INTERNATIONAL MONETARY FUND

STAFF GUIDANCE NOTE FOR PUBLIC DEBT SUSTAINABILITY ANALYSIS IN MARKET-ACCESS COUNTRIES

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ABBREVIATIONS AND ACRONYMS

AEs	Advanced Market Economies
AT	Analytical Tool
CDS	Credit Default Swap
CLs	Contingent Liabilities
DSA	Debt Sustainability Analysis
EMBI	Emerging Markets Bond Index
EMBIG	Emerging Markets Bond Index Global
EMs	Emerging Market Economies
EWE	Early warning exercise
FAD	Fiscal Affairs Department
FSSA	Financial Sector Stability Assessment
GDP	Gross Domestic Product
GFN	Gross Financing Needs
GFSM	Government Finance Statistics Manual
GRA	General Resources Account
IDA	International Development Agency
IMF	International Monetary Fund
IPSAS	International Public Sector Accounting Standards
LIC	Low-Income Country
MAC	Market-Access Country
MTDS	Medium Term Debt Management Strategy
NPL	Non-performing Loans
OECD	Organization for Economic Co-operation and Development
PPG	Public and Publicly Guaranteed
PPPs	Public-Private Partnerships
PRGT	Poverty Reduction and Growth Trust
RAM	Risk Assessment Matrix
REER	Real Effective Exchange Rate
SOEs	State-Owned Enterprises
SPR	Strategy, Policy, and Review Department
UFR	Use of Fund Resources
VE	Vulnerability Exercise
WEO	World Economic Outlook

I. INTRODUCTION

1. The framework for fiscal policy and public debt sustainability analysis (DSA) in market-access countries (MACs) was reviewed by the Executive Board in August 2011.[1] The review responded to shortcomings in identifying fiscal vulnerabilities and assessing risks to debt sustainability against the backdrop of increased concerns over fiscal policy and public debt sustainability in many advanced economies.

2. The review clarified the conceptual framework for fiscal policy and public 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. Conversely, if no realistic adjustment in the primary balance—i.e., one that is both economically and politically feasible—can bring debt to below such a level, public debt would be considered unsustainable. The higher the level of public debt, the more likely it is that fiscal policy and public debt are unsustainable. This is because—other things equal—a higher debt requires a higher primary surplus to sustain it. Moreover, higher debt is usually associated with lower growth and higher interest rates, thus requiring an even higher primary balance to service it.

3. In practice, assessing debt sustainability for MACs involves probabilistic judgments about the trajectory of debt and the availability of financing on favorable terms. In making such an assessment there are several important considerations: (i) are debt burden indicators projected, at a minimum, to stabilize at levels consistent with an acceptably low rollover risk and with preserving growth at a satisfactory level, taking into account cyclical considerations, not only in the baseline scenario but also under plausible stressed scenarios? (ii) are the level and trajectory of the debt burden indicators underpinned by realistic projections for primary balance adjustment? (iii) are the assumptions for other key macroeconomic variables (e.g., growth and interest rates) realistic? and (iv) is the debt profile well balanced in terms of maturity, currency composition, and investor base so as to facilitate continued market access? The tools in this guidance note help make such assessments.

4. Against this background, the review identified several areas where DSAs could be improved in MACs. These included: (i) realism of baseline assumptions; (ii) risks associated with the debt profile (financing structure); (iii) analysis of macro-fiscal risks; (iv) vulnerabilities related to the level of public debt; and (v) coverage of fiscal and public debt aggregates. The review also discussed

[1] See Modernizing the Framework for Fiscal Policy and Public Debt Sustainability Analysis. For the purpose of this guidance note, MACs are defined as non-PRGT-eligible countries. This covers all advanced economies and most emerging markets. For PRGT-eligible countries that are non-IDA only, Fund staff may opt to undertake a MAC DSA instead of a LIC DSA if the country has durable and significant access to market financing. See Staff Guidance Note on the Application of the Joint Bank-Fund Debt Sustainability Framework for Low-Income Countries.

the importance of contingent liabilities as a source of risk and the use of fan charts as complementary tools.

5. The review called for a risk-based approach to MAC DSAs. In particular, Executive Directors agreed that the depth and extent of the analysis should be commensurate with the concerns regarding sustainability, while maintaining a reasonable level of standardization. Thus instead of requiring the same degree of analysis in all countries, this guidance note is structured to require more analysis in countries facing greater risks; and commensurately less in countries facing lower risks. This approach is also in line with the recommendations of the 2011 Triennial Surveillance Review to focus on a more granular assessment of risks and macro-financial linkages.[2]

6. The remainder of the guidance note is structured as follows. Section II introduces the main aspects of the new risk-based approach. Section III addresses data coverage and other design issues. Section IV presents the elements of the basic DSA, and Section V discusses the modules to be used when deeper analysis is required. Section VI presents the reporting requirements of DSAs, and Section VII describes procedural requirements.

II. A RISK-BASED APPROACH

7. This note proposes deeper analysis and more in-depth reporting on debt sustainability assessments based on triggers of debt burden indicators and access to Fund resources. In line with "Modernizing the Framework for Fiscal Policy and Public Debt Sustainability Analysis", this approach balances the need for more in-depth assessments of sustainability risks in situations where they are warranted with the need to contain the use of staff resources. An excel-based template has been developed to facilitate the preparation of DSAs and should be used by all MAC teams.[3] Specifically, all MAC teams are required to conduct a basic DSA, comparing the baseline with alternative scenarios. The basic DSA is a more streamlined version of the current DSA. For MACs that (i) have a current or projected debt-to-GDP ratio above 60 percent if classified as an advanced economy (AE) or 50 percent if classified as an emerging market economy (EM); (ii) have current or projected gross financing needs-to-GDP ratio above 15 percent if classified as AE or 10 percent if classified as EM[4] (see Annex II); or (iii) have or are seeking exceptional access to Fund resources,[5] teams are required to use a set of tools to identify and assess specific risks to debt sustainability. For these countries, which, for simplicity, are referred to as "higher scrutiny" cases, teams are also

[2] See 2011 Triennial Surveillance Review—Overview Paper,

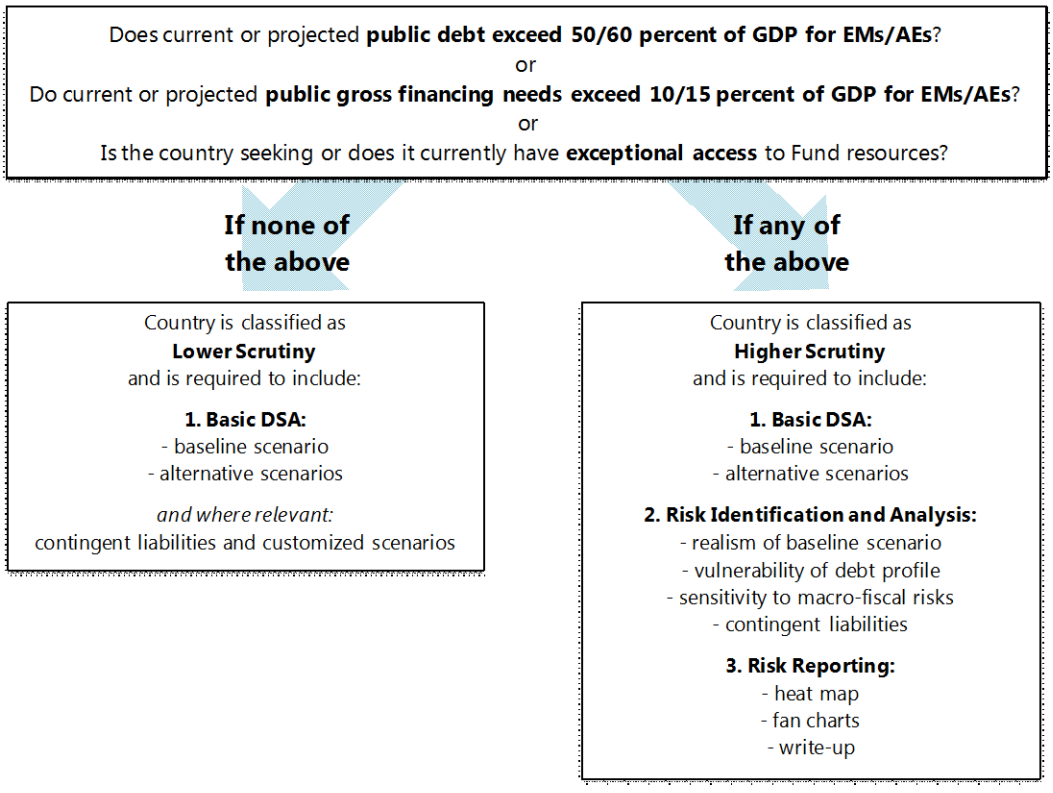
[3] The template will be made available on the IMF external website in the coming months. Annex I presents the analytical derivation of the evolution of the public debt-to-GDP ratio.

[4] Countries are designated as AEs or EMs based on their WEO classification (further details can be found in WEO Q&A and WEO Statistical Appendix). The quantitative triggers are based on the early warning results presented in Annex II with respect to debt level and gross financing needs. Recognizing the uncertainty associated with estimating benchmarks and to be conservative, the model estimates presented in Annex II Tables A1 and A2 were reduced by about 15 percent to arrive at these triggers.

[5] This also includes countries that received exceptional access and are undergoing post-program monitoring.

required to produce a standardized summary of risks in a heat map and prepare a write-up to discuss risks, including any country-specific considerations (Figure 1).[6] This guidance note does not discuss how an unsustainable debt position should be resolved.

Figure 1. Risk-Based Approach



Group characteristics: [1/]

61 countries	54 countries
Public debt ranges from 2 to 53 percent of GDP	Public debt ranges from 33 to 237 percent of GDP
Gross financing needs range from -8 to 11 percent of GDP	Gross financing needs range from 6 to 59 percent of GDP

1/ Based on estimated 2013 data for gross public financing needs and end-2012 data for gross public debt and exceptional access.

8. Staff guidance allows some flexibility in the use of triggers for more in-depth assessment of risks (further details provided in Section VI below). The final determination on the use of flexibility should be made in agreement with review departments in the review process.

[6] All the tools required for higher scrutiny countries could be used for lower scrutiny countries at the discretion of staff.

- Recognizing that debt problems may emerge at lower debt burden levels than the ones suggested above (particularly for EMs), some countries may be treated as "higher scrutiny" cases despite having lower debt burden indicators than the proposed benchmarks. To help make this determination staff should assess vulnerabilities that may arise from: (i) large projected fiscal adjustment; (ii) volatile growth; (iii) large spreads; (iv) high external financing requirements; (v) a large share of debt held by non-residents; (vi) a large share of foreign-currency denominated debt; or (vii) a rapid increase in short-term debt. Indicators above the levels presented in Table 1 may point to emerging vulnerabilities. These values are calibrated to either reflect the upper tail (25–30 percent) of historical data in AEs and EMs (for primary balance and growth) or from early warning models of debt distress (for debt profile indicators, see Annex II). Staff should also use the results of existing vulnerability and risk assessment exercises such as the Vulnerability Exercises and Early Warning Exercise, to help in this regard. In the event that significant vulnerabilities are found to exist, it is expected that the basic DSA be complemented with steps 2 and 3 in Figure 1. This should be discussed and agreed during the review process and would take into account country-specific circumstances including history of debt difficulties, spending rigidities, and high tax rates.

Table 1. Potential Indicators for Additional Analysis in Lower Scrutiny Countries

Indicators	AEs[1/]	EMs[1/]
3-year cumulative primary balance adjustment (percent of GDP)	2	2
Coefficient of variation of growth	1	1
Bond yield spreads or EMBI global spreads (basis points) [2/]	600	600
External financing requirements (percent of GDP)[3/]	25	15
Public debt held by non-residents (share of total)	45	45
Public debt in foreign-currency (share of total)	n.a.	60
Annual change in the share of short-term public debt at original maturity	1.5	1.0

Source: Fund staff estimates.
1/ Benchmarks are rounded. See Annex II.
2/ Bond yield spreads for AEs, defined as the spread over U.S. or German bonds of similar maturity, and EMBI spreads for EMs.
3/ Defined as current account balance plus amortization of total short-term external debt at remaining maturity.

- Conversely, some countries with debt burden indicators above the proposed benchmarks could be classified in the "lower scrutiny" category of reporting for which only the basic DSA is produced. This could be the case for countries that have sufficiently large highly-liquid assets or other unique characteristics that significantly mitigate the risks stemming from their high (gross) debt burden.

9. The framework for identifying and analyzing risks in "higher scrutiny" cases also relies on a set of triggers to facilitate DSA comparisons among homogeneous country groupings. On the one hand, if all risks are identified on the basis of common metrics applied uniformly to all countries, it would allow for ready cross-country comparability, but would neglect relevant country-specific considerations. On the other hand, complete country specificity would make it difficult to compare results and to assess risks on a relative basis across countries. Thus in many parts of the

guidance note, the metrics used to identify risks are differentiated across advanced economies and emerging markets in light of their different experiences with debt sustainability. The framework and accompanying template also allow for the use of flexibility in the application of metrics within country categories so as to permit country teams to bring in relevant country-specific considerations. For example, country teams can change the magnitude of the standard shocks in the stress tests if they consider that a different shock would better suit the country-specific characteristics.

10. The flexibility built into the risk-based framework should be used judiciously and transparently by country teams. When country teams make a departure from the standard guidance provided in this guidance note, e.g., by reclassifying countries from "higher scrutiny" to "lower scrutiny" or vice versa, they should flag it clearly and the appropriateness of such departures should be agreed upon with departments in the review process. It is expected that over time such flexibility would be used symmetrically, so that some countries would use the flexibility to apply less stringent metrics and provide less than the standard analysis (e.g., in cases of low net debt), while others would go beyond the guidance in this note to apply more stringent metrics and provide additional analysis of risks.

III. DATA COVERAGE AND OTHER DESIGN ISSUES

11. The appropriate coverage of public debt is pivotal to adequately assessing risks to public debt sustainability (Box 1)**.** Staff should consider three important issues: (i) coverage of the "public" sector; (ii) long-term spending pressures; and (iii) gross versus net debt.[7] The coverage of public debt in the DSA should be as broad as possible, but consistent with the coverage of the fiscal accounts monitored for surveillance and program purposes, and should take into account the availability (and frequency) of fiscal data. Government intervention in the financial sector should be carefully reflected in fiscal accounts and public debt either directly or through stress tests (Box 2). While DSAs should be based on gross debt, complementary analysis based on net debt could be presented to show the impact of risk-mitigating factors, when relevant.[8]

[7] See "What Lies Beneath: The Statistical Definition of Public Sector Debt" (Staff Discussion Notes No. 12/09) for a discussion of other important issues such as (i) instrument coverage; (ii) valuation of debt instruments (market or nominal); and (iii) consolidation of intra-government holdings.

[8] This would be especially relevant in DSAs for countries that were reclassified from "higher scrutiny" to "lower scrutiny" based on the level of their highly-liquid assets.

Box 1. Issues Related to Coverage of Public Debt

Three important issues related to the coverage of public debt are briefly discussed in this box: (i) public sector coverage; (ii) net vs. gross debt; and (iii) long-run spending pressures.

The coverage of the public sector in the DSA is expected to be the same as in the macroeconomic framework for surveillance and program monitoring purposes. Fund guidance on coverage of the public sector is based on Government Finance Statistics Manual 2001 and the Manual on Fiscal Transparency. While guidelines suggest that "statistics be compiled for the public sector as well as for the general government," a large number of countries report fiscal aggregates only at the general government level or at the budgetary central government or central government level. This reflects data availability and difficulties with the appropriate treatment of some public entities, including state-run financial entities. Staff is encouraged to add, at least, high-risk public enterprises under fiscal targets. See "Fiscal Risks—Sources, Disclosure, and Management" for additional guidance on identification of fiscal risks beyond the central government.

The DSA should be based on gross debt, but the concept of net debt could be applied as a complementary measure to reflect factors that could mitigate risks associated with high levels of gross debt. Considerations in this regard include: (i) whether the country has large financial assets that could realistically be used to repay or service debt; and (ii) whether reliable data on government assets are available.[1] DSAs presented on a net basis are expected to clearly disclose the definition of net debt used. The use of a standard statistical definition of net debt in line with the Public Sector Debt Statistics Guide is recommended. In some countries, where this concept may provide an incomplete assessment of net debt, alternative measures can be used, such as net financial liabilities (relevant in advanced economies where data are most likely to be available) or debt-net-of highly liquid assets (relevant in countries where data constraints are binding).

When relevant information is available, DSAs should reflect vulnerabilities associated with pension and/or health systems. However, assessing the impact of long-term spending pressures, which tend to be significant in AEs, is not a straightforward exercise and often requires the use of modeling techniques that are time-consuming. A key consideration is to determine how soon and how likely these pressures could materialize, which in itself depends on country-specific conditions, such as the characteristics of the system, percent of the population covered, and elderly dependency ratio. One reporting option is to estimate the fiscal cost of projected spending increases associated with the pension and/or health care system, in the absence of reform.[2] The fiscal cost can then be reflected in the DSA tables as a memo item (in present value terms). Additionally, the macroeconomic framework could also be extended beyond the 5-year projection horizon to illustrate the impact of such expenditures on fiscal and debt sustainability over the long term.

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1/ For recent estimates of net debt, please see the Fiscal Monitor (April 2012).

2/ See "The Challenge of Public Pension Reform in Advanced and Emerging Economies" for recent estimates of these costs for some AEs and EMs.

Box 2. Reporting of Financial Sector Intervention in Fiscal Accounts and DSAs

The treatment of government intervention in the financial sector in fiscal accounts depends on whether it creates a claim on a financial institution of equivalent value in the year of the intervention. The general principle is that when the government's intervention creates a claim on a financial institution of equivalent value (intervention is based on market price), the operation is recorded as a financing transaction below the line with no effect on the fiscal balance. Such an operation does not change the government's net worth. If the government receives less than the full value of the asset it exchanges (intervention is above market price implying a subsidy), the shortfall in value needs to be recorded above the line as government expense under capital transfer.

The impact of government intervention on public debt depends on how it is financed. For gross debt, the effect depends on whether the intervention is financed by borrowing or use of liquid assets. For net debt, the impact depends in principle on whether there is a capital transfer. In cases without a capital transfer, net debt generally does not increase unless the government acquires direct equity (which is not included in the assets that are netted out of gross debt). In cases with a capital transfer, net debt generally increases.

While there are differing standards on how the impact of government intervention beyond the year in which it occurs should be reflected in the fiscal accounts, DSAs should capture any expected realization of contingent liabilities through stress tests. The treatment of gains and losses arising from changes in the fair value of acquired assets during the financial crisis has varied. Under the Government Finance Statistics Manual 2001, such gains and losses, whether realized or unrealized, are not recognized above the line, but directly impact the net worth of the government. Under internationally accepted private sector accounting standards adopted by some governments, such realized and unrealized gains and losses of assets classified as held for trading are included above the line in the period in which they arise (as the gain/loss is reflected immediately in the income statement), while unrealized gains and losses of assets classified as available for sale do not have an immediate impact on the fiscal balance until such assets are sold. Notwithstanding these differing accounting standards, DSAs should in general capture in a timely manner any expected realization of contingent liabilities. At a minimum, DSAs should assess the impact of expected losses arising from changes in the value of acquired assets through stress tests.

Explicit guarantees are reported in the fiscal accounts once the guarantee is called or if a provision is made in this regard, but their impact on debt should be routinely captured by stress-testing in the DSA. If at the time the guarantee is extended a provision is not made, the DSA should analyze risks from losses that are considered highly probable, in the context of stress tests. It is worth noting that GFSM 2001 asks explicitly for the disclosure of the value of contingencies in memorandum items in the fiscal accounts. When the guarantee is called, depending on the value of the claim received by the government on the defaulting bank, the operation is recorded as a capital transfer and/or financial transaction below the line.

When intervention takes place by public entities outside the general government, it is prudent to reflect such quasi-fiscal operations in the DSA and fiscal accounts. To the extent possible, wider aggregates than general government should be considered for the DSA and fiscal accounts to capture risks to public debt. Quasi-fiscal activities undertaken by the central bank (e.g., liquidity support) or government-owned asset management companies should be routinely reflected in the fiscal accounts and public debt. In addition to such direct costs, the implicit carrying costs of quasi-fiscal activities by central banks (including the settlement of central bank losses resulting from past interventions) or other public entities undertaking interventions should be reported over time as memo items in the fiscal accounts and consolidated into public debt in the DSA.

12. In line with the time horizon of the WEO, assessments of debt sustainability should generally be based on a 5-year projection horizon. As noted above, an assessment of debt sustainability is based on projections for debt burden indicators. The uncertainty associated with these projections grows significantly with the projection horizon. Thus assessments of sustainability made on the basis of debt burden indicators far in the future risk undermining the credibility of the DSA. For Fund-supported programs there is a more pressing reason to base sustainability assessments on developments within the projection horizon, as repayments to the Fund start between 3¼ and 4½ years after the start of a program. Prospects for the Fund to be repaid would be undermined if debt is not sustainable and the member is not able to access markets to repay the Fund. When the output gap remains sizable within the standard 5-year projection horizon—for example for countries undertaking large multi-year fiscal adjustment—teams could undertake complementary analysis based on debt-to-potential GDP to identify the underlying trend in the debt path. In such cases the feasibility of the fiscal adjustment effort as well as the assumptions regarding potential output would need to be subjected to particularly close scrutiny.

13. Departures from the standard 5-year projection horizon could be considered in some specific circumstances. Debt sustainability could be assessed on the basis of a longer time horizon where a 5-year horizon may not capture relevant risks to debt sustainability, such as from long-term spending pressures from an aging population, ballooning debt service, or other considerations. In cases of prolonged fiscal adjustment where debt burden indicators remain high during the 5-year period, teams could, by agreement with SPR, propose to present complementary analysis based on a longer timeframe. In such cases, the rationale for considering longer-term projections alongside the results of the standard DSA template based on the 5-year horizon should be presented in the text of the policy note and staff report to inform the assessment.

IV. BASIC DSA

A. Guidelines for the Preparation of the Basic DSA

14. The baseline scenario should be consistent with the macroeconomic framework presented in the accompanying staff document. It should be based on reliable data as well as realistic and consistent assumptions and projections, including for: (i) real GDP growth; (ii) inflation measured by the GDP deflator; (iii) government revenues and grants; (iv) non-interest government expenditures; (v) the current stock of gross debt, including the projection of interest and amortization payments, the average maturity, and a breakdown between foreign currency and local currency-denominated debts;[9] (vi) the interest rate and other gross financing terms and conditions

[9] This is important in order to appropriately capture exchange rate risks. Country teams may need to gather the data on the current outstanding stock of debt from the authorities' debt management office. If the data are not available, staff could assume that the projected share of foreign currency amortization and interest payments in total debt service is proportional to the share of foreign currency debt in total debt, if appropriate. Chapter 5 of the *External Debt Statistics Guide 2003* (and its 2012 draft update available at http://www.tffs.org/edsguide.htm) provides guidance on the concepts, definitions, and classifications of external public and publicly guaranteed debt data. Also, the Quarterly External Debt Statistics (QEDS) database (see www.worldbank.org/qeds) provides quarterly external debt position data for over a hundred economies, including data on public sector external debt in many cases.

(such as currency denomination and grace and maturity period of new borrowing); (vii) the exchange rate; and (viii) other debt-creating (or reducing) flows, including bank recapitalization costs and privatization proceeds.[10]

15. The baseline scenario should be constructed around the programmed macroeconomic adjustment for UFR (or near UFR) cases and the most likely scenario for surveillance countries. In particular, the analysis of debt sustainability for the purpose of assessing the second criterion under the Fund's Exceptional Access policy should be done on the basis of implementation of programmed adjustment. The impact of the debt level on growth and interest rates should be factored in. The potential contractionary impact of the fiscal adjustment on growth would need to be taken into account.[11] In particular, projecting buoyant growth alongside sizeable fiscal adjustment would require strong justification. In addition, projections of the GDP deflator and exchange rates should take into account the impact of the programmed adjustment on relative prices in line with WEO guidelines on projections.[12]

16. The framework emphasizes the importance of the structure of debt to assess prospects for market access and thus debt sustainability. The recent crisis has illustrated the problems sovereigns can experience when international financial markets close while a country is faced with high rollover requirements. In order to undertake meaningful stress tests related to the structure of fiscal financing, the new template is set up to allow for a wide range of possible financing instruments, which may vary in terms of interest rate, payments terms (annual or semi-annual), grace period, maturity, currency denomination, and residency of holder. Staff is encouraged to discuss with the authorities the appropriate assumptions for new financing which could be informed by the country's medium-term debt management strategy (Box 3). The appropriate extent of granularity of new financing will be determined by staff based on the risks related to the debt profile and availability of information. It is expected that over time staff would have access to the required information and data to make adequate financing assumptions.[13, 14] Higher granularity would allow for more accurate assessment of risks, including to the debt profile and investor base.

[10] It is not proposed to impose new data requirements on member countries. Rather, the aim is to leverage existing data and information and encourage the collection and provision of otherwise unavailable data.

[11] See Fiscal Monitor (April 2012). Fiscal multipliers vary significantly across countries and time, calling for country-specific analysis. In general, estimates have shown short-term revenue multipliers to be smaller than short-term expenditure multipliers. There is also evidence that fiscal multipliers vary with the business cycle. Other considerations when estimating fiscal multipliers include (i) openness of the economy; (ii) size of automatic stabilizers; (iii) monetary policy reaction; (iv) state of the banking system; and (v) the level of indebtedness.

[12] For WEO projections, there is flexibility in implementing the standard assumption of no change in REER. For example, the REER in program countries may vary. The WEO treats output gap projections similarly, which should be zero by the end of the projection period but in some program countries are not.

[13] Simplifying assumptions could be made in cases where information is unavailable and risks with the debt profile are low.

[14] If there are residual financing needs, these are automatically filled in the template with a domestic-currency bond (interest rate and maturity can be determined by the country team). Staff should minimize the residual financing

(continued)

Box 3. Medium-Term Debt Management Strategy

The Medium-Term Debt Management Strategy (MTDS) Framework developed by the staff of the IMF and World Bank aims to help developing countries elaborate effective debt management strategies.

The MTDS framework and toolkit comprises two elements: An operational guidance note and a spreadsheet-based analytical tool (AT). The guidance note provides practical guidance on the process of developing an effective MTDS, describing each step involved, while the AT provides quantitative analysis to guide the MTDS decision-making process.

The MTDS framework aims to provide technical and operational guidance on the process for developing a plan that the government intends to implement over the medium term (typically next 3–5 years) in order to achieve a desired composition of the government debt portfolio. It also captures the government's preferences with regard to the cost-risk trade-off, and is consistent with long-term debt sustainability.

The AT has been developed to illustrate the cost and risk trade-offs associated with different debt management strategies. Under certain circumstances, the AT can provide useful input for developing a country's borrowing strategy.

More information on the MTDS can be found on the following dedicated website: Managing Public Debt-Formulating Strategies and Strengthening Institutional Capacity.

17. The basic DSA includes two standardized alternative scenarios.[15]

- *Historical scenario:* real GDP growth, the primary balance, and real interest rates are set at their historical average. Other variables are the same as in the baseline.
- *Constant primary balance scenario:* the primary balance is assumed to remain unchanged compared to the first (current) year of the projection (in percent of GDP). Other variables are the same as in the baseline.

18. Baseline debt ratios that are much lower than those in the standardized alternative scenarios may signal unrealistic baseline assumptions and warrant discussion in the write-up where relevant. In some cases, optimism in projections may be justified by structural breaks or recent performance improvements that are not adequately reflected in historical averages. Furthermore, recent history may not be an appropriate benchmark for (crisis) countries that experienced a (pre-crisis) boom. These reasons should be highlighted in the write-up to explain that changes to the baseline may not be necessary.

needs. For pre-funding, staff should adjust the residual financing line by hard-coding "0" for the year in which financing is obtained, and for the year(s) that is (are) pre-funded.

[15] Annex III describes how alternative scenarios and stress tests are designed in the DSA template.

19. The DSA should include any customized alternative scenarios prepared by staff. For example, if the PN or staff report compares an active policy scenario with a no-change-in-policy scenario, judgment would need to be made as to which framework serves as the baseline. The alternative scenario would then be expected to be modeled as a customized DSA scenario (see Section V.C). Moreover, risks to debt sustainability may arise from weak or highly indebted public entities or other off-budget items such as guarantees on public-private partnerships (PPPs) that pose fiscal risks and these could be simulated in a customized DSA scenario.[16]

B. Reporting Guidelines for the Basic DSA

20. The basic DSA output includes: (i) selected economic indicators under the baseline scenario, including the evolution of debt burden indicators; (ii) latest relevant market indicators, such as risk rating, EMBI and CDS spreads;[17] (iii) the debt dynamics under the baseline scenario, which presents the contribution of different factors to the evolution of the debt-to-GDP ratio; (iv) the debt-stabilizing primary balance; (v) the maturity structure (short-term vs. medium- and long-term debt) as well as the currency composition of public debt (domestic vs. foreign currency-denominated debt); and (vi) a comparison of the evolution of debt burden indicators under the baseline, historical, constant primary balance, and, where relevant, contingent liabilities and customized scenarios (Figure 2).

21. While a DSA write-up is not required for lower scrutiny cases, commentary on the DSA output in staff documents should focus on risks to debt sustainability, where present.

- The main issue is to assess whether debt burden indicators, in particular the level and trajectory of the debt-to-GDP ratio, would remain at or below levels consistent with an acceptably low rollover risk and with preserving growth at a satisfactory level during the forecasting period taking into account cyclical considerations, not only under the baseline but also under the alternative or other plausible stressed scenarios. If not, this could suggest, among other things, that an adjustment in the primary balance may be necessary to improve the debt dynamics and guard against the risk that debt may become unsustainable.
- In this context, it would be critical to evaluate the realism of the required primary balance path by comparing it with the primary balance maintained by the country in the past and with the historical distribution of primary balances for other countries (paying appropriate attention to countries in similar economic conditions, including the debt level and their institutional settings such as the presence of fiscal rules and the exchange rate regime). Large changes in the contribution of the primary balance to the debt dynamics over the projection period (compared to history) should also be justified explicitly.

[16] If the baseline framework is sufficiently uncertain to merit an alternative scenario, the DSA output should include the results of stress tests (Figure 4) even for low debt burden countries. The alternative scenario can then be presented as a customized stress test. Alternatively, these risks may be analyzed as contingent liabilities stress tests.

[17] Instead of EMBI, AEs should use the spread over U.S. or German bonds at a similar maturity. For the U.S. (Germany), spread over German (U.S.) bonds at similar maturity should be used.

- An assessment of the realism of the projected interest-growth differential and its implications is also essential. For a given debt stock, higher interest rates mean that a larger share of public resources needs to go toward paying interest, leaving fewer resources to pay down the debt. Lower growth will bring down the debt ratio more slowly by decreasing the denominator in the debt-to-GDP ratio, and by making it more difficult to maintain large primary balances. The higher the debt ratio, the higher the interest rate and the lower growth are expected to be.
- In addition, staff should look closely at the evolution and size of the residuals in the debt dynamics (unexplained variations in the stock of public debt). Large residuals are expected to be explained.[18]
- Risks associated with particular types of financing (for example foreign currency-denominated, short-term, and domestically-issued debt) and potential bunching of maturities should be discussed. Finally, apparent inconsistencies between sovereign risk ratings, sovereign spreads, and findings of the DSA should also be flagged.

[18] Large residuals could reflect a number of factors, including: (i) the use of different definitions for the stock of debt and the fiscal balance, for example, use of general government gross debt but central government fiscal balance; and (ii) one-off factors affecting the stock of debt that are not taken into consideration in "other debt-creating flows."

Figure 2. Example of a Basic DSA

Country Public Sector Debt Sustainability Analysis (DSA) - Baseline Scenario (in percent of GDP unless otherwise indicated)

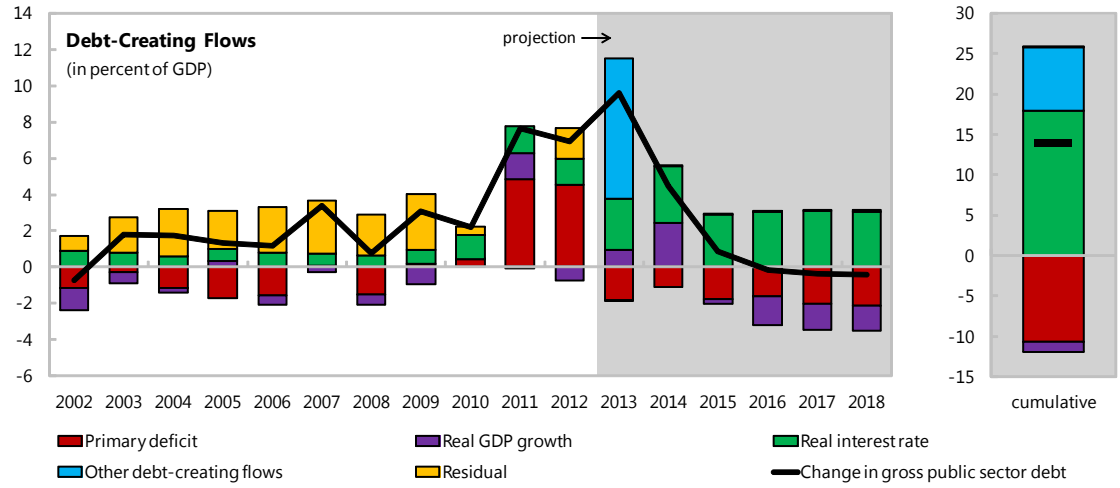
Debt, Economic and Market Indicators [1/]

	Actual			Projections					
	2002-2010	2011	2012	2013	2014	2015	2016	2017	2018
Nominal gross public debt	39.4	55.4	62.3	71.9	76.4	77.2	77.1	76.7	76.3
Public gross financing needs	-0.8	4.8	4.5	20.3	20.1	20.2	27.4	32.2	19.2
Real GDP growth (in percent)	1.3	-2.9	1.4	-1.5	-3.3	0.3	2.1	1.9	1.9
Inflation (GDP deflator, in percent)	2.9	0.9	1.0	1.0	1.0	1.3	1.3	1.4	1.6
Nominal GDP growth (in percent)	4.2	-2.0	2.4	-0.5	-2.3	1.7	3.4	3.4	3.6
Effective interest rate (in percent) [3/]	5.1	4.0	3.7	5.4	5.2	5.2	5.4	5.6	5.8

As of March 26, 2013		
Sovereign Spreads		
Spread (bp) 2/		550
CDS (bp)		575
Ratings	Foreign	Local
Moody's	Aa3	Aa3
S&Ps	AA	AA-
Fitch	AA	A

Contribution to Changes in Public Debt

	Actual			Projections							
	2002-2010	2011	2012	2013	2014	2015	2016	2017	2018	cumulative	debt-stabilizing
Change in gross public sector debt	1.6	7.65	6.93	9.6	4.5	0.9	-0.1	-0.4	-0.4	14.0	primary
Identified debt-creating flows	-0.4	7.71	5.28	9.6	4.5	0.8	-0.1	-0.4	-0.5	14.0	balance [7/]
Primary deficit	-0.8	4.8	4.5	-1.8	-1.1	-1.8	-1.7	-2.1	-2.2	-10.6	1.7
Revenue and grants	26.6	26.5	27.7	29.8	28.5	28.4	28.1	28.0	27.9	170.8	
Primary (noninterest) expenditure	25.9	31.3	32.3	28.0	27.4	26.6	26.5	26.0	25.8	160.2	
Automatic debt dynamics [4/]	0.3	2.9	0.8	3.7	5.6	2.7	1.5	1.7	1.7	16.8	
Interest rate/growth differential [5/]	0.3	2.9	0.7	3.7	5.5	2.6	1.5	1.6	1.6	16.6	
Of which: real interest rate	0.8	1.5	1.4	2.8	3.1	2.9	3.0	3.1	3.0	18.0	
Of which: real GDP growth	-0.5	1.4	-0.7	0.9	2.4	-0.3	-1.6	-1.4	-1.4	-1.3	
Other identified debt-creating flows	0.0	0.0	0.0	7.8	0.0	0.0	0.0	0.0	0.0	7.8	
Privatization receipts (negative)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Other debt-creating flows (specify)	0.0	0.0	0.0	7.8	0.0	0.0	0.0	0.0	0.0	7.8	
Residual [6/]	2.1	-0.1	1.7	-0.1	0.1	0.0	0.1	0.0	0.1	0.2	



Source: IMF staff.

1/ Public sector is defined as general government.

2/ Bond Spread over U.S. Bonds.

3/ Defined as interest payments divided by debt stock at the end of previous year.

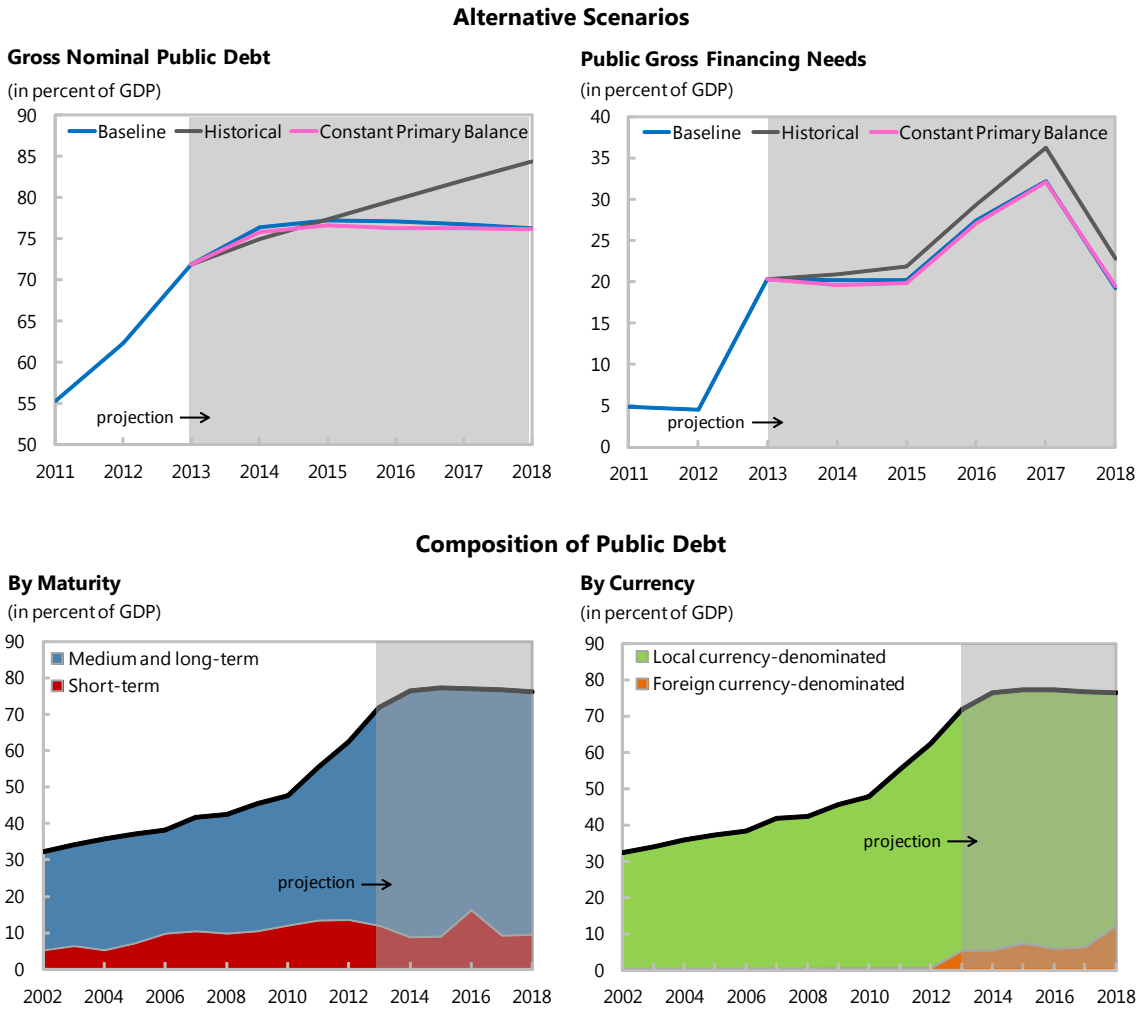
4/ Derived as [(r - p(1+g) - g + ae(1+r)]/(1+g+p+gp)) times previous period debt ratio, with r = interest rate; p = growth rate of GDP deflator; g = real GDP growth rate; a = share of foreign-currency denominated debt; and e = nominal exchange rate depreciation (measured by increase in local currency value of U.S. dollar).

5/ The real interest rate contribution is derived from the denominator in footnote 2/ as r - π (1+g) and the real growth contribution as -g.

6/ Including asset and exchange rate changes.

7/ Assumes that key variables (real GDP growth, real interest rate, and other identified debt-creating flows) remain at the level of the last projection year.

Figure 2. Example of a Basic DSA (continued)
Country Public DSA – Alternative Scenarios and Composition of Public Debt



Source: IMF staff.

V. IDENTIFYING AND ASSESSING RISKS FOR "HIGHER SCRUTINY" CASES

22. A comprehensive identification of specific risks to debt sustainability is at the core of the risk-based approach to the new MAC DSA. For countries where a granular assessment of debt sustainability risks is warranted beyond those covered in the basic DSA, the framework provides four sets of tools, in addition to fan charts, to help assess: (i) the realism of the baseline scenario;

(ii) vulnerability of the debt profile (financing structure); (iii) sensitivity of projected debt burden indicators to macro-fiscal shocks; and (iv) potential risks from the realization of contingent liabilities. These tools have been calibrated based on historical evidence to increase the automaticity and standardization of risk assessments, but without constraining teams' discretion to use their judgment to tailor the assessment of risks to specific circumstances. In such instances, teams would be expected to explain the reason for using such discretion in the review process.

A. Realism of the Baseline Scenario

23. A realistic baseline scenario for the main macroeconomic variables is key for credible assessments of sustainability. Debt dynamics are critically determined by assumptions for key macro variables, including real GDP growth, primary balance, and inflation (GDP deflator). A number of tools have been provided in the accompanying template to: (i) examine the track record in projecting macroeconomic variables relative to the track record for all other countries; (ii) assess the realism of projected fiscal adjustments relative to cross-country historical experience; and (iii) assess growth projections in countries that may have entered a boom-bust cycle. An example of the output of this module is shown in Figure 3. Although not formally assessed in this module, other important macro variables, including real interest rates, the real exchange rate, and asset changes/sales, should also be subjected to rigorous scrutiny. Staff is also encouraged to flag how projections of key variables compare to consensus, where available. While these tools are intended to help country teams in such an assessment, teams can also complement these tools with additional country-specific analyses.[19]

24. The first analytical tool in this module presents a forecast track record for growth, primary balance, and inflation. Specifically, the DSA template automatically produces a chart for each of these three variables that compare the yearly history of forecast errors (defined as actual minus projected values) for a country to the distribution of forecast errors for other MACs. The projection for each year is taken from the Spring WEO vintage at year t-1 and the actual is taken from the Spring WEO vintage at year t+2.[20] While projections may be expected to differ from actual outcomes in individual years due to unforeseen developments, consistent one-sided projection errors suggest a more systematic projection bias. To the extent that past experience can be helpful in projecting the future, these charts are intended to help calibrate realistic baseline projections. In addition to a visual representation, the template also calculates two summary statistics: (a) the median forecast error for the country from the available historical projections; and (b) the percentile rank of this median forecast error in the distribution of median forecast errors from other MACs, which may be a useful summary statistic of the extent of past biases. A low percentile reflects a median forecast error that is relatively large compared to other countries and may be an indication

[19] Staff is encouraged to use these tools to assess the realism of assumptions for all countries, not only when preparing the DSA, to inform the design of the baseline scenario.

[20] Actual outcomes are taken from the WEO vintage of year t+2 rather than from the most recent WEO vintage to account for historical revisions that appear in later vintages. Also, the vintage from year t+1 contains only an estimate of growth for the previous year for many countries.

of persistent optimism in past projections. For example, a percentile rank of 6 percent means that 94 percent of MACs had smaller projection errors in the past several years. Staff has the option to choose all MACs, program MACs, or surveillance MACs as the appropriate comparator group.

25. The second tool assesses the realism of projected fiscal adjustments based on the historical experience of countries. As argued in "Modernizing the Framework for Fiscal Policy and Public Debt Sustainability Analysis", cross-country experience provides useful insights about the prevalence of, and circumstances underpinning, large and sustained primary surpluses. The assessment of the realism of fiscal projections should consider both the adjustment in the primary balance as well as its level. Based on high debt country experience with cyclically-adjusted primary balances, closer scrutiny of the fiscal path would be required if (i) the planned cyclically-adjusted primary fiscal adjustment over any three years during the projection horizon is larger than 3 percent of GDP; or (ii) the average of the cyclically-adjusted primary balance for any consecutive 3-year period during the projection horizon is greater than 3.5 percent of GDP (Figure 3).

26. The third tool in this module compares growth assumptions to the historical experience of boom-bust cases and is only applied to countries that may be in a boom. Based on early warning models using the signal approach, a country is defined to be in a boom if the output gap has been positive for three consecutive years or the three-year cumulative change in the credit-to-GDP ratio exceeds 15 percent for EMs and 30 percent for AEs (see Table 4 below and Annexes IV and V). These benchmarks have historically been good predictors of boom-bust episodes. In such cases, the tool automatically plots the baseline growth rate against the growth experience of past boom-bust cases (Figure 3). This analysis could be useful in designing customized scenarios that better reflect boom-bust output developments.

B. Vulnerability of the Debt Financing Profile

27. The financing profile can pose risks to debt sustainability for market-access countries. As discussed in "Modernizing the Framework for Fiscal Policy and Public Debt Sustainability Analysis", debt structure characteristics—maturity, currency composition, and the creditor base—can inform the assessment of debt sustainability. A high share of short-term debt at original maturity, which may reflect the inability of certain sovereigns to issue long-term debt, and a high share of debt held by non-residents increases vulnerability to rollover and interest rate risks. A high share of foreign currency-denominated debt increases vulnerabilities to exchange rate adjustment and can put pressure on foreign exchange reserves. The nature of the creditor base—for example, whether it is diversified, reliable, captive, domestic, or foreign—also matters for rollover risk.[21] Debt distress events have typically been preceded by an increase in the shares of short-term debt and foreign currency-denominated debt and by an increase in external financing needs, which increase pressure on existing foreign exchange reserves. Bond spreads also tend to increase before debt distress episodes, although fluctuations in spreads may be related to a number of underlying factors

[21] Arslanalp and Tsuda (2012) propose risk indices to assess vulnerabilities to shifts in investor confidence.

associated with country-specific macroeconomic fundamentals and political risk, as well as other factors related to global financial conditions and investors' preferences.

28. As safeguarding market access is a key aspect of debt sustainability, greater focus on debt profile indicators is called for in the revamped DSA. The analysis gauges risks from the debt profile by comparing a set of indicators to early warning benchmarks derived from the signal approach. This approach identifies the level of the indicator that has best predicted debt crises in the past (Table 2 and Annex II).[22] In order to provide an early warning of emerging vulnerabilities and to err on the side of caution, these benchmarks from the signal approach are reduced by roughly 75 percent for EMs and 50 percent for AEs (Figure 5, Annex II).

Table 2. Debt Profile Benchmarks for AEs and EMs

Debt profile indicators	AEs[1]	EMs[1]
Bond yield spreads or EMBI global spreads (basis points) [2]	800	800
External financing requirements (percent of GDP)[3]	35	20
Public debt held by non-residents (share of total)	60	60
Public debt in foreign currency (share of total)	n.a.	80
Annual change in the share of short-term public debt at original maturity	2.0	1.5

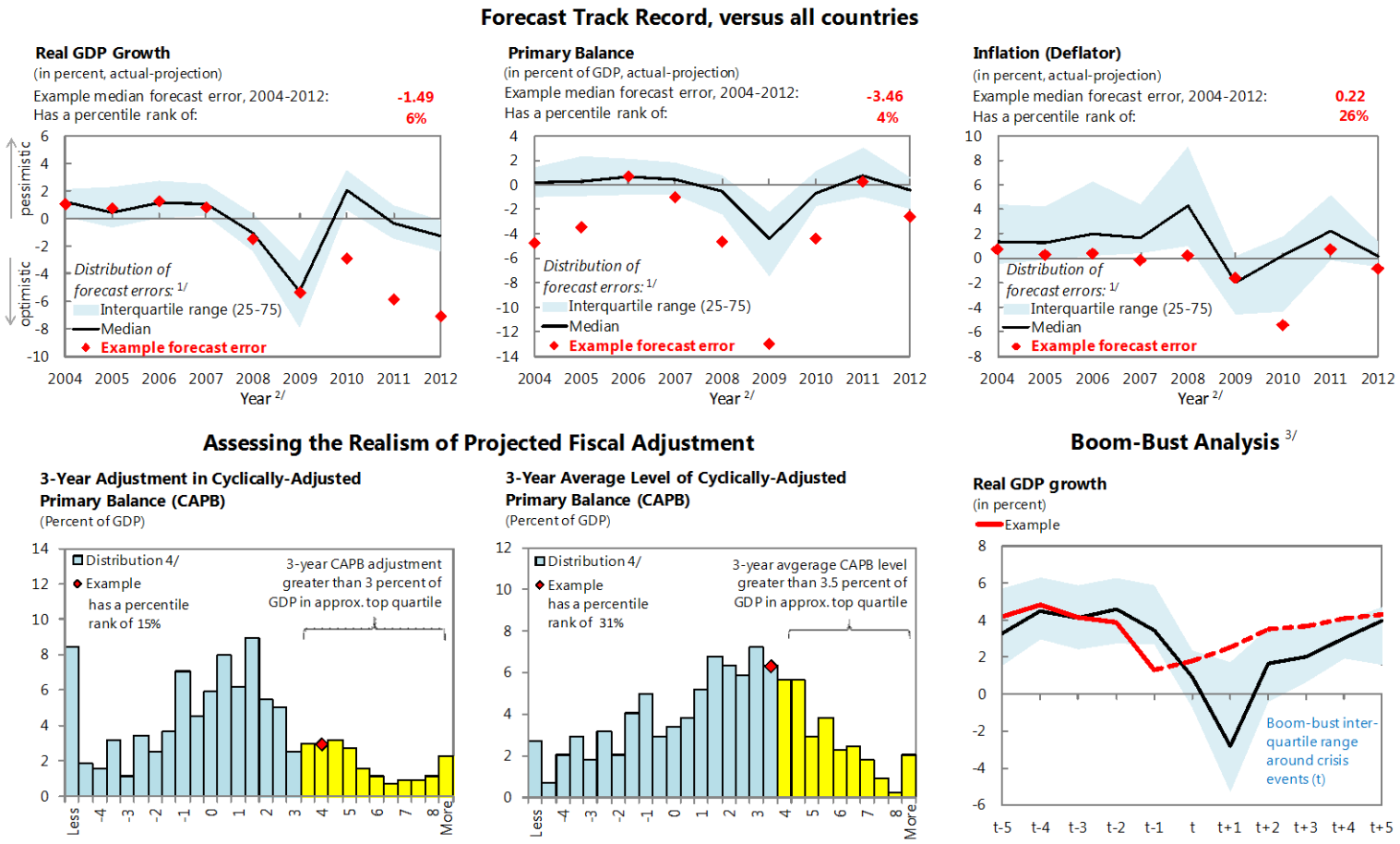
Source: Fund staff estimates.
1/ Benchmarks are rounded. See Annex II.
2/ Bond yield spreads for AEs, defined as the spread over U.S. or German bonds of similar maturity, and EMBI spreads for EMs.
3/ Defined as current account balance plus amortization of total short-term external debt at remaining maturity.

29. If a country faces risks to debt sustainability from the debt profile, staff should scrutinize the financing assumptions underlying the baseline scenario. For example, are the results from the debt profile analysis suggesting upside risks to interest rates or downside risks to external financing flows? When risks are identified, staff should consider producing an alternative scenario that would include, as relevant, higher interest rates, shorter maturities or grace periods, and a more depreciated exchange rate. This could be implemented as a customized scenario in the template.

[22] This approach has been used in other risk and vulnerability assessment exercises within the Fund to identify benchmark values of indicators that best predict various types of crises including sudden stops. For the purposes of this guidance note the benchmarks were based on predicting past episodes of debt distress as opposed to other types of crises such as sudden stops or pure banking crises that did not involve debt crises.

Figure 3. Example of Realism Module Output

Country Public DSA – Realism of Baseline Assumptions



Source: IMF staff.

1/ Plotted distribution includes all countries, percentile rank refers to all countries.

2/ Projections made in the spring WEO vintage of the preceding year.

3/ Example has had a cumulative increase in private sector credit of 44 percent of GDP, 2009-2012. For Example, t corresponds to 2013; for the distribution, t corresponds to the first year of the crisis.

4/ Data cover annual obervations from 1990 to 2011 for advanced and emerging economies with debt greater than 60 percent of GDP. Percent of sample on vertical axis.

C. Sensitivity of Debt Burden Indicators to Macro-Fiscal Shocks

30. Shocks to macro-fiscal variables could result in worsening debt dynamics. It is therefore critical to complement a baseline assessment of sustainability with an assessment that incorporates the main macro-fiscal risks. Specifically, this module assesses the implications for debt sustainability posed by shocks to the primary balance, growth, interest rate, and exchange rate. Table 3 lists the standard magnitude and duration of shocks applied in the template to these four variables. These stress tests allow for interaction among the variables, so that, for example, a lower-than-programmed primary balance is associated with higher borrowing costs. The output is a series of standardized charts shown in Figure 4.

Table 3. Summary of Macro-Fiscal Stress Tests

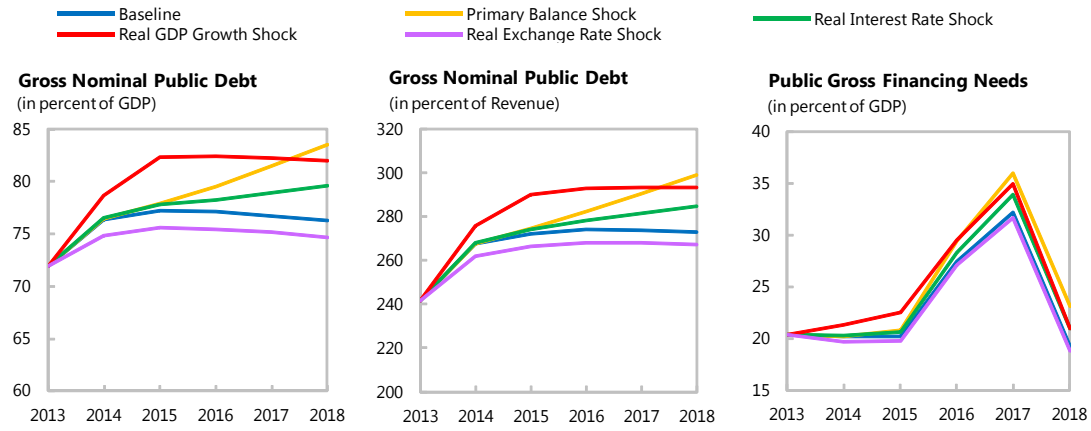
	Risk	Size and Duration of Shocks	Default Interaction
1.	Primary balance	Minimum shock equivalent to 50 percent of planned cumulative adjustment or baseline minus half of the 10-year historical standard deviation, whichever is larger.[1]	Additional borrowing leads to increase in interest rate of 25 basis points per 1 percent of GDP worsening of the deficit.[2]
2.	Real GDP growth	Real GDP growth is reduced by 1 standard deviation for 2 consecutive years.	Primary balance deteriorates (the revenue-to-GDP ratio remains the same as in the baseline, but the ratio of non-interest expenditures to GDP increases as the level of spending is kept the same as in the baseline). Deterioration in primary balance leads to higher interest rate (see above). Decline in growth leads to lower inflation (0.25 percentage point per 1 percentage point decrease in GDP growth).[3]
3.	Interest rate	Nominal interest rate increases by the difference between the maximum real interest rate over history (last 10 years) and the average real interest rate level over projection, or by 200bp, whichever is larger.[4]	Size of shock can be adjusted if risks are high (gross financing needs are higher).
4.	Exchange rate	Estimate of real exchange rate overvaluation, or maximum historical movement of exchange rate over 10 years, whichever is highest.[5]	Pass-through to inflation with default elasticity of 0.25 for EMs and 0.03 for AEs.[6]

1/ This calibration is derived from historical experience of market-access countries in missing primary balance projections taking into account cyclical considerations.
2/ See Aisen and Hauner (2008). The empirical literature finds mixed evidence on the relationship between additional borrowing and interest rates.
3/ See Chadha et al. (1992) and Roberts (1995), assuming constant growth of potential GDP.
4/ See Kaminsky and Schmuckler (2002). A rating or outlook change by credit agencies leads to an average absolute change of spreads of about 200 basis points in their sample.
5/ The estimate of real exchange rate overvaluation should be consistent with the one reported in the most recent exchange rate assessment.
6/ See Ca'Zorzi et al. (2007).

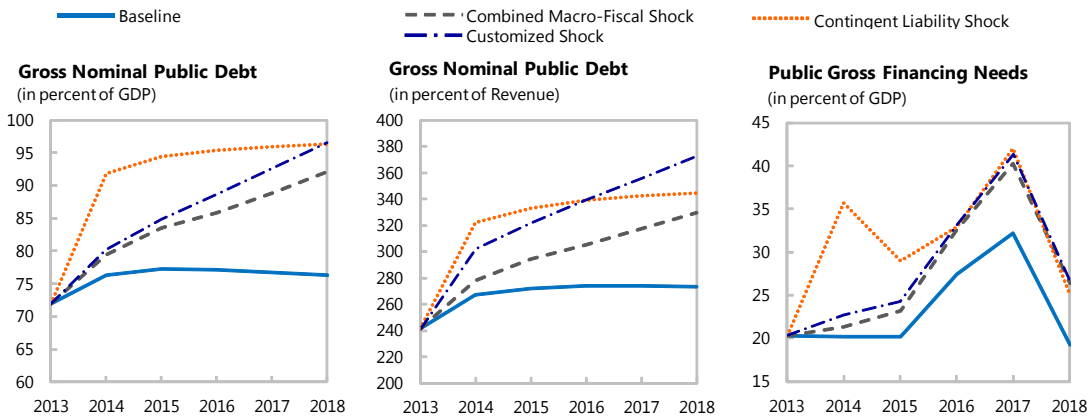
Figure 4. Example of the Output of the Macro-Fiscal Module

Country Public DSA - Stress Tests

Macro-Fiscal Stress Tests



Additional Stress Tests



Underlying Assumptions
(in percent)

Baseline Scenario	2013	2014	2015	2016	2017	2018
Real GDP growth	-1.5	-3.3	0.3	2.1	1.9	1.9
Inflation	1.0	1.0	1.3	1.3	1.4	1.6
Primary balance	1.8	1.1	1.8	1.7	2.1	2.2
Effective interest rate	5.4	5.2	5.2	5.4	5.6	5.8
Real GDP Growth Shock						
Real GDP growth	-1.5	-4.8	-1.2	2.1	1.9	1.9
Inflation	1.0	0.6	1.0	1.3	1.4	1.6
Primary balance	1.8	0.6	0.7	1.7	2.1	2.2
Effective interest rate	5.4	5.4	5.2	5.5	5.7	5.8
Real Exchange Rate Shock						
Real GDP growth	-1.5	-3.3	0.3	2.1	1.9	1.9
Inflation	1.0	4.3	1.3	1.3	1.4	1.6
Primary balance	1.8	1.1	1.8	1.7	2.1	2.2
Effective interest rate	5.4	5.4	5.2	5.3	5.7	5.8
Contingent Liability Shock						
Real GDP growth	-1.5	-3.3	0.3	2.1	1.9	1.9
Inflation	1.0	1.0	1.3	1.3	1.4	1.6
Primary balance	1.8	-13.9	1.8	1.7	2.1	2.2
Effective interest rate	5.4	5.9	6.5	6.1	6.1	6.2

Primary Balance Shock	2013	2014	2015	2016	2017	2018
Real GDP growth	-1.5	-3.3	0.3	2.1	1.9	1.9
Inflation	1.0	1.0	1.3	1.3	1.4	1.6
Primary balance	1.8	1.2	1.2	0.0	0.0	0.0
Effective interest rate	5.4	5.4	5.2	5.4	5.9	6.1
Real Interest Rate Shock						
Real GDP growth	-1.5	-3.3	0.3	2.1	1.9	1.9
Inflation	1.0	1.0	1.3	1.3	1.4	1.6
Primary balance	1.8	1.1	1.8	1.7	2.1	2.2
Effective interest rate	5.4	5.4	5.7	6.2	6.9	7.2
Combined Shock						
Real GDP growth	-1.5	-4.8	-1.2	2.1	1.9	1.9
Inflation	1.0	0.6	1.0	1.3	1.4	1.6
Primary balance	1.8	0.6	0.7	0.0	0.0	0.0
Effective interest rate	5.4	5.4	5.7	6.2	6.9	7.3
Customized Shock						
Real GDP growth	-1.5	-5.3	-1.7	0.1	-0.1	-0.1
Inflation	1.0	1.0	1.3	1.3	1.4	1.6
Primary balance	1.8	-0.9	-0.2	-0.3	0.1	0.2
Effective interest rate	5.4	5.4	5.2	5.5	5.8	6.0

Source: IMF staff.

31. The stress tests are designed to balance standardization and tailoring to country-specific circumstances. While the size and duration of the shocks presented in Table 3 should be seen as minima, the degree of interaction between variables following each shock can be adjusted to reflect country-specific information and circumstances. For example, use of country-specific estimates of revenue and expenditure elasticities is encouraged whenever available and especially when the country applies fiscal rules (see Girouard and Andre (2005) and European Commission (2005) for example). There could also be non-linearity in the revenue to GDP relationship, especially in times of crisis so that a large growth decline may lead to a decline in the revenue-to-GDP ratio. Estimates of the relationship between the output gap and primary balance (for example in Abiad and Ostry (2005), or Celasun, Debrun, and Ostry (2007)) can also be used. If inflation is particularly volatile or sensitive to the output gap, a larger decline in inflation should be considered. Also, consideration could be given to allowing some persistence in the increase in interest rate following a shock particularly if the debt level remains elevated. The sizes of the interest rate and exchange rate shocks may be adjusted in cases where historical maxima are not plausible because they reflect periods of significant distress that are not likely to be repeated. Adjustments should be transparently presented and explained during the review process and noted in the staff report or write-up when relevant.

32. A combined shock scenario is also automatically produced. When individual shocks are aggregated, care is taken to avoid double counting the effects of individual shocks that affect multiple variables. For example, a country may be vulnerable to a growth shock and a primary balance shock. In this case, the combined shock would net out the deterioration in the primary balance that results from the growth shock (through lower revenues) as it would already be reflected by the primary balance shock. As a result, the combined shock incorporates the largest effect of individual shocks on all relevant variables (real GDP growth, inflation, primary balance, exchange rate, and interest rate).

33. If the proposed stress tests do not capture adequately country-specific risks, or if the macroeconomic framework includes an alternative scenario, staff should design customized alternative DSA scenarios. The analysis of alternative scenarios is facilitated in the new template, which allows flexibility in the design of scenarios for the following variables: real GDP growth, inflation, revenue-to-GDP ratio, non-interest government expenditures-to-GDP ratio, interest rate, and exchange rate. For example, alternative scenarios could be undertaken to consider the debt sustainability impact of spillovers from a crisis in another country (macro and/or financial linkages) or could represent a no-policy-change scenario. In addition, a tailored alternative scenario may be warranted to reflect, for example, feedback loops between the sovereign and the financial sector, or to assess the impact of sudden stops of capital flows. For major commodity producers, staff should consider the impact of commodity price and volume shocks on the main drivers of public debt and design a customized scenario to assess the relevant risks.[23]

[23] Staff may also consider the behavior of the non-commodity primary balance in assessing debt sustainability.

D. Contingent Liabilities

34. Contingent liabilities (CLs) can have a significant impact on fiscal sustainability, and corresponding stress tests should therefore be included in DSAs, when appropriate.[24] CLs can arise because of explicit or implicit guarantees to banks, sub-national governments, and public or private enterprises in times of stress as well as from ongoing government intervention in the financial system. While explicit CLs are widespread, implicit CLs are found to account for the bulk of the so-called "hidden deficits"—increases in public debt that are not explained by headline fiscal balances.[25]

35. This module focuses on CLs stemming from the risk of banking crises. A set of quantitative triggers is introduced to help identify risks to debt sustainability posed by potential banking crises (Table 4 and Annex V). The quantitative triggers are defined for two variables: (i) cumulative change in private sector credit-to-GDP ratio over 3 years; and (ii) loan-to-deposit ratio. The higher the value of these indicators, the higher is the likelihood that a banking crisis, with its attendant fiscal costs, will materialize. As explained below, the size of the contingent liability shock can be standardized to past banking crises or calibrated to the specific circumstances of a particular country.

Table 4. Contingent Liabilities: Quantitative Triggers for Banking Crises[1]

	EMs	AEs
Private sector credit-to-GDP (3-year cumulative level change)	Above 15 percent	Above 30 percent
Loan-to-deposit ratio	Above 1.5	Above 1.5

Source: Fund staff estimates.
1/ Benchmarks are rounded.

36. The identification of debt sustainability risks, particularly in AEs, could also be informed by the evolution of house prices. Analytical work shows that rapid increase in house prices can be a good indicator of potential risks in AEs. In particular, an average annual increase in nominal housing prices over the preceding 5-year period in excess of 7.5 percent has also been found to be a useful indicator of banking crises in the case of AEs (see Annex V).

37. Findings of the Financial System Stability Assessment (FSSA) should also inform the identification of financial sector risks. As the full range of analytical outputs typically prepared for the FSSA exercise is ultimately integrated in the Risk Assessment Matrix (RAM), this tool could act as

[24] For further guidance on the treatment of contingent liabilities see Hemming et al. (2006), Cebotari (2008), Cebotari et al. (2008) and Everaert et al. (2009). Other useful references include Polackova, Brixi and Schick (2002), OECD (2001 and 2005), Irwin (2003, 2007) and the IMF's Fiscal Transparency Manual.

[25] See for example, Cebotari et al. (2008); Panizza et al. (2006); and Kharas and Mishra (2001).

an interface between financial sector assessments and debt sustainability analyses.[26] The RAM provides a qualitative assessment and a rating (high, medium, or low) of the likelihood that the risks will be exposed by shocks over a three-year horizon. A contingent liability shock should be undertaken for both higher and lower scrutiny cases whenever (i) the quantitative triggers are breached or (ii) financial sector vulnerabilities are identified in the FSSA, or by the country team in the absence of a recent FSSA.

38. If a quantitative trigger is breached, a standard financial CL shock based on the size of the banking system will be automatically generated. A recent study (Laeven and Valencia (2012)) estimates that the gross fiscal outlays for financial system bailouts averaged about 10 percent of financial system assets. The shock is calibrated to gross rather than net fiscal outlays since asset recovery often takes many years and is highly uncertain. Many studies have also shown that contingent liability shocks are associated with a significant output loss. Therefore, the standard contingent liability shock also includes a one standard-deviation shock to growth and resulting deterioration of the primary balance, increase in interest rates, and decrease in inflation (see growth shock in Table 3).

39. The calibration of the standard shock should be tailored to country-specific circumstances. In particular, fiscal costs would be dependent on (i) whether potential banks at risk are domestically- or foreign-owned; (ii) the likely magnitude of government's intervention; (iii) the specific bail-in mechanism; and (iv) resolution strategies adopted in the past—such as the provision of unlimited deposit guarantees, open-ended liquidity support, repeated recapitalizations, and regulatory forbearance.[27] The write-up should discuss the calibration of the contingent liability shock when it diverges from the standard calibration.

40. Staff is strongly encouraged to identify vulnerabilities and calibrate stress tests associated with other possible sources of CLs. Other such possible sources include natural disasters, failures of Public-Private Partnerships (PPPs), bailouts of state-owned enterprises (SOEs) and subnational government defaults which, in some countries, may present the most significant risk to debt sustainability."Fiscal Risks—Sources, Disclosure, and Management" provides guidance on identification of fiscal risks beyond the central government. A country's history should inform its vulnerability to natural disasters. Information on a country's history of natural disasters can be found online at: http://www.emdat.be. Staff is encouraged to look at the last 10 years of history to guide their assessment of likelihood of occurrence of natural disasters and the magnitude of costs. The government's use of hedging instruments to absorb the costs should also be considered as a

[26] The Risk Assessment Matrix was formally introduced in "Financial Sector Assessment Program After Ten Years—Experience and Reforms for the Next Decade". Its use as a framework for approaching financial stability issues in Article IV consultations was discussed in "Financial Sector and Bilateral Surveillance – Toward Further Integration".

[27] Useful references that may be helpful in calibrating the shock include Laeven and Valencia (2012) and Claessens, Kose and Terrones (2008), which provide a wide range of estimates of the fiscal costs and output losses of past banking crises for many AEs and EMs. The calibration of the banking CL stress test could also be informed by the results of the stress tests implemented in the financial sector assessment program. However, these stress tests come in several varieties, and should therefore be used with caution to calibrate the banking stress test in the DSA.

mitigating factor. In general, staff is encouraged to investigate weaknesses in any sector that may present significant implicit or explicit contingent liabilities. Non-financial sector CL shocks should be analyzed in the DSA as customized scenarios.

41. When discussing CLs in DSAs, especially ones associated with the financial system, staff should be mindful of confidentiality policies, moral hazard, and market sensitivity issues.[28] The Fund's Transparency Policy defines the key elements of the IMF's policy on publication of Board documents, including safeguards to maintain the frankness of policy discussions with members and the appropriate balance between transparency and confidentiality. These safeguards include the possibility for members to request deletions of highly market-sensitive material.

E. Fan Charts

42. Fan charts provide a probabilistic view of the uncertainty around the baseline. While the stress tests presented above assess the sensitivity of debt dynamics to key exogenous and policy variables, fan charts show a spectrum of possible outcomes based on the stochastic properties of country-specific data. In particular, fan charts incorporate feedback between macroeconomic variables that drive the debt dynamics and can rely on historical data to calibrate the persistence of shocks. A simple fan chart tool designed by FAD is included in the MAC DSA template and is required for higher scrutiny countries (Box 4). Staff should present both a symmetric fan chart for which upside and downside risks are treated as equally likely, as well as an asymmetric fan chart representing staff's best assessment of the likelihood of shocks.

43. The fan charts provided in the template can be complemented by alternative fan charts based on vector autoregression. If staff includes fan charts based on other methodologies, staff should clearly point out the underlying assumptions including (i) the sample period; (ii) variables included in the underlying model and lag length; (iii) inclusion/exclusion of a fiscal policy reaction function; and (iv) the definition of the central scenario (macroeconomic framework or the projection of the underlying model). Staff can also draw on the work already undertaken in the context of the vulnerability exercises to produce fan charts.[29]

[28] Note that requirements to assess fiscal risks associated with the assumption of CLs are part of internationally-accepted accounting and statistical standards. The International Public Sector Accounting Standards (IPSAS) for accrual accounting require disclosure of contractual contingent liabilities when the possibility of payment is "not remote." Under cash accounting, disclosure similar to that under accrual standards is recommended, though not required. Disclosure of key contingent liabilities is also required as a memorandum item to the balance sheet under statistical reporting standards, such as the Government Finance Statistics Manual 2001, while further risk disclosure recommendations are included in various fiscal transparency initiatives, such as the IMF Code of Good Practices on Fiscal Transparency, the IMF Manual on Fiscal Transparency, and the OECD Best Practices.

[29] So far, fan charts have been estimated for 26 EMs (Hungary, Latvia, Turkey, Iceland, Croatia, Israel, Lithuania, Poland, Romania, Russia, Ukraine, Brazil, India, Mexico, South Africa, Dominican Republic, Malaysia, Thailand, Venezuela, Bulgaria, Estonia, China, Korea, Chile, Indonesia, and Peru) and for 3 AEs (Greece, Ireland, and Portugal).

Box 4. Fan Charts

Fan charts present the possible evolution of the debt-to-GDP ratio (frequency distribution) over the medium term. Fan charts are constructed by looking at the impact on the debt-to-GDP ratio of simulating a large number of shocks to relevant macroeconomic variables.

The fan chart tool, designed by FAD and incorporated in the MAC DSA template, relies on historical annual data for: (i) real GDP growth; (ii) the effective real interest rate on government debt; (iii) the variation in the real exchange rate; and (iv) the primary balance in percent of GDP. Country-specific historical data are used to generate the sample means and the variance-covariance matrix that define the joint normal distribution for these variables. Draws for each of the variables from the joint distribution are used to generate shocks that are added to the baseline projections for each of the variables and fed into the debt evolution identity equation to calculate a distribution of projected debt paths.

By construction, a joint normal distribution of shocks would generate a symmetrical fan chart, with upside risks matching downside risks. To improve the relevance of fan charts, staff should also modify the assumption of joint normality by considering a relevant range of shocks. For example, there may be reason to believe negative shocks to the primary balance should be more likely than positive shocks for some countries at certain times. This could be the case if a country has programmed a large fiscal consolidation. Similarly, in cases when the real exchange rate is significantly overvalued and the baseline scenario incorporates only marginal adjustment, we may expect future shocks to be biased toward depreciation. The template is designed to allow staff to make modifications to the size of potential shocks in a straightforward and user-friendly manner.

The increasing spread of the distribution over the projection period (Figure 5) is due to the increased uncertainty over time, since the shocks compound over the years. Accordingly, if every year simulations lead to adverse shocks (e.g., low real GDP growth), then the debt-to-GDP ratio will increase and evolve along a path in the upper bands of the fan chart distribution. Alternatively, if every year simulations lead to positive shocks (e.g., high real GDP growth), then the debt-to-GDP ratio will decline and evolve along a path in the lower bands of the fan chart distribution.

This fan chart tool provides a probabilistic view of the evolution of the debt-to-GDP ratio over the medium term. However, to keep the computational requirements manageable, shocks are drawn taking into account only the contemporaneous correlations between variables—the tool does not take into account intertemporal correlations between variables or the potential autocorrelation of the individual variables.

VI. REPORTING OF RISKS FOR "HIGHER SCRUTINY" CASES

44. In higher scrutiny cases, reporting of risks comprises two elements: (i) a write-up to discuss the identified risks to debt sustainability; and (ii) a heat map and two fan charts to summarize such risks. While the previous section discussed the new toolkit to help identify risks to debt sustainability, this section provides a framework for reporting of risks. The idea is to complement the findings and the write-up from the basic DSA discussed in Section IV.

A. Guidelines for the Write-up on Risks to Debt Sustainability

45. The write-up should discuss country-specific factors that mitigate or amplify risks. It should provide an explanation for the main assumptions used in the tools and the key results from the various modules available to assess risks to debt sustainability. It could include a discussion of relevant structural breaks, for example, in the institutional setting or policy regime that reduce the relevance of a country's historical performance. In line with the considerations mentioned in paragraph 21, the discussion in the write-up could include but not be limited to the following:

- *Realism of the baseline scenario:* Are the projections for the primary balance realistic (see paragraph 25)? A projected primary surplus close to or at the maximum level sustained by the country in the past or by comparable countries would leave little or no room for accommodating the materialization of downside macro-fiscal risks. The assessment needs to consider whether past primary surpluses were an appropriate comparator, taking into account the debt level. Has any bias uncovered in historical projections been addressed? Are assumptions about growth consistent with planned fiscal adjustment? What factors underlie the projected interest rate-growth differential? Is the differential consistent with the debt level? Are there reasons to believe that a country in a boom of at least three years should not be concerned about a potential bust?

- *Debt profile risks:* Are the early warning benchmarks identifying vulnerabilities appropriately? Did the identification of vulnerabilities lead to the design of a customized stress test? Are large external financing needs exacerbating the risks associated with a large share of foreign currency public debt or with contingent liabilities?

- *Macro-fiscal risks and contingent liabilities:* Are risks to the debt indicator paths manageable in the event of shocks to key macroeconomic variables? For example, is the projected fiscal consolidation reflecting cyclical fluctuations or large movements in commodity prices? What changes were introduced to the design and/or calibration of stress tests? What are the factors that may suggest the country can carry a debt burden larger (or lower) than suggested by the benchmarks used in the risk assessment?

46. In cases where debt is judged to be unsustainable or in high-debt cases where sustainability is in question, staff may discuss estimates of maximum sustainable primary balances as well as estimates of maximum sustainable debt ranges. Discussion of maximum sustainable primary balances should include the relevant country-specific determinants. If staff concludes that debt is unsustainable under any feasible primary surplus path, care should be taken to explain why a higher primary surplus is not feasible. Annex VI presents selected quantitative methods that can be used to estimate country-specific maximum sustainable debt ranges.[30]

[30] See Jarmuzek and Miao (forthcoming) for further details.

B. Summarizing Risks: Heat Map and Fan Charts

47. The heat map is intended convey risks in a standardized and transparent way. Reported risks can be classified as high (colored in red), moderate (yellow), or low (green). The sections below describe how the results from the tools discussed in the previous sections are represented in the heat map.

Debt Profile Risks

48. For debt profile risks, the assessment depends on a comparison of the latest data available to benchmarks (Tables 5a, 5b and Annex II).[31] In order to provide an early warning of emerging risks, and to err on the side of caution, a country is deemed to be at high risk with respect to a particular indicator when recent data are above 75 percent of the benchmarks for that indicator. Countries are deemed at a low risk when recent data are below 25 percent of the benchmark for EMs and 50 percent for AEs. Otherwise, countries are deemed to be at a moderate risk.

Table 5a. Risk Assessment for EMs: Debt Profile[1]

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 (percent of GDP)[2]	Below 5	Between 5 and 15	Above 15
Public debt in foreign currency (share of total)	Below 20	Between 20 and 60	Above 60
Change short-term public debt (in percent of total debt) [3]	Below 0.5	Between 0.5 and 1.0	Above 1.0
Public debt held by non-residents (share of total)	Below 15	Between 15 and 45	Above 45

Source: Fund staff estimates.
1/ Benchmarks are rounded.
2/ Defined as current account balance plus amortization of total short-term external debt at remaining maturity.
3/ Annual change in short-term public debt (at original maturity) as a percent of total public debt.

[31] For bond and EMBIG spreads, staff should use an average of the last 3 months in order to smooth short-term fluctuations.

Table 5b. Risk Assessment for AEs: Debt Profile[1]

Debt profile indicators	Low risk	Moderate risk	High risk
Bond spreads (basis points)[2]	Below 400	Between 400 and 600	Above 600
External financing requirements (percent of GDP) [3]	Below 17	Between 17 and 25	Above 25
Change short-term public debt (in percent of total debt) [4]	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

Source: Fund staff estimates.
1/ Benchmarks are rounded.
2/ Bond spreads are defined as the spread over U.S. or German bonds at similar maturity.
3/ Defined as current account balance plus amortization of total short-term external debt at remaining maturity.
4/ Annual change in short-term public debt (at original maturity) as a percent of total public debt.

Macro-Fiscal and Contingent Liabilities Modules

49. Macro-fiscal and CLs risks are measured in relation to certain benchmarks for the debt-to-GDP and GFN-to-GDP ratios (Table 6 and Annex II). These benchmarks should not be construed as levels beyond which debt distress is likely or inevitable, but rather as an indication that risks increase with the level of indebtedness. The proposed benchmarks for the gross debt-to-GDP ratio and gross financing needs-to-GDP ratio capture two important concepts related to debt difficulties, namely, solvency and liquidity respectively. Different benchmarks are used for AEs and EMs, with benchmarks for AEs higher than those for EMs, which is consistent with empirical analysis (Table 7). In order to differentiate countries within the higher scrutiny group for the purposes of the heat map, the debt level indicator benchmark derived from the signal approach is increased by about 20 percent (to 70 for EMs and 85 for AEs). The determination of the appropriate threshold is done automatically in the template.

50. Macro-fiscal and CLs risks are measured by their impact on debt burden indicators under both the baseline and stressed scenarios. If the baseline debt-to-GDP ratio is above the benchmark in the current or any projection year, this high risk (red) would, a fortiori, carry over for all stressed tests (the second column entry in Table 6 would also be red). A debt-to-GDP ratio below the benchmark in the baseline but above it under stressed scenarios in any projection year would translate into a relatively moderate risk (yellow) for that specific stress test. A debt-to-GDP ratio below the benchmark under the baseline and a stress test would translate into a relatively low risk (green) for that specific stress test. A similar risk assessment applies to GFN-to-GDP ratio.

Table 6. Risk Assessment: Macro-Fiscal Risks and Contingent Liabilities
(done automatically for all stress tests)

	Baseline above benchmark	Stress test above benchmark
High (red)	**Yes**	**Yes**
Moderate (yellow)	**No**	**Yes**
Low (green)	**No**	**No**

Source: Fund staff estimates.

Table 7. Debt Burden Benchmarks

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

Source: Fund staff estimates.

Heat Map

51. The heat map (Figure 5) summarizes in a standardized way the risks to debt sustainability from the various modules in the template. The first and second rows of the heat map present the impact from macro-fiscal (primary balance, real GDP growth, real interest rate, and exchange rate) and contingent liabilities shocks on the debt-to-GDP ratio and the gross financing needs-to-GDP ratio. The third row summarizes the likelihood of risks from the debt profile (bond spread, reserves to short-term debt ratio, external financing requirements, the share of short-term debt, and the share of foreign currency debt).

52. The heat map does not produce an overall debt rating. Instead it is meant to summarize in one place the results from the tools used in the DSA for assessing risks to debt sustainability. Combined with the DSA write-up and fan charts, it is intended to contribute to an objective summary of debt sustainability. However, in summarizing risks these tools do not go to the extent of the Debt Sustainability Framework for Low-Income Countries (LIC DSF),[32] which produces an overall risk of debt distress rating. Results from the heat map and fan charts should be interpreted carefully and country-specific factors, discussed in the write-up, should inform the assessment of risks.

[32] See Staff Guidance Note on the Application of the Joint Fund-Bank Debt Sustainability Framework for Low-Income Countries (SM/10/16).

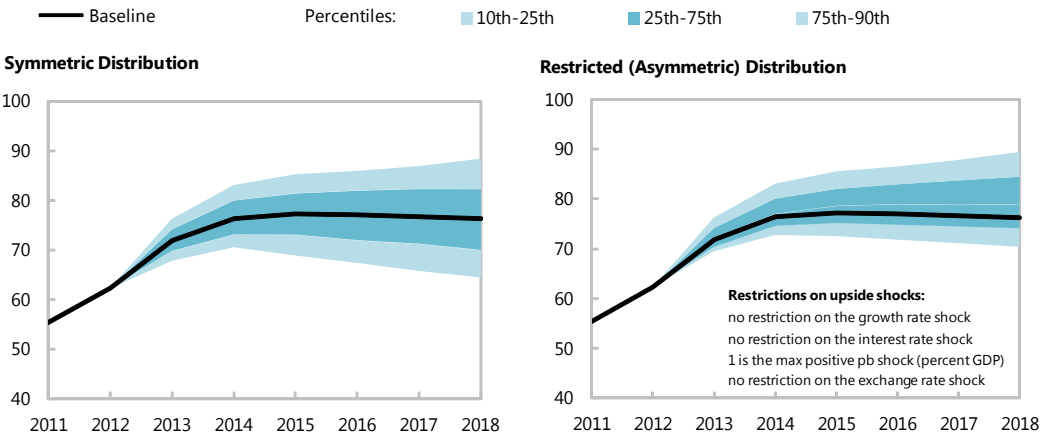
Figure 5. Example of a Heat Map
Country Public DSA Risk Assessment

Heat Map

Debt level [1/]	Real GDP Growth Shock	Primary Balance Shock	Real Interest Rate Shock	Exchange Rate Shock	Contingent Liability shock
Gross financing needs [2/]	Real GDP Growth Shock	Primary Balance Shock	Real Interest Rate Shock	Exchange Rate Shock	Contingent Liability Shock
Debt profile [3/]	Market Perception	External Financing Requirements	Change in the Share of Short-Term Debt	Public Debt Heldy by Non-Residents	Foreign Currency Debt

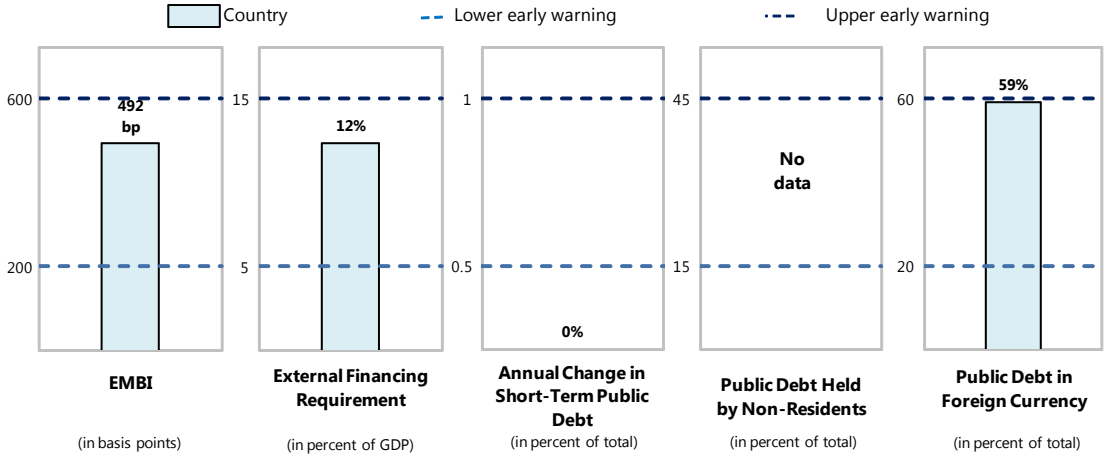
Evolution of Predictive Densities of Gross Nominal Public Debt

(in percent of GDP)



Debt Profile Vulnerabilities

(Indicators vis-à-vis risk assessment benchmarks)



Source: IMF staff.

1/ The cell is highlighted in green if debt burden benchmark is not exceeded under the specific shock or baseline, yellow if exceeded under specific shock but not baseline, red if benchmark is exceeded under baseline, white if stress test is not relevant.

2/ The cell is highlighted in green if gross financing needs benchmark of 15% is not exceeded under the specific shock or baseline, yellow if exceeded under specific shock but not baseline, red if benchmark is exceeded under baseline, white if stress test is not relevant.

3/ The cell is highlighted in green if country value is less than the lower risk-assessment benchmark, red if country value exceeds the upper risk-assessment benchmark, yellow if country value is between the lower and upper risk-assessment benchmarks. If data is unavailable, cell is white. Lower and upper risk-assessment benchmarks are: 200 and 600 basis points for EMBI spreads; 5 and 15 percent of GDP for external financing requirement; 0.5 and 1.0 percent for change in the share of short-term debt; 15 and 45 percent for the public debt held by non-residents; and 20 and 60 percent for the share of foreign-currency denominated debt.

54. Countries that are classified under the "higher scrutiny" category are also required to produce two fan charts. One fan chart is intended to produce a symmetric distribution of risks. The other is not intended to be centered on the baseline and should present the team's best assessment of the likely balance of risks. The provided tool in the template allows in a simple manner for shocks to be distributed asymmetrically around the baseline. Thus, for example, when the baseline already incorporates a significant adjustment in the primary balance, it is expected that teams would cut off the upward distribution of shocks so that underperformance of the fiscal balance is more likely than overperformance (Box 4).

VII. PROCESS ISSUES

55. A DSA should be prepared at least once a year for program countries (at each review for exceptional access cases) and at the time of the Article IV consultation for non-program countries. DSAs should be undertaken for all requests for UFR in the GRA. Thereafter, DSAs should be done on an annual basis for program countries, unless developments in the outlook for public debt warrant a more frequent analysis. However, for exceptional access countries, an updated DSA should be included in every review.[33]

56. Early engagement between area departments and SPR would be required to identify risks and design alternative scenarios. For Article IV consultations, it is expected that the engagement start 3–6 months before the mission. In most cases this would mean consultation during the preparation for the staff visit that typically precedes the Article IV mission. For program countries, consultation should start as early as possible. This would allow reviewing departments (SPR in particular) to provide early input and facilitate convergence of views on the assumptions underlying the DSA and the interpretation of its results.

57. Staff should discuss the results of the DSA with the authorities, especially for exceptional access and high debt countries. The write-up should highlight the authorities' views, particularly when those differ from the staff's, including on the baseline scenario or the calibration of stress tests and alternative scenarios. Issues related to the market sensitivity of the analysis would be addressed in the context of the Fund's transparency policy.

[33] This requirement does not constitute an additional element of the procedural requirements under the exceptional access policy.

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Annex I. Debt Dynamics

This annex presents the analytical derivation of the evolution of the public debt-to-GDP ratio.

The level of public debt

The market-access country (MAC) debt sustainability analysis (DSA) framework is based on a general and flexible identity characterizing the evolution of the stock of public debt. In its most basic form, the evolution of public debt can be characterized in the following way:

$$D_{t+1} = \frac{e_{t+1}}{e_t} * (1 + i^f_{t+1}) * D^f_t + (1 + i^d_{t+1}) * D^d_t - (T_{t+1} + G_{t+1} - S_{t+1}) + O_{t+1} + RES_{t+1} \quad (1)$$

Obligations associated with the stock of debt from the previous period

Primary Fiscal Balance

Other one-time factors

Where subscripts refer to time periods and superscript *"f"*, *"d"*, refer to foreign-currency and domestic-currency denominated debt, respectively.

D^f_t is the stock of foreign currency-denominated debt at the end of period t.
D^d_t is the stock of local currency-denominated debt at the end of period t.
e_{t+1} is the nominal exchange rate (LC/USD) at the end of period t+1.
i^f_{t+1} is the effective nominal interest rate on foreign currency-denominated debt in period t+1.
i^d_{t+1} is the effective nominal interest rate on local currency-denominated debt in period t+1.
T_{t+1} is total public sector revenues in local currency (LC) in period t+1.
G_{t+1} is total grants to the public sector in local currency (LC) in period t+1.
S_{t+1} is public expenditures excluding interest payments in local currency (LC) in period t+1.
O_{t+1} is other identified debt-creating flows in period t+1. These are flows having an impact on the level of debt that are not captured by the public sector fiscal balance. They include items such as: (i) privatization receipts; (ii) recognition of contingent liabilities; (iii) debt relief; and (iv) other specific items such as bank recapitalization.
RES_{t+1} is a residual ensuring that the identity holds. In order to minimize the residual the user should ensure that there is consistency between the definition of the stock and flow variables.

For simplification, the primary balance (PB) is no longer decomposed into taxes (T), grants (G) and expenditures (S). The basis for the decomposition of the change in the debt-to-GDP ratio—the debt dynamic—is as follows:

$$D_{t+1} = (1+\varepsilon_{t+1})*(1+i^f_{t+1})*D^f_t + (1+i^d_{t+1})*D^d_t - PB_{t+1} + O_{t+1} + RES_{t+1} \quad (2)$$

$$\text{where, } 1+\varepsilon_{t+1} = \frac{e_{t+1}}{e_t}$$

The debt-to-GDP ratio and debt dynamics

In order to measure the debt burden, it is appropriate to scale the stock of debt by a measure of repayment capacity. Because the template focuses on the evolution of the debt-to-GDP ratio, this section presents only the decomposition of this ratio.

Dividing equation (2) by nominal GDP in local currency (Y) in period t+1, yields the following expression:

$$\frac{D_{t+1}}{Y_{t+1}} = (1+\varepsilon_{t+1})*(1+i^f_{t+1})*\frac{D^f_t}{Y_{t+1}} + (1+i^d_{t+1})*\frac{D^d_t}{Y_{t+1}} - \frac{PB_{t+1}}{Y_{t+1}} + \frac{O_{t+1}}{Y_{t+1}} + \frac{RES_{t+1}}{Y_{t+1}}$$

Using small caps to express contemporaneous ratios:

$$d_{t+1} = (1+\varepsilon_{t+1})*(1+i^f_{t+1})*\frac{D^f_t}{Y_{t+1}} + (1+i^d_{t+1})*\frac{D^d_t}{Y_{t+1}} - pb_{t+1} + o_{t+1} + res_{t+1}$$

Let $Y_{t+1} = (1+g_{t+1})*(1+\pi^d_{t+1})*Y_t$, where g is the real growth rate of the economy and π is domestic inflation (as measured by the change in the GDP deflator), we can further define the previous expression:

$$d_{t+1} = \frac{(1+\varepsilon_{t+1})*(1+i^f_{t+1})*D^f_t}{(1+g_{t+1})*(1+\pi_{t+1})*Y_t} + \frac{(1+i^d_{t+1})*D^d_t}{(1+g_{t+1})*(1+\pi_{t+1})*Y_t} - pb_{t+1} + o_{t+1} + res_{t+1}$$

Deducting d_t from both sides, the change in the debt-to-GDP ratio (the debt dynamic) is therefore:

$$d_{t+1} - d_t = \frac{(1+\varepsilon_{t+1})*(1+i^f_{t+1})}{(1+g_{t+1})*(1+\pi_{t+1})}*d^f_t + \frac{(1+i^d_{t+1})}{(1+g_{t+1})*(1+\pi_{t+1})}d^d_t - pb_{t+1} + o_{t+1} + res_{t+1} - d_t$$

Let $\rho_{t+1} = (1+g_{t+1})*(1+\pi_{t+1})$:

$$d_{t+1} - d_t = \frac{1}{\rho_{t+1}}\left[(1+\varepsilon_{t+1})*(1+i^f_{t+1})*d^f_t + (1+i^d_{t+1})*d^d_t\right] - pb_{t+1} + o_{t+1} + res_{t+1} - d_t$$

Isolating the contribution from the exchange rate,

$$d_{t+1} - d_t = \frac{1}{\rho_{t+1}}\left[(1+i^f_{t+1})*d^f_t + (1+i^d_{t+1})*d^d_t + \varepsilon_{t+1}*(1+i^f_{t+1})*d^f_t\right] - pb_{t+1} + o_{t+1} + res_{t+1} - d_t$$

Moving the right-hand side d_t inside the brackets…

$$d_{t+1}-d_t=\frac{1}{\rho_{t+1}}\left[(1+i^f_{t+1})*d^f_t+(1+i^d_{t+1})*d^d_t+\varepsilon_{t+1}*(1+i^f_{t+1})*d^f_t-d_t*(1+g_{t+1})*(1+\pi^d_{t+1})\right]-pb_{t+1}+o_{t+1}+res_{t+1}$$

Isolating the contribution from real GDP growth,

$$d_{t+1}-d_t=\frac{1}{\rho_{t+1}}\left[(1+i^f_{t+1})*d^f_t+(1+i^d_{t+1})*d^d_t+\varepsilon_{t+1}*(1+i^f_{t+1})*d^f_t-d_t*g_{t+1}-d_t*(1+\pi_{t+1}*g_{t+1}+\pi_{t+1})\right]-pb_{t+1}+o_{t+1}+res_{t+1}$$

Isolating the contribution from interest rates,

$$d_{t+1}-d_t=\frac{1}{\rho_{t+1}}\left[i^f_{t+1}*d^f_t+i^d_{t+1}*d^d_t+d^f_t+d^d_t+\varepsilon_{t+1}*(1+i^f_{t+1})*d^f_t-d_t*g_{t+1}-d_t*(1+\pi_{t+1}*g_{t+1}+\pi_{t+1})\right]-pb_{t+1}+o_{t+1}+res_{t+1}$$

$$d_{t+1}-d_t=\frac{1}{\rho_{t+1}}\left[i^f_{t+1}*d^f_t+i^d_{t+1}*d^d_t+\varepsilon_{t+1}*(1+i^f_{t+1})*d^f_t-d_t*g_{t+1}+d^f_t+d^d_t-d_t-d_t*(\pi_{t+1}*g_{t+1}+\pi_{t+1})\right]-pb_{t+1}+o_{t+1}+res_{t+1}$$

$$d_{t+1}-d_t=\frac{1}{\rho_{t+1}}\left[i^f_{t+1}*d^f_t+i^d_{t+1}*d^d_t+\varepsilon_{t+1}*(1+i^f_{t+1})*d^f_t-d_t*g_{t+1}-d_t*\pi_{t+1}*(1+g_{t+1})\right]-pb_{t+1}+o_{t+1}+res_{t+1}$$

$$d_{t+1}-d_t=\frac{1}{\rho_{t+1}}\left[d_t*\left(\frac{i^f_{t+1}*d^f_t}{d_t}+\frac{i^d_{t+1}*d^d_t}{d_t}\right)-d_t*\pi_{t+1}*(1+g_{t+1})+\varepsilon_{t+1}*(1+i^f_{t+1})*d^f_t-d_t*g_{t+1}\right]-pb_{t+1}+o_{t+1}+res_{t+1}$$

$$d_{t+1}-d_t=\frac{1}{\rho_{t+1}}\left[d_t*i_{t+1}-d_t*\pi_{t+1}*(1+g_{t+1})+\varepsilon_{t+1}*(1+i^f_{t+1})*d^f_t-d_t*g_{t+1}\right]-pb_{t+1}+o_{t+1}+res_{t+1}$$

Where i_{t+1} is the effective nominal interest rate (weighted average)

$$d_{t+1}-d_t=\frac{1}{\rho_{t+1}}\left[d_t*(i_{t+1}-\pi_{t+1}*(1+g_{t+1}))+\varepsilon_{t+1}*(1+i^f_{t+1})*d^f_t-d_t*g_{t+1}\right]-pb_{t+1}+o_{t+1}+res_{t+1}$$

Contribution of the effective interest rate	Contribution of the exchange rate	Contribution of real GDP growth	Contribution of primary balance and other factors

This can also be expressed in terms of real interest rates and real exchange rates:

$$d_{t+1}-d_t=\left(\frac{1}{1+g_{t+1}}\right)*\left(d_t*\left[r^d_{t+1}\frac{d^d_t}{d_t}+r^f_{t+1}*\frac{d^f_t}{d_t}\right]-d_t*g_{t+1}+d^f_t*\xi_{t+1}*(1+r^f_{t+1})\right)-pb_{t+1}+o_{t+1}+res_{t+1}$$

Contribution of the effective real interest rate	Contribution of real GDP growth	Contribution of the real exchange rate	Contribution of primary balance and other factors

Where,

$$(1+i^{d}_{t+1}) = (1+r^{d}_{t+1}) * (1+\pi^{d}_{t+1})$$

$$(1+i^{d}_{t+1}) = (1+r^{f}_{t+1}) * (1+\pi^{f}_{t+1})$$

$$1+\xi_{t+1} = \frac{e_{t+1}}{e_t}\left(\frac{1+\pi^{f}_{t+1}}{1+\pi^{d}_{t+1}}\right)$$

Annex II. Debt Burden and Debt Profile Risk Benchmarks

This annex discusses the calibration of benchmarks for two distinct elements of the MAC DSA framework: (i) debt burden benchmarks used in the risk assessment; and (ii) benchmarks for the debt profile risk indicators. These benchmarks are discussed in parallel as they reflect the application of the same methodology (signal approach). The signal approach is applied to EM-only and AE-only samples separately to reflect different characteristics of EMs and AEs, and because the definition of debt distress is different for EMs and AEs. Countries are designated as EMs or AEs based on their WEO classification.

Definition of debt distress events[1]

For EMs, debt distress events are defined as:

1) Default: arrears on principal or interest payments to commercial or official creditors;
2) Restructuring and rescheduling: any operation which alters the original terms of the debtor-creditor contract; or
3) IMF financing: addressing liquidity issues associated with sovereign debt distress.

For AEs, debt distress events are defined as:[2]

1) Default: a sovereign not current on its debt obligations (Standard and Poor's definition);
2) Restructuring and rescheduling: any operation which alters the original terms of the debtor-creditor contract;
3) IMF financing: in excess of 100 percent of quota;
4) Inflation: greater than 35 percent per annum; or
5) Sovereign spreads: greater than 1000 basis points or 2 standard deviations from the country average.

Debt burden and debt profile risk indicators

While the same debt burden indicators are used for EMs and AEs (general government debt in percent of GDP and gross public financing requirements in percent of GDP), different indicators are used for debt profile risks.

Debt profile risk indicators for EMs:

1) EMBIG spreads;

[1] The definition of events is in line with previous studies on early warning of public debt distress including Reinhart and Rogoff (2011). The definition however is refined with a view to reducing type-II errors—i.e., sending false alarms. In particular, it excludes IMF precautionary arrangements, as well as those associated with natural disasters, economic transition, and current account crises.

[2] This definition was used in "Assessing Fiscal Stress" by Baldacci, Emanuele, Iva Petrova, Nazim Belhocine, Gabriela Dobrescu, and Samah Mazraani (2011).

2) Gross external financing requirements in percent of GDP;
3) Share of foreign currency-denominated public debt in total public debt;
4) Change in share of short-term public debt at original maturity in total public debt; and
5) Share of debt held by non-residents in total public debt.

Debt profile risk indicators for AEs:

1) Bond yield spreads (spread over U.S. or German bonds at similar maturity);
2) Gross external financing requirements in percent of GDP;
3) Change in share of short-term public debt at original maturity in total public debt; and
4) Share of debt held by non-residents in total public debt.

Signal-approach benchmarks

The signal approach developed by Kaminsky et al (1998) was used to derive "benchmarks" for debt burden and debt profile risk indicators. These benchmarks indicate the level of the indicator that best predicts the occurrence of a debt distress event in the sense that it minimizes the sum of the missed crises and false alarms. The benchmarks were obtained by calculating sample-specific medians (for AEs and EMs) for the different indicators.[3] A noise-to-signal ratio below 100 suggests that the indicator is an efficient predictor of debt distress. In order to differentiate countries within the higher scrutiny group for the purposes of the heat map, the debt level indicator benchmark derived from the signal approach is increased by about 20 percent (to 70 for EMs and 85 for AEs).

Table A1. Signal Approach-Benchmarks for EMs

	Indicative benchmarks[1/]	Noise-to-signal ratio	Direction to be safe
Debt burden indicators			
Gross government debt (percent of GDP)	60	51	<
Gross public sector financing requirements (percent of GDP)[2/]	15	92	<
Debt profile indicators			
EMBI global spreads (basis points)	800	28	<
External financing requirements (percent of GDP)	20	40	<
Public debt in foreign currency (share of total)	80	64	<
Annual change in the share of short-term public debt at original maturity	1.5	83	<

1/ Benchmarks are rounded.
2/ Defined as current account balance plus amortization of short-term external private and public debt at remaining maturity.

[3] Countries which did not experience a debt distress event over the sample period were excluded from the calculation of the signal-approach benchmarks. Outliers were also excluded from the calculation of the signal-approach benchmarks. Specifically, country-specific results above 2 standard deviations and below 1.5 standard deviations from the sample average were excluded from the calculations. This applies to all indicators, except for bond spreads and gross financing needs-to-GDP for AEs. For bond spreads, country-specific results above 2 standard deviations and below 1 standard deviation from the sample average were excluded from the calculations. For gross financing needs-to-GDP, country-specific results above 1 standard deviation and below 1.5 standard deviations from the sample average were excluded from the calculations.

Table A2. Signal Approach-Benchmarks for AEs

	Indicative benchmarks[1/]	Noise-to-signal ratio	Direction to be safe
Debt burden indicators			
Gross government debt (percent of GDP)	70	44	<
Gross public sector financing requirements (percent of GDP)[2/]	20	60	<
Debt profile indicators			
Bond spreads (basis points)[3/]	800	27	<
External financing requirements (percent of GDP)	35	18	<
Annual change in the share of short-term public debt at original maturity	2	58	<
Debt held by non-residents (share of total) [4/]	60	57	<

1/ Benchmarks are rounded.
2/ Defined as current account balance plus amortization of short-term external private and public debt at remaining maturity.
3/ Defined as the bond spread over U.S. or German bonds at similar maturity. The low noise-to-signal ratio for this particular indicator may reflect the inclusion of sovereign spread in the definition of debt distress events for AEs. However, the level of the benchmark is similar to the one derived for EMs, where this issue of endogeneity is not present.
4/ Although not estimated for EMs due to data limitations, it is also applied to EMs in the framework.

Risk assessment benchmarks for debt profile indicators

In order to provide an early warning of emerging risks, and to err on the side of caution, signal-approach benchmarks for debt profile indicators are scaled down. These early warning benchmarks, to be used in the identification of risks and in the risk assessment of debt profile, are derived by minimizing the sum of type I and type II errors when comparing to VEE and VEA results for similar year vintages. Separate early warning benchmarks for EMs and AEs were calculated.

Table A3. Debt Profile Risks
Risk Assessment Benchmarks for EMs 1/

	Indicative benchmarks[1/]	Early warning upper benchmarks (75 percent)	Early warning lower benchmarks (25 percent)
Debt profile indicators			
EMBI global spreads (basis points)	800	600	200
External financing requirements (percent of GDP)	20	15	5
Public debt in foreign currency (share of total)	80	60	20
Annual change in the share of short-term public debt at original maturity	1.5	1.0	0.5
Share of public debt held by non-residents	60	45	15

1/ Benchmarks are rounded.

Table A4. Debt Profile Risks
Risk Assessment Benchmarks for AEs 1/

	Indicative benchmarks[1/]	Early warning upper benchmarks (75 percent)	Early warning lower benchmarks (50 percent)
Debt profile indicators			
Bond spreads (basis points)	800	600	400
External financing requirements (percent of GDP)	35	25	17.5
Annual change in the share of short-term public debt at original maturity	2.0	1.5	1.0
Share of public debt held by non-residents	60	45	30

1/ Benchmarks are rounded.

Annex III. Alternative Scenarios and Stress Tests in Template

The analysis of alternative scenarios and stress tests in the MAC DSA template focuses on the evolution of three debt burden indicators: (i) debt-to-GDP ratio; (ii) debt-to-revenue ratio; and (iii) gross financing needs-to-GDP ratio.

Debt burden indicators comprise two elements: (i) a measure of indebtedness, i.e. nominal stock of public debt, debt service or gross financing needs; and (ii) a measure of repayment capacity, i.e. GDP or government revenues. When analyzing the outcome of alternative scenarios and stress tests, the template automatically considers the impact on both elements of the debt burden indicator (measures of indebtedness and repayment capacity).

Alternative scenarios and stress tests have an impact on the measure of indebtedness by affecting the gross financing needs of the government and/or the stock of debt (through the revaluation of foreign currency-denominated debt in the context of an exchange rate shock). Gross financing needs of the government include the primary balance, interest and amortization payments (on domestic and foreign currency-denominated debts), as well as other factors e.g., bank recapitalization, privatization receipts, drawdown of deposits, change in arrears, and debt relief. In addition, alternative scenarios and stress tests may also have an impact on the measure of repayment capacity.

A shock affecting the gross financing needs of the government changes the amount of debt to be issued by the government during the year of the shock (in order to meet its additional financing needs). In addition, a change to the amount of debt to be issued at time *t* may affect gross financing needs in subsequent years through its impact on interest and amortization payments. Additional financing needs are met by issuing debt instruments in the same proportion as in the baseline scenario.[1]

For example, a shock to the primary balance at time *t* has a direct impact on the gross financing needs of the government contemporaneously. Moreover, the shock may also have an impact on the measure of repayment capacity, depending on the particular assumptions made in the stress tests. In addition, new debt issued to meet the additional financing needs at time *t* may affect financing needs in subsequent years (through additional interest and amortization payments).

[1] To avoid circular references, new debt instruments issued in the alternative scenarios and stress tests do not pay interest during the year of issuance. However, baseline interest payments at time *t* on new debt issued at time *t* are added to gross financing needs in the alternative scenarios and stress tests.

Annex IV. Boom-Bust Analysis

The boom-bust tool in the realism module compares growth assumptions for a particular country to the historical experience of boom-bust cases. It is only applied to countries that are identified to be in a boom. For such countries the realism module automatically plots the country's real GDP growth projections against the distribution of growth observed during previous boom-bust episodes.

For the purposes of this module, a country is identified to be in a boom if either of the following conditions is met:

(i) A positive output gap during the last 3 consecutive years (taken from latest WEO); or
(ii) A 3-year cumulative level change in private sector credit-to GDP exceeding 15 percent for EMs or 30 percent for AEs.[1]

To construct the distribution of post-crisis real GDP growth, a boom-bust crisis sample was selected using an event study of crises in EMs and AEs. The sample is based on Reinhart and Rogoff (2011), and Laeven and Valencia (2010) and covers debt, banking and currency crisis events.[2] Since the focus of this analysis is on boom-bust episodes, the sample was adjusted to include only those events related to boom-bust crises. For this purpose, a crisis event was considered a boom-bust crisis when the 5-year average post-crisis growth was below the 10-year average of the pre-crisis growth.[3]

To test the efficiency of this approach in identifying risks related to boom-bust crises, a backward-looking exercise was conducted using each country's growth projections from previous WEO vintages. The first step was to identify countries in a boom at the time of the WEO vintage. For example, using the spring 2008 WEO vintage, 46 countries (out of a sample of 113 EMs and AEs) would have been identified as experiencing a boom. However, the growth projections of these countries at that time indicated that only 8 projected a degree of growth slowdown similar to previous bust episodes.[4] The second step was to assess whether countries that were identified to be in a boom indeed experienced a bust. To this end, the WEO vintage growth projections were replaced with actual growth figures. Using the definition for a boom-bust episode above described, we found that, out of the 46 identified countries, 37 in fact experienced a bust after 2008.

[1] This is the same trigger used in the contingent liability module to identify potential credit bubbles.

[2] The sample of debt and banking crisis events is the same sample as in the signal approach used in other modules in the MAC DSA. Currency crisis events were taken from Laeven and Valencia (2008).

[3] In order to exclude crisis events related to commodity price booms, large commodity exporter countries were not included in the sample.

[4] This was assessed by comparing the growth projections at that time, to the growth observed during boom-bust episodes.

Annex V. Contingent Liability Module

Following the definition in Laeven and Valencia (2010), a systemic banking crisis is defined when a country's corporate and financial sectors experience a large number of defaults and financial institutions and corporations face great difficulties repaying contracts on time.

In particular, a banking crisis is considered to be systemic if two conditions are met:

1) Significant signs of financial distress in the banking system (as indicated by significant bank runs, losses in the banking system, and bank liquidations); and
2) Significant banking policy intervention measures in response to significant losses in the banking system.

The first year that both criteria are met is considered to be the starting year of the banking crisis. Policy interventions in the banking sector are considered to be significant if at least three out of the following six measures have been used (additional details in Laeven and Valencia (2010)):

1) Extensive liquidity support;
2) Bank restructuring costs (at least 3 percent of GDP);
3) Significant bank nationalizations;
4) Significant guarantees put in place;
5) Significant asset purchases (at least 5 percent of GDP); and
6) Deposit freezes and bank holidays.

In addition to using these quantitative criteria, the study also includes a list of "borderline cases" that almost met the definition of systemic crisis. The study also states that when the above definition is not exactly met, it considers as sufficient conditions for a crisis episode to be deemed systemic when either (i) a country's banking system exhibits significant losses resulting in a share of nonperforming loans above 20 percent or bank closures of at least 20 percent of banking system assets); or (ii) fiscal restructuring costs of the banking sector are sufficiently high–exceeding 5 percent of GDP.

Based on the above definition, 25 emerging and 23 advanced markets were identified as having experienced systemic banking crises over the period 1993–2010 and included in the contingent liabilities database.

Triggers

The analysis establishes three potential indicators (or "triggers") that are correlated with systemic banking crises. The triggers are intended to flag the need for a stress-test analysis on a specific risk and should be seen as a reference point rather than a precise indication of the presence or absence of risks. All three indicators pertain to advanced economies, while only the first two apply to emerging markets:

1) Loan-to-deposit ratio. This is defined as the ratio of gross loans to total customer deposits for the current year. Underlying balance sheet data are taken from the Bankscope database.
2) Credit-to-GDP ratio. This is defined as the 3-year cumulative level change in credit to private sector-to-GDP ratio, in percent. Underlying credit data are taken from the International Financial Statistics database.
3) Nominal housing prices. This is defined as the moving average of annual growth in nominal housing prices over the preceding 5 years. Underlying data are taken from OECD Analytic database.

Indicative benchmarks

The signaling power of each of the three indicators above can be evaluated, using the signal approach.

This procedure is applied to advanced and emerging market economies separately, so that a median threshold is obtained for each sample. Countries which did not experience a systemic banking crisis over the whole period were excluded from the calculation of the median threshold. Outliers were also excluded from the calculation of the median threshold. In particular, countries witnessing indicator values above 2 standard deviations or below 1.5 standard deviations from the sample average were excluded from the calculation of the median threshold.

Table A5. Contingent Liabilities: Benchmarks for Banking Crises

	Indicative benchmarks[1/]	Noise-to-signal ratio	Direction to be safe
EMs			
Private sector credit-to-GDP (3-year cumulative level change)	15	17.8	<
Loan-to-deposit ratio	1.5	20.7	<
AEs			
Private sector credit-to-GDP (3-year cumulative level change)	30	22.0	<
Loan-to-deposit ratio	1.5	59.6	<
Nominal housing prices (moving average of annual growth in preceding 5 years, soft trigger)	7.5	24.1	<

1/ Benchmarks are rounded.

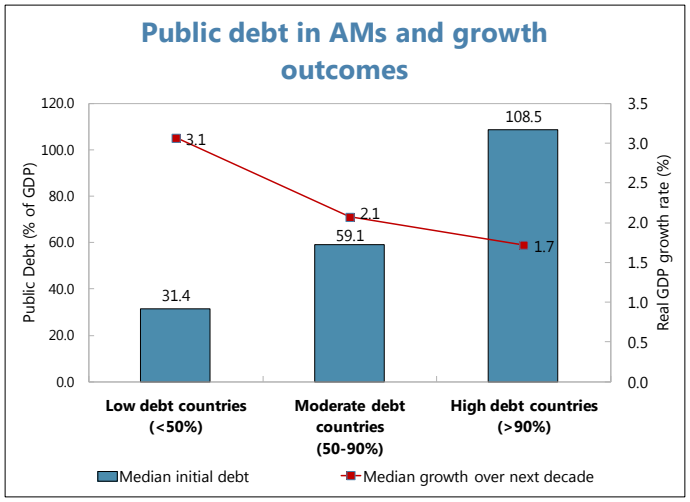
Annex VI. Deriving Country-Specific Maximum Sustainable Public Debt Ranges

This annex (i) highlights that the level of debt matters for debt sustainability (in addition to considerations about the trend in the debt-to-GDP ratio); (ii) explains why sustainable debt levels are likely to vary by country; and (iii) outlines several methodologies to estimate country-specific public debt thresholds.

I. Why does the level of debt, in addition to its trend, matter in assessing sustainability?

As argued in the recent joint FAD-SPR Board paper (*Modernizing the Framework for Fiscal Policy and Public Debt Sustainability Analysis*, 8/5/2011):

1. High debt levels are associated with lower subsequent growth (see figure). This can perpetuate recessions and worsen the debt outlook.



2. High debt requires large primary surpluses just to stabilize the level of debt, let alone decrease it. Sustaining high primary surpluses for several years can be difficult.

3. High debt increases the vulnerability to growth shocks and reduces the scope for countercyclical fiscal policy.

4. For a given maturity structure, high debt generally means high rollover requirements, which increases the sovereign's vulnerability to market risk and magnifies the impact of an interest rate shock on the debt-to-GDP ratio.

II. Why should the sustainable level of debt vary by country?

At a conceptual level:

1. The maximum sustainable level of debt for a country depends on country-specific factors. These include a country's (i) ability to generate primary surpluses, and therefore service its debt; (ii) growth prospects; (iii) cost of borrowing that reflects both the interest cost of debt already contracted and market perceptions of a country's ability to service future borrowings; (iv) history of meeting its debt obligations (whether it had debt distress/ lost market access); (v) vulnerability to shocks; (vi) nature of investor base; and other factors.

At an empirical level:

2. Experience shows that some countries have run into debt difficulties at relatively low debt levels, while others have been able to sustain high levels of indebtedness for prolonged periods without experiencing debt distress. Argentina defaulted when its debt was around 60 percent of GDP while Japan has continued to sustain a debt-to-GDP ratio of over 150 percent of GDP. There is no one common level across countries at which debt has been perceived to become unsustainable.

3. Public debt varies widely across countries for a given level of sovereign spreads. That two countries with very different levels of public debt have similar spreads reflects the important role country-specific factors play in market participants' perception of sovereign risk.

As a result of these considerations, recent analytical work has moved in the direction of introducing more country specificity in estimating maximum sustainable public debt ranges (Ostry et. al., 2011). Similarly, a key element of the 2005 reform to the debt sustainability framework for low-income countries was to allow debt thresholds to vary across countries in accordance with a country's macro fundamentals and debt management capacity.

III. Quantitative Methodologies for Estimating Country-Specific Maximum Sustainable Public Debt Ranges[1]

A. Early Warning (Signal) Approach

Key principle: Based on past experience, what is the level of debt that best predicts a subsequent debt crisis? This is the same approach as used in the VEE and VEA. For this approach, (i) countries that experienced debt distress in the past are selected; and (ii) the optimal debt threshold is derived by minimizing the noise-to-signal ratio.

Method: For any given threshold X, a signal is considered to have been sent if actual debt in that year is greater than X. Whether a signal was sent is then compared to whether the country experienced a debt crisis in the subsequent year. Thus for each country-year there are four possible outcomes (labeled A-D in the table below). For a given threshold, errors in prediction are represented by cells B (false alarms) and C (missed crises). The exercise consists of varying the threshold X to find the value that minimizes the sum of (i) missed crises as a share of total number of crises ($\frac{C}{A+C}$) and (ii) false alarms as a share of total number of non-crises ($\frac{BB+D}{}$).

[1] See Jarmuzek and Miao (forthcoming) for a further discussion of these approaches. The debt level is not the only factor determining the probability of a debt crisis/debt default. Countries can run into debt difficulties at very different debt levels, and markets can perceive countries to carry similar sovereign risk while having very different debt levels. This clearly indicates that other factors, including a country's capacity to adjust, also matter.

Signal? \ Crisis?	Yes	No
Yes	A	B
No	C	D

Country-specific thresholds: Instead of having a common debt-to-GDP threshold across all countries, the methodology allows for country-specific factors that over history may have allowed one country to consistently sustain a higher level of debt than another country. Operationally, the loss function is minimized over the percentile rank of the distribution of the debt-to-GDP in each country, rather than the level the debt-to-GDP ratio itself. Once the optimal common percentile has been identified by minimizing the loss function, the country-specific threshold is obtained from the country's distribution of the debt-to-GDP ratio.

B. Exceptional Fiscal Performance Approach

This approach starts with the following debt dynamics equation, which relates the debt-to-GDP ratio (*d*) to the real interest rate (*r*), GDP growth rate (*g*) and primary balance (*p*):

$$d_t \approx (1 + r_t - g_t) * d_{t-1} - p_t$$

This can be rearranged to obtain the steady-state level of debt for constant values of the interest rate, growth, and the primary balance:

$$d = \frac{p}{r - g}$$

The higher the primary balance a country can sustain, the lower the interest rates it faces, and the higher the growth rate it can maintain, the higher the steady-state level of debt that this country can maintain. They key to this approach is to determine the maximum sustainable level of primary balance and an appropriate level for *r – g*, which together yield the maximum level of debt that can be sustained. If debt exceeds this level, it will rise indefinitely as the primary balance required to stabilize it is beyond the maximum that can be sustained. Using a country's best historical fiscal performance as a proxy for future fiscal performance helps inform the assessment of what constitutes maximum fiscal effort. As Reinhart et al. (2003) argues: "history matters: a country's record at meeting its debt obligations and managing its macroeconomy in the past is relevant to forecasting its ability to sustain moderate to high levels of indebtedness for many years into the future." While the country's historical performance can help inform the assessment of the maximum primary balance, relatively low primary surpluses in the past may simply relate to a period in which

there was no urgent need for fiscal adjustment. They do not imply that a country cannot achieve higher surpluses when it faces high or unsustainable debt and wants to bring the debt on a firm downward path. Also, for $r - g$, although historical experience can be informative, the assessment is essentially a forward-looking exercise, and comparator countries' experience could be used where appropriate.

C. The Uncertainty Approach

Building on the analysis in WEO (2003), the uncertainty approach is a derivative of the exceptional fiscal performance approach and relies on the same underlying concepts and equations. Under this approach:

- A country's historical fiscal performance, taking into account shocks to revenues and credibility of expenditure adjustment, sets the basis for the path of primary fiscal balance; and
- The historical track record for growth and the maximum level of interest rate is taken as a basis for the paths of the interest rate-growth differential.