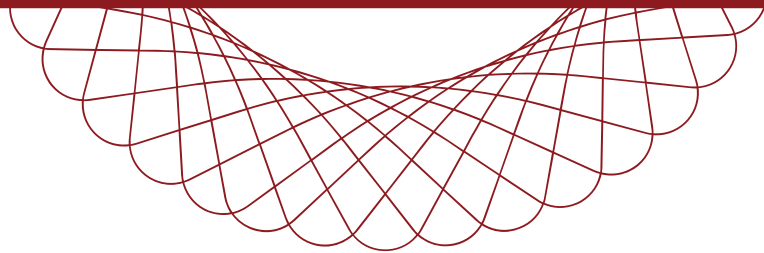


Debt Sustainability Analysis: Fundamental Concepts and International Practice

The background of the slide is a composite image. It features a long bridge spanning a body of water under a hazy sky. In the foreground, there are several tall stacks of coins. Overlaid on this scene are several line graphs with different colored lines (yellow, red, white) and data points, suggesting financial analysis or market trends.

Juan Pradelli

November 2024



Fundamental Concepts

DEBT SUSTAINABILITY

Public debt is sustainable when the government is both **solvent** and **liquid**

PUBLIC DEBT SUSTAINABILITY

The ability of a government to honor its current and future financial obligations...

...preserving sound policies over time, without being forced to undertake major fiscal adjustments (presumably unrealistic), debt restructurings, or outright defaults

ABILITY TO PAY



WILLINGNESS TO PAY

THE GOVERNMENT'S FLOW OF FUNDS AND THE PUBLIC DEBT DYNAMICS

- The flow of funds reflects the *accounting identity*:

$$Revenues_t + Financing\ Sources_t + Debt\ Issuances_t = Expenditures_t + Financing\ Needs_t + Debt\ Repayments_t$$

Any **receipt** on the left-hand side of the equation...



... must be allocated to a certain **payment** on the right-hand side.

- Just re-arranging terms:

$$Debt\ Issuances_t - Debt\ Repayments_t = (Expenditures_t - Revenues_t) + (Financing\ Needs_t - Financing\ Sources_t)$$



$$Debt_t - Debt_{t-1}$$

A *debt manager* sees the annual variation in public debt is driven by debt issuances and repayments.



$$Debt_t - Debt_{t-1}$$

A *fiscal policy maker* observes the annual variation in public debt is driven by budget imbalances and financing transactions.

THE GOVERNMENT'S FLOW OF FUNDS AND THE NOTIONS OF SOLVENCY AND LIQUIDITY

Consider other rearrangements of receipts and payments:

$$\text{Debt Issuances}_t = (\text{Expenditures}_t - \text{Revenues}_t) + \text{Debt Repayments}_t + (\text{Financing Needs}_t - \text{Financing Sources}_t)$$

Why the government
borrows? ...

... to finance the
budget deficit ...

... to service
maturing debts ...

... to finance other needs
(beyond the budget deficit ...

$$\text{Debt Repayments}_t = \underbrace{\text{Debt Issuances}_t}_{\text{Borrowed funds}} + \underbrace{(\text{Revenues}_t - \text{Expenditures}_t) + (\text{Financing Sources}_t - \text{Financing Needs}_t)}_{\text{Non-borrowed funds ('Own resources')}} + \text{Debt Repayments}_t$$

Borrowed funds

Non-borrowed funds
(‘Own resources’)

Debt repayments corresponding to maturing financial liabilities are financed either with

(i) non-borrowed funds (own resources) → **solvency**

(ii) borrowed funds → **liquidity**

SOLVENCY AND LIQUIDITY

SOLVENCY

A government's capacity to repay financial obligations over an extended period of time

- Funding debt repayment with budgetary resources in the long-term
- Without systematically borrowing to fund budget deficits and rollover maturing liabilities
- No need to incur in unrealistic fiscal policy adjustment to generate budgetary resources sufficient to repay financial obligations
- No need to engage with creditors to restructure existing liabilities in view of insufficient budgetary resources in the long-term to repay them under the original contractual terms

LIQUIDITY

A government's capacity to borrow funds in the short- to medium term, at a reasonable cost to meet gross financing needs (including rollover of maturing financial obligations)

- Without facing higher-than-normal interest rates or severe disruptions in the financing flows provided by regular creditors
- In theory, a solvent debtor would always be liquid. Creditors recognize the short-term borrowing is consistent with a long-term path where the debtor's financial liabilities and repayment capacity are balanced
- However, liquidity issues may arise due to coordination failures or information asymmetry, e.g., uncertainty about a debtor's budgetary resources or capacity to undertake policy adjustments
- A solvent government who fails to raise enough short-term funds to service maturing debt, may become insolvent due to liquidity problems

HOW IS DEBT SUSTAINABILITY ASSESSED?

SOLVENCY, LIQUIDITY, AND PUBLIC DEBT DYNAMICS

- The two sources of funding for debt repayments are reflected in the notions of **solvency** and **liquidity**.
- How debt repayments are funded by the government is essential to the public debt dynamics:
 - The government effectively reduces the public debt stock if and when it is able to generate own resources and allocate them to fund repayment of maturing liabilities
 - The government, however, maintains the public debt stock unchanged if and when it is able to access borrowed funds and roll over maturing debts

SUSTAINABILITY ASSESSMENT

- **Formulate a judgement** on whether the government will have the ability and willingness to meet its current and future financial obligations
- **Identify the risks** likely to affect the economic and policy performance driving the public debt dynamics over the medium term

HOW IS DEBT SUSTAINABILITY ASSESSED?

SOLVENCY, LIQUIDITY, AND SUSTAINABILITY

- **Public debt is sustainable** when the government can (and is willing to) service financial liabilities maturing in the foreseeable future **within the current policy framework and economic outlook**, without ever having to:
 - (i) Borrow systematically to fund budget imbalances, debt repayments and other net financing needs
 - (ii) Undertake major fiscal adjustments, which may be socially or politically unfeasible or unduly painful
 - (iii) Restructure obligations owed to its financiers, thus unilaterally imposing a debt-service moratorium or outright default
- **Public debt is unsustainable** when the government debtor is not solvent and/or not liquid. Public debt is deemed unsustainable **when the government cannot (and/or is not willing to) service the financial liabilities that are due within the current policy framework and economic outlook**, because both elements are not conducive to generate sufficient own resources now or later for the government to honor the obligations owed to its financiers.

An unsustainable public debt also results when the government cannot (and/or is not willing to) service financial liabilities because it has no access to borrowed funds to roll over debts maturing in the near future.

In such challenging circumstances, the government may decide to:

- (i) Undertake a budgetary adjustment to slow the pace of borrowing
- (ii) Declare a default and stop servicing maturing debt
- (iii) Both (i) and (ii)

HOW IS DEBT SUSTAINABILITY ASSESSED?

DEBT RATIOS USED AS INDICATORS

LIABILITIES TO SERVICE

(in nominal values)

Total financial obligations (debt stock)
Debt service obligations (flow)

REPAYMENT CAPACITY

(in nominal values)

Repayment in the long term
Re-financing in the short- to medium term (rollover)

SOLVENCY

RELATES TO DEBT BURDEN

Public Debt
External Debt
Present Value (PV) of Debt

LIQUIDITY

RELATES TO FINANCING NEEDS

Budget deficit
Gross financing needs
Interests and amortizations

REPAYMENT CAPACITY

RELATES TO INCOMES

GDP
Revenues
Exports

HOW IS DEBT SUSTAINABILITY ASSESSED?

DEBT RATIOS AND PUBLIC DEBT DYNAMICS

Dynamics of public debt ratios (e.g., debt-to-GDP)

LIABILITIES TO SERVICE
(in nominal values)

>

REPAYMENT CAPACITY
(in nominal values)

*Debt-sustainability conditions would **deteriorate** and result in a **rising public debt ratio**.*

LIABILITIES TO SERVICE
(in nominal values)

<

REPAYMENT CAPACITY
(in nominal values)

*Debt-sustainability conditions would **improve** and result in a **decreasing public debt ratio**.*

Debt/GDP ratio evolves over time as a result of **debt dynamics** and **GDP growth**

- Borrowings depend on fiscal deficits and other financing needs → Fiscal and financing policies
- Exchange rates (ER), interest rates, and other market conditions → Monetary, financial, and ER policies
- Economic growth and price inflation → Economic conditions and policies

**SUSTAINABILITY
INDICATORS**



Subjective judgements and interpretations



Collective consensus and conventions

HOW IS DEBT SUSTAINABILITY ASSESSED?

DEBT RATIOS AND PUBLIC DEBT DYNAMICS

Debt is **SUSTAINABLE** if projected debt-to-GDP ratio is low, or if it shows a declining trend

Debt is **UNSUSTAINABLE** if projected debt-to-GDP ratio is high, or if it shows an increasing trend

THESE 2 BASIC INTUITIONS TO OPERATIONALIZE THE NOTION OF DEBT SUSTAINABILITY ARE NOT ENOUGH BECAUSE ...

- Projection need to be based on realistic assumptions
- Economies are vulnerable to unexpected shocks
- Economies with declining debt ratios but high debt levels would still be unsustainable if high risk of default or illiquidity
- Public debt could be low but gross financing needs could be high affecting the market perception in the short-term.

HOW IS DEBT SUSTAINABILITY ASSESSED?

ANALYST'S JUDGEMENT TO ASSESS UNCERTAINTIES AND RISKS

CERTAINTY

Outstanding debts assumed in past years

UNCERTAINTY

Debts to be assumed in future years (rollovers, deficit financing)
Repayment capacity (GDP, revenues, exports)

Debt is **SUSTAINABLE** if projected debt-to-GDP ratio is low, or if it shows a declining trend with high probability of occurrence

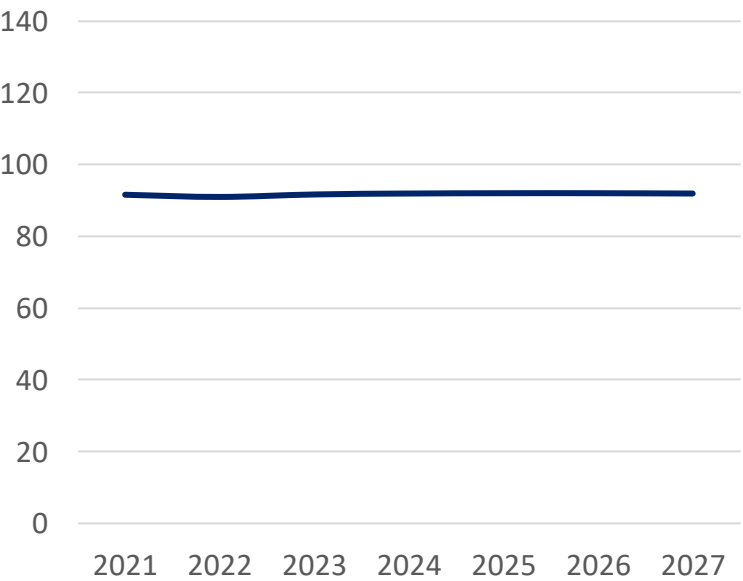
Debt is **UNSUSTAINABLE** if projected debt-to-GDP ratio is high, or if it shows a declining trend with low probability of occurrence, or if it shows an increasing trend with high probability

Debt sustainability to be assessed regularly in order to incorporate:
(i) new information on events; and
(ii) changing expectations about the future outlook and risks.

EXAMPLE - WHICH COUNTRY EXHIBITS A SUSTAINABLE PUBLIC DEBT?

Debt/GDP

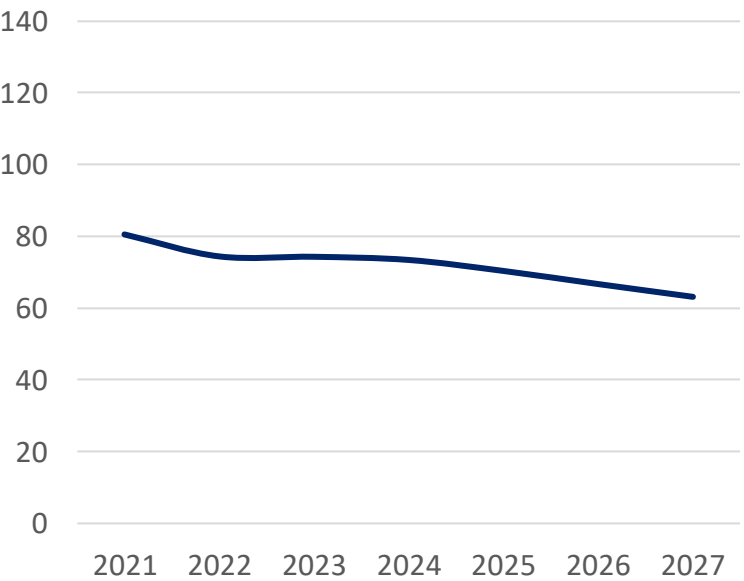
Brazil



SUSTAINABLE

... with moderate risk

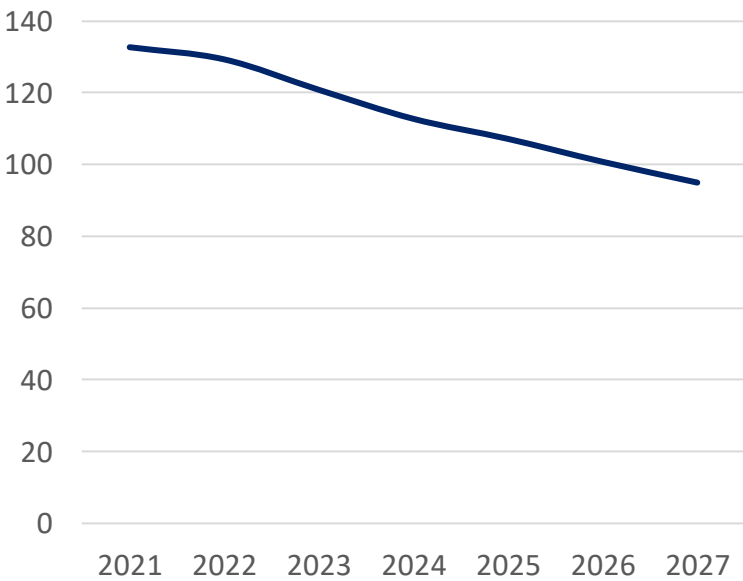
Argentina



SUSTAINABLE

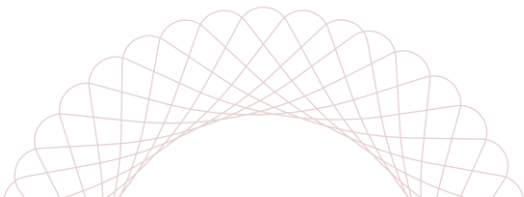
... but not with high probability

Zambia



UNSUSTAINABLE

In Debt Distress



Frameworks for Assessing Debt Sustainability

FRAMEWORKS TO ASSESS DEBT SUSTAINABILITY

	MACSR DSF	MAC DSA	LIC DSF	DDT
Used for	Advanced Economies & Emerging Markets	Advanced Economies & Emerging Markets	Low-Income Countries	All Countries
Why?	Countries with sustained access to international capital markets	Countries with sustained access to international capital markets	Countries relying on concessional resources	Countries with limited data availability and technical capacity
Horizon	5 years (optional 10 years)	5 years	20 years	12 years
Debt Scope	Total PPG Debt N.B.: PPG = Public and Publicly Guaranteed Debt Total = Domestic + External	Total PPG Debt External PPG Debt	Total PPG Debt External PPG Debt	Total PPG Debt
Solvency/Liquidity Assessment	YES/YES	YES/YES	YES/YES	YES/NO
Perspective	Debt Manager	Debt Manager	Debt Manager	Fiscal Policy Maker

FRAMEWORKS TO ASSESS DEBT SUSTAINABILITY

- In practice, IFIs use these tools both during the process of granting additional financing, as well as to assess/monitor the macro situation and the economic program (in terms of impact on debt sustainability).
- These tools supports the IMF surveillance and lending functions.
- In surveillance, these tools acts as an early warning system gauging debt-related risks. When risks are detected, these frameworks can help identify policy recommendations to prevent potential stress from materializing.
- Where public debt is found to be unsustainable, these frameworks provides a methodology for setting targets to guide debt restructurings.
- Policy recommendations are derived from these evaluations.

Low-Income Country Debt Sustainability Framework (LIC DSF)

LIC DSF: COUNTRIES AND ASSESSMENTS

- A **sophisticated framework** for assessing debt sustainability and evaluating the risk of debt distress, developed jointly by the IMF and the World Bank in 2005.
- Integrates concepts and procedures from the **three approaches** (accountability, analytical and empirical) and tackles **solvency and liquidity** issues.
- Suitable for **low-income countries whose sovereigns still significantly rely on concessional financing**.
- Combines the assessments of debt sustainability and debt-distress risk by adopting the empirical approach and using debt projections and thresholds for sustainability.
- The assessments aim to **identify two conditions**:
 - **Vulnerability to debt-distress events**:
 - episodes where a country has difficulty servicing debt;
 - a risk rating is established to measure such vulnerability.
 - The **risk of the unsustainability** of the public debt due to the breaching of the debt indicators thresholds:
 - LIC DSF determines whether a country's public debt is sustainable or unsustainable.

LIC DSF: STRENGTHS AND DRAWBACKS



LIC DSF's main **strengths** are:

- delivers **projections for several debt indicators** in various scenarios;
- provides **detailed analysis** of debt stocks, issuances and debt-service obligations;
- formulates a **debt-distress risk rating** for the public external debt and the total public debt; and
- **rigor and high quality** of calculations and visualizations.



Main **drawbacks** are:

- is **complex**, the spreadsheets implementing it is **not easy to use**;
- **several inputs are required** and debt targets and fiscal-policy adjustment paths are not addressed;
- It **does not include stochastic simulations** and fan charts.

PUBLIC DSA

EXTERNAL DSA

Domestic PPG Debt

External PPG Debt

External Private Debt

N.B.: PPG Debt = Public and Publicly Guaranteed Debt

LIC DSF: DEBT DYNAMICS, HORIZON, DEBT COVERAGE

- LIC DSF adopts the **debt manager's perspective** for projecting debt indicators and tracking gross and net borrowings required to fund budget imbalances, debt repayments and other net financing needs.
- Tracks **individual types of financial liabilities** separately, emphasizing major classes of financiers.
- **Inputs needed:**
 - Historical annual data and 20-year forecasts for macro and debt-related variables.
- Calculates the debt ratios involving the **present value of all future debt-service obligations due until maturity**.
- LIC DSF's projections extend to a protracted, **20-year horizon**. The horizon allows assessment of the opportunity for a government to boost repayment capacity in the long term as the country develops and grows.
- **Empirical thresholds** correspond to debt indicators related to solvency and liquidity.

LIC DSF: DEBT DISTRESS RATINGS

- Assesses **two debt-distress risk ratings**:
 - **Risk of public external debt distress**:
 - indicators related to public external debt are compared against their respective thresholds.
 - LIC DSF quantifies the risk of undergoing public external debt distress, since the (estimated) probabilities of occurrence are utilized to calibrate the thresholds.
 - builds a risk rating for the public external debt distress.
 - **Risk of total public debt distress**:
 - analysis of public external debt is extended by adding a comparison between the indicator of total public debt and its threshold.
 - LIC DSF determines a risk rating for the total public debt distress.
- Determining debt-distress risk ratings needs to be complemented with the analyst's expert judgment. The LIC DSF calls for expert judgment when the analysis encounters circumstances that may justify a deviation from the mechanical comparison of debt-indicator projections and threshold.

LIC DSF: DEBT-CARRYING CAPACITY

- Distinguishes between **three groups of countries**, depending on their **debt-carrying capacity**.
- Reflects the maximum acceptable **probability of debt distress**, conditional upon a country's capacity to service and manage debt.
- Debt-carrying capacity is based in **two pillars**:
 - Country Institutional and Policy Assessment (CPIA, elaborated by the World Bank)
 - Prevailing macroeconomic framework
- The LIC DSF thresholds distinguish between three groups of countries exhibiting strong, medium, or weak debt-carrying capacity.

LIC DSF: DEBT THRESHOLDS

Thresholds for public external debt and total public debt are estimated as follows:

- episodes of “public external debt distress” are identified as a situation where a government has **difficulty paying foreign debt**.
- the probability of a country undergoing public external debt distress is formalized using a **probit model**; estimated with a large sample of **observed events**, including debt distress and normal situations for many countries **throughout the last 50 years** or so.
- thresholds are calibrated to reflect the **maximum acceptable probability of debt distress**, conditional upon a country’s capacity to service and manage debt (debt-carrying capacity).

Identification of debt distress and non-distress episodes on the basis of ‘signals’ of external debt servicing difficulties such as arrears, Paris Club reschedulings, and IMF GRA financing.

Estimation of a parsimonious econometric model (probit) to explain the incidence (probability) of debt distress. The probit model takes the following form:

$$P(\text{debt distress}) = \Phi(\beta_1 * \text{debt burden} + \beta_2 * \text{governance} + \beta_3 * \text{shock} + \beta_4 * \text{other}) \quad (1)$$

where “debt distress” is a binary variable taking the value of 1 if the country experiences debt distress and zero otherwise; Φ is the cumulative distribution function (CDF) of the standard normal distribution; “debt burden” is a measure of indebtedness (PV of debt or debt service) scaled by a measure of repayment capacity (GDP, exports, or government revenue); “governance” is a measure the quality of policies and institutions (the World Bank’s CPIA index); “shock” is a proxy for macroeconomic shocks to the economy (real GDP growth); and “other explanatory variables” in Staff 2004 included GDP per capita and a dummy variable for Africa.²

Calibration of indicative debt burden thresholds. This is achieved by fixing in equation (1) the values for the probability of debt distress, governance, and macroeconomic shock, and solving for the debt burden. In the DSF, the probability of debt distress was set between 18–22 percent, depending on the debt burden indicator.³

$$\text{Threshold} = \frac{\Phi^{-1}(P(\text{debt distress})) - \hat{\beta}_2 * \text{governance} - \hat{\beta}_3 * \text{shock} - \hat{\beta}_4 * \text{other}}{\hat{\beta}_1} \quad (2)$$

LIC DSF: DEBT THRESHOLDS

- LIC DSF debt indicators are projected under various scenarios:

SOLVENCY

- Present value (PV) of the public and publicly guaranteed (PPG) total debt-to-GDP ratio
- PV of the PPG external debt-to-GDP ratio
- PV of the PPG external debt-to-exports ratio

LIQUIDITY

- PPG external debt service-to-exports ratio
- PPG external debt service-to-revenues ratio

- LIC DSF thresholds depend on a country's debt carrying capacity (strong, medium, weak):

	Strong	Medium	Weak
○ PV of PPG total debt-to-GDP	70%	55%	35%
○ PV of PPG external debt-to-GDP	55%	40%	30%
○ PV of PPG external debt-to-exports	240%	180%	140%
○ PPG external debt service-to-exports	21%	15%	10%
○ PPG external debt service-to-revenues	23%	18%	14%

LIC DSF: ANALYTICAL FRAMEWORK

Debt Carrying Capacity (DCC = weak, medium, strong) based on the WBG's CPIA and other key fundamentals

Thresholds for the three DCC categories. Higher (lower) thresholds for strong (weak) DCC

Macro-fiscal projections (20 years)

- Baseline Scenario
- Stress tests (history-driven and shock scenarios)

Debt projections (ratios of PV, debt service, etc.) for various scenarios

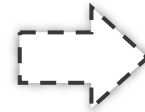
Additional Tools

Assessment of forecast realism
Domestic debt vulnerabilities
Fiscal space to absorb shocks

Comparisons between debt projections and thresholds for all scenarios

Rules to assign debt-distress risk ratings (akin to credit-risk ratings) based on those comparisons

Analyst's judgment complements rules to avoid 'mechanistic' determination of risk ratings



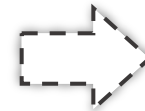
Debt-Distress Risk for Public External Debt

Low

Moderate

High

In debt distress



Debt-Distress Risk for Total Public Debt

Low

Moderate

High

In debt distress

LIC DSF: ANALYTICAL FRAMEWORK

LIC DSF assigns a debt-distress risk rating for the public external debt where a country is rated as having:



Low risk if none of the indicators breach their respective thresholds under the baseline scenario or in the stress-test scenarios



Moderate risk if none of the indicators breach their respective thresholds under the baseline scenario, but at least one indicator breaches its threshold in a stress-tests scenario



High risk if one indicator breaches its threshold in the baseline scenario



In **public external debt distress** when specific conditions are observed (e.g., arrears to official creditors, nonvoluntary debt negotiations) regardless of any comparison between indicators and thresholds

LIC DSF: ANALYTICAL FRAMEWORK

LIC DSF assigns a debt-distress risk rating for the total public debt where a country is rated as having:



Low risk if the risk rating for external public debt is low and the total public debt indicator does not breach its respective threshold under any scenario



Moderate risk if the risk rating for external public debt is moderate, or if it is low and the total public debt indicator does breach its respective threshold in a stress-test scenario



High risk if the risk rating for external public debt is high, or if it is low or moderate and the total public debt indicator does breach its respective threshold in the baseline scenario



In **total public debt distress** when specific conditions are observed (e.g., arrears to official creditors, nonvoluntary debt negotiations) regardless of any comparison between indicators and thresholds

Ghana LIC DSF 2023-2024



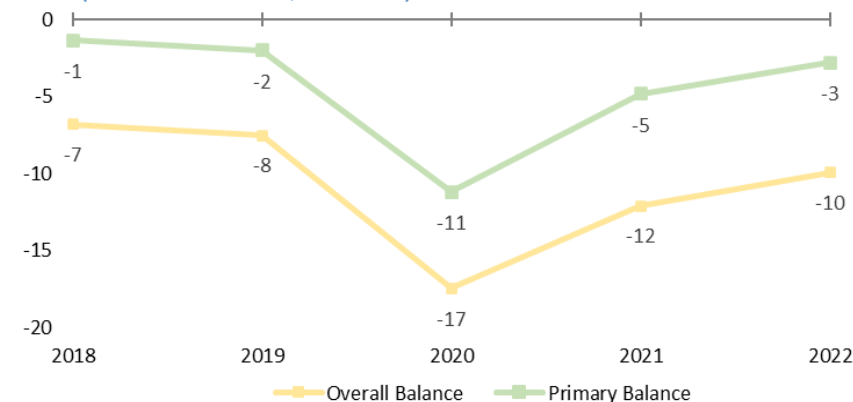
EXAMPLE - LIC DSF - GHANA



Recent Economic Developments

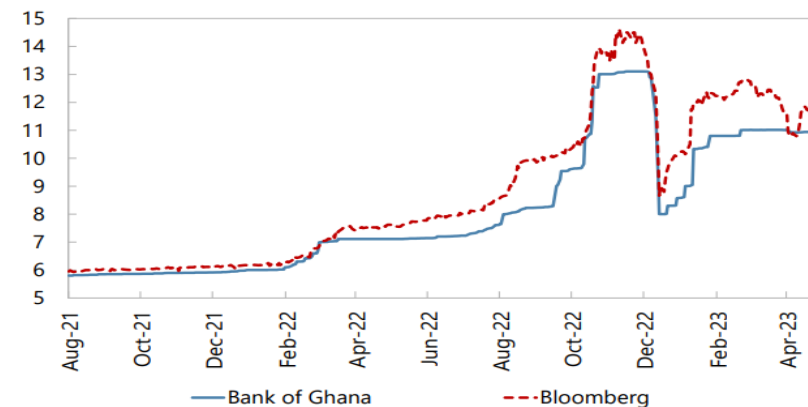
- **GDP growth** dropped to 3.2% in 2022 from 5.4% in 2021 driven by non-extractive sectors as business and consumer confidence declined.
- **Inflation** in 2022 was nearly four times higher than in 2021. (54% vs. 12%)
- **Fiscal deficit** decreased after the pandemic (12% of GDP in 2021 and 10% in 2022) but remains above the 2019-level (7%).
Ghana committed to achieve a fiscal deficit of 6% of GDP and a primary surplus of 1.5% by 2025, under the IMF program.
- **International reserves** declined to a critical level of USD1 billion (half a month of imports) in 2023, USD5 billion below than a year earlier, as a consequence of loss to capital market access, capital outflows and BoG's FX interventions.
- **Exchange rate** depreciated more than 50% against USD since 2021.

Ghana: Fiscal Outturns
(Commitment basis, % of GDP)



Source: own elaboration based on WEO Apr-2023

Ghana: Official and Market Exchange Rate
(GHS per USD)



Sources: Bloomberg L.P., Ghanaian authorities and IMF staff calculations.

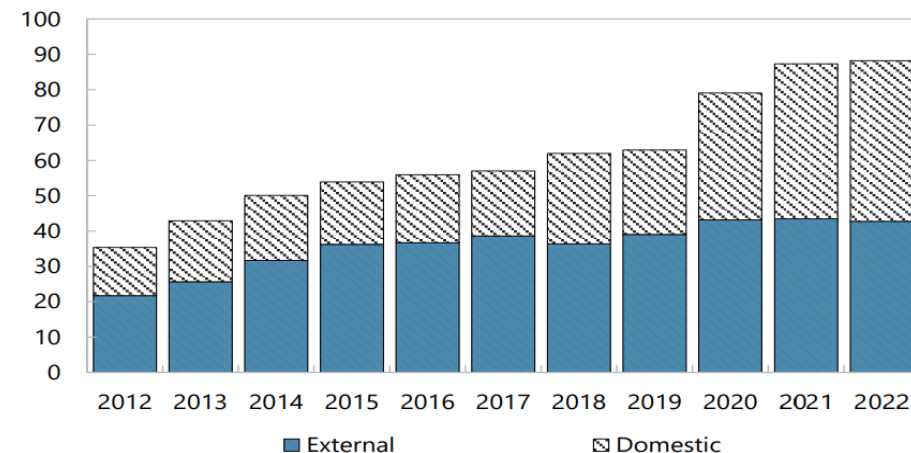


EXAMPLE - LIC DSF - GHANA

Recent Debt Dynamics

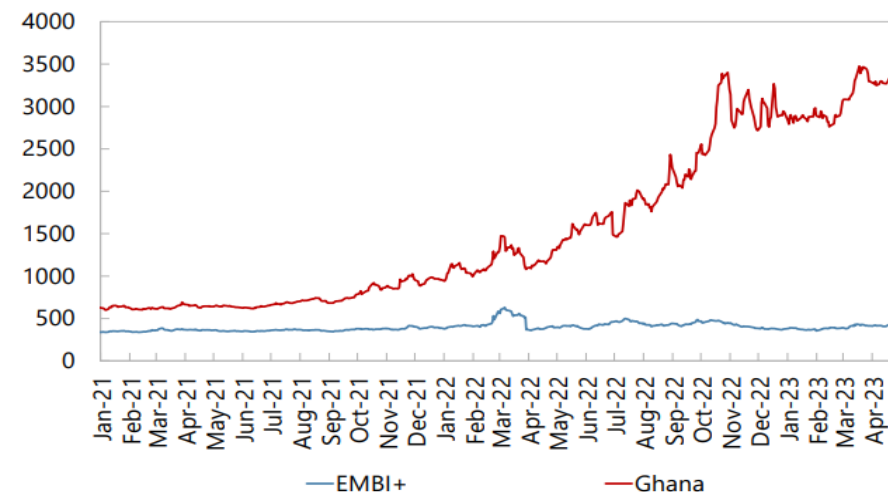
- Public debt increased 25p.p. of GDP between 2019 and 2022, mainly driven by the domestic debt.
- Ghana lost access to international markets in late 2021 and Eurobond spreads reached around 3000 bps. in 2022.
- Government faced difficulties in rolling-over domestic debt and increased reliance on monetary financing by the BoG.
- Ghana launched a restructuring that involves both domestic and external debt:
 - Domestic debt restructuring was conducted through a voluntary exchange of all domestic debt instruments other than T-bills.
 - Govt requested the restructuring of external obligations under the G20 Common Framework, after suspending debt service payments to commercial and bilateral creditors.
- Ghana reached an agreement with the IMF for a loan of USD 3bn last month .

Public Debt
(In percent of GDP)



Sources: Ghanaian authorities and IMF staff calculations

Evolution of Sovereign Spreads
(Basis points)





EXAMPLE - LIC DSF - GHANA

Debt Composition in 2022

- Domestic debt reached 45% of GDP and accounts for 52% of public debt, of which 35% is held by the BoG.
- External debt was 42% of GDP being China the holder of the 3% of total public debt and the 6% of the external debt.

Text Table 2. Ghana: Decomposition of Public Debt at end-2022 ¹

	Face Value			Present Value ²	
	(In US\$ mn)	(Percent total debt)	(Percent GDP)	(In US\$ mn)	(Percent total debt)
Total	63,332	100.0	88.1	64,882	100.0
External	30,483	48.1	42.4	32,033	49.4
Multilateral creditors	8,055	12.7	11.2	5,529	8.5
IMF	1,710	2.7	2.4	1,379	2.1
World Bank	4,750	7.5	6.6	3,132	4.8
African Development Bank	1,193	1.9	1.7	715	1.1
Other Multilaterals	401	0.6	0.6	303	0.5
Bilateral Creditors	5,438	8.6	7.6	4,982	7.7
Paris Club	2,867	4.5	4.0	2,484	3.8
o/w: Belgium	437	0.7	0.6	425	0.7
o/w United Kingdom	430	0.7	0.6	421	0.6
Non-Paris Club	2,572	4.1	3.6	2,498	3.8
o/w: China	1,900	3.0	2.6	1,816	2.8
o/w: India	475	0.7	0.7	496	0.8
Bonds	13,104	20.7	18.2	16,490	25.4
Commercial creditors	3,886	6.1	5.4	5,033	7.8
o/w local-currency government debt held by non-residents	1,614	2.5	2.2	2,481	3.8
Domestic	32,849	51.9	45.7	32,849	50.6
Short-term bills	5,009	7.9	7.0	5,009	7.7
Medium-to-long term bonds	18,320	28.9	25.5	18,320	28.2
Loans	76	0.1	0.1	76	0.1
Arrears	3,186	5.0	4.4	3,186	4.9
Other (Overdraft and SDRs on-lent)	6,258	9.9	8.7	6,258	9.6

Source: [Ghana: Request for an Arrangement Under The Extended Credit Facility](#)



EXAMPLE - LIC DSF - GHANA

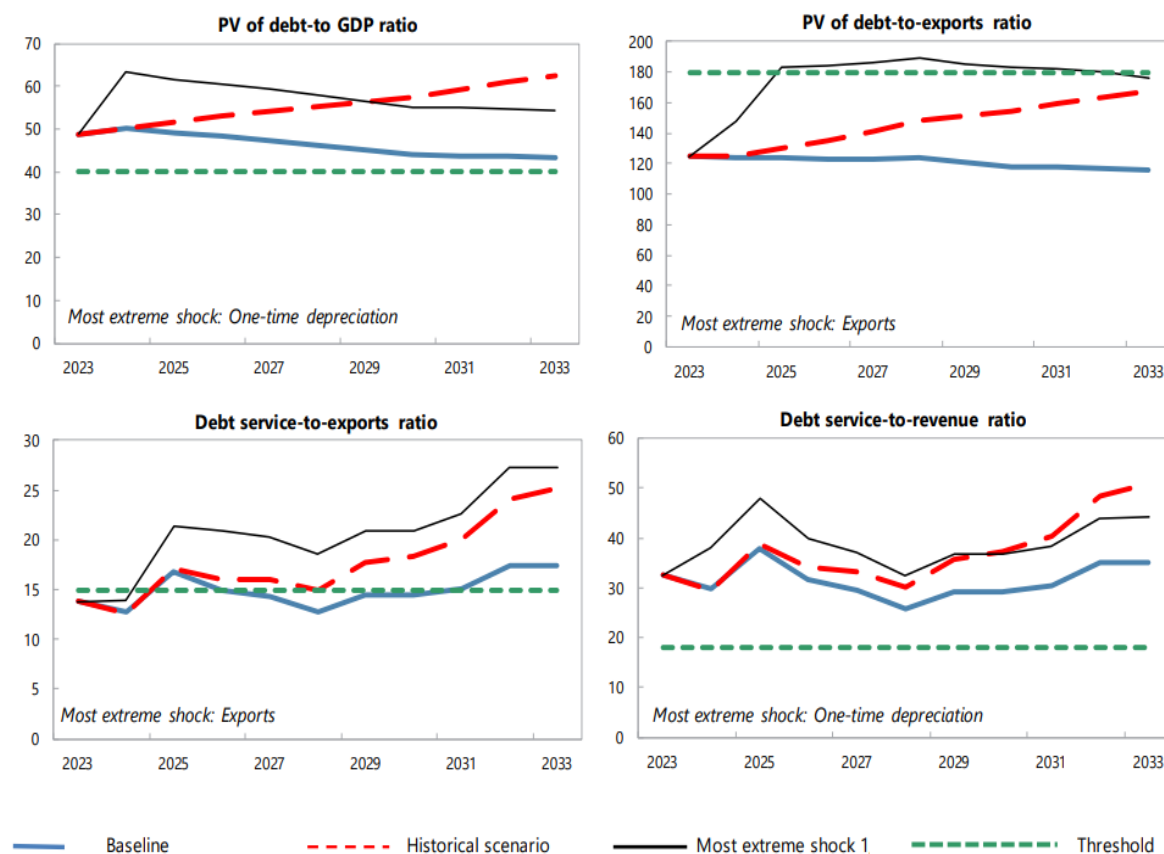
Baseline scenario

- Regarding solvency, the PV of external debt-to-GDP ratio is expected to be above the threshold throughout the whole projection horizon. The PV of external debt-to-exports ratio is expected not to breach the threshold in the baseline.
- Regarding liquidity, debt service-to-exports ratio is expected to breach the threshold in 2025 and 2031. Meanwhile, the debt service-to-revenue ratio is expected to remain above the threshold throughout the entire projected period.

Stress tests

- In the most extreme shock (exports) for the PV of external debt-to-exports and the debt service-to-exports breach the threshold.
- The most extreme shock for the PV of debt-to-GDP ratio and debt service-to-revenue ratio is the currency depreciation. For both indicators the thresholds are breached during the entire projection horizon.

Figure 1. Ghana: Indicators of Public and Publicly Guaranteed External Debt Under Alternative Scenarios, 2023–33 ^{2/}





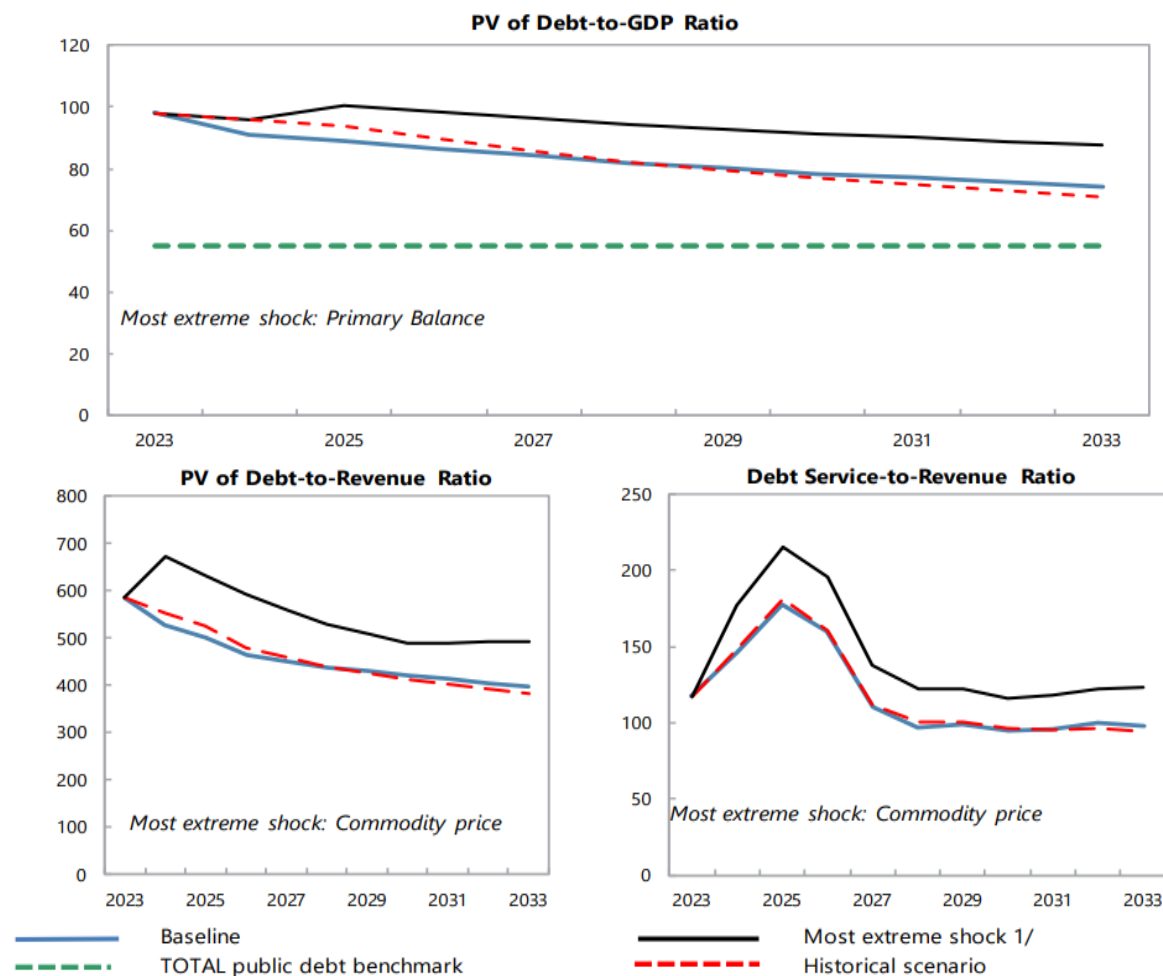
EXAMPLE - LIC DSF - GHANA

Risk assessment:

- Due to the suspension of debt service payments, the ongoing debt restructuring and the extended and large breaches of most debt burden indicators, Ghana's external debt and overall public debt is rated as **in debt distress** and to be **unsustainable**.

Ghana: Joint Bank-Fund Debt Sustainability Analysis ^{1,2}	
Risk of external debt distress	<i>In debt distress</i>
Overall risk of debt distress	<i>In debt distress</i>
Granularity in the risk rating	<i>Unsustainable</i>
Application of judgment	<i>No</i>

Figure 2. Ghana: Indicators of Public Debt Under Alternative Scenarios, 2023-33





EXAMPLE - LIC DSF - GHANA



Macroeconomic Framework underpinning the DSA

- GDP growth is envisaged to slow down in the short-term and recover gradually in the medium-term
- Primary balance (commitment basis) would improve 5p.p. of GDP between 2022 and 2026
- Revenue is envisaged to increase near 3p.p. of GDP by 2027
- Domestic real interest rate would be negative in the first years of projection
- External real interest rate is projected around 3% in the short-term, 150-basis points lower than in 2021 Article-IV

Text Table 3. Ghana: Macroeconomic Assumptions, 2021–43

	2021	2022	2023	2024	2025	2026	2027	2028-43 1/
	Annual Percentage Change							
Real GDP growth								
2021 Article IV	4.7	6.2	4.7	5.0	5.8	5.2	5.1	4.5
2023 Program	5.4	3.2	1.5	2.8	4.7	5.0	5.0	5.0
Inflation GDP deflator								
2021 Article IV	11.2	7.7	7.2	6.9	6.1	6.4	5.9	6.2
2023 Program	11.2	29.8	39.9	20.1	10.9	7.6	7.6	7.7
Nominal GDP (in Billion of USD)								
2021 Article IV	75.5	82.0	87.7	94.0	101.0	108.4	115.9	198.3
2023 Program	79.2	72.8	66.5	67.6	71.5	75.9	80.9	146.7
Exports, Goods & Services								
2021 Article IV	12.5	4.8	1.9	3.7	8.5	7.5	8.0	6.5
2023 Program	9.1	7.7	1.0	4.7	4.3	5.0	4.0	6.6
Imports, Goods & Services								
2021 Article IV	6.6	8.8	5.1	5.0	4.4	6.7	5.9	6.5
2023 Program	5.8	1.4	0.2	3.9	3.3	5.5	4.5	6.5
	In percent of GDP							
Non-interest Current Account Deficit								
2021 Article IV	-0.6	0.8	1.6	1.9	1.0	1.1	0.7	0.1
2023 Program	-0.4	-0.2	-0.1	-0.5	-0.3	0.3	0.4	1.0
Revenue and Grants								
2021 Article IV	14.9	15.0	15.0	15.2	15.3	15.5	15.9	16.4
2023 Program	15.3	15.7	16.8	17.3	17.8	18.7	18.7	18.7
Primary Expenditure 2/								
2021 Article IV	20.8	16.4	15.2	14.9	14.0	14.2	14.1	14.2
2023 Program	17.2	16.5	18.0	17.5	16.9	17.7	17.7	17.7
Primary Deficit 2/								
2021 Article IV	5.9	1.4	0.2	-0.3	-1.3	-1.4	-1.8	-2.2
2023 Program	1.9	0.8	1.2	0.2	-0.9	-0.9	-1.0	-1.0
	In percent							
Average real interest rate on domestic debt								
2021 Article IV	6.7	9.8	9.9	10.3	10.4	9.4	9.3	6.2
2023 Program	3.5	-12.8	-20.6	-1.0	6.3	5.5	4.6	4.8
Average real interest rate on external debt								
2021 Article IV	3.3	3.3	3.8	4.2	4.4	4.4	4.6	4.9
2023 Program	4.5	-2.5	1.6	2.9	3.0	2.9	2.8	3.6

Source: Ghanaian Authorities; and IMF staff estimates and projections.

1/ For 2021 Article IV: 2028-41

2/Primary expenditure and deficit are computed on a cash basis.

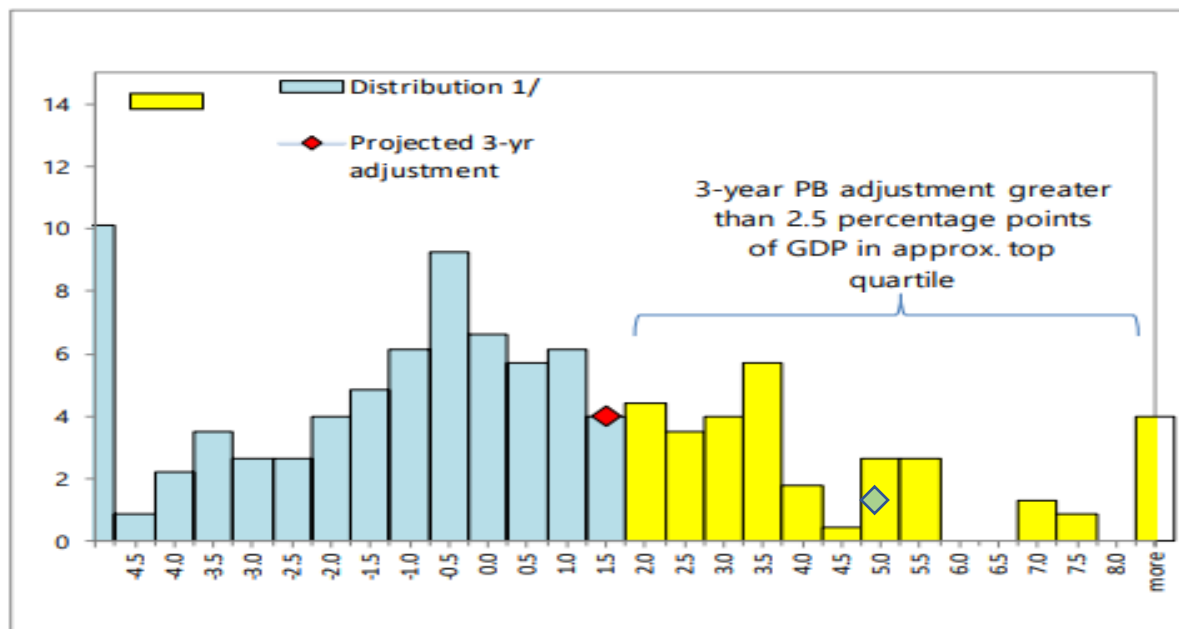


EXAMPLE - LIC DSF - GHANA

Realism tool: is the fiscal adjustment too optimistic?

- Fiscal consolidation of 5p.p. of GDP (commitment basis) falls within the top quartile for peers. In the figure the red marker represents the PB adjustment on cash basis and the green one on commitment basis.

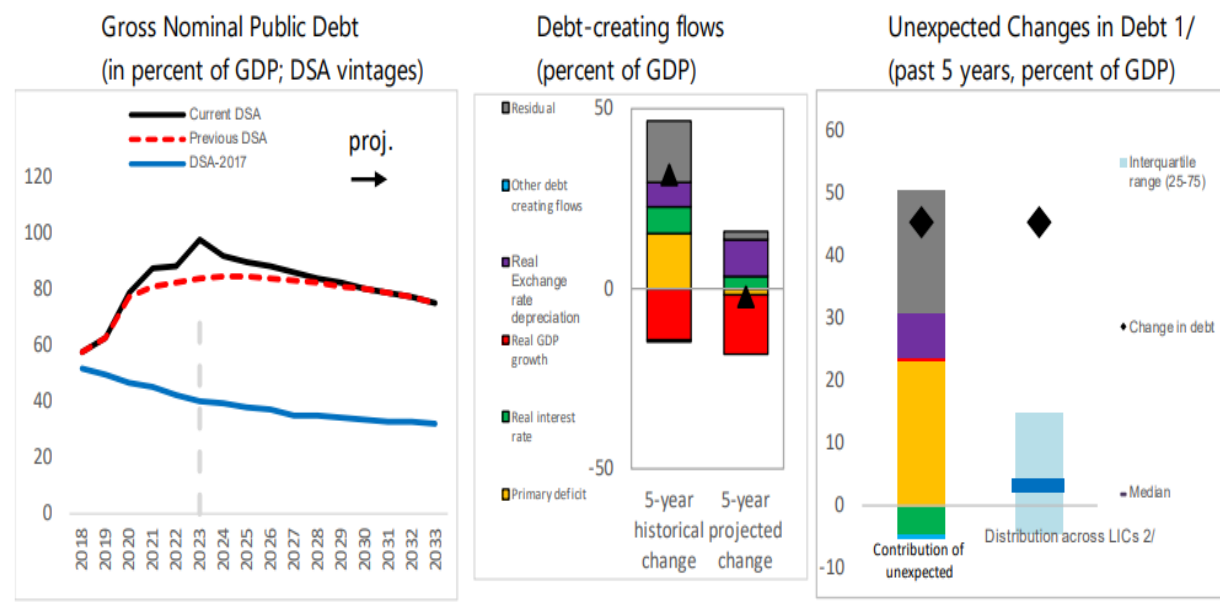
3-Year Adjustment in Primary Balance
(Percentage points of GDP)



Realsim tool: drivers of debt dynamics

- Compared to the five-year projection in the 2017 DSA, total public debt exceeded estimates by 28p.p. of GDP on average due to higher-than-expected fiscal deficits and other factors.
- Main drivers of unexpected changes in debt in the past 5 years were the fiscal deficit and the exchange rate.

Public debt



Lao PDR LIC DSF 2023-2024



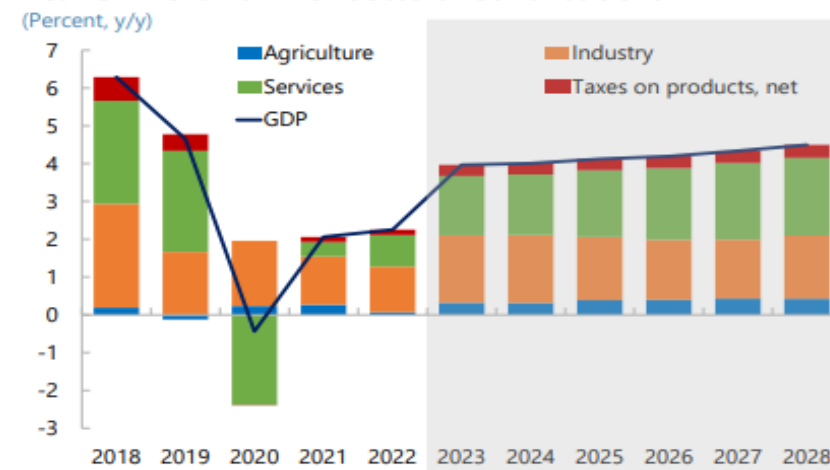
EXAMPLE - LIC DSF – LAO PDR



Recent Economic Developments

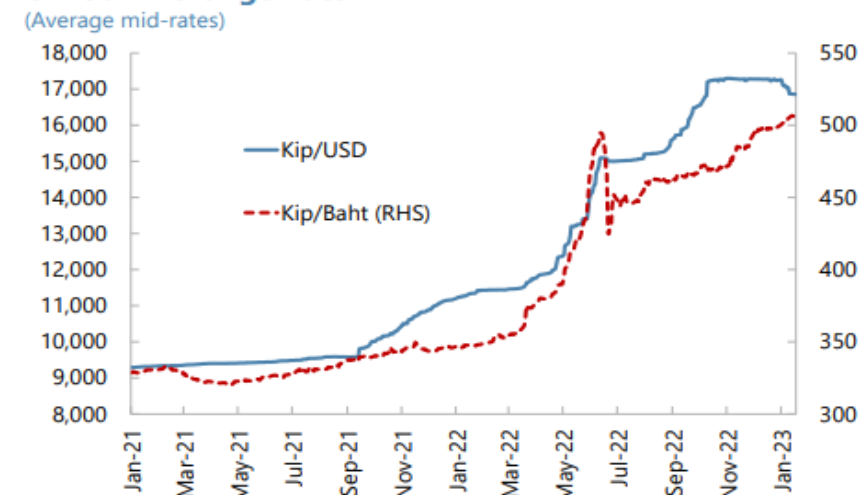
- **GDP growth** was nearly flat in 2020 and gradually recover the next two years
- Increase in global commodity prices accelerated **exchange rate** pressures and increased **inflation** rates
- **Fiscal policy** was contractive, driven equally by expenditure cuts and recovery in revenue collection
- **FX reserves** fell down posing the economy with little room to absorb external shocks
- **Exchange rate** depreciated more than 50% against USD since 2021.
- **Current account** deficit widened in 2022 with income repayment pressures, despite the surplus achieved in the trade balance the precedent year

Real GDP Growth with Sectoral Contributions



Sources: National authorities and IMF staff calculations and projections.

Official Exchange Rate



Sources: National authorities and IMF staff calculations.

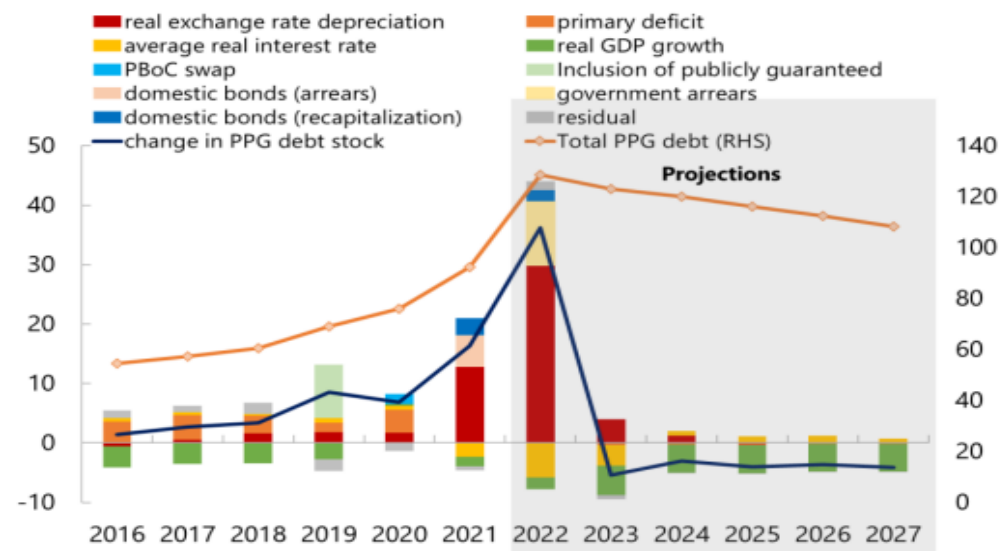


EXAMPLE - LIC DSF – LAO PDR

Recent Debt Dynamics

- Public debt ratio increased 36p.p. to 129% of GDP in 2022, mainly explained by the exchange rate depreciation, contributing 30 p.p.
- Domestic arrears to private contractors account for around 11 percentage points of GDP
- External debt repayment was deferred the past three years: accumulating arrears with China for US\$ 1,280 during this period

Text Figure 3. PPG Debt Changes And Contributions
(In percent of GDP)



Sources: National authorities; and IMF staff calculations and projections.



EXAMPLE - LIC DSF – LAO PDR

Public Debt Composition

- China is by far the largest creditor of Lao, representing 36.9% of Total PPG Debt and 42.9% of Total External PPG Debt in 2021.
- Multilateral (ADB and IDA) account for 12.6% of external debt.

Text Table 3. Stock of Public Debt as of end-2021
(in percent of total external PPG and domestic debt)

At end-2021	as percent of total PPG debt	as percent of total external PPG debt	as percent of GDP	in mln USD
Total PPG debt	100.0%	-	92.36%	14,950.8
External debt	86.1%	100.0%	79.5%	12,869.9
ADB and IDA	10.9%	12.6%	10.02%	1,622.8
Other Multilateral	1.2%	1.3%	1.07%	172.7
China	36.9%	42.9%	34.07%	5,515.6
Other Bilateral	10.3%	12.0%	9.54%	1,544.6
Commercial Banks	6.4%	7.5%	5.96%	964.1
External Bonds	6.8%	7.9%	6.32%	1,023.1
Publicly Guaranteed	13.6%	15.8%	12.52%	2,027.1
Domestic debt	13.9%	-	12.85%	2,080.8

Sources: Authority data and IMF staff calculations

Note: \$300 million from the PBoP swap and \$130 million of deferred interest payment in 2021 is included in China, in addition to the authority numbers.

Gross Financing Needs (GFN) Composition

- Gross Financing Needs associated to payments to China represent around 7.9% of GDP in 2023 and 48% of total GFN's.

Decomposition of GFNs in 2023

	mln in Kip	mln in USD	percent of GDP
GFNs in 2023	42,733,278.8	2,295.1	16.3%
Primary deficit	-838,129.1	-45.0	-0.3%
Debt service for domestic existing debt	6,332,375.8	340.1	2.4%
Debt service for domestic new debt	2,717,302.0	145.9	1.0%
Debt service for external existing debt	34,185,509.2	1,836.1	13.0%
of which: ADB	1,222,412.4	65.7	0.5%
WB	807,256.0	43.4	0.3%
Other multilateral	294,998.3	15.8	0.1%
China (including PBoC swap)	20,642,494.0	1,108.7	7.9%
Principal	11,310,760.4	607.5	4.3%
Interest (excluding swap interest)	3,466,736.2	186.2	1.3%
Swap interest	279,285.6	15.0	0.1%
PBoC swap repayment	5,585,711.8	300.0	2.1%
Other bilateral	2,552,613.2	137.1	1.0%
Bonds/Commercial bank	8,665,735.3	465.4	3.3%
Debt service for external new debt	336,221.0	18.1	0.1%

Sources: Country authorities; and staff estimates and projections.



EXAMPLE - LIC DSF – LAO PDR

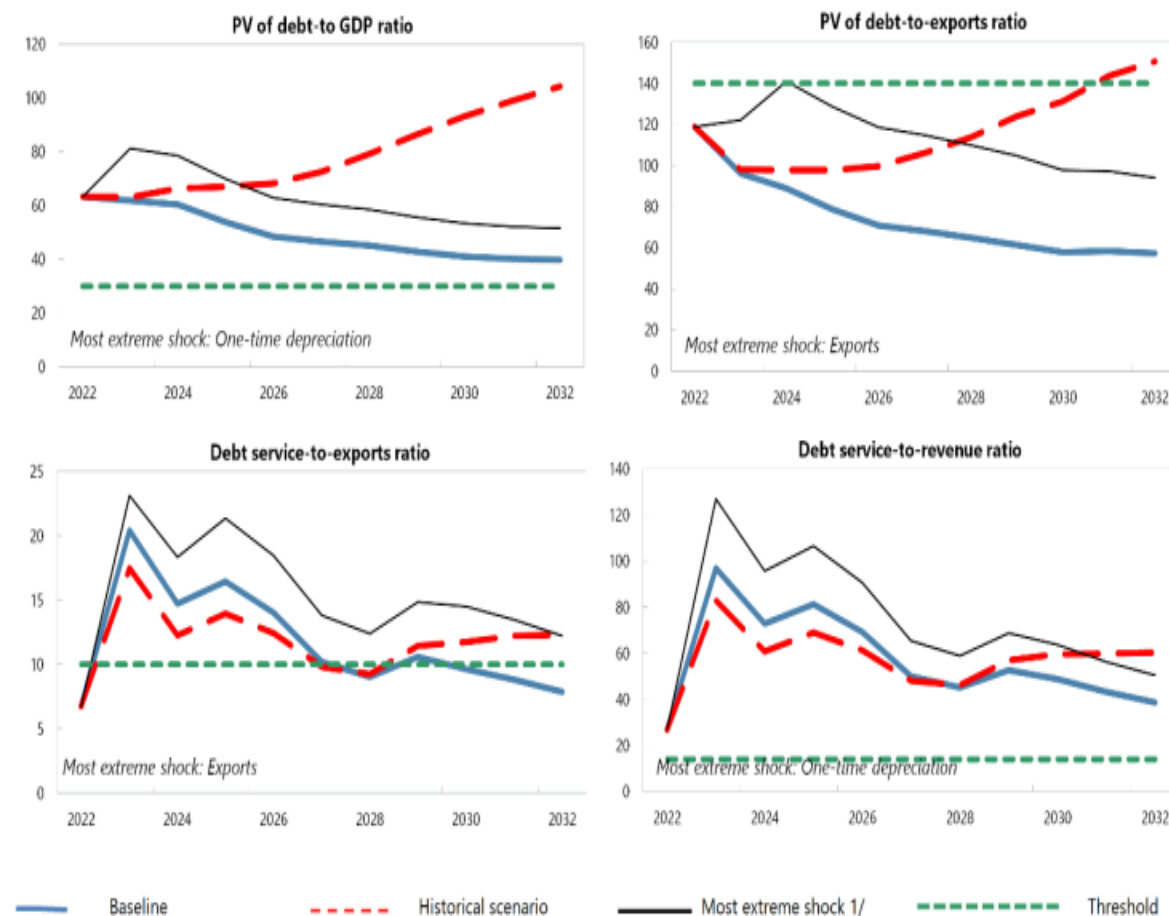
Baseline scenario

- Regarding solvency, the PV of external debt-to-GDP ratio is expected to breach the threshold throughout the whole projection horizon. The PV of external debt-to-exports ratio is expected not to breach the threshold in the baseline.
- Regarding liquidity, debt service-to-exports ratio is expected to breach the threshold. Meanwhile, the debt service-to-revenue ratio is expected to breach the threshold throughout the entire projected period.

Stress tests

- In the most extreme shock (exports) for the PV of debt-to-exports and the debt service-to-exports breach the threshold.
- The most extreme shock for the PV of debt-to-GDP ratio and debt service-to-revenue ratio is the currency depreciation. For both indicators the thresholds are breached during the entire projection horizon.

Figure 1. Indicators Of Public And Publicly Guaranteed External Debt Under Alternative Scenarios, 2022–2032





EXAMPLE - LIC DSF – LAO PDR

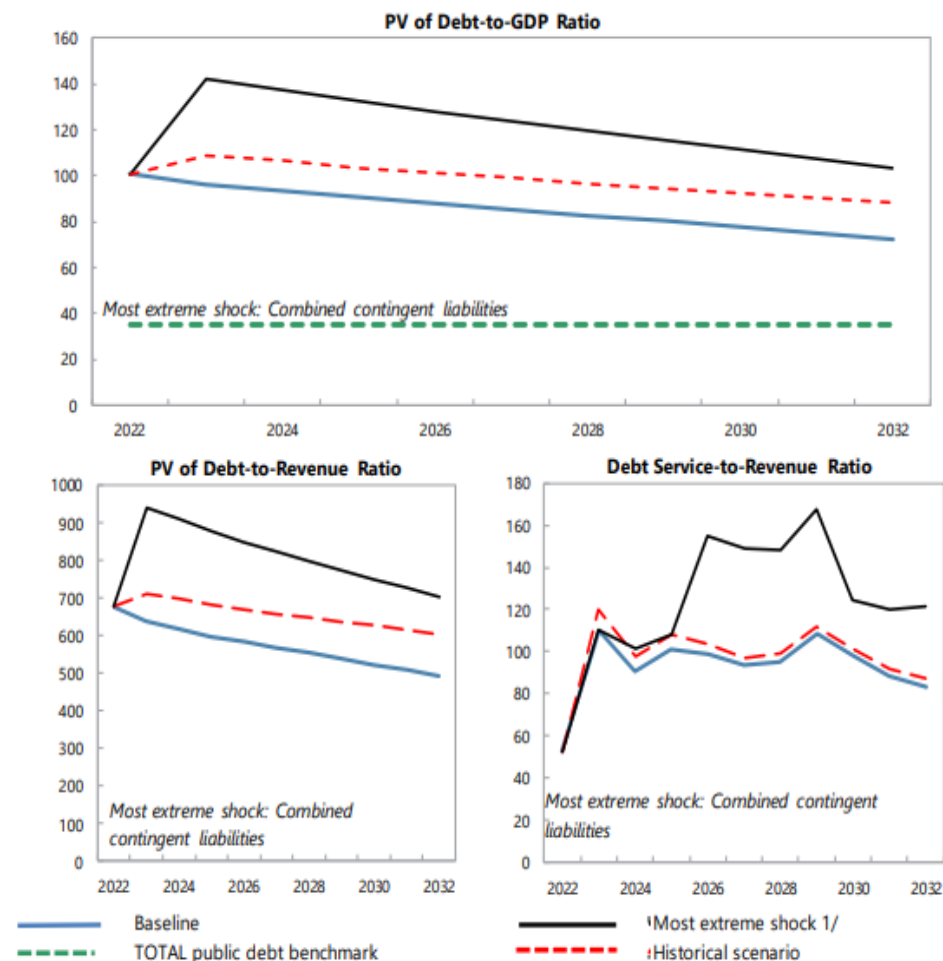


Risk assessment:

- Due to the on-going negotiations about debt service deferral and sustained breaches of indicative debt thresholds, Lao's debt is rated as **in debt distress** and **unsustainable**.

Risk of external debt distress	In debt distress
Overall risk of debt distress	In debt distress
Granularity in the risk rating	Unsustainable
Application of judgement	Yes. Given on-going negotiations about debt service deferral and significant and sustained breaches of debt thresholds

Figure 2. Indicators Of Public Debt Under Alternative Scenarios, 2022–2032





EXAMPLE - LIC DSF – LAO PDR



Macroeconomic Framework underpinning the DSA

- GDP growth is envisaged to slow down to around 2% in the ST and increase gradually to 4% in the MT, representing a reduction of more than 2% from the previous DSA
- Primary balance is assumed to be slightly positive in the medium-term (on average: 0.2% of GDP)
- Primary expenditure is projected constant at 15% of GDP over the entire horizon and interest payments increase significantly in the next few years

Text Table 4. Key Macroeconomic Assumptions

	2021	2022	2023	2024	2025	2026	2027	Long-term 1/
Real GDP (y/y growth)								
Current DSA	2.1	2.3	4.0	4.0	4.1	4.2	4.3	4.7
Previous DSA (2019 AVI)	6.7	6.8	6.8	6.8	6.7	6.5	6.6	5.9
GDP deflator (y/y growth)								
Current DSA	5.6	17.6	16.1	3.5	3.0	3.0	3.0	3.0
Previous DSA (2019 AVI)	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Primary fiscal balance (percent of GDP)								
Current DSA	-0.1	0.1	0.3	0.3	0.2	0.2	0.1	-0.3
Previous DSA (2019 AVI)	-2.4	-2.3	-2.2	-2.2	-2.2	-1.9	-1.8	-1.5
Revenue and grants (percent of GDP)								
Current DSA	15.0	14.9	15.1	15.1	15.1	15.1	15.0	14.7
Previous DSA (2019 AVI)	16.0	16.1	16.3	16.3	16.4	16.5	16.6	17.2
Primary expenditure (percent of GDP)								
Current DSA	15.1	14.8	14.8	14.8	14.9	14.9	14.9	15.0
Previous DSA (2019 AVI)	18.4	18.4	18.5	18.6	18.6	18.4	18.4	18.7
Fiscal balance (percent of GDP)								
Current DSA	-1.3	-1.6	-3.4	-3.5	-3.4	-3.6	-3.0	-2.6
Previous DSA (2019 AVI)	-3.9	-3.8	-3.7	-3.8	-3.7	-3.4	-3.3	-2.5
Current account balance (percent of GDP)								
Current DSA	-0.6	-6.0	-2.6	-6.2	-7.8	-8.4	-7.6	-6.1
Previous DSA (2019 AVI)	-11.1	-10.8	-10.9	-10.9	-10.8	-10.4	-9.7	-7.4
Exports of goods and services (percent of GDP)								
Current DSA	42.2	53.2	64.4	68.0	68.4	68.4	68.4	70.0
Previous DSA (2019 AVI)	36.5	37.0	37.1	35.8	35.3	34.8	34.4	31.9
Imports of goods and services (percent of GDP)								
Current DSA	38.2	52.8	60.0	66.1	69.0	70.3	70.9	75.2
Previous DSA (2019 AVI)	45.7	45.6	45.0	44.2	43.5	42.8	42.1	38.3

Sources: FSM authorities and IMF staff estimates and calculations.

1/ Average 2028-2042 for current DSA and 2028-2038 for previous one.

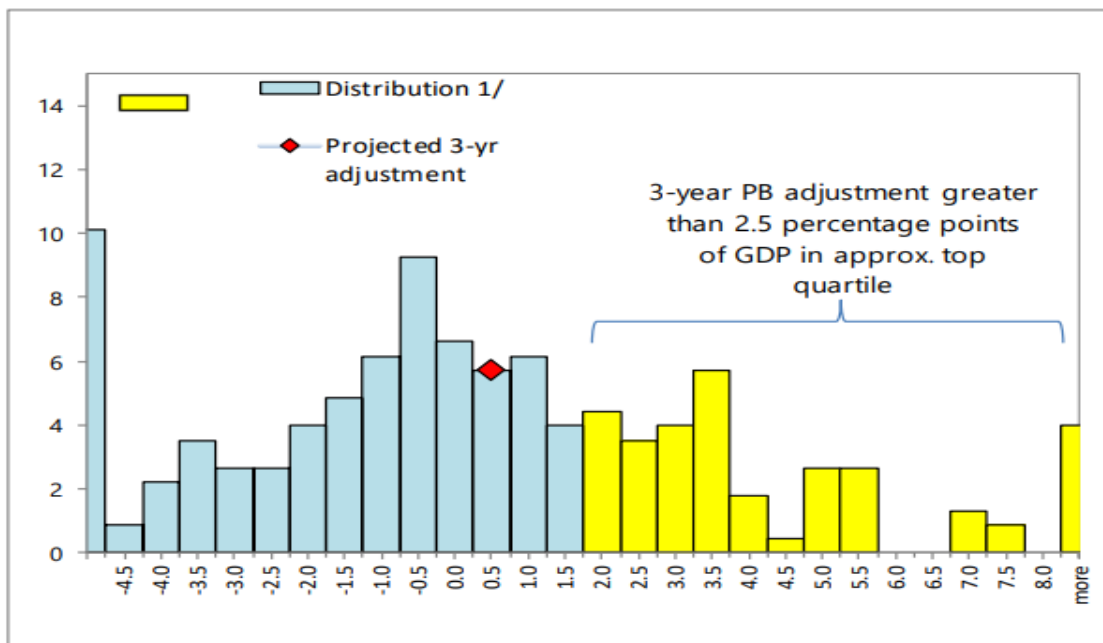


EXAMPLE - LIC DSF – LAO PDR

Realism tool: is the fiscal adjustment too optimistic?

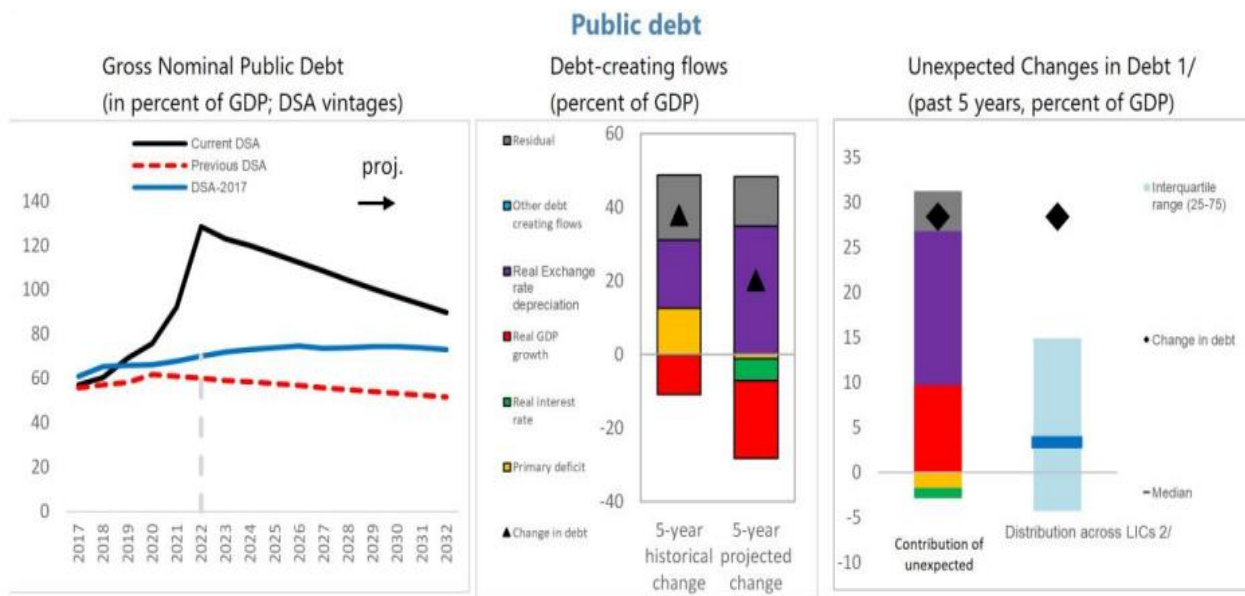
- The 3-year fiscal adjustment lies below the upper quartile of the distribution, showing credibility on the baseline fiscal assumption

3-Year Adjustment in Primary Balance
(Percentage points of GDP)



Realism tool: drivers of debt dynamics

- Main contributors of unexpected changes in public debt in the past were the real exchange rate depreciation (violet) and the real GDP growth (red), indicating both variables were underestimated in previous assessments



1/ Difference between anticipated and actual contributions on debt ratios.

2/ Distribution across LICs for which LIC DSAs were produced.

3/ Given the relatively low private external debt for average low-income countries, a ppt change in PPG external debt should be largely explained by the drivers of the external debt dynamics equation.

Market-Access Country Sovereign Risk and Debt Sustainability Framework (MAC SR DSF)

MAC SR DSF: COUNTRIES AND ASSESSMENTS

- Introduced in 2021 by the IMF to succeed the MAC DSA, developed in 2002.
- **A sophisticated framework** to assess debt sustainability and evaluate the risk of sovereign debt-related stress.
- Built on concepts and procedures from **the three approaches** (accounting, analytical and empirical), **focusing on solvency- and liquidity-related indicators**.
- Suitable for **advanced economies and emerging markets** whose sovereigns have regular access to domestic and international capital markets.
- It has been utilized in a few countries thus far.

MAC SR DSF: STRENGTHS AND DRAWBACKS



SRDSF's main **strengths** are:

- availability of **projections for several debt indicators** in various scenarios;
- a **detailed analysis** of debt-service obligations, gross financing needs, gross borrowing requirements and borrowing options with assumed financing terms;
- elaboration of a **risk rating** to assess sovereign debt-related stress;
- **simplicity of stochastic simulations** and fan charts; and
- **rigor and high quality** of calculations and visualizations.



Its main drawback:

- SRDSF is **technically complex** and not straightforward to apply;
- **significant amounts of historical data** and forecasts required as inputs;
- It **does not systematically analyze debt targets and fiscal-policy adjustment paths**.

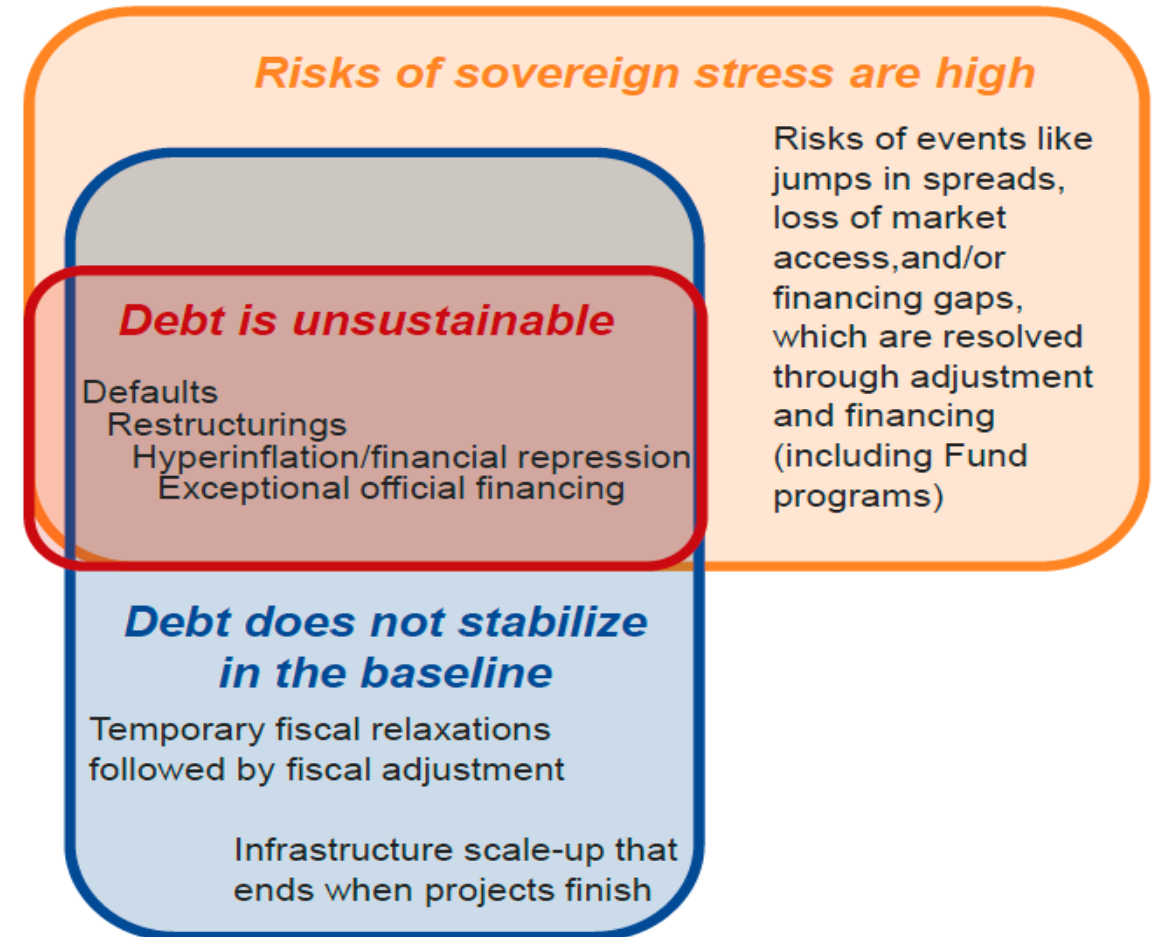
MAC SR DSF: DEBT DYNAMICS, HORIZON, DEBT COVERAGE

- SRDSF adopts the **debt manager's perspective** to project the public debt ratio and other indicators, emphasizing gross and net borrowings required to fund budget imbalances, debt repayments and other net financing needs.
- **Inputs needed** are:
 - Historical annual data and 10-year forecasts for the same variables for the DDT.
 - The debt-service obligations of outstanding financial liabilities and working assumptions for new debt issuances and their financing terms.
- Provides guidance to determine the overall rating of sovereign stress risk, which takes on board the risk ratings corresponding to each of the three horizons, together with the prospects for stabilizing the public debt ratio in the baseline outlook by implementing feasible policies and reforms.

MAC SR DSF: SOVEREIGN RISK AND DEBT SUSTAINABILITY

● SRDSF provides two assessments: sovereign debt-related stress risk and debt sustainability.

- **Sovereign stress** refers to an event where market and/or fiscal pressures related to public debt become acute
- **Unsustainable debt** is the most severe type of stress event. It occurs when there are no politically and economically feasible policies that stabilize debt-to-GDP and deliver acceptable rollover risks without restructuring and/or exceptional bilateral support
- **Debt that does not stabilize in baseline projections** describes a situation where the debt-to-GDP ratio is not expected to stabilize. Sometimes it is an indicator of sovereign stress or unsustainable debt, but not always.



MAC SR DSF: SOVEREIGN RISK AND DEBT SUSTAINABILITY

● SRDSF provides two assessments: sovereign debt-related stress risk and debt sustainability.

Both assessments aim to identify three conditions:

1. Vulnerability to “sovereign stress events”: refers to an event where market and/or fiscal pressures related to public debt become acute.
 - Risk rating to measure such vulnerability: **High**, **Moderate** or **Low** risk of sovereign stress.
 - Three horizons: near term (one to two years ahead), medium term (up to five years ahead) and long term (more than five years ahead).
2. Risk that public debt may become unsustainable: lack of politically and economically feasible policies that can stabilize the debt-to-GDP ratio while reducing the rollover risk.
 - Signal on debt sustainability: **Unsustainable**, **Sustainable but not with high probability**, or **Sustainable with a high probability**.
3. The prospects for stabilizing the public debt ratio in the baseline outlook by implementing politically and economically feasible policies and reforms.

MAC SR DSF: SOVEREIGN RISK AND DEBT SUSTAINABILITY

- SRDSF provides two assessments: sovereign debt-related stress risk and debt sustainability.

Sovereign Risk Assessment

Critical for IMF's **surveillance** function: ("Early Warning System" for alerting sovereigns to the risk of falling into debt-related stress").

Debt Sustainability Assessment

Critical to support IMF **lending** decisions: Underpin the Fund's judgments on whether debt is sustainable (or sustainable with high probability, in exceptional access cases).

The IMF uses this definition for debt sustainability:

In general terms, public debt can be regarded as sustainable when the **primary balance** needed to **at least stabilize debt** under both the **baseline and realistic shock scenarios** is **economically and politically feasible**, such that the **level of debt** is consistent with an **acceptably low rollover risk** and with preserving **potential growth at a satisfactory level**.

Stock and flow concepts

Covers both solvency and liquidity concepts. In practice it is often difficult to disentangle these two risks

Academic literature often focuses on stabilization instead of rollover risk

Feasibility of options

If there are feasible options to avoid explosive debt and unmanageable rollovers, then debt is sustainable

Debt is unsustainable when there are no options except default/restructuring

Accounting for Uncertainty

It is important to consider alternative scenarios when assessing debt sustainability

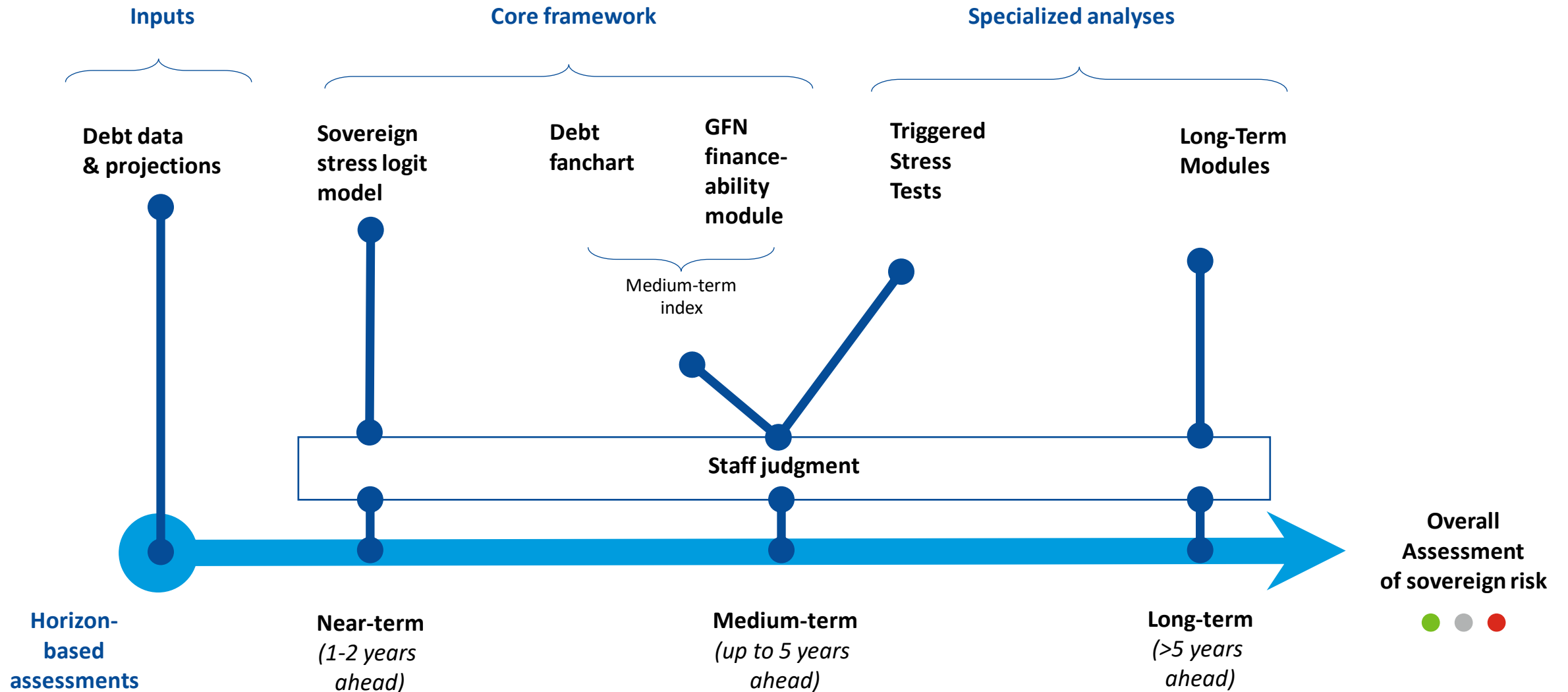
It is aligned with modern methodologies for debt sustainability, which often focus on probabilistic techniques

Balance other macro outcomes

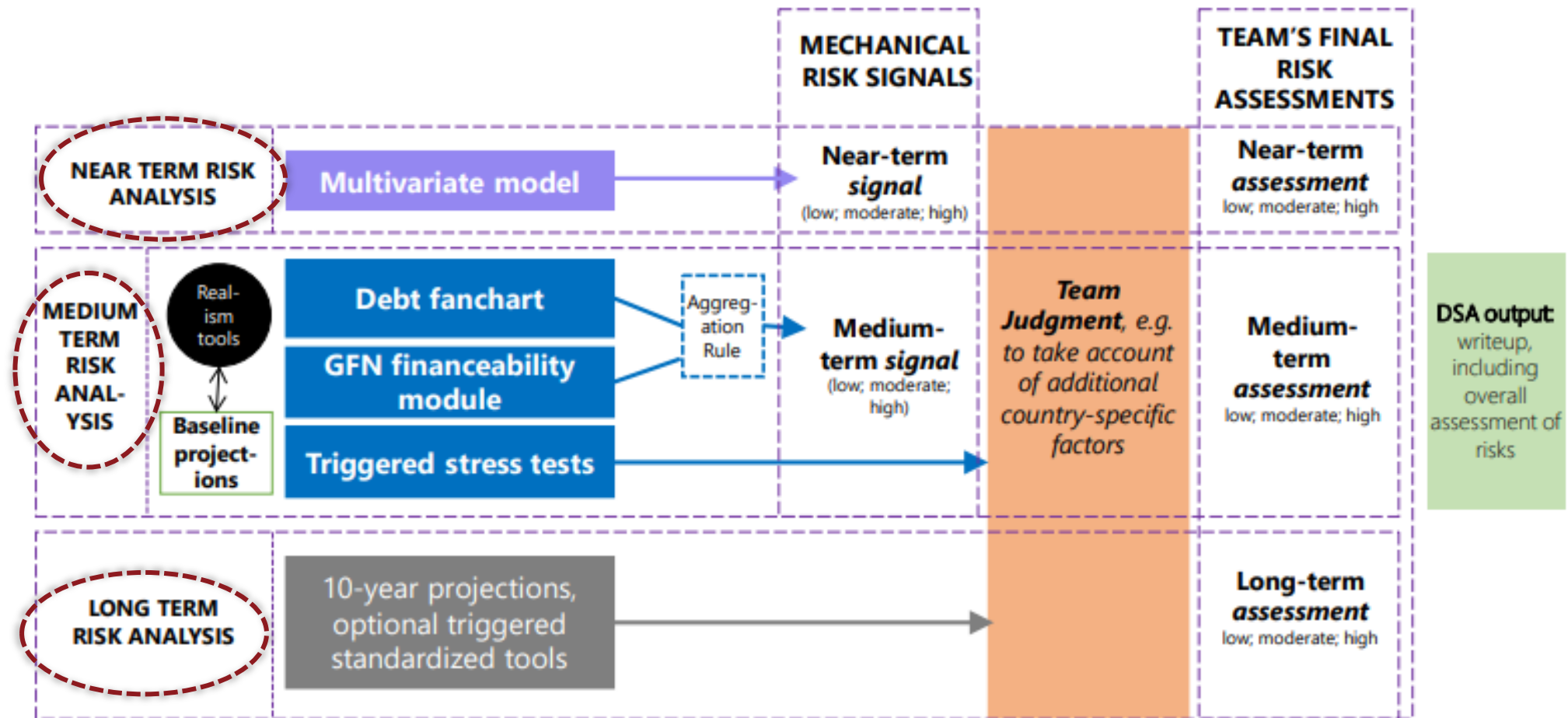
This criterion aims to avoid potential destructive policies to service debt

It is also related to feasibility as it is often difficult to implement such policies over a sustained period of time

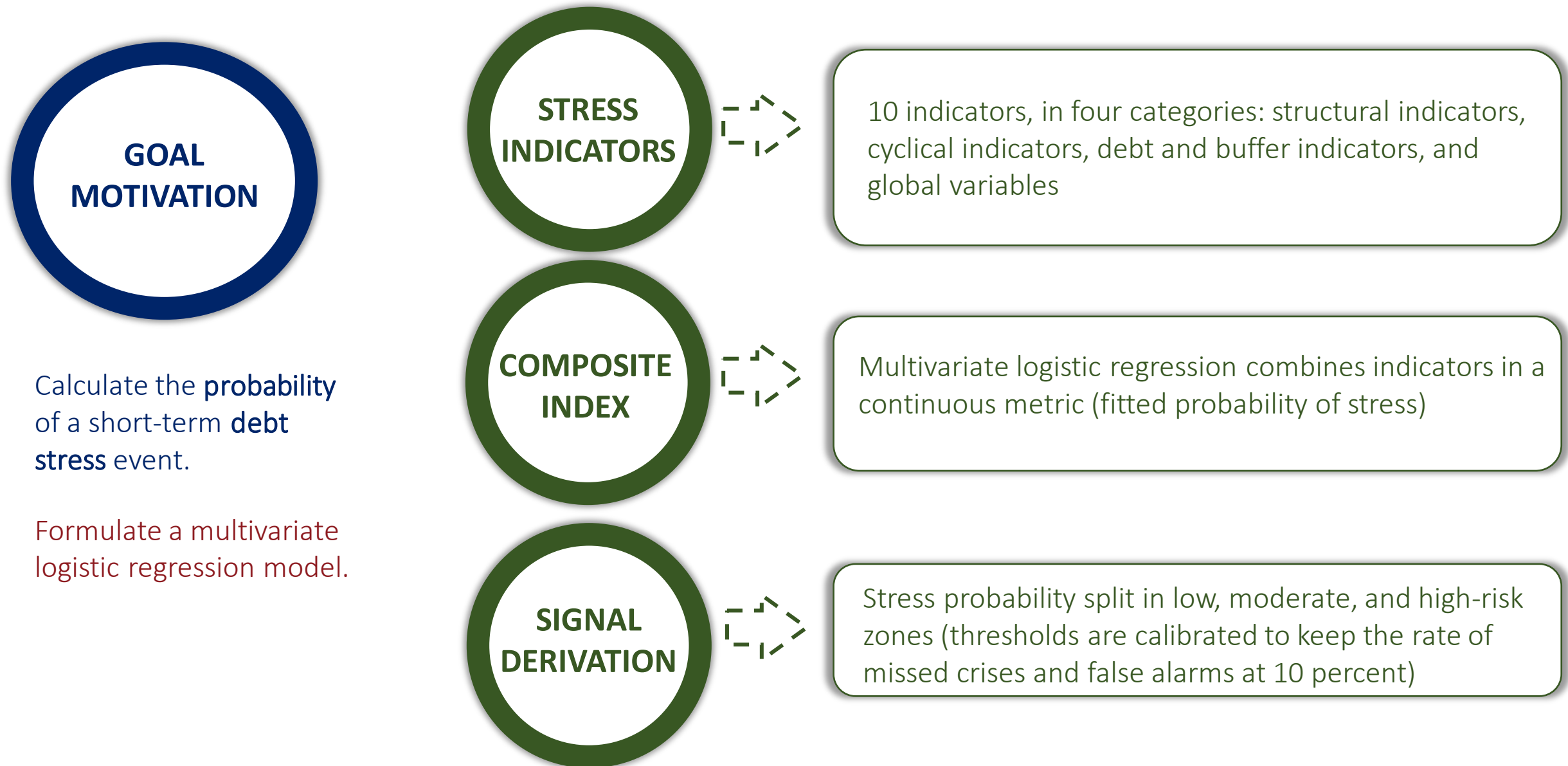
MAC SR DSF: ANALYTICAL FRAMEWORK



MAC SR DSF: ANALYTICAL FRAMEWORK FOR SOVEREIGN RISK



MAC SR DSF: ANALYTICAL FRAMEWORK FOR SOVEREIGN RISK NEAR TERM ASSESSMENT



MAC SR DSF: ANALYTICAL FRAMEWORK FOR SOVEREIGN RISK NEAR TERM ASSESSMENT

Local Variables

Structural Indicators

Institutional Quality
Stress History

Cyclical Indicators

Current account
balance/GDP
3-year real effective
exchange rate
appreciation
Lagged credit/GDP
gap

Debt and Buffer Indicators

Change in public
debt/GDP
Public debt/revenue
FX public debt/GDP
International
reserves/GDP

Global Variables

Change in VIX

MAC SR DSF: ANALYTICAL FRAMEWORK FOR SOVEREIGN RISK NEAR TERM ASSESSMENT

Logit Model: Explanatory Variables

Category	Explanatory Variable	Intuition	Calculation	Source
Structural factors	Institutional quality	A proxy for debt carrying capacity where stronger institutions point to lower probability of stress	Average of government effectiveness and regulatory quality components of the World Governance Indicators	Fund staff calculation on World Governance Indicators (Kaufmann and Kraay)
	Stress history	Summarizes the track record of stress episodes, with recent events indicating higher probability of renewed stress	If a country is in stress, previous observation + 1. If a country is not in stress, 0.9 x previous year's observation.	Fund staff calculation
Cyclical position	Current account/GDP	Weaker current accounts may signal overheating that is subject to reversal	Current account/GDP x 100, with appropriate currency conversion to GDP	Country authorities or WEO
	Three-year change in REER	Strong appreciation can raise risks of abrupt exchange rate depreciations that can cause FX debt to spike	$[REER(t)/REER(t-3)-1] \times 100$	IMF, Information Notice System (INS) University of Bruegel when INS unavailable
	Credit-to-GDP gap, lagged (if positive)	Positive gaps suggest potential excess in the financial system that could result in contingent liabilities for the government if financial sector instability emerges	Cyclical component from a one-sided HP filter run on credit-to-GDP ratios with smoothing parameter of 400,000 if positive (zero otherwise). Credit-to-GDP calculated as private credit/GDP x 100.	Bank for International Settlements or Fund staff calculation on IFS data when BIS unavailable
Debt burden and buffers	Change in debt-to-GDP ratio	Sudden spikes in debt tend to be difficult to manage and result in stress	$[Total\ Public\ Debt(t)/GDP(t) - Total\ Public\ Debt(t-1)/GDP(t-1)] \times 100$	Latest WEO or SRDSF user (when updated data available)
	Public debt/revenues	More readily available resources to service debt make stress less likely	$[Total\ Public\ Debt(t)/Total\ Revenues(t)] \times 100$	Latest WEO or SRDSF user (when updated data available)
	FX public debt/GDP	Higher FX debt increases vulnerability	$[Forex\ Debt(t)/GDP(t)] \times 100$	Latest WEO or SRDSF user (when updated data available)
	International reserves/GDP	Higher buffers to service foreign currency debt reduce stress risks	$[Gross\ International\ Reserves(t)/GDP(t)] \times 100$	Latest WEO or SRDSF user (when updated data available)
Global conditions	Change in VIX	Weaker global market sentiment can raise probability of stress	Year-to-year level change in VIX, with VIX indexed to 2010 = 100.	Fund staff calc., Chicago Board of Trade via Haver Analytics
	Currency union members in stress (alternate specification)	When stress is spreading around the currency union members, vulnerability to contagion is higher	Number of countries in stress (e.g. where stress history defined above = 1) divided by number of countries in currency union	Fund staff calculation

MAC SR DSF: ANALYTICAL FRAMEWORK FOR SOVEREIGN RISK NEAR TERM ASSESSMENT

Sheet
LOGIT

Near-term risk assessment calculation								
			2018	2019	2020	2021	2022	
Logit stress probability calculation								
Group	Regressor	Coefficient		Data				
		Estimate	Sig.					
Constant	Ones	-2.957	***	1.00	1.00	1.00	1.00	1.00
Institutions	Institutional quality index	-0.972	***	0.31	0.30	0.34	0.14	0.14
History	Stress history index	0.521	***	0.05	0.05	N.A.	N.A.	N.A.
Cyclical position	Current account balance-to-GDP	-0.029	**	6.83	4.27	-6.34	10.45	14.34
	3-year pct. change in REER	0.008		-4.87	-2.00	1.14	-0.60	N.A.
	Credit-to-GDP gap, if positive (t-1)	0.079	***	6.06	5.19	5.51	8.18	#N/A
Debt burden & buffers	Change in public debt-to-GDP	0.053	***	0.87	4.58	15.14	0.70	-6.28
	Public debt-to-revenue	0.002	**	200.76	197.58	299.66	301.34	211.07
	FX public debt-to-GDP	0.024	***	14.62	15.72	20.78	19.15	17.30
	International reserves-to-GDP	-0.036	***	31.82	28.75	28.15	24.19	20.31
Global condition	Change in VIX (2010=100)	0.011	***	24.61	-5.55	61.48	-42.56	-22.03
	Share of currency union MACs in stress	0.000		0.00	0.00	0.00	0.00	0.00
	Check: All variables entered			TRUE	TRUE	FALSE	FALSE	FALSE
	Logit stress probability			0.04	0.05	n.a.	#N/A	#N/A
	Signal							#N/A
	Change in logit stress probability			n.a.	0.00	#N/A	#N/A	#N/A
Contribution to change in logit stress probability								
Part 1. Averages								
Constant	Ones				-2.96	-2.96	-2.96	-2.96
Institutions	Institutional quality index				-0.30	-0.31	-0.24	-0.14
History	Stress history index				0.03	#VALUE!	#VALUE!	#VALUE!
Cyclical position	Current account balance-to-GDP				-0.16	0.03	-0.06	-0.36
	3-year pct. change in REER				-0.03	0.00	0.00	#VALUE!
	Credit-to-GDP gap, if positive (t-1)				0.44	0.42	0.54	#N/A
Debt burden & buffers	Change in public debt-to-GDP				0.14	0.52	0.42	-0.15
	Public debt-to-revenue				0.40	0.50	0.60	0.51
	FX public debt-to-GDP				0.36	0.44	0.48	0.44
	International reserves-to-GDP				-1.09	-1.02	-0.94	-0.80
Global condition	Change in VIX (2010=100)				0.10	0.31	0.10	-0.36
	Share of currency union MACs in stress				0.00	0.00	0.00	0.00

MAC SR DSF: ANALYTICAL FRAMEWORK FOR SOVEREIGN RISK MEDIUM TERM ASSESSMENT

GOAL MOTIVATION

Assess the prospects for medium-term debt stabilization and the volume of GFN to be met (including rollover risk that may cause a **debt stress** event).

Formulate projections of public debt and GFN, and produce stochastic simulations and fan charts.

Debt Fanchart Index



1. Degree of uncertainty surrounding the medium-term dynamics of the public debt, measured by the dispersion of the fan chart.
2. Probability of the public debt ratio not being stabilized over the medium-term, derived from the shock-driven realizations of the debt-stabilizing primary balance.
3. Interaction between the medium-term median value of the public debt ratio and a proxy indicator for the country's capacity to manage government debt.

GFN Financeability Index



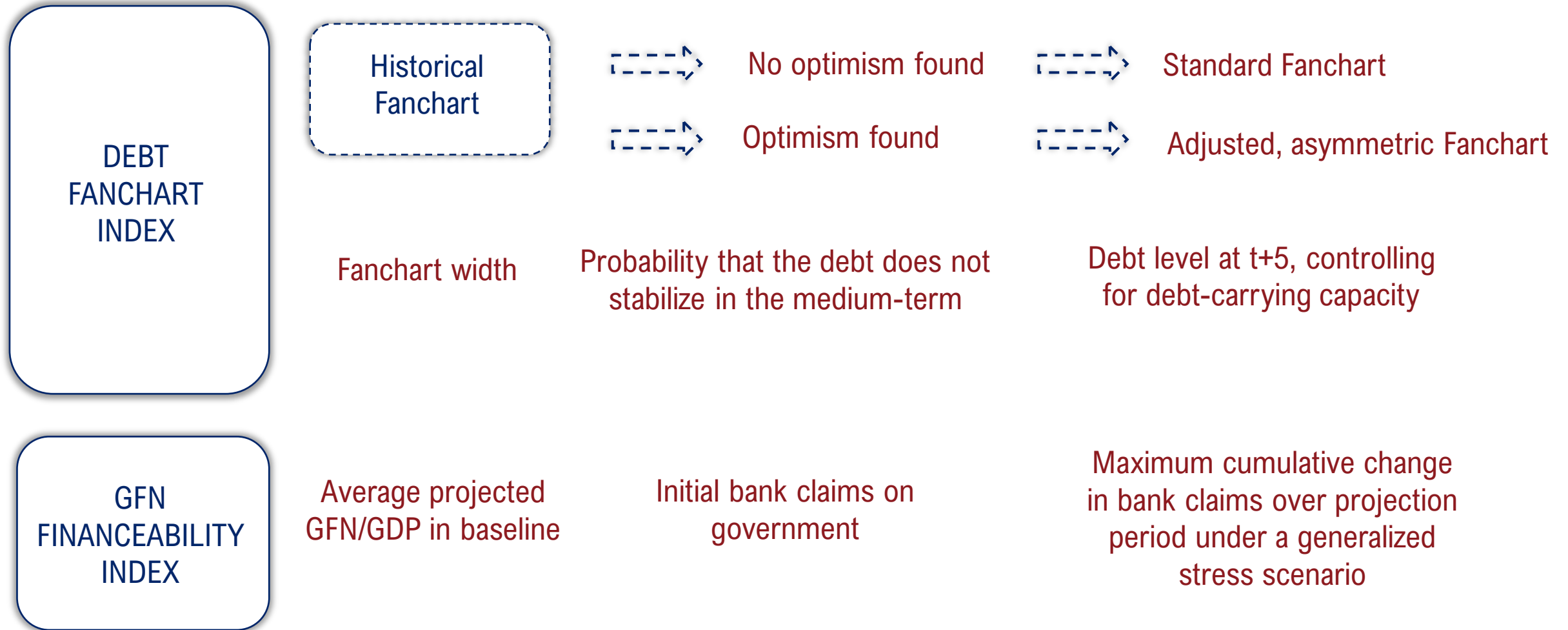
1. Volume of GFN to be covered in the baseline scenario, measured by the projected GFN-to-GDP ratio.
2. Variation in bank holdings of government debt in baseline case.
3. Variation in bank holdings of government debt induced by shocks in stress-tests scenarios

SIGNAL DERIVATION



Values of both indices are confronted against thresholds. A medium term index is calculated and split into low, moderate, and high-risk zones (thresholds are calibrated for acceptable risk).

MAC SR DSF: ANALYTICAL FRAMEWORK FOR SOVEREIGN RISK MEDIUM TERM ASSESSMENT



MAC SR DSF: ANALYTICAL FRAMEWORK FOR SOVEREIGN RISK MEDIUM TERM ASSESSMENT

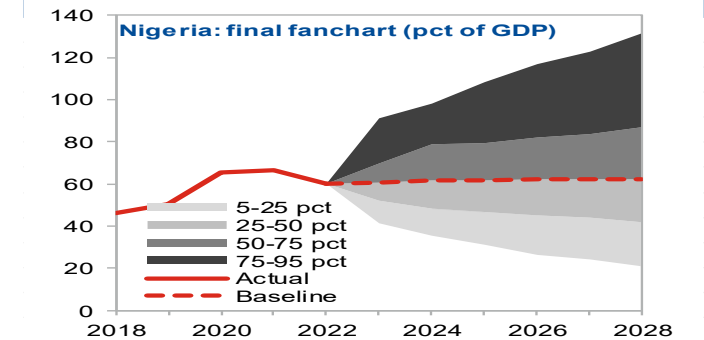
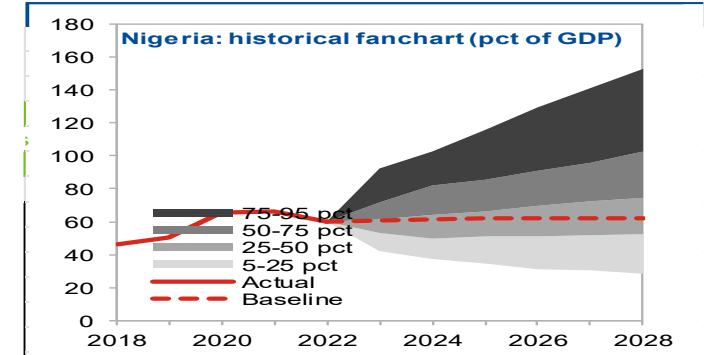
Sheet
FAN

Historical fanchart

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Actual	45.9	50.5	65.7	66.4	60.1						
Baseline					60.1	60.4	61.5	61.8	62.1	62.2	62.1
0-5 pct					60.1	42.4	37.1	34.9	31.4	30.4	28.3
5-25 pct					0.0	10.5	12.9	15.9	19.8	21.6	24.1
25-50 pct					0.0	8.5	14.0	15.7	18.3	20.1	22.4
50-75 pct					0.0	10.0	17.9	19.3	21.5	24.0	28.1
75-95 pct					0.0	21.1	20.6	30.2	38.7	45.0	50.0

Final fanchart

	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Actual	45.9	50.5	65.7	66.4	60.1						
Baseline					60.1	60.4	61.5	61.8	62.1	62.2	62.1
0-5 pct					60.1	41.3	35.2	31.2	26.5	24.3	21.0
5-25 pct					0.0	10.6	13.1	15.4	18.6	19.9	21.0
25-50 pct					0.0	8.5	13.1	15.2	17.1	18.0	20.1
50-75 pct					0.0	9.6	17.4	17.8	19.7	21.6	24.5
75-95 pct					0.0	21.4	19.5	28.5	35.2	38.8	44.8



Deriving the debt fanchart index and mechanical signal

Indicator	Raw value	Transform	Final value	AUC	Weight	Index
Fanchart width	110.4%	0.22	4.91	0.71	0.33	1.60
Prob of debt non-stabilization	45.9%	0.38	1.22	0.69	0.32	0.38
Debt(t+5) x institutions	34.6%	0.16	2.10	0.78	0.36	0.75
Debt fanchart index						2.74
Signal						High
Memo:						
Debt(t+5)	62.1%					
Institutional quality index (scaled)	0.56					

Thresholds:	Low-Moderate	Moderate-high
Debt fanchart index	1.13	2.08

MAC SR DSF: ANALYTICAL FRAMEWORK FOR SOVEREIGN RISK MEDIUM TERM ASSESSMENT

Sheet
GFN

Average GFN-to-GDP ratio in the baseline							
Avg		2023	2024	2025	2026	2027	2028
2023-28							
GFN/GDP	6.8%	8.1%	7.1%	6.0%	8.4%	6.7%	4.7%
Initial bank claims on the government in percent of banking system assets							
Bank claims on gen. govt.				Banking system assets			
Pct. of assets		Billion Nigerian		Pct of GDBillion Nigerian Nairas			
2022	20.8%	40		103.8%		192	
Change in bank claims in stress							
Changes relative to year:		2023	2024	2025	2026	2027	2028
	2021	0.0%	1.9%	3.9%	3.8%	3.7%	3.5%
	2022		0.0%	2.0%	1.9%	1.8%	1.5%
	2023			0.0%	-0.1%	-0.2%	-0.5%
	2024				0.0%	-0.1%	-0.4%
	2025					0.0%	-0.2%
	2026						0.0%
Maximum change:							3.9%
Deriving the GFN financeability index and mechanical signal							
Indicator				Weight	Value		
Average GFN-to-GDP ratio in the baseline				0.34	6.8%		
Initial bank claims on the govt (pct of assets)				0.32	20.8%		
Change in bank claims on govt, stress scenario (pct of assets)				0.33	3.9%		
GFN financeability index					10.4		
Signal					Moderate		
Thresholds:							
Moderate-high					17.9		
Low-Moderate					7.6		

MAC SR DSF: ANALYTICAL FRAMEWORK FOR SOVEREIGN RISK LONG TERM ASSESSMENT (optional)

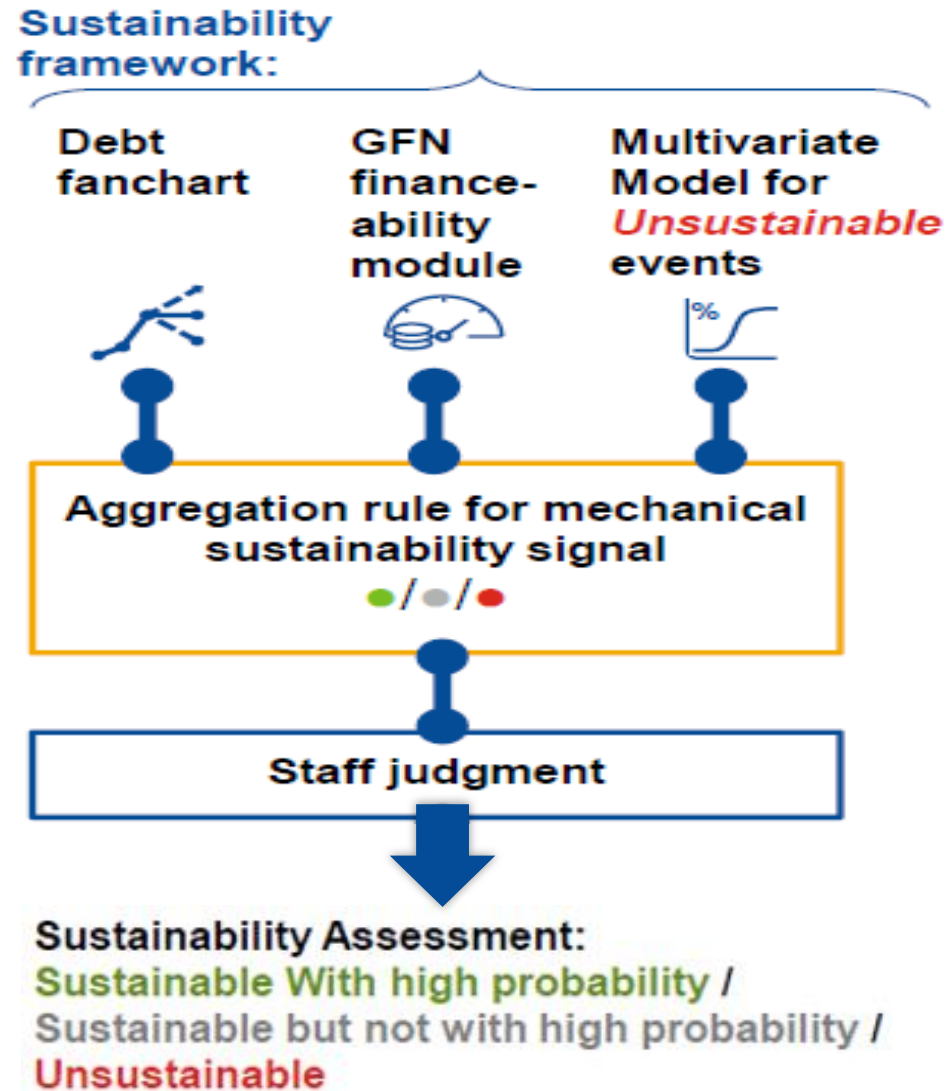
- A rating for sovereign stress risk in the long term is computed using a combination of alternative scenarios with the key economic and policy variables calibrated to represent the phenomena pertinent to the country under analysis.
- No mechanical signals are associated with the long-term tools.
- The modules cover the following risk categories:
 - Population aging:
 - the demographic changes and age-related public expenditures such as pensions and health.
 - Scaling up/down of natural resources:
 - the discoveries or exhaustion of natural resources that would affect government revenues.
 - Large debt amortizations:
 - sizable debt redemptions in the long term that imply significant rollover risks.
 - Climate change:
 - the public investments to build resilience and cope with climate change through adaptation and mitigation

MAC SR DSF: ANALYTICAL FRAMEWORK FOR DEBT SUSTAINABILITY

Debt sustainability assessment consists of a comparison between debt projections under baseline and various scenarios. Depends on both solvency (debt stabilization) and liquidity (rollover risk).

- Determining the economic and political feasibility of delivering a debt-stabilizing primary balance often involves judgment
- Debt sustainability assessments can be further expressed in probabilistic terms
 - The near- and medium-term tools can be used to provide a mechanical assessment of debt sustainability
- Signal is derived as follows:
 - Sustainability logit model.
 - Debt fanchart: The debt fanchart index (DFI) quantifies prospects for medium-term debt stabilization. Its calculation is unchanged from the metric used for sovereign stress analysis.
 - GFN module.
- Signal on debt sustainability: The probability of unsustainable debt, the DFI, and the GFI are combined into a numerical sustainability index, which can be compared against thresholds to derive the mechanical sustainability assessment.

MAC SR DSF: ANALYTICAL FRAMEWORK FOR DEBT SUSTAINABILITY



MAC SR DSF: ANALYTICAL FRAMEWORK

Hypothetical
country: SRDSF
Guidance Note

Ruritania: Summary of the sovereign risk and debt sustainability assessment

Horizon	Mechanical signal	Final assessment	Comments
Overall	...	Moderate	The overall risk of sovereign stress is moderate, reflecting a relatively consistent level of vulnerability across the medium-, and long-term horizons.
Near term ¹	Moderate	Moderate	The near-term risk of sovereign stress is moderate. This reflects a large increase in public debt-to-GDP in the past year, and a low level of international reserves-to-GDP.
Medium term	Low	Moderate	Medium-term risks are assessed as moderate against a mechanical low risk signal due to the potential effects of contingent liabilities from a narrow debt coverage and sub-national governments that are demonstrating symptoms of weak finances.
Fanchart	Low	...	
GFN	Moderate	...	
Stress test	Cont. Liab, Exch. Rate	...	
Long term	...	Moderate	Long-term risks are moderate arising from population aging, the expected need to refinance concessional debt at less favorable terms, and the winding up of oil production. That said, the long time horizon and the authorities plans for corrective reforms should contain risks.
Sustainability assessment ²	Sustainable but not with high probability	Sustainable but not with high probability	With the implementation of the policies in the program, the projected debt path is expected to stabilize and GFNs will remain at manageable levels. There continue to be important risks with respect to market sentiment, and therefore debt is assessed as sustainable but not with high probability.
Debt stabilization in the baseline			Yes

Sri Lanka MAC SR DSF 2023-2024



EXAMPLE – MAC SR DSF - SRI LANKA

Sri Lanka announced in April 2022, external debt service suspension.

Authorities stopped servicing their foreign-law government and government guaranteed debt, except multilateral debt and emergency credit lines received from India in 2022.

Sri Lanka: Decomposition of Public Debt and Debt Service by Creditor, 2023-25 1/

	Debt Stock (end of period, incl. arrears)			Debt Service on end-2022 debt stock (on contractual terms)					
	2022			2023	2024	2025	2023	2024	2025
	(In US\$mn)	(Percent total debt)	(Percent GDP)	(In US\$mn)			(Percent GDP)		
Total public debt	83,595	100.0	128.1	27,727	10,164	9,887	36.8	13.4	12.6
External (foreign law)	41,474	49.6	63.6	7,356	5,190	5,803	9.8	6.8	7.4
Multilateral creditors ²	11,495	13.8	17.6	1,080	1,141	1,152	1.4	1.5	1.5
IMF	1,062	1.3	1.6	212	244	236	0.3	0.3	0.3
World Bank	3,836	4.6	5.9	284	291	307	0.4	0.4	0.4
ADB	5,973	7.1	9.2	521	525	530	0.7	0.7	0.7
Other Multilaterals	624	0.7	1.0	63	81	80	0.1	0.1	0.1
Bilateral Creditors	11,419	13.7	17.5	1,755	1,167	1,377	2.3	1.5	1.8
Paris Club	4,784	5.7	7.3	473	422	392	0.6	0.6	0.5
o/w: Japan	2,828	3.4	4.3	197	188	180	0.3	0.2	0.2
Non-Paris Club	6,635	7.9	10.2	1,282	745	985	1.7	1.0	1.3
o/w: China	4,483	5.4	6.9	596	576	519	0.8	0.8	0.7
India	1,833	2.2	2.8	653	137	438	0.9	0.2	0.6
Bonds	13,364	16.0	20.5	2,010	2,343	2,741	2.7	3.1	3.5
Commercial creditors	3,159	3.8	4.8	479	540	533	0.6	0.7	0.7
o/w: China Development Bank	2,901	3.5	4.4	477	538	532	0.6	0.7	0.7
Central bank bilateral currency swaps	2,036	2.4	3.1	2,033	-	-	2.7	0.0	0.0
Domestic (local law)	42,121	50.4	64.6	20,372	4,973	4,084	27.1	6.5	5.2
T-Bills	11,364	13.6	17.4	10,404	-	-	13.8	0.0	0.0
Bonds	25,124	30.1	38.5	6,106	4,829	3,946	8.1	6.4	5.0
Loans	5,633	6.7	8.6	3,862	144	138	5.1	0.2	0.2



EXAMPLE – MAC SR DSF - SRI LANKA

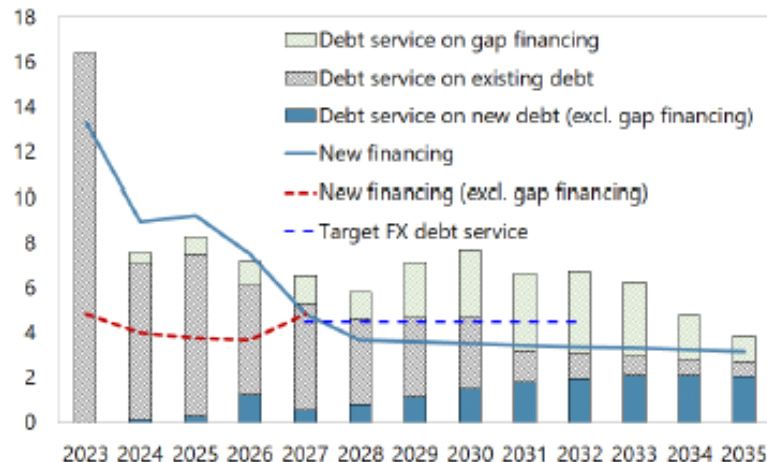
Scenario Without Debt Restructuring

Annex II. Public Debt Sustainability Analysis

8. Under an illustrative “pre-restructuring” scenario, debt would remain unsustainable, despite the large fiscal adjustment. For illustrative purposes, this scenario assumes that the external financing gap in 2022-27 is closed through additional new external financing, which Sri Lanka does not presently have access to.³ The charts below show that, under the baseline macroeconomic assumptions, the debt stock and gross financing needs would remain above the targets of 95 percent of GDP and 13 percent of GDP throughout the projection horizon. If additional downside risks were to materialize, debt would fail to stabilize. FX debt service would spike in the post-program period, exceeding the new financing, which would lead to a rapid decline in reserves.

Pre-Restructuring Scenario: FX Debt Flows

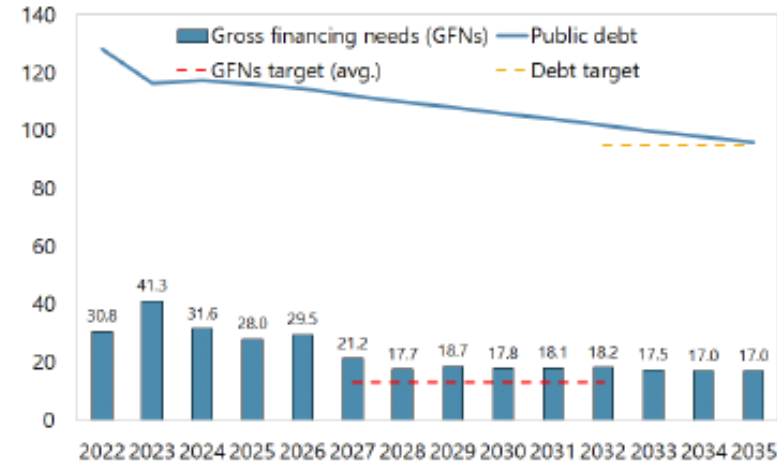
(In percent of GDP)



Sources: Sri Lanka authorities; and IMF staff calculations.

Pre-Restructuring Scenario: Public Debt and GFNs

(In percent of GDP)



Sources: Sri Lanka authorities; and IMF staff calculations.



EXAMPLE – MAC SR DSF - SRI LANKA

Restructuring Scenario

Annex II. Public Debt Sustainability Analysis

9. **Staff's restructuring scenario serves purely illustrative purposes.** There are many alternative ways of restructuring Sri Lanka's debt that would also achieve the debt restructuring targets described above. The authorities have indicated their objective to take each creditor's specific needs into account when designing the restructuring operation, while also stressing the importance of fair burden sharing across creditors. The perimeter of restructuring is based on preliminary considerations shared by the authorities and their financial advisors, taking into account the need to safeguard domestic financial stability. Accordingly, under the staff's illustrative restructuring scenario: T-bills held by the Central Bank are exchanged into longer term debt instruments⁴; a select pool of the remaining domestic debt is assumed to be reprofiled to reduce gross financing need, while limiting the impact on the financial sector. For external private debt, a principal reduction is assumed, with amortization beyond the program period, implying a large NPV reduction. For official bilateral debt, similar debt relief in NPV terms is assumed, implemented through a long maturity extension – with amortization payments starting in 2033.



EXAMPLE – MAC SR DSF - SRI LANKA

Table 1. Sri Lanka **Risk of Sovereign Stress (Restructuring Scenario)**

Horizon	Mechanical signal	Final assessment	Comments
Overall	...	High	Sri Lanka is in debt distress. The fiscal adjustment, combined with debt restructuring will eventually restore debt sustainability. However, downside risks remain high under a restructuring scenario.
Near term 1/	n.a.	n.a.	Not applicable
Medium term	High	High	Risks remain high under a restructuring scenario due to relatively high levels of debt and GFNs, a strong sovereign-bank nexus, and the economy's vulnerability to large shocks.
Fanchart	High	...	
GFN	High	...	
Stress test	
Long term	...	High	Long-term risks include slowing growth due to a declining labor force and climate vulnerabilities.
Sustainability assessment 2/	...	Sustainable	The debt operation will put Sri Lanka on a firm downward path. But the reduction of debt vulnerabilities to safe levels will take time. Meanwhile, external shocks or domestic policy reversals could lead to renewed debt increase.
Debt stabilization in the baseline	Yes		

DSA summary assessment

Sri Lanka is in a deep crisis, as debt is unsustainable. Deep fiscal reforms are necessary but not sufficient to address the situation in a durable manner. Contributions from creditors are therefore needed, along with new concessional financing, to restore debt sustainability. Even after a successful program and debt restructuring, debt risks will remain high for many years.

Argentina MAC SR DSF 2023-2024



EXAMPLE – MAC SR DSF - ARGENTINA

- Under an IMF Extended Fund Facility program.
- Considerable fiscal imbalances.
- Inflation and FX market pressures.
- Trade balance has deteriorated on account of sharply weaker export performance.
- Argentina's capacity to repay debt obligations hinge on strong policy implementation to improve reserve coverage and an eventual resumption of market access.
- Under the current baseline and policy framework, Argentina's public debt is sustainable but not with high probability.



EXAMPLE – MAC SR DSF - ARGENTINA

Annex II. Application of the Sovereign Risk and Debt Sustainability Framework

Debt Stock (end of period)			
	31-Dec-22		
	(In US\$ bn)	(Percent total debt)	(Percent GDP)
Total	394.10	100.00	83.23
External	144.44	36.65	30.50
Multilateral creditors^{2,3}	75.44	19.14	15.93
IMF	45.71	11.60	9.65
World Bank	9.20	2.33	1.94
CAF	3.93	1.00	0.83
ADB/AfDB/IADB	20.35	5.16	4.30
FONPLATA	0.48	0.12	0.10
BEI	0.21	0.05	0.04
BCIE	0.09	0.02	0.02
Other Multilaterals	0.18	0.05	0.04
OFID	0.14	0.04	0.03
FIDA	0.04	0.01	0.01
o/w: list largest two creditors			
list of additional large creditors			
Bilateral Creditors²	5.09	1.29	1.07
Paris Club	1.97	0.50	0.42
list of additional large creditors			
Non-Paris Club	3.11	0.79	0.66
o/w: China	2.54	0.65	0.54
T-Bills	0.78	0.20	0.16
Bonds	63.00	15.99	13.30
Commercial creditors	0.08	0.02	0.02
o/w: list largest two creditors			
list of additional large creditors			
Other international creditors			
o/w: list largest two creditors			
list of additional large creditors			
Domestic	249.66	63.35	52.72
T-Bills	98.40	24.97	20.78
Held by: central bank			
local banks			
local non-banks			
Bonds	129.11	32.76	27.27
Held by: central bank			
local banks			
local non-banks			
Loans	19.86	5.04	4.19
Held by: central bank			
local banks			
local non-banks			

Source: [Argentina: Fourth Review Under the Extended Arrangement Under the Extended Fund Facility, Requests for Modification of Performance Criteria, Waiver for Nonobservance of Performance Criteria, and Financing Assurances Review-Press Release; Staff Report; and Statement by the Executive Director for Argentina \(imf.org\)](#)



EXAMPLE – MAC SR DSF - ARGENTINA

Annex II. Application of the Sovereign Risk and Debt Sustainability Framework

Table 1. Argentina: Risk of Sovereign Stress

Horizon	Mechanical signal	Final assessment	Comments
Overall	...	High	Despite moderate risk signal at the medium-term horizon, the exceptional level of current uncertainty and risks around the necessary eventual re-entry to international markets indicate that overall risks of sovereign stress continue to be high.
Near term 1/	n.a	n.a	Not applicable.
Medium term	Moderate	Moderate	Staff concurs with the mechanical signal. While there is substantial uncertainty around the baseline debt trajectory, the 2020 restructuring and implementation of the program should help contain financing risks.
Fanchart	Moderate	...	
GFN	Moderate	...	
Stress test	Cont. Liab.	...	
Long term	...	High	Given Argentina's susceptibility to adverse shocks, need to maintain tight fiscal policy, and re-enter international debt markets after the program, there are relevant risks of a renewed episode of sovereign stress over the longer term. Full implementation of the program will help contain these risks.
Sustainability assessment 2/	...	Sustainable but not with high probability	There are good prospects for debt stabilization and acceptable rollover risks, consistent with debt sustainability. However, substantial uncertainty around the baseline indicates high risks to this assessment.
Debt stabilization in the baseline			Yes

Source: [Argentina: Fourth Review Under the Extended Arrangement Under the Extended Fund Facility, Requests for Modification of Performance Criteria, Waiver for Nonobservance of Performance Criteria, and Financing Assurances Review-Press Release; Staff Report; and Statement by the Executive Director for Argentina \(imf.org\)](#)



EXAMPLE – MAC SR DSF - ARGENTINA

DSA Summary Assessment

The Sovereign Risk and Debt Sustainability Framework (SRDSF) tools indicate that debt is sustainable but not with high probability, although overall risks of sovereign stress are high.

At a medium-term horizon, staff assesses risks to be moderate, unchanged from the third review. The GFN module continues to show moderate risk, including because vulnerabilities are contained somewhat by the 2020 restructuring and expectations of financing from less risky creditors. Notably, the updated baseline incorporates significantly lower gross financing needs over the forecast period, reflecting the impact of the authorities' new financing strategy, including the recent bond exchange and the planned long-term extension of public sector peso debt maturities. The debt fanchart signal also indicates moderate risk, as at the third review. Importantly, the continued high/moderate borderline result is largely due to the very wide fan chart, reflecting Argentina's history of high volatility.

Over the longer-term, 10-year fanchart analysis points to debt sustainability (albeit with substantial risks) and there are high risks of a renewed round of sovereign stress as Argentina needs to re-enter international debt markets. While projected long-term private debt service metrics are now somewhat lower than at the third review, reflecting the new financing strategy, they remain above the targets set out in the March 2020 Technical Note on Debt Sustainability (consistent at the time with sustainable debt with high probability), indicating that buffers remain limited.

Risks to the updated baseline are exceptionally high, reflecting Argentina's exposure to shocks, significant uncertainty around the evolution of the drought and external conditions, and policy implementation risks, including with respect to the new financing strategy. In this context, the assessment of moderate risk of sovereign distress in the medium term still hinges critically on the steadfast implementation of macroeconomic and structural policies under the Fund program. Notably, failure to successfully implement the new financing strategy, would imply greater near-term financing pressures, and higher gross financing needs over the medium- to long-term. In this context, contingency planning and agile policy making remain indispensable to improve the likelihood of program success, with additional policy tightening and FX policy adjustments potentially required.

Latent structural vulnerabilities remain including: the low and undiversified export base, thin domestic capital markets, high shares of foreign currency and non-resident debt, and contingent liabilities from provinces' FX debt and central bank balance sheet weaknesses. In this context, sustained fiscal consolidation, including beyond the program, along with efforts to deepen domestic capital markets and boost exports and productivity, remain essential to mobilize domestic saving, strengthen reserves, and improve prospects of international market access, which in turn would strengthen debt-servicing capacity. Importantly, measures (i.e., debt buybacks or foreign-financed repos) that compromise reserves and add to near-term external debt service must be avoided.

Thank You

Q & A

ANNEX

Market-Access Country Debt Sustainability Analysis (MAC DSA)

MARKET-ACCESS COUNTRY DEBT SUSTAINABILITY ANALYSIS (MAC DSA)

- Historical predecessor of the SRDSF.
- Relies on **empirical thresholds** as benchmarks against which different debt indicators can be compared, improving the sustainability assessment relative to the DDT.
- Thresholds for the public debt-to-GDP ratio and the GFN-to-GDP ratio are used in relation to **solvency and liquidity**, respectively.
- **Debt indicators projected** in the baseline and alternative scenarios **are compared against the indicative benchmarks**.
- MAC DSA introduces a procedure to **quantify sovereign debt-related risks** emerging from solvency or liquidity vulnerabilities. Presents a **heat map** comparing vulnerability indicators.
- **Risk indicators:**
 - **Emerging Markets Bond Index Global Spread** is a measure of cost of borrowing,
 - the **external financing requirements as a share of GDP** indicate liquidity needs,
 - the **share of public debt in foreign currency** as a measure of currency-risk exposure and the
 - **change in short-term public debt as a percentage of total debt**, together with the **share of public debt held by nonresidents**, indicates **liquidity risk**.

MARKET-ACCESS COUNTRY DEBT SUSTAINABILITY ANALYSIS (MAC DSA) - DEBT INDICATORS & THRESHOLDS

- MAC DSA debt indicators:
 - **Public debt-to-GDP ratio** (solvency)
 - **GFN-to-GDP ratio** (liquidity)
- MAC DSA thresholds depend on a country's level of development and market integration:
 - Emerging Markets
 - Advanced Economies

	Advanced Economies	Emerging Markets
Public Debt-to-GDP ratio	85%	70%
GFN-to-GDP ratio	20%	15%

MARKET-ACCESS COUNTRY DEBT SUSTAINABILITY ANALYSIS (MAC DSA) - SIGNALS & HEAT MAP

HEAT MAP COLORS

Debt and GFN

Baseline above
benchmark?

Stress test above
benchmark?



High

Yes

Yes



Moderate

No

Yes



Low

No

No

Debt Profile Vulnerabilities

If actual values are over, between or
under benchmarks



High






Moderate






Low

MARKET-ACCESS COUNTRY DEBT SUSTAINABILITY ANALYSIS (MAC DSA) - SIGNALS & HEAT MAP (CONT.)

DEBT PROFILE EMERGING MARKETS

Debt Profile Indicators	Low Risk	Moderate Risk	High Risk
EMBI Global Spreads (basis points)	Below 200	Between 200 and 600	Above 600
External Financing Requirements (% of GDP)	Below 5	Between 5 and 15	Above 15
Public Debt in Foreign Currency (share of total)	Below 200	Between 20 and 60	Above 60
Change Short-Term Public Debt (in percent of total debt)	Below 0.5	Between 0.5 and 1	Above 1.0
Public Debt held by non-residents (share of total)	Below 15	Between 15 and 45	Above 45
			

DEBT PROFILE ADVANCED ECONOMIES

Debt Profile Indicators	Low Risk	Moderate Risk	High Risk
Bonds Spreads (bases points)	Below 400	Between 400 and 600	Above 600
External Financing Requirements (% of GDP)	Below 17	Between 17 and 25	Above 25
Change Short-Term Public Debt (in percent of total debt)	Below 1.0	Between 1.0 and 1.5	Above 1.5
Public Debt held by non-residents (share of total)	Below 30	Between 30 and 45	Above 45
			

ANNEX

MAC SR DSF – Other issues

Mechanical Signals



- Core tools produce risk indexes, and each tool has upper and lower thresholds
- The mechanical signal can be high risk if above upper threshold, low risk if below lower threshold, or moderate risk if between the two thresholds






Final Assessments











- Are determinations of risk at each of the 3 horizons (near, medium, and long-term). There is also an overall risk assessment that synthesizes all horizons
- Like signals, assessments can take values of high, moderate, or low

Using Judgment

- Refers to when an assessment is not given by a mechanical signal.
- It can occur if there is a disagreement with the mechanical result (in either direction) and can be warranted in various situations. Some examples include:
 - Widely conflicting results between various tools
 - Results distorted by well-understood anomalies in the data
 - Factors outside the tools
 - Historical performance
- It can also occur if the underlying analytical tool does not produce a mechanical signal
- All judgment is confirmed through the Fund's internal review process

Worksheet tab color codes	
Color	Meaning
	User input sheets Enter data/information on these worksheets
	Output sheets Contains the output tables/charts
	Major function sheet Contains the formulas and macros needed to run a tool
	Important configuration sheet Contains settings for the tools and generally should not be edited
	Fiscal space exercise tools

Cell color codes	
Color	Meaning
	Section headers No need to edit
	User input requested It is ok to edit even if pre-populated
	Date headers Automatically updating
	Indicates a default parameter <u>Do not</u> overwrite these cells.
	Lookup or parameter setting <u>Do not</u> edit these cells
	Something to take note of Relevant information about a calculation
	Function to be added
	Consistency check

Key worksheets in the main SRDSF workbook covered in this course

Questions	Basic data and metadata entry
Macrofw	Main worksheet to enter data and projections
NewMacrofw	Processes data and data entry for some debt structure charts
IdentFin and ResidFin	Entry of financing assumptions
BaseDB	Key worksheet for data/projection organization and checking values
LOGIT	Near-term module
FAN	Debt fanchart module
GFN	GFN fnanceablity module
LRModules	Long-run modules
STDesign (and STOps)	Operates the stress tests
Signals	Medium Term Index and results summary
Output	Contains the SRDSF output

	Framework
Coverage	<ul style="list-style-type: none"> • General Government (GG) as default; justification required for narrower coverage; broader coverage (including central bank) in some cases • Disclosure requirements on coverage definitions, debtholder profile, and guidance on certain instruments (like swaps)
Horizon	<ul style="list-style-type: none"> • 10-year debt and Gross Financing Needs (GFN) projections for all cases • Risk assessments for near-, medium-, and long-term horizons
Realism tools	<ul style="list-style-type: none"> • Cover additional drivers (exchange rate, financing terms on external debt, stock-flow adjustments), and public debt • In-depth tools for potential growth and fiscal multipliers.
Near-term risks	<ul style="list-style-type: none"> • 10 indicators, in five categories: quality of institutions, stress history, cyclical, debt burden, and global • Multivariate logistic regression combines indicators in a continuous metric (fitted probability of stress) • Stress probability split in low, moderate, and high-risk zones, (calibrated to 10% missed crisis and false alarm rates)
<i>Stress indicators</i>	
<i>Composite index</i>	
<i>Signal derivation</i>	

	Framework
Medium-term risks	Debt fan chart
<i>Stress indicators</i>	Three indicators: i) probability debt does not stabilize in MT, ii) fan chart width, and iii) debt level at t+5 controlling for debt-carrying capacity (fan chart accounts for deviation of baseline projections from historical trends via skewed shocks)
<i>Composite index</i>	Index based on 3 indicators weighted by predictive power Index split in low, moderate, and high-risk zones, (calibrated to 10% missed crisis and false alarms)
<i>Signal derivation</i>	
<i>Stress indicators</i>	GFN Tool with three indicators: (i) initial bank claims on government, (ii) maximum cumulative change in bank claims over projection period under a generalized stress scenario; (iii) average projected GFN/GDP in baseline.
<i>Composite index</i>	Index based on 3 indicators weighted by predictive power
<i>Signal derivation</i>	Index split in low, moderate, and high-risk zones, (calibrated to 10% missed crisis and false alarm rates).
Triggered stress-tests	<ul style="list-style-type: none"> • Simulate debt and GFN paths under: (i) contingent liabilities related to narrow coverage, (ii) banking crisis, (iii) natural disasters, (iv) commodity price shocks, and (v) REER shock. • Allow for customized stress-tests for idiosyncratic risks.

	Framework
Long-term risk analysis	Optional tools for risks from: population aging, natural resource discovery/depletion, debt amortizations; and climate change.
Judgment and communication	<ul style="list-style-type: none">• Judgment-based risk assessments at each horizon, with deviation from mechanical signals explained.• Overall risk assessment based on team judgment.

Minimum Total Misspecification Error¹

		NTS Ratio	Minimum total mis-specification error	<i>of which:</i>	
				Missed crises	False alarms
Near-term risk analysis	Logit model (1990-2015) ²	30%	37%	10%	27%
Medium-term risk analysis	Medium-Term Index (2014-15)	14%	38%	27%	10%
	Debt fanchart (2010-15)	34%	43%	14%	29%
	GFN module (2014-15)	13%	42%	33%	9%
All indicators in heatmap (current framework)	OR condition (2006-16, AE and EM average)	76%	79%	12%	68%
	AND condition (2006-16, AE and EM average)	NaN	100%	100%	0%

1 The Total Misspecification Error (TME) is the sum of the probabilities of missed crisis and false alarm errors. The minimum TME provides information on the discriminatory capacity of the corresponding tools based on a single threshold that divides the space of possible results in two zones (high risk, predicting a crisis; and low risk, predicting no crisis). Two options are explored for how this space could be divided: (1) a crisis is predicted if just one of the heatmap indicators flashes red ("OR condition"); (2) a crisis is predicted if all heatmap indicators flash red ("AND condition"). A crisis prediction based on the "OR condition" rarely misses a crisis (just 12%, about in line with the logit model and the debt fanchart tool), but at the cost of frequently sending false alarms (68%, much higher than any of the new tools). The TME is 79%, much worse than that of the new tools. A crisis prediction based on the "AND condition" never sends a false alarm (all crises are associated with at least one red signal) but misses all crises (no crisis is associated with the *entire* heatmap being red).

2 Analysis based on 1,579 country-year observations for the logit model, 99 for the medium-term index, 403 for the debt fanchart, 125 for the GFN module, and 805 for the debt and GFN thresholds.

How to communicate the findings?

Divide the index into three risk zones (low, moderate, high) based on two cutoffs corresponding to probabilities of missed crises and false alarms:

- the risk of sovereign stress will be deemed “high” if the risk index exceeds the upper cutoff, corresponding to a false-alarm probability of 10 percent;
 - the risk of sovereign stress will be deemed “low” if the risk index is below the lower cutoff, corresponding to a missed-crisis probability of 10 percent;
 - the risk of sovereign stress will be deemed “moderate” for intermediate cases, with a risk index between the upper and lower cut-offs.
-
- Steps (i) and (ii) are based on statistical procedures aiming to maximize predictive performance
 - Step (iii) is underpinned by the good capacity of the tools to separate stress from non-stress episodes, which allows to calibrate the low- and high-risk thresholds to relatively low probabilities of missed crises and false alarms, respectively (10 percent), without implying a very wide moderate risk zone.

Sheet OUTPUT REALISM

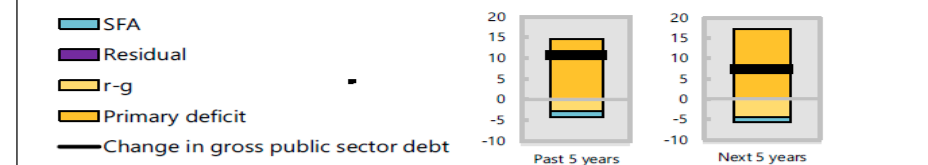
Forecast track Record ^{1/}: 2018

Comparator group: Surveillance [Comm. Exp.]

		1 Yr. ahead	3 Yr. ahead	5 Yr. ahead
optimistic				
above 75th percentile	Public debt to GDP			
below 75th percentile	Primary deficit			
conservative	r - g			
below 25th percentile	Exchange rate depreciat			
above 25th percentile	SFA			

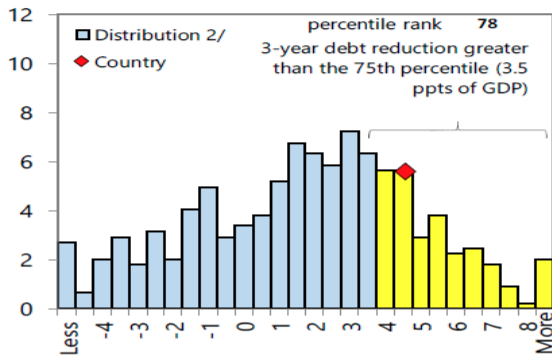
Public Debt Creating Flows

(Percent of GDP)



3-Year Debt Reduction

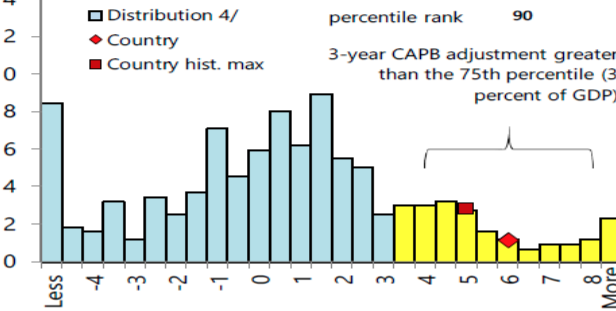
(Percent of GDP)



3-Year Adjustment in Cyclically-Adjusted

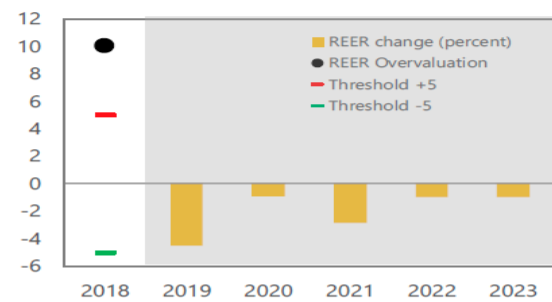
Primary Balance (CAPB)

(Percent of GDP)



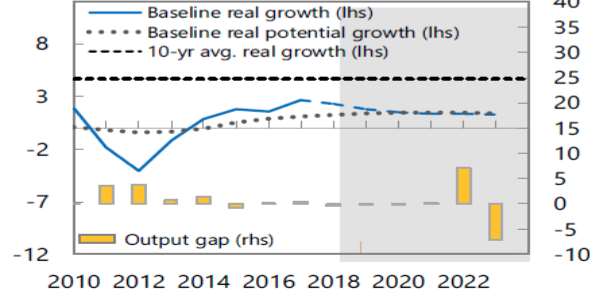
REER Gap (+ overvaluation) ^{3/}

(Percent)



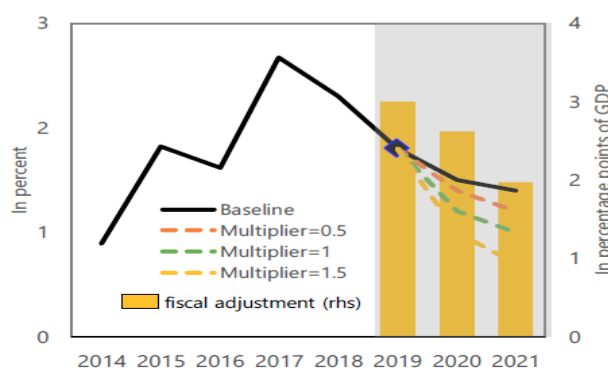
Real GDP Growth

(in percent)



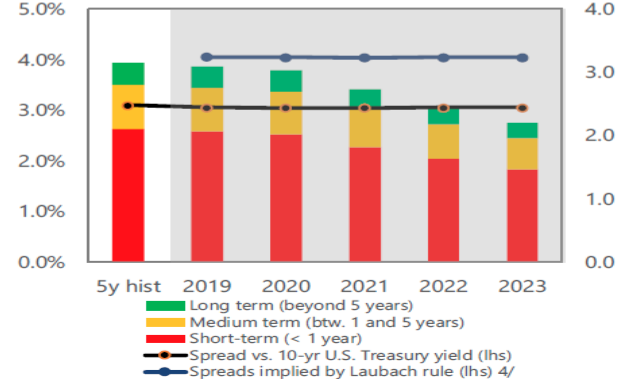
Fiscal Adjustment and Possible Growth Paths

(Bars show fiscal adjustment (RHS) and lines show real GDP growth paths under different fiscal multipliers (LHS))



External bond Issuances

(Bars show new debt issuances (RHS, %GDP), lines show avg marginal interest rates (LHS, percent))



Historical Output Gap Revisions ^{5/}

		above 75th percentile
Real-Time	3 year ahead	50-75 percentile
5 year ahead		25-50 percentile

Sheet LOGIT

Regressors:

1. *Institutional quality* (World Governance Indicators, Kaufmann and Kraay)
2. *Stress history* (If a country is in stress, previous observation + 1. If a country is not in stress, 0.9 x previous year's observation.)
3. *Cyclical* (current account balance/GDP, 3-year real effective exchange rate appreciation, lagged credit/GDP gap);
4. *Debt burden and buffers* (change in public debt/GDP, public debt/revenue, FX public debt/GDP, and international reserves/GDP), and
5. *Global* (change in VIX).

Table 4. Specification of Multivariate Logit Model

Bucket	Regressor	Coeff.	Std. Coeff.
	Institutional Quality	-1.073 ***	-0.377
	Stress History	0.514 ***	0.1006
Cyclical	Current account balance/GDP	-0.024 **	-0.095
	REER (3-year change)	0.013 **	0.070
	Credit/GDP gap (t-1) (if + ve)	0.086 ***	0.258
Debt burden and buffers	Δ(Public debt/GDP)	0.052 ***	0.1182
	Public debt/revenue	0.002 ***	0.1213
	FX public debt/GDP	0.024 ***	0.1601
	International reserves/GDP	-0.034 ***	-0.2348
Global	ΔVIX	0.015 ***	0.1373
Number of Observations			1,579
LR chi2			246.70
Pseudo R2			0.25

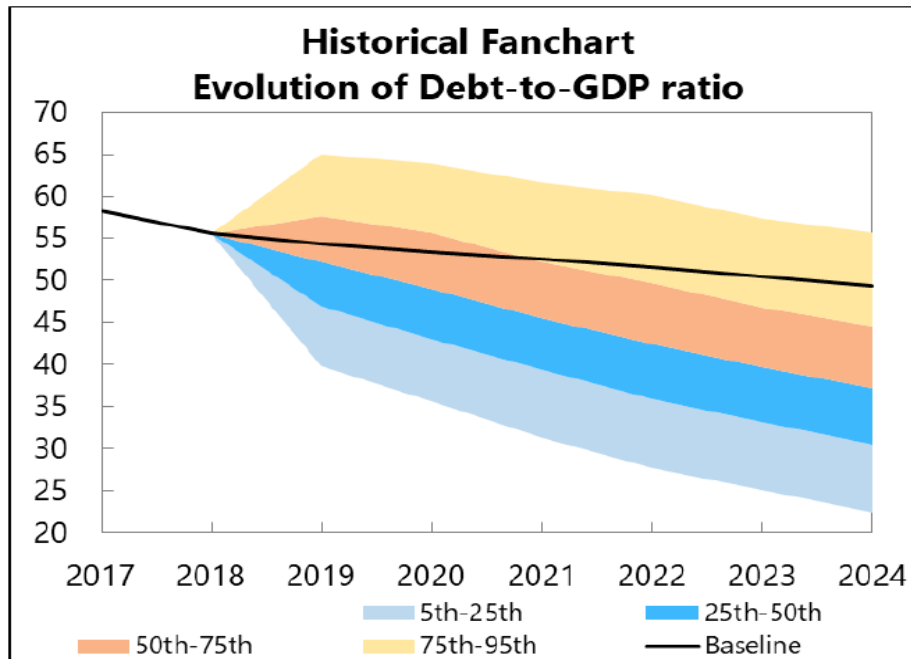
Source: Fund staff calculations.

Note: Stars indicate statistical significance at the 1 percent (***) and 5 percent (**) levels. Standardized coefficients are scaled by variable standard deviations, thus providing a measure of relative importance (Long, 1997). For instance, the standardized coefficient for the FX public debt to GDP is about 1.4 times the magnitude of the coefficient for the change in public debt-to-GDP. This implies that ceteris paribus, a 1 standard deviation higher FX public debt-to-GDP ratio (about 16.8 percent of GDP, see Table AV.5) would have roughly the same effect on the stress probability as a 1.4 standard deviation increase in change in public debt-to-GDP (approximately 7.5 percent of GDP, see Table AV.5).

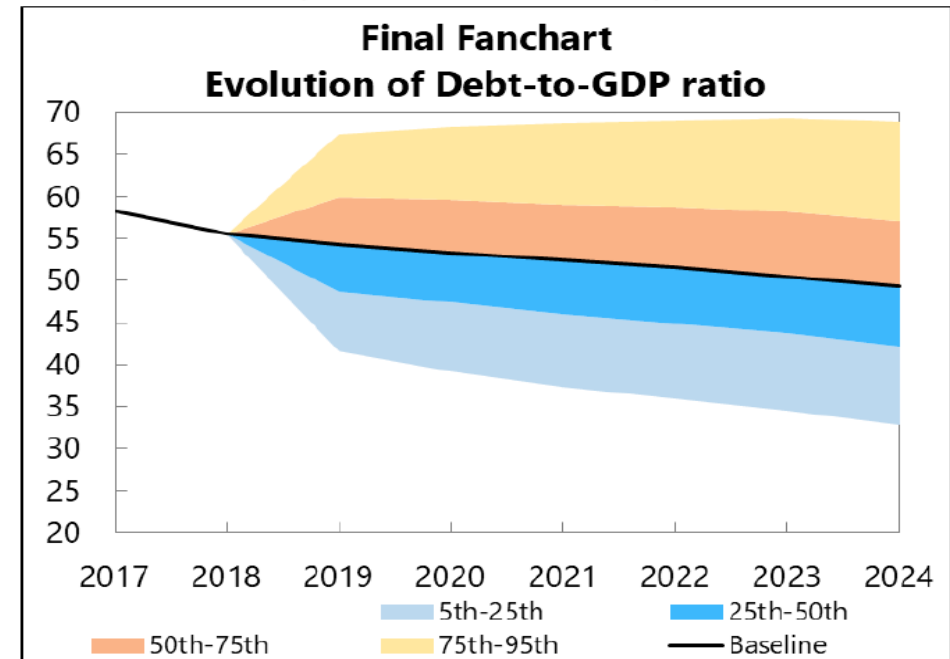
Sheet
FAN

1. Debt fanchart from baseline projections to assess prospects for debt/GDP stabilization in a probabilistic way.
2. GFN module analyzes financing risks, taking into account the country's debtholder profile.
3. Triggered/tailored stress-tests to capture risks facing that are not fully covered by the fanchart and GFN tools.

Country 1 (2019): Baseline above 20th percentile of historical fanchart



Country 1 (2019): Final fanchart obtained by applying de-meaned shocks to baseline (standard fanchart)



Sheet FAN

- *Projecting GFNs and financing*: GFN-to-GDP projections. User must allocate domestic issuance among the central bank, commercial banks, and other private creditors; similarly, foreign issuance will be divided among foreign official and foreign private creditors.
- *Modeling risk*: a generalized stress scenario that includes adverse shocks in three key areas: (i) *macro-fiscal variables*; (ii) *maturities*, to illustrate implications of shortening of maturity of issuances in stressed conditions; and (iii) *access to external debt markets*, to examine the impact of a loss in foreign private investor appetite for a sovereign's debt.
- *Analyzing residual financing*: The stress scenario creates a need for financing at a time when the pool of potential creditors has shrunk. It is assumed that the residual financing need is absorbed by domestic banks. However, customizations will be available to take account of relevant mitigating/aggravating factors like the availability of government liquid asset holdings and the domestic non-banking sector's role as risk dampener/amplifier.

Sheet
OUTPUT

Stress-test	Rationale
Contingent liabilities related to narrow coverage	Highlight risks from narrow debt coverage (and incentivize broader coverage)
Banking crisis	Capture vulnerabilities of countries with oversized and vulnerable banking systems
Natural disasters	Incorporate events outside country's history and/or where future impact could be different from the past
Commodity price shock	Assess the impact of a negative ToT shock, for both commodity exporters and importers
REER shock	Capture risks associated with large sudden currency movements, tied to the realism tool on REER