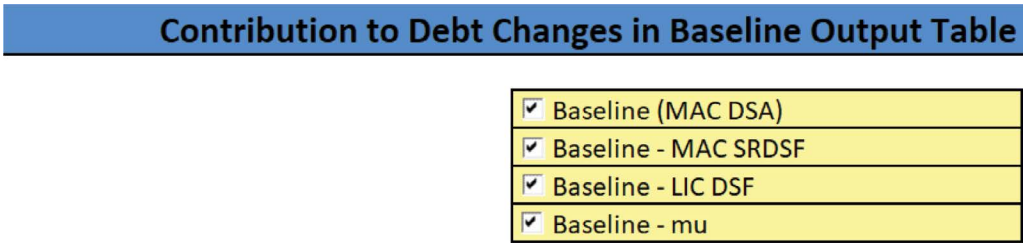
**Figure 24. Contributions to Debt Changes with Stock-Flow Adjustment Coefficients (Output – Baseline_mu)**

| | Actual | | Est. | Projections | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2012–18 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | Cumulative |
| Change in gross public sector debt | 2.4 | 0.1 | 10.2 | 3.0 | 1.0 | 0.1 | 0.3 | 0.5 | 0.4 | 5.4 |
| Identified debt-creating flows | 1.6 | 2.8 | 7.8 | 3.0 | 1.0 | 0.1 | 0.3 | 0.5 | 0.4 | 5.4 |
| Primary deficit | 1.6 | −0.6 | 3.5 | 4.1 | 1.1 | −0.5 | −0.3 | −0.2 | −0.3 | 3.9 |
| Automatic debt dynamics | 0 | 0 | 4.9 | −0.9 | −0.7 | −0.1 | −0.1 | −0.1 | −0.2 | −2.1 |
| Of which: interest rate | 2.7 | 2.9 | 2.4 | 3.3 | 3.4 | 3.7 | 3.9 | 4.0 | 4.0 | 22.3 |
| Of which: inflation | −1.7 | −1.8 | −1.9 | −2.1 | −2.0 | −2.1 | −2.1 | −2.1 | −2.3 | −12.8 |
| Of which: exchange rate depreciation | 0.4 | 0.2 | −0.1 | 0.1 | 0.1 | 0.4 | 0.3 | 0.3 | 0.3 | 1.6 |
| Of which: real GDP growth | −1.5 | −1.2 | 4.4 | −2.3 | −2.2 | −2.0 | −2.2 | −2.3 | −2.3 | −13.2 |
| Other identified debt-creating flows | 0 | 0 | 0 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 | 5.4 |
| Change in guarantees (uncalled) | 0.1 | 3.4 | −0.5 | −1.0 | −0.3 | −0.2 | −0.2 | −0.1 | 0 | −1.8 |
| Residual | 0.8 | −2.7 | 2.4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Source: IMF staff.

Note: Est. = estimated.

**Figure 25. Choice of Presentations for Contributions to Debt Changes (Readme)**




Source: IMF staff.

## B. Key Indicators Table

As the DDT, the DDT_GFN also presents key indicators in the "Realism and Fiscal Adjustments" blue table in the baseline output worksheets (Output – Baseline, Output – Baseline_mu, Output – Baseline_MAC SRDSF, and Output – Baseline_LICDSF). In the DDT_GFN, the blue table, as illustrated in Figure 26, follows the structure it has in the DDT; but in addition to indicators for the debt ratio reported in the DDT, the table includes indicators for the following:

- The GFN ratio over the medium term ("Year for medium-term indicators" in Readme) for the historical and constant primary balance scenarios.
- The level and yearly change in the primary balance needed to reach the GFN ratio target after the adjustment period (under parameters chosen by the user in Readme).
- The probabilities of having a GFN ratio below that of the last historical year and the user-defined GFN ratio target at the end-of-adjustment-period (with probabilities approximated using the symmetric fan chart for the GFN ratio).

## C. Alternative Scenarios

As in the DDT, Output – Shocks presents debt dynamics under alternative scenarios, the underlying assumptions for these scenarios, and debt fan charts. In the DDT_GFN, the new worksheet Output – Shocks – GFN presents the dynamics of the GFN ratio under alternative scenarios, the underlying assumptions for these scenarios, and the GFN ratio fan charts.

**Figure 26. Key Indicators Table**

| Realism and Fiscal Adjustments | |
|---|---|
| Historical and constant primary balance scenarios | |
| Debt levels in 2026 | |
| 74.8 | 84.6 |
| GFN in 2026 | |
| 14.5 | 18.2 |
| Debt-stabilizing primary balance in 2021 and in 2026 | |
| 0 | 0.7 |
| Level and yearly change in primary balance to yield 50 percent debt in 2028 | |
| 2.8 | 1.7 |
| to yield 9 percent GFN in 2028 | |
| 2.5 | 1.9 |
| Probability of: | |
| Debt level below end-2020 and 50 percent in 2028 | |
| 29.5 | 10.2 |
| GFN below end-2020 and 9 percent in 2028 | |
| 65.6 | 32.7 |

Source: IMF staff.
Note: GFN = gross financing needs.

# APPENDIX 1. GFN-to-GDP Ratio

Recall that:

$$GFN_t = e_t^{avg} am_t^f D_{t-1}^f + am_t^d D_{t-1}^d + e_t^{avg} i_t^f D_{t-1}^f + i_t^d D_{t-1}^d - PB_t. \quad (1)$$

To obtain the GFN ratio in equation (2), we first divide equation (1) by period-$t$ nominal GDP ($P_t Y_t$):

$$\frac{GFN_t}{P_t Y_t} = \frac{e_t^{avg}\left(am_t^f + i_t^f\right) D_{t-1}^f}{P_t Y_t} + \frac{\left(am_t^d + i_t^d\right) D_{t-1}^d}{P_t Y_t} - \frac{PB_t}{P_t Y_t}.$$

To obtain debt ratios for $t-1$, we multiply $t-1$ debt stocks by $\frac{P_{t-1}Y_{t-1}}{P_{t-1}Y_{t-1}}$ and the foreign currency debt stocks by $\frac{e_t^{eop}}{e_t^{eop}}$ and $\frac{e_{t-1}^{eop}}{e_{t-1}^{eop}}$:

$$gfn_t = \frac{P_{t-1}Y_{t-1}}{P_t Y_t}\frac{e_t^{avg}}{e_t^{eop}}\frac{e_t^{eop}}{e_{t-1}^{eop}}\left(am_t^f + i_t^f\right)\frac{e_{t-1}^{eop} D_{t-1}^f}{P_{t-1}Y_{t-1}} + \frac{P_{t-1}Y_{t-1}}{P_t Y_t}\left(am_t^d + i_t^d\right)\frac{D_{t-1}^d}{P_{t-1}Y_{t-1}} - pb_t.$$

Using $\frac{P_{t-1}Y_{t-1}}{P_t Y_t} = \frac{1}{(1+g_t)(1+\pi_t)}$, $\frac{e_t^{eop}}{e_{t-1}^{eop}} = (1+\varepsilon_t^{eop})$, $\frac{e_{t-1}^{eop} D_{t-1}^f}{P_{t-1}Y_{t-1}} = \alpha_{t-1} d_{t-1}$, and $\frac{D_{t-1}^d}{P_{t-1}Y_{t-1}} = (1-\alpha_{t-1})\, d_{t-1}$, we obtain equation (2):

$$gfn_t = \frac{\alpha_{t-1}(1+\varepsilon_t^{eop})\frac{e_t^{avg}}{e_t^{eop}}\left(am_t^f + i_t^f\right) + \left(1-\alpha_{t-1}\right)\left(am_t^d + i_t^d\right)}{(1+g_t)(1+\pi_t)} d_{t-1} - pb_t. \quad (2)$$

# APPENDIX 2. Building Fan Charts

This appendix presents details on how the DDT_GFN builds the fan charts for the GFN ratio. The approach for building GFN fan charts follows closely the one for building the public debt fan charts (which are built as in the DDT). Recall first that $Y_t^{gfn} \equiv (g_t, r_t^{d,gfn}, r_t^{f,gfn}, pb_t)$ is the vector of variables shocked for building the GFN fan charts. For each fan chart path, the value of this vector is calculated as $Y_t^{gfn} = \theta_t^{gfn} + \epsilon_t^{gfn}$, where the vector $\theta_t^{gfn}$ contains the baseline mean value of the four variables in $Y_t^{gfn}$ and $\epsilon_t^{gfn} \sim N(0, \Omega^{gfn})$ is a vector of jointly normally distributed shocks. Using historical data for $g_t, r_t^{d,gfn}, pb_t$, and $r_t^{f,gfn}$, the DDT_GFN computes their mean and variance–covariance matrix. Then, a visual basic code implements the following steps:

1. Computes the Cholesky factor of the variance–covariance matrix $\Omega^{gfn}$, matrix **K**, with dimension 4 x 4.
2. Generates four columns to project GFN ratios 15 years ahead, each with 15,000 random numbers extracted from a standard normal distribution. The result is a matrix **R** of random numbers with dimension 15,000 x 4.
3. The next step consists of modifying those random numbers in such a way that they end up having the same joint behavior of the historic values of the four original variables. To do that, the code multiplies matrices **R** and **K'** (the transpose of the Cholesky factor of the variance–covariance matrix $\Omega^{gfn}$). The result will be a new matrix of shocks **S** with dimension 15000 x 4. The first column of **S** presents shocks to *g*, the second shocks to $r_t^{d,gfn}$, the third shocks to $pb_t$, and the last column shocks to $r_t^{f,gfn}$.

Using Excel formulas, the DDT_GFN reorganizes shocks in groups of 15 columns (one for each projection year) of 1,000 rows each. These shocks are added to the baseline values for building 1,000 GFN-to-GDP ratio paths for each of the 15 projection years. For the first year of the GFN ratio projections, the DDT_GFN uses the debt level observed before the projection period begins. Starting in the second projection year, each GFN-to-GDP ratio path uses one of the 1,000-previous-year debt projections obtained for the debt fan chart, making the GFN fan charts consistent with the debt fan charts.

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**PUBLICATIONS**

A Guide and Tool for Projecting Public Gross Financing Needs

TNM/2025/01

ISBN 9798400289446