

INTERNATIONAL MONETARY FUND

Modernizing the Framework for Fiscal Policy and Public Debt Sustainability Analysis

Prepared by the Fiscal Affairs Department and
the Strategy, Policy, and Review Department

Approved by Carlo Cottarelli and Reza Moghadam

August 5, 2011

Contents	Page
Executive Summary.....	3
I. Introduction	4
II. Conceptual Framework and Areas for Improvement.....	5
III. Realism of Baseline Projections	7
A. Realistic Primary Fiscal Balance Paths.....	8
B. Realism of Economic Growth and Interest Rate Assumptions	10
IV. Role of the Debt Level in the DSA.....	11
V. Improving the Analysis of Fiscal Risks.....	15
A. Contingent Liabilities.....	15
B. Identifying Country-Specific Shocks	17
C. Assessing the Impact of Shocks.....	21
Bound tests.....	21
Stochastic simulation methods.....	22
VI. Vulnerabilities Associated with the Profile of Public Debt.....	25
VII. Coverage of Fiscal Balance and Public Debt	28
A. Expanding the Coverage of the Fiscal Accounts	28
B. Integrating Long-Run Spending Pressures into DSA	29
C. Assessing Gross and Net Debts.....	31
VIII. A Risk-Based Approach to DSAs - Implementation	33
IX. Issues for Discussion	36
References.....	54

Tables

1. Debt Ceilings for Selected Members	11
2. Summary of the Cost of Banking Crises.....	16

Figures

1. Frequency Plots of Maximum Primary Balance.....	9
2. Largest Primary Balance Turnaround.....	10
3a. Long-run Debt and Maximum Sustainable Debt: Advanced Economies	14
3b. Long-run Debt and Maximum Sustainable Debt: Emerging Market Economies.....	14
4. Incidence of Systemic Banking Crises, 1970–2008	16
5. Banking Sector Credit to Private Sector Around Debt Distress Events	18
6a. Debt Structure Indicators Around Debt Distress Events.....	25
6b. Liquidity and Risk Pricing Indicators Around Debt Distress Events	26
7. Country: Debt Profile Vulnerabilities.....	26
8a. Long-Term Spending Pressures: Advanced Economies.....	29
8b. Long-Term Spending Pressures: Emerging Markets.....	30
9. Gross Minus Net Debt for Selected Countries, 2010.....	31
10. Change in Gross vs. Net Debt.....	32

Boxes

1. Conceptual Framework for Fiscal Policy and Public Debt Sustainability.....	6
2. Using Confidence Intervals to Help Gauge Uncertainty	23
3. Defining Indicative Benchmarks for Debt Vulnerability Indicators.....	27
4. Implementation of the Proposed Framework.....	34

Annexes

I. Debt Sustainability Analysis in Selected Countries	37
II. Overview of Current Framework for Public DSA in Market-Access Countries	41
III. Estimation of Indicative Public Debt Thresholds	43
IV. Using Historical Episodes to Calibrate Tail Risks	49
V. Defining Gross and Net Debt.....	53

Executive Summary

Modernizing the framework for fiscal policy and public debt sustainability analysis (DSA) has become necessary, particularly in light of the recent crisis and rising sustainability concerns in some advanced economies. While recognizing the inherently challenging nature of such analysis, this paper highlights areas where improvements are needed and makes both general and specific proposals on how this could be achieved. It also proposes to move to a risk-based approach to DSAs for all market-access countries, where the depth and extent of analysis would be commensurate with concerns regarding sustainability, while a reasonable level of standardization would be maintained.

DSA could be improved through a greater focus on:

- ***Realism of baseline assumptions.*** Close scrutiny of assumptions underlying the baseline scenario (primary fiscal balance, interest rate, and growth rate) would be expected particularly if a large fiscal adjustment is required to ensure sustainability. This analysis should be based on a combination of country-specific information and cross-country experience.
- ***Level of public debt as one of the triggers for further analysis.*** Although a DSA is a multifaceted exercise, the paper emphasizes that not only the trend but also the level of the debt-to-GDP ratio is a key indicator in this framework. The paper does not find a sound basis for integrating specific sustainability thresholds into the DSA framework. However, based on recent empirical evidence, it suggests that a reference point for public debt of 60 percent of GDP be used flexibly to trigger deeper analysis for market-access countries: the presence of other vulnerabilities (see below) would call for in-depth analysis even for countries where debt is below the reference point.
- ***Analysis of fiscal risks.*** Sensitivity analysis in DSAs should be primarily based on country-specific risks and vulnerabilities. The assessment of the impact of shocks could be improved by developing full-fledged alternative scenarios, allowing for interaction among key variables, and more regular use of fan charts. Different tools and analyses (e.g., FSAP and vulnerability exercises) could be used as inputs to identify and quantify macroeconomic risks and contingent liabilities risks.
- ***Vulnerabilities associated with the debt profile.*** The paper proposes to integrate the assessment of debt structure and liquidity issues into the DSA. Indicative benchmarks are proposed to facilitate staff analysis in this regard.
- ***Coverage of fiscal balance and public debt.*** It should be as broad as possible, with particular attention to entities that present significant fiscal risks, including state owned enterprises, public-private partnerships, and pension and health care programs.

Based on Directors' views, specific guidance would be developed in the coming months to render these proposals fully operational, facilitate country team work, and ensure adequate implementation. The public DSA template would be revised accordingly.

I. INTRODUCTION¹

1. **Large increases in public debt in advanced economies (AEs) have brought the sustainability of fiscal policy and public debt to the forefront of policy discussions.** The recent worsening of the debt outlook in AEs reflects a number of factors, including a sharp deterioration of fiscal balances during the crisis and, in some cases, government intervention in the banking sector. This deterioration is in addition to the long-term spending pressures related to population aging.

2. **Before the crisis, Fund analysis did not always pay sufficient attention to public debt sustainability in market access countries (MACs), particularly in AEs.** As illustrated in Annex I, debt sustainability analysis (DSA) had often turned into a routine exercise, with mechanical implementation of the DSA template, little discussion of DSA results, and limited linkages between the DSA and discussion of macroeconomic and financial policies. While problems with the implementation of the framework are not universal, with hindsight, it is also clear that the framework has shortcomings that need to be addressed: for instance, stress testing was not commensurate with the magnitude of the crisis.

3. **These developments make it timely to modernize the framework for public DSA.**² The objective of the paper is to highlight areas where improvements are needed and to make both general and specific proposals on how this could be achieved.³ This paper not only suggests new tools to improve the analysis, but also draws attention to existing ones that could be mobilized in light of interconnections across sectors. Based on Directors' views on these proposals, more specific guidance would be developed in the coming months to render them fully operational, facilitate country team work, and ensure adequate implementation. The public DSA template would be revised accordingly.

4. **The paper is organized as follows.** Section II presents the conceptual framework and outlines areas for improvement. Section III discusses issues related to the realism of projections, particularly the fiscal path underlying baseline scenarios. Section IV analyzes vulnerabilities associated with the level of public debt. Section V presents ideas to improve

¹ This paper was prepared by a staff team led by Said Bakhache (SPR) and Ricardo Velloso (FAD) under the broad guidance of Dominique Desruelle, Hervé Joly (both SPR), and Paolo Mauro (FAD). The team comprised Santiago Acosta (FAD), Karina Garcia, Douglas Hostland, Mariusz Jarmuzek, Andrew Jewell, Kadima Kalonji (all SPR), Andrea Lemgruber (FAD), Keiichi Nakatani, Francois Painchaud (both SPR), Christine Richmond (FAD), Esteban Vesperoni (SPR), and Li Zeng (FAD).

² The current DSA framework is briefly described in Annex II.

³ Some of these proposals were made in the past (see [Sustainability Assessments – Review of Application and Methodological Refinements](#),) but were not satisfactorily implemented, possibly reflecting a number of issues ranging from insufficiently specific guidance on implementation, difficulty to find relevant information, significant resource implications, and a sense of complacency during the “great moderation.”

the analysis of fiscal risks. Section VI examines debt vulnerabilities associated with the profile of public debt. Section VII discusses the appropriate coverage of fiscal balance and public debt. Section VIII discusses the implementation of the proposed approach. Issues for discussion are proposed in Section IX.

II. CONCEPTUAL FRAMEWORK AND AREAS FOR IMPROVEMENT

5. **The fiscal policy stance can be regarded as unsustainable if, in the absence of adjustment, sooner or later the government would not be able to service its debt** (Box 1). If no realistic fiscal adjustment can prevent this situation from arising, not only fiscal policy, but also public debt would be unsustainable. To assess these issues, a DSA begins with a baseline trajectory for public debt based on the assumptions underlying the macroeconomic framework. It then tests these baseline assumptions and analyzes how materialization of various risks would affect the public debt trajectory.

6. **The paper proposes ways to improve the various elements that make up the DSA.** The objective is to improve the DSA framework and its use, while remaining realistic about what can be achieved. Indeed, assessments of sustainability will remain inherently challenging given the uncertainties associated with many aspects of the exercise. Staff has identified the following areas where analysis could be improved.

- **Realism of baseline assumptions.** Assumptions underlying the baseline scenario, particularly the primary fiscal balance path, should be subjected to greater scrutiny, especially for countries where significant fiscal adjustment is projected.
- **Level of public debt.** Although a DSA is a multifaceted exercise, the paper emphasizes that not only the trend but also the level of the debt-to-GDP ratio is a key indicator in this framework. The paper does not propose adopting specific public debt thresholds, but recommends a more stringent analysis of vulnerabilities when the debt ratio exceeds a certain level.
- **Analysis of fiscal risks.** Stress testing can be better tailored to country-specific circumstances with improved identification of relevant risks, including those associated with contingent liabilities arising from the financial sector, and greater customization of bounds tests and alternative scenarios.
- **Vulnerabilities associated with the debt profile.** Refinancing risks have typically been analyzed outside of the DSA framework. The paper proposes to integrate the analysis of this issue into the DSA, where relevant.
- **Coverage of fiscal balance and public debt.** Off-budget public entities, partnerships with the private sector, and long-term spending pressures associated with population aging can have a sizable impact on the evolution of public debt. The paper reiterates that coverage of public debt should be as broad as possible, with particular attention to entities that present significant fiscal risks.

Box 1. Conceptual Framework for Fiscal Policy and Public Debt Sustainability

Fiscal policy sustainability and public debt sustainability are two inter-related concepts whose analysis is a complex and multifaceted exercise. The analysis needs to consider: (i) the trajectory of the debt-to-GDP ratio, both under a baseline scenario and alternative scenarios exploring key fiscal risks;¹ (ii) whether, at a minimum, the debt ratio stabilizes at a level consistent with an acceptably low rollover risk and with preserving growth; (iii) the realism of underlying assumptions; and (iv) debt composition, which also affects the likelihood of debt distress.

The fiscal policy stance can be regarded as unsustainable if, in the absence of adjustment, sooner or later the government would not be able to service its debt. Specifically, two cases should be distinguished:

- The current level of the primary balance might not be sufficient to stabilize the debt-to-GDP ratio (which therefore would be on an explosive path) but sufficient fiscal adjustment would be realistic (both economically and politically) to bring the primary balance to a level that is necessary to service public debt. In this case, while fiscal policy would be currently unsustainable (in the sense that an adjustment in the primary balance is needed), public debt can be regarded as sustainable.
- Alternatively, the primary balance needed to stabilize the debt ratio is politically and/or economically infeasible. In this case, not only fiscal policy, but also public debt would be unsustainable (solvency problem) and debt restructuring would be necessary.²

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 ratios are usually associated with higher interest rates (and possibly lower growth; see below), thus requiring an even higher primary balance to service it.

A proper assessment of fiscal policy and public debt trajectory must be based on certain macroeconomic baseline assumptions, notably economic growth and the interest rate on public debt,³ as well as the likelihood that fiscal risks (including those from contingent liabilities) might materialize. Thus, it is critical that the assessment of fiscal policy and debt sustainability be based on realistic assumptions. It is equally important to stress test the underlying assessment of both fiscal and debt sustainability with respect to deviations from baseline assumptions for all these variables. Higher interest rates (possibly stemming from changes in market sentiment) or lower growth assumptions could, for example, result in less favorable debt dynamics, requiring an increase in the primary balance needed to stabilize the debt ratio, which could in turn change the assessment of debt sustainability.

Fiscal policy and public debt may be sustainable in the above sense, but the debt level may still be so high that bringing it down would be recommended. This can occur for various reasons:

- A high debt level exacerbates an economy's vulnerability to shocks: the higher the initial debt level, the greater the impact of a given increase in interest rates or of a decline in the growth rate on the primary surplus needed to maintain debt stable. So, countries with a high debt level are more exposed to interest and growth shocks.
- The risk of a rollover crisis depends on the size of borrowing requirements and hence on the level of the fiscal deficit (which depends in part on the level of the debt, through the size of the interest bill) and the composition of the debt (e.g., short maturities) and investor base (e.g., a high share of externally-held debt).
- Beyond certain levels, the higher the debt level the lower is long-term economic growth (see, for example, Kumar and Woo, 2010).⁴

¹ Assuming that the interest rate on public debt exceeds the growth rate of the economy, the government's intertemporal budget constraint is met when the debt-to-GDP ratio is stable. For details see Bartolini and Cottarelli (1994).

² In principle, assessing whether bringing down debt ratios through a primary adjustment is too costly requires looking at the alternative by evaluating the costs of bringing down debt ratios through debt restructuring.

³ Potential growth is particularly important not only because it affects directly the evolution of debt-to-GDP ratios given a certain primary balance, but also because sustaining a larger primary balance is likely to be easier when potential growth is higher.

⁴ At the same time, for countries with substantial infrastructure needs (e.g., low income countries), it is particularly important to assess whether an increase in debt that finances public investment could have a positive impact on long-term growth.

7. **In an environment marked by tight resource constraints, the paper also suggests adopting a risk-based approach to DSA.** While a minimum level of standardization would be maintained to foster discipline, evenhandedness, and a degree of comparability across countries, depth of analysis would be tailored to the magnitude of concerns about sustainability (e.g., level of public debt; need for and size of fiscal adjustment; extent of fiscal risks; and liquidity issues) or to operational requirements such as the need for “a rigorous and systematic analysis” of debt sustainability in cases of exceptional access to Fund resources.⁴

8. **While the main focus of this paper is on public DSA for MACs, many of the issues also apply to low-income countries (LICs).** The conceptual framework underpinning the LIC DSA is essentially the same as that for the MAC DSA. However, its implementation involves different data and operational issues and reflects the prevalence of concessional financing from the official community. Furthermore, LICs face a number of unique challenges such as overcoming large infrastructure gaps, which raises questions on how best to capture the impact of public investment on growth and debt sustainability. LIC DSAs are also conducted jointly with the World Bank and are more detailed than MAC DSAs, particularly as regards external debt. In light of these differences with MACs, a review of the LIC DSA framework will be undertaken separately in a forthcoming paper prepared jointly with the World Bank. Given the general recognition that the analysis of total public debt in LICs needs to be given more prominence (relative to the analysis of external public debt), that review will draw on a number of the proposals made in this paper, with adaptation to LICs’ specific circumstances when appropriate.

III. REALISM OF BASELINE PROJECTIONS

9. **As the first step in the DSA is to derive the projected path of the debt-to-GDP ratio, a crucial element of DSAs is the realism of the underlying assumptions regarding the primary fiscal path as well as economic growth and interest rate projections.** This is particularly important in countries where sustainability is contingent upon large fiscal adjustments. For example, the adjustment in primary balances required for AEs to bring debt ratios to or below 60 percent of GDP is estimated, on average, at about 8 percentage points of GDP between 2010 and 2020 (Abbas et al, 2010). Even though fiscal consolidations of this magnitude were achieved in several cases in the past, they will pose major challenges and their realism needs to be assessed in light of country-specific

⁴ Decision No. 14064–(08/18), February 22, 2008, as amended by Decision Nos. 14184–(08/93), October 29, 2008, 14284–(09/29), March 24, 2009, and 14716–(10/83), August 30, 2010.

circumstances. Moreover, the potential contractionary impact of fiscal consolidation on growth needs to be taken into account.⁵

A. Realistic Primary Fiscal Balance Paths

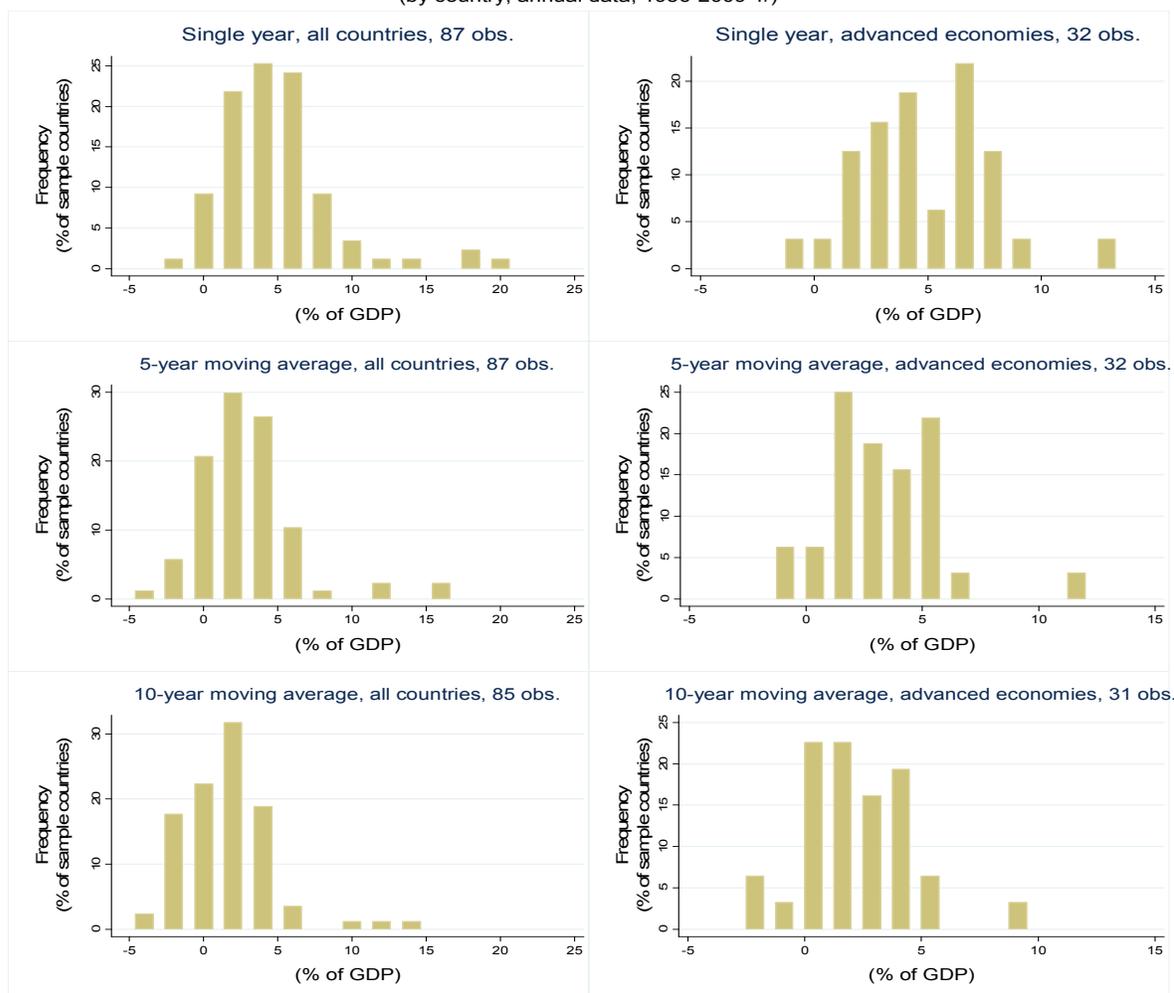
10. Cross-country experience provides useful insights about the prevalence of, and circumstances underpinning, large and sustained primary surpluses.

- ***Large primary surpluses have been frequent, but sustained large surpluses have been less common*** (Figure 1). Out of 87 countries sampled, over 40 percent had a maximum primary surplus exceeding 5 percent of GDP in at least one year. However, only 16 countries (less than 20 percent) sustained surpluses exceeding 5 percent of GDP for five years or longer.
- ***Some episodes of sustained large surpluses have been linked to specific conditions that are not easily applicable to most countries.*** Out of the 16 countries that recorded episodes of sustained surpluses, five had this performance in connection to exogenous factors—large increase in revenue related to natural resources (Botswana, Chile, Egypt, and Uzbekistan) or transfers arising from customs union membership (Lesotho).
- ***Episodes of sustained large surpluses in the absence of facilitating exogenous factors have been limited to 11 countries (13 percent of the sample).*** A few of these countries ran large primary surpluses in the absence of a large debt burden (Denmark, New Zealand, Turkey), but the majority engaged in adjustment at times when they were facing debt levels above 60 percent of GDP (Belgium, Canada, Dominica, Israel, Jamaica, Panama, Seychelles, and Singapore).
- ***Episodes of significant fiscal correction have been numerous, and the correction has generally been larger when the starting fiscal position was worse*** (Figure 2). There were 30 instances in which countries were able to improve their five-year average primary balance by at least 5 percentage points of GDP relative to the average of the previous three years. Larger improvements in the primary balance were positively correlated with weaker starting fiscal positions; in only 9 episodes, the ensuing five-year primary balance was equal to or larger than 5 percent of GDP.

⁵ For example, the October 2010 *World Economic Outlook*, Chapter III (<https://www.imf.org/external/pubs/ft/weo/2010/02/index.htm>) found that a 1 percent of GDP fiscal consolidation typically reduces GDP growth by ½ percent within two years.

Figure 1. Frequency Plots of Maximum Primary Balance

(by country, annual data, 1956-2009 1/)



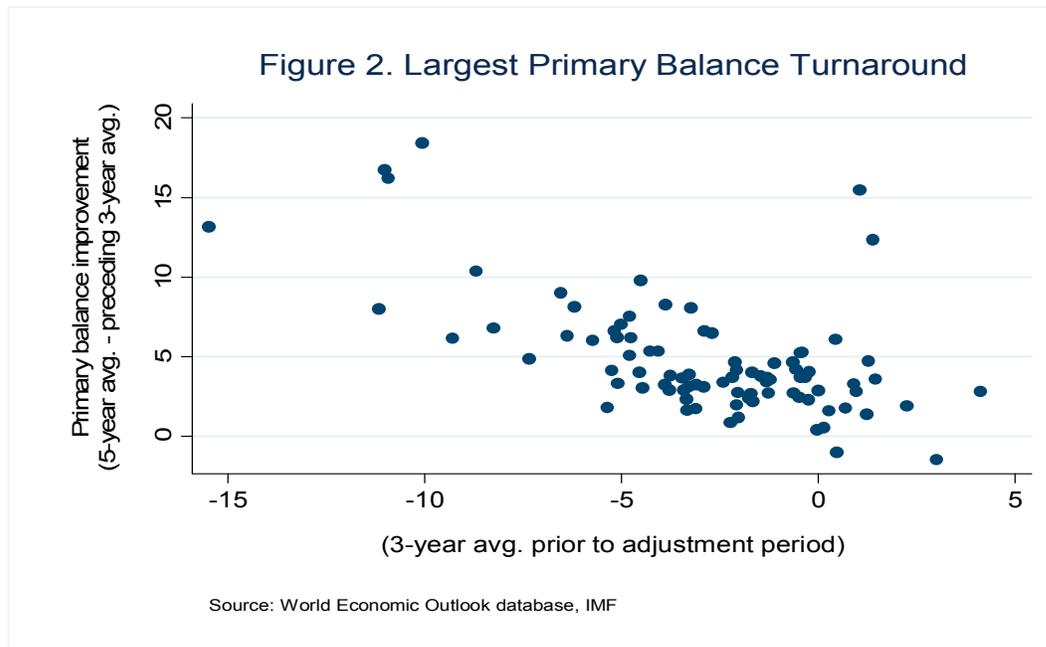
Source: World Economic Outlook database, IMF

1/ Oil and primary product exporters, as defined by the WEO, and HIPC MDRI beneficiary countries are excluded from the sample. Data are available beginning in 1956 for Japan, in the 1960s and 1970s for another 15 advanced economies, in the 1980s for about 30 countries, and in the 1990s for the bulk of the sample. The total number of country-year observations is 2061.

11. **In countries where a large fiscal adjustment is planned, this cross-country experience can be combined with country-specific information to assess the realism of fiscal projections.** If the planned fiscal adjustment is located close to the right-hand tail of the cross-country distribution of fiscal adjustment (e.g., sustained surplus around 5 percent of GDP or more), particularly close scrutiny of assumptions would be warranted. Country-specific information includes past record of fiscal adjustment, extent of political commitment to adjustment, and the implementation of supporting policy measures. These issues would be expected to be taken into account in the development of the baseline scenario.

12. **Comparisons of the baseline scenario with “no policy change” and historical scenarios would be particularly helpful to inform the analysis of whether policy actions and commitments are substantial enough to make a credible break from past or current trends.** This analysis would take account of the design of the authorities’ fiscal adjustment

plans, existing legal and institutional mechanisms to support a realistic implementation of these plans, and experience regarding budget forecast errors.



B. Realism of Economic Growth and Interest Rate Assumptions

13. **The interest rate-growth differential plays a critical role in DSA and its underlying assumptions should be carefully assessed.** A strongly negative differential has been a key benign force for debt sustainability in emerging markets (EMs) and LICs, while a generally positive differential in AEs has not been favorable for debt dynamics given the need to run primary surpluses just to ensure debt stabilization.⁶ In light of the sensitivity of debt dynamics to the interest rate-growth differential, the latter deserves proper scrutiny. In particular, a significant deviation vis-à-vis historical trends and market participants' forecasts should be fully justified.

14. **Experience suggests the need to scrutinize growth and interest rate assumptions, especially when substantial fiscal adjustment is considered:**

- Timmermann (2006) found that *World Economic Outlook* real GDP growth forecasts showed a tendency to systematically exceed outcomes. This phenomenon was particularly prevalent in countries with an IMF-supported program. Such bias was found to be most statistically significant in the next-year forecast.

⁶ IMF (2011) shows that the interest rate-growth differential in G-20 AEs has been on average 1 percent, while this differential has been negative in EMs (-4 percent) and LICs (-8 percent).

- Bornhorst et al (2010) pointed out differences between growth forecasts estimated by WEO and by country authorities in the (post-crisis) medium-term fiscal adjustment plans prepared in 2010. In AEs with large adjustment needs, growth assumptions underlying national plans were somewhat more optimistic than WEO or Consensus Forecast projections. On the other hand, growth assumptions in EMs were largely in line with WEO and Consensus Forecast projections.
- IMF (2011) reported that shocks—especially to economic growth—often derailed fiscal adjustment amongst 20 episodes of fiscal adjustment plans in G-7 countries. Some of those plans were derailed almost immediately by unexpected downturns (e.g., Germany in the 1970s, Japan), while success of some plans was facilitated by higher-than-expected growth and asset prices (e.g., United States in the 1990s).⁷
- Differences between interest rate projections in WEO and those done by the authorities tend to be higher in EMs, while projections are more aligned for AEs.⁸

IV. ROLE OF THE DEBT LEVEL IN THE DSA

15. **Having determined that the underlying assumptions are realistic, the analysis turns to examining the projected path of the debt-to-GDP ratio.** In this context, not only the trend, but also the level of the debt-to-GDP ratio is highly relevant in the DSA. For instance, a (modestly) increasing debt ratio from a “low” initial level may well entail less risk than a stable but “high” debt ratio. The difficulty lies in defining “high” and “low”—a definition that is likely to be country-specific. Some countries have indeed run into difficulties at relatively low levels of debt, while others have been able to sustain high levels of indebtedness for prolonged periods without experiencing debt distress. Many countries have adopted debt ceilings in their fiscal responsibility laws or in the context of regional integration agreements. A commonly used ceiling is 60 percent of GDP (Table 1).

Table 1. Debt Ceilings for Selected Members
(in percent of GDP at end-2010)

Member	Ceiling	Actual ¹
Economic and Monetary Union of the EU	60	85
Eastern Caribbean Currency Union ²	60	103
Individual Countries		
Pakistan	60	59
Panama	40	40
United Kingdom	60	77

Source: WEO

¹ Actual for currency unions is based on aggregated debt and GDP data.

² Actual level of debt is at end-2009.

16. **As discussed in Box 1, a high level of debt raises a number of challenges.** First, large primary fiscal surpluses are needed to service a high level of debt; such surpluses may

⁷ See Mauro (ed.) 2011.

⁸ See Bornhorst et al (2010).

be difficult to sustain, both economically and politically. Second, a high level of debt exacerbates an economy's vulnerability to interest rate and growth shocks. Third, a high debt level is generally associated with higher borrowing requirements, and therefore exposes a country to a higher risk of a rollover crisis (i.e., being unable to fulfill borrowing requirements from private sources or being able to do so only at very high interest rates). Fourth, high levels of debt may be detrimental to economic growth; while lower growth is a concern in itself, it also has a direct impact on debt dynamics and debt sustainability in the long term.

17. Estimating robust thresholds for sustainable levels of public debt in MACs has proven elusive in previous empirical studies.⁹ This may reflect, among others, the many channels through which high debt levels can lead to debt distress (see above). The empirical literature on this issue can be summarized as follows. Two related concepts of sustainable levels of debt have been studied and estimates vary significantly (Annex III):

- The “*long-run debt level*” is the level to which the debt-to-GDP ratio converges over the long run, as long as the actual debt-to-GDP ratio does not rise above the *maximum sustainable debt level* (defined below). Estimates are derived using fiscal policy track records and historical averages for growth and interest rates. Across previously existing empirical studies, cross-country median estimates range from 50 to 75 percent of GDP for AEs, while the one available estimate for EM is 25 percent of GDP.¹⁰
- The “*maximum sustainable debt level*” is the level beyond which a debt distress event is likely or inevitable. Estimates are based either on identification of defined debt distress events, with statistical approaches used to estimate related debt thresholds, or on evaluation of policy reaction functions to increasing levels of debt. For AEs, median estimates range from 80 to 192 percent of GDP, while for EMs the range is 35 to 77 percent of GDP.

18. Staff analysis based on more recent data confirms the difficulty of defining generally applicable debt thresholds, while pointing to an improved ability of EMs to carry debt.

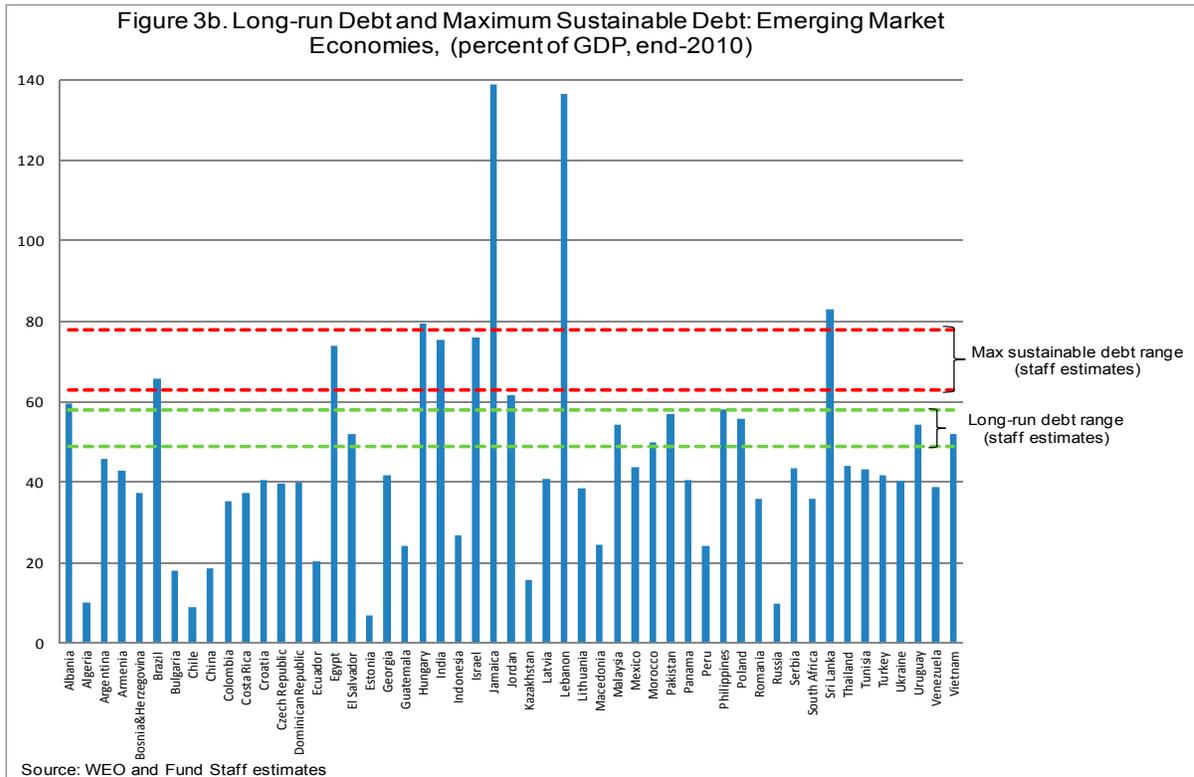
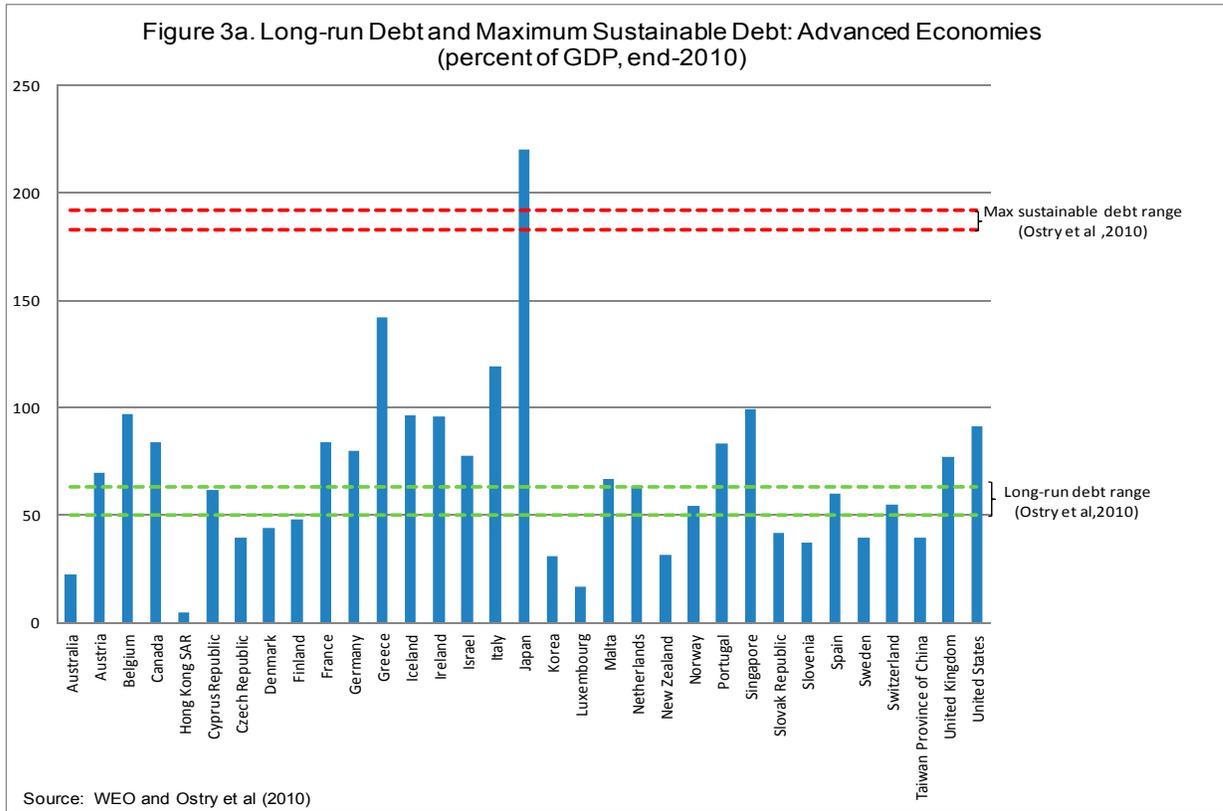
⁹ See Ghosh (2011); Ostry et al. (2010); IMF, 2003, *World Economic Outlook*, Chapter III (<http://www.imf.org/external/pubs/ft/weo/2003/02/>); and Hemming et al (2003). Much work has been done on the sustainable level of *external debt* – for example, Reinhart et al (2003) and Manasse et al (2003) – particularly in light of the crises of the 1990s.

¹⁰ In this and subsequent bullets, estimates refer to average values of each individual study's country sample. Individual country estimates vary widely.

- A re-estimation of public debt thresholds for a sample of EMs for the period 1993–2009 gives a range of 49–58 percent for the long-run debt level and 63–78 percent for the maximum sustainable debt level (Annex III).¹¹
- These estimates, particularly those relating to long-run debt levels, are significantly higher than earlier ones, which reflect the improved fiscal performance of EMs over the past decade. Estimated long-run debt levels for EMs are also now closer to the most recent estimates for AEs based on Ostry et al (2010).

19. **The dispersion of empirical findings precludes introducing formal sustainability thresholds in MAC DSAs, but they provide a useful reference to determine when to conduct deeper analysis.** As indicated above, many countries use a ceiling of 60 percent of GDP as an anchor for fiscal policy. This ceiling is relatively close to the most recent estimates of long-run debt levels for both AEs and EMs. As of end-2010, the public debt level for 19 AEs and 9 EMs was close to or exceeded the 60 percent mark (Figures 3a and 3b). A possible way to use this reference in DSAs would be as follows. When public debt exceeds or is projected to exceed 60 percent of GDP for a substantial part of the projection horizon, particularly in the baseline scenario, a detailed discussion of potential risks to sustainability arising from high debt levels would normally be expected. In this approach, the reference to 60 percent of GDP should not be construed as a level beyond which debt distress is likely or inevitable, nor should it be used to judge whether debt is sustainable or not. Rather the reference point should be used as an indication that more analysis is needed. While a single reference ratio would be applied to both AEs and EMs for simplicity, this approach should recognize that potential risks are country specific and that debt below 60 percent of GDP may not be safe in some countries. As a result, a detailed analysis may be needed where debt distress happened at lower debt levels (e.g. in some EMs), even if debt were projected to remain below the reference point. Indeed, the presence of other vulnerabilities (for example, stemming from fiscal risks or debt structure) would call for in-depth analysis even for countries where public debt is below 60 percent of GDP.

¹¹ The estimates for maximum sustainable debt level are broadly similar to those obtained by the application of a probit regression model using a sample of 155 middle-income and low-income countries. This model has been used to estimate external public debt thresholds for LICs, taking account of the impact of institutional and policy implementation capacity. The forthcoming paper on reforming the LIC DSA framework will provide further details.



V. IMPROVING THE ANALYSIS OF FISCAL RISKS

20. **The current public DSA framework assesses risks around the baseline scenario mainly through standardized sensitivity analysis.** Stress tests are applied to the baseline scenario to illustrate the potential impact of adverse shocks on the debt path. Macroeconomic shocks are generally reported in a standardized way for all countries.
21. **Risks, however, vary considerably across countries.** Examples of risks that materialized and resulted in a substantial rise in public debt range from large exchange rate depreciations to systemic banking crises and include off-budget entities that were bailed out by governments.
22. **The analysis of contingent liabilities in DSAs has typically been too succinct and uniform, which stands in sharp contrast to the actual impact of the materialization of such liabilities on public debt.** DSAs rarely discuss contingent liabilities in any significant detail. The related stress test is not particularly informative as it assumes the same 10-percent-of-GDP shock for all countries regardless of the size and risk of materialization of contingent liabilities in each country.
23. **Thus, this section suggests placing greater emphasis on contingent liabilities and proposes ways to improve the analysis of country-specific fiscal risks.**¹² It points to various tools that could be used to improve the *identification* of such risks. It also suggests ways to enrich the analysis of the *impact* of shocks on the debt outlook.

A. Contingent Liabilities

24. **Strengthening the analysis of contingent liabilities is critical given the scope and magnitude of off-budget risk materialization.** Both financial and non-financial sectors have historically benefited from government financial interventions, including financial support provided by the central bank.¹³ These interventions arose out of explicit and implicit guarantees to various public entities including sub-national governments and state-owned enterprises (SOEs) and banks, explicit or implicit guarantees embedded in public-private partnerships (PPPs), or support to private companies that were deemed too big to fail.¹⁴

¹² Fiscal risks are defined as “deviations of fiscal outcomes from what was expected at the time of the budget or other forecast,” and may arise from *macroeconomic shocks* and the realization of *contingent liabilities*. See Cebotari et al (2009).

¹³ Cebotari (2008) and chapter 4 of the *Public Sector Debt Statistics Guide* (<http://www.tffs.org/PSDStoc.htm>) provide useful outlines of the typology of contingent liabilities.

¹⁴ It is particularly important to report properly on and assess carefully fiscal risks from public interventions aimed at restoring confidence in the markets and stabilizing financial conditions. In the case of the recent global financial crisis, these interventions have been carried out rapidly and by a wide range of institutions, with different reporting and oversight mechanisms. They include liquidity injections; the resolution of financial

(continued)

25. **Assistance to the financial sector has been particularly costly.** Systemic banking crises have not only been frequent, but they have often carried heavy fiscal costs (Figure 4 and Table 2). The estimated increase in public debt in the wake of a banking crisis often far exceeds the size of the contingent liability shock in the current DSA template.¹⁵ The median overall increase in public debt, which reflects both direct and indirect effects of banking crises, is close to 20 percent of GDP. However, the large variation across countries suggests that a standardized shock is not likely to meaningfully capture the impact of banking crises on public debt (although it remains as a default option when detailed information on contingent liabilities is not available).

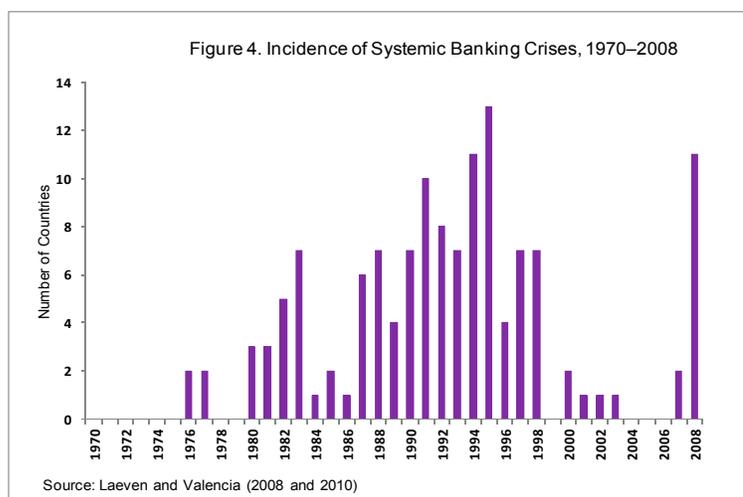


Table 2. Summary of the Cost of Banking Crises, 1970-2009

	Direct Fiscal Costs ¹	Increase in Public Debt ²	Output Losses ³
	Medians (% of GDP)		
Old crises (1970-2006)			
Advanced economies	3.7	36.2	32.9
Emerging markets	11.5	12.7	29.4
All	10.0	16.3	19.5
New crises (2007-2009) ⁴			
Advanced economies	5.9	25.1	24.8
Other economies	4.8	23.9	4.7
All	4.9	23.9	24.5

Source: Laeven and Valencia (2008 and 2010)

¹ Direct fiscal costs include fiscal outlays committed to the financial sector from the start of the crisis (t) up to t+5 (or up to end-2009 for the recent crises), and capture the direct fiscal implications of intervention in the financial sector.

² The increase in public debt is estimated by computing the difference between pre and post-crisis debt projections, measured in percent of GDP over [T-1, T+3], where T is the starting year of the crisis. For the 2007-2009 crises, debt reflects fall WEO projections from the year before the crisis year as pre-crisis debt figures (i.e., September 2006 WEO for the UK and US and October 2007 WEO for all other recent crises) and the Spring WEO 2010 debt projections for the post-crisis debt figures. For past episodes, the actual change in debt is reported.

³ Output losses are computed as deviations of actual GDP from its trend over a period of three years from the start of the crisis.

⁴ New crises include Austria, Belgium, Denmark, Germany, Iceland, Ireland, Latvia, Luxembourg, Mongolia, Netherlands, Ukraine, United Kingdom, and the United States.

institutions with public support through closure, nationalization, recapitalization, or mergers; the establishment of funds to purchase troubled securities from financial institutions; and extensions of deposit and other guarantees.

¹⁵ The cost of banking crises include the impact of government bailout, the shortfall in revenue due to the resulting economic downturn, and the stimulus packages that often accompany some the banking crises. Typically, the cost is partially covered by asset recovery.

26. **Guarantees for SOEs and PPPs often pose sizable risks.** For instance, in Chile, revenue guarantees granted to airport and toll-road concessionaires were estimated to have created government exposure of about 4 percent of GDP. In Portugal, guarantees of SOEs debt amount to about 7 percent of GDP.¹⁶

27. **Demands on the government arising from natural disasters have been substantial in some cases.** In small economies, the cost of natural disasters relative to the size of the economy can be very large. For instance, in 2004, hurricane Ivan inflicted damage estimated at about twice the size of Grenada's GDP. Even in larger countries, natural disasters can have sizeable costs. For example, the recent earthquakes in New Zealand are estimated to have cost the central government about 4 percent of GDP.

B. Identifying Country-Specific Shocks

28. **Identification of relevant country-specific shocks can be based on a combination of cross-country and individual experience.** Different tools can be used to identify risks stemming from macroeconomic imbalances, private sector liabilities, off-balance-sheet public sector liabilities, and other shocks like natural disasters.

Sensitivity of public debt to economic shocks

29. **Identification and calibration of risks arising from exchange rate depreciation could be informed by exchange rate assessments done using CGER¹⁷ (or other) methodologies.** For example, in cases where the exchange rate is found to be overvalued (undervalued), an exchange rate shock of at least the maximum estimated magnitude of the overvaluation (undervaluation) would be expected in the DSA, recognizing that exchange rate adjustment may be accompanied by some overshooting.

30. **More generally, the vulnerability exercises for emerging and advanced economies as well as the spillover reports could be used to identify macroeconomic risks.**¹⁸ The vulnerability exercises provide sectoral risk ratings (low, medium, and high risk) for each country covered by the exercise. A medium or high risk rating in a certain sector would warrant further investigation of the source of the vulnerability, which could suggest relevant macro risks to include in the DSA.

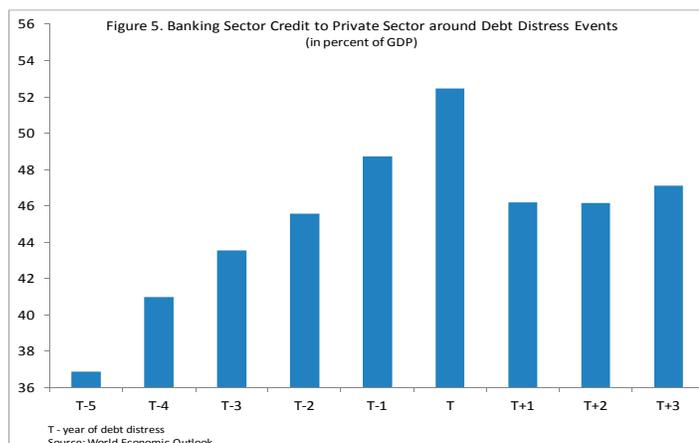
¹⁶ See Cebotari et al (2009) for further evidence.

¹⁷ CGER refers the methodologies used by the IMF's Consultative Group on Exchange Rate Issues (CGER). For further information please see <http://www.imf.org/external/np/sec/pr/2006/pr06266.htm>.

¹⁸ For more information, please see <http://www.imf.org/external/pp/longres.aspx?id=4479>, and <http://www.imf.org/external/pubs/ft/survey/so/2011/CAR090211B.htm>.

Risk of transformation of private debt into public debt

31. **Rapid credit growth, asset price bubbles, and sustained surges in capital flows have been shown to precede banking crises.**¹⁹ Banking sector credit to the private sector is particularly relevant in this regard. Staff analysis shows that the ratio of domestic private sector credit to GDP is an efficient predictor of sovereign debt distress (Figure 5).²⁰



32. **Indicators of banking sector credit, in combination with other relevant financial indicators, could thus inform decisions on the merit of running a “tail risk” scenario or a bound test incorporating a financial crisis.** Naturally, to avoid misunderstandings, it would be important to clarify the rationale and goal of such exercises, which should not be misconstrued as predicting a financial crisis or suggesting that the public sector should bail out private firms. Rather, stress testing contingent liabilities that may arise from the financial sector should be seen as an analytical exercise (similar to stress testing other shocks) to be used to inform the authorities’ approach to dealing with macro-financial issues. Such an exercise may well result in consideration of further regulatory and supervisory efforts to minimize the risk of financial sector difficulties. In many cases, the authorities may be already taking appropriate action to mitigate relevant risks or draw up contingency plans. In others, stress tests may give further impetus to undertake risk-reducing actions. As with other sensitive issues addressed in Fund surveillance, communication challenges stemming from such stress testing would be handled in the framework set by existing policies on transparency.

33. **The financial stability assessment component of the FSAP sheds important light on the extent of financial sector risks.**²¹ In particular, FSAPs include estimates of capital

¹⁹ See Laeven and Valancia (2010), Reinhart and Rogoff (2009), Mendoza and Terrones (2008), and Kaminsky and Reinhart (1999) for further details.

²⁰ This analysis suggests a domestic banking sector credit to the private sector-to-GDP ratio above 70 percent provide an early warning signal of sovereign debt distress. Values around debt distress episodes (Figure 5) are lower than the threshold because they are averages that do not reflect the optimization criteria used in the signal approach. It should be noted also that an increase in this indicator may reflect financial deepening particularly in countries undergoing structural reforms.

²¹ For more information on the Financial Sector Assessment Program (FSAP), please see <http://www.imf.org/external/np/exr/facts/fsap.htm>.

shortfalls in the financial sector under a range of stress tests. While these capital shortfall estimates should not, and hopefully would not, automatically become public liabilities in the event financial stresses do arise, they provide valuable indications on the merit of reflecting financial sector risks in DSAs. The size of the banking sector is also likely to have a bearing on the impact of the financial sector contingent liability on the sustainability of public debt.

34. **Various possibilities to reflect FSAP results in DSA exist, where relevant.** One approach would be to calibrate bound test(s) using stress test estimates of the capital shortfalls of the systemic (or largest) banks.²² Another approach would be to use results from the FSSA's risk assessment matrix (RAM). For instance, for risks that have a medium or high impact on the banking sector, the public DSA could include a contingent liability shock equivalent to half of the impact on the capital base. The size of the shock could be further calibrated to take into account factors such as the nature of the banking sector (e.g., extent of state ownership) and current market conditions (e.g., ability of private sector to raise capital). In cases where risks stemming from the financial sector are high, a more ambitious step would be to undertake a joint stress test of the financial sector and public debt. Joint stress testing could focus first on simple feedbacks while understanding of the complex macro-financial linkages is being developed. For example, where feasible, joint stress testing could involve using the same underlying assumptions, and allowing contingent liabilities arising from the financial sector to feed into the fiscal projections and vice versa.²³ It should be recognized that full-fledged general equilibrium stress tests may not be feasible even for AEs, and the extent to which this ideal can be approached will vary from country to country.

35. **Where available, the balance sheet approach (BSA) can also play a useful complementary role in identifying risks to public debt.** The BSA focuses on the structure of assets and liabilities of the main sectors of the economy and on key linkages across sectors. The BSA can help identify vulnerabilities in different sectors, including the non-financial corporate and household sectors, by providing information on different sectors' net financial position, net foreign currency position, and net short-term position. The BSA could therefore help point to potential sources of contingent claims under adverse macroeconomic scenarios.^{24 25} Consideration could be given to encouraging the conduct of BSA in cases

²² Important issues related to the conduct of the FSAP may affect how and the extent to which the results of the FSAP can be used in public DSAs. For example, in addition to the size of shocks being ad hoc, reporting of the results of stress testing is not standardized with quantification often absent from the main report. It is intended that the use of FSAP results in the DSA be done in the context of existing policies on confidentiality of information.

²³ Work in this area would involve close collaboration between various departments, including MCM.

²⁴ Existing methodologies, such as the contingent claims approach (CCA), could be used where data is available to inform this judgment. The CCA uses information based on the financial sector balance sheet, in addition to market prices and measures of uncertainty, to derive forward-looking indicators of potential fiscal costs. See Gapen et al (2005) for further information.

where, for example, the external debt sustainability analysis points to high and potentially unsustainable levels of private sector external debt.

Transformation of off-balance-sheet public liabilities into on-balance-sheet public liabilities

36. **Obligations arising from PPPs and SOEs can be reflected in DSA in a number of ways that depend on the extent of available information.**²⁶ PPP contracts give rise to obligations on the government to purchase services from a private operator and to honor calls on guarantees. These obligations can influence debt sustainability in much the same way as if the government had incurred debt to finance public investment and provided services itself. Country teams could present information on the present value of liabilities under PPPs or other concession arrangements. There are two ways to take non-debt obligations into account when undertaking debt sustainability analysis. First, the net present value of future payments—such as under PPP contracts—could be added to public debt. Debt sustainability would then be judged by reference to public debt plus non-debt obligations. Second, an analytically equivalent approach is to count known and potential costs of non-debt obligations as primary spending.²⁷ More generally, the emphasis should be placed on conducting scenario analyses that correspond to alternative degrees of risk exposure to test debt projections under different assumptions about the materialization of contingent liabilities.

37. **The impact of natural disasters should be reflected in DSAs for countries prone to recurrent floods, earthquakes, and other disasters** (e.g., Caribbean islands). Baseline scenarios do not take into account such disasters, even though they affect regularly many countries that are not fully insured against such disasters. Alternative scenarios could be developed using historical evidence on the frequency and cost of natural disasters.²⁸

²⁵ Insights based on BSA concepts have been used in Fund surveillance for some time to inform the buildup of debt-related vulnerabilities. [Rosenberg et al \(2005\)](#) details the benefits of the BSA in Argentina (2001), Turkey (2001), and Uruguay (2002). Iceland Selected Issues (<http://www.imf.org/external/pubs/cat/longres.aspx?sk=24255.0>) is a recent application of the BSA and that is used to inform the public debt sustainability analysis. Improvements in the availability of data necessary for the application of the BSA have facilitated the conduct of the exercise, although it remains resource intensive.

²⁶ Guidance on the identification and quantification of fiscal risks due to contingent liabilities may be found in Cebotari (2008), Cebotari et al (2009), Everaert et al (2009), Hemming (2006), and Irwin (2007).

²⁷ While this approach could be applied to other legal obligations, extending it to implicit contingent liabilities could be difficult to implement because the government may be able to constrain spending that it is not legally bound to undertake.

²⁸ A useful resource in this regard is the comprehensive database on natural disasters compiled and maintained by Centre for Research on the Epidemiology of Disasters (CREED) at the Catholic University of Louvain (<http://www.emdat.be/>).

C. Assessing the Impact of Shocks

38. **Bound tests, alternative scenarios, and stochastic simulations are different methods to examine the impact of shocks on the debt trajectory.**²⁹ The first two are used to assess the impact of specific shocks, while stochastic simulations typically capture the uncertainty surrounding the baseline scenario by examining the impact of a series of shocks drawn from historical experience. Bound tests currently used in the DSA template are relatively mechanistic, with generally only one variable shocked at a time, while history suggests that shocks tend to be correlated. Another issue is whether existing bound tests are always relevant, and conversely whether they capture all relevant shocks. This section proposes improvements to the way bound tests are set up in the current framework and suggests that fan charts from stochastic simulations could be used more widely.

Bound tests

39. **An examination of historical episodes of large public debt increases suggests that there is room to enhance the assessment of shocks, in particular “tail risks,” using the current bound test approach.** The current framework includes one macroeconomic stress test—a 30 percent exchange rate depreciation—that is in the realm of tail risks compared to the other less extreme, but more likely, stress tests. Looking back at the historical record across a wide spectrum of countries, there have been several episodes where public debt burdens have increased significantly over the space of just a few years (Annex IV). Although the circumstances surrounding such episodes vary greatly, there are a few empirical regularities that could be reflected in the analysis of macroeconomic shocks.

- ***Growth collapses and large terms of trade shocks appear to have played a prominent role in episodes of large public debt increases,*** which is not reflected in the current stress tests. For example, in one half of episodes where real GDP growth was negative over a five-year period, public debt increased by more than 14 percent of GDP.³⁰ Similarly, in one half of episodes where the terms of trade deteriorated by more than 25 percent in one year, public debt increased by more than 11 percent of GDP.
- ***The assessment of risks can be enhanced by taking into account linkages observed between some key macro variables after certain shocks.*** For example, in episodes

²⁹ Bound tests refer to the stress-testing used in the DSA templates to assess the impact of specific shocks to certain key variables. Alternative scenarios refer to more elaborated scenarios, either standardized (e.g., no policy change) or tailor made.

³⁰ The frequency and size of growth “down-breaks” (statistically significant permanent reduction in growth) are relatively large. Fifteen percent of a sample of 88 middle-income and advanced economies experienced at least one such growth down-break with an average size of 4.7 percent, which is much higher than the negative shocks implied by the bound test approach for the same period. See Berg et al (2008) for further details.

where the nominal exchange rate depreciated by more than 30 percent in one year against the U.S. dollar, the inflation rate increased significantly, and real GDP growth declined sharply relative to its historical trend. Banking crises, growth collapses, and large terms of trade shocks tend to coincide with large output losses, exchange rate depreciations, and higher inflation, all of which affect the public debt outlook. The impact of such shocks can be made more realistic by taking into account how output, inflation, and the exchange rate evolved over the course of the historical episodes. Alternatively, country teams could develop full-fledged scenarios to capture country specific linkages among key variables (such as endogenous increases in cost of borrowing) not reflected in stress tests.

Stochastic simulation methods

40. **Stochastic simulation methods could be applied to improve estimates of uncertainty surrounding baseline debt projections and enhance assessments of fiscal risks.** The current configuration of stress tests provides a rough estimate of uncertainty surrounding debt projections, and the persistence of shocks is calibrated in an ad-hoc manner.³¹ The individual shocks do not allow for feedback between key macroeconomic and fiscal variables. Box 2 illustrates the usefulness of confidence intervals generated on a country-specific basis, based on empirical models that take into account interaction between key variables. The dynamics of the underlying empirical models determine the persistence of shocks, which can vary greatly across countries, providing an additional dimension of realism.

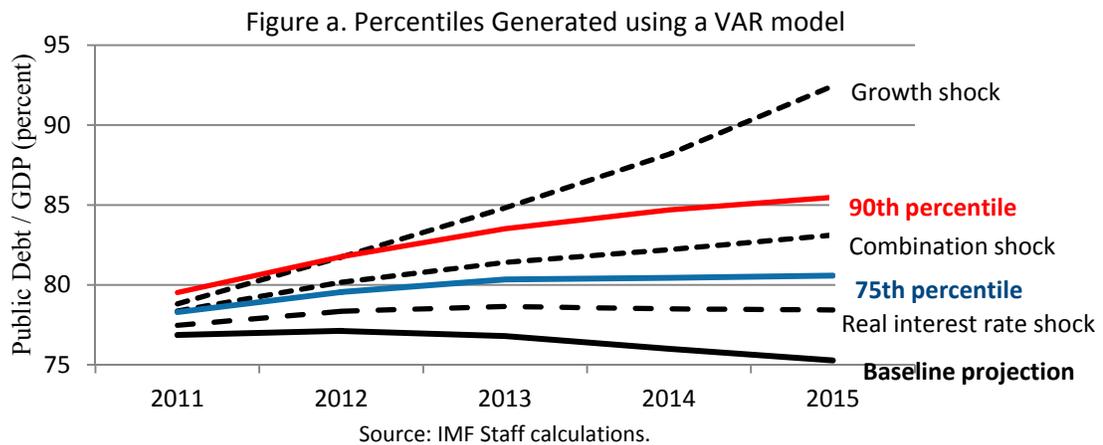
41. **Stochastic simulations could be encouraged for countries where data are available.** The coming on line of new data and tools since the issue of stochastic simulations was last discussed by the Board (see [Sustainability Assessments – Review of Application and methodological Refinements](#)) suggests that they could be used more widely, and indeed they have been more prevalent in staff analysis.³² Confidence intervals however are sensitive to model specification and the sample period used for estimation (Box 2). They may also not be particularly useful in cases where there have been structural shifts, for example in the conduct of policy (such as change in exchange rate regime and fiscal/monetary policy objectives/tools). Consideration could be given to developing guidelines to ensure that the

³¹ The most extreme stress test is estimated to occur with a likelihood of 15 to 30 percent for MACs and around 25 percent for LICs. The duration of shocks is five years for MACs and two years for LICs.

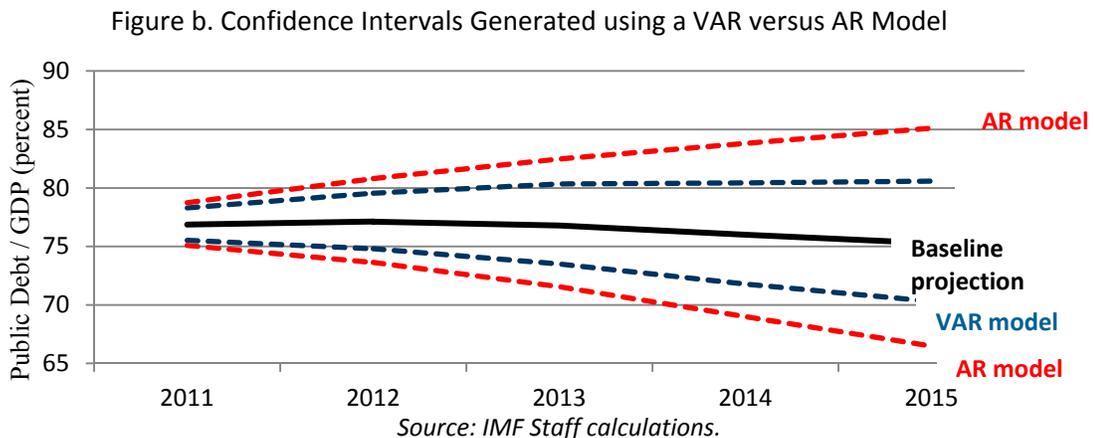
³² Most applications to date have been based on vector autoregressive models using quarterly data, which are available for around 40 countries, the majority of which are AEs. Examples include fan charts for public debt projections for Greece, the UK, Germany, and the US reported in the November 2010 Fiscal Monitor and for Greece, Ireland, Italy, Portugal and Spain reported in the Fall 2010 Vulnerability Exercise for Advanced Economies. Recent examples of cases where DSAs in staff reports have included fan charts include [Morocco](#), [Mauritius](#), [El Salvador](#), [Indonesia](#), [Israel](#), and [Costa Rica](#).

Box 2. Using Confidence Intervals to Help Gauge Uncertainty

Confidence intervals generated using stochastic simulation methods provide a well-defined measure of uncertainty surrounding debt projections. This is illustrated using data for a market access country. Stochastic simulation methods are applied to a vector autoregressive (VAR) model, estimated using annual data over the period 1995–2010, to generate a probability distribution for the public debt-to-GDP ratio over a five-year projection period (2011–2015). Public debt is projected to decline in the baseline projection scenario, reaching 75 percent by 2015 (Figure a). Under the most extreme shock reported in the current public DSA framework, public debt increases to 92 percent of GDP by 2015, 17 percentage points above the baseline projection. Stochastic simulations indicate that there is a 25 percent probability that public debt would exceed 80 percent of GDP by 2015 (the 75th percentile) and a 10 percent probability that it would exceed 85 percent (the 90th percentile), implying that the growth shock is not a likely outcome based on recent historical experience.

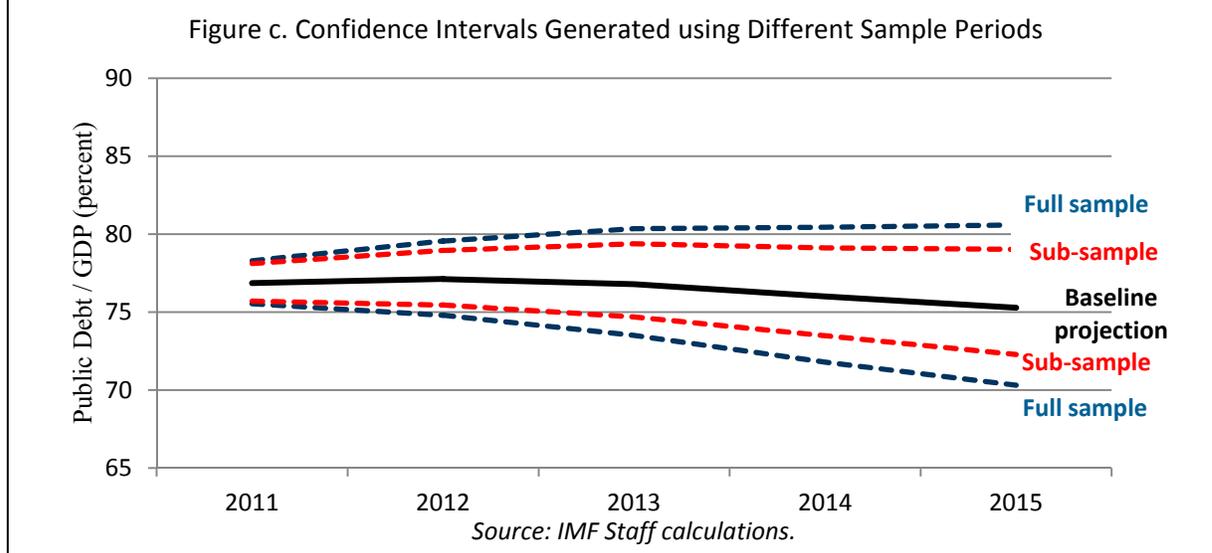


Confidence intervals can be sensitive to model specification issues and the sample period used for estimation. For example, confidence intervals generated using an autoregressive (AR) model are significantly wider than those generated using a VAR (Figure b), indicating the underlying dynamic specification and covariance of shocks play a prominent role in deriving measures of uncertainty surrounding debt projections.



Box 2. Using Confidence Intervals to Help Gauge Uncertainty (continued)

Similarly, estimating the VAR over a shorter sample period (1999–2010 versus 1995–2010) results, in this particular case, in narrower confidence intervals (Figure c).



statistical foundations of the analysis are sound and comparability across countries is maintained to the greatest extent possible, while realizing that the DSA is a tool best used for single country analysis.³³ A possible approach that recognizes the resource intensity of this exercise and ensure more cross country comparability would be to generate confidence intervals centrally for countries where data are available. This however would not preclude country teams from tailoring stochastic simulation models to country-specific circumstances. In cases where stochastic simulations are not considered useful or cannot be conducted, country teams would be expected instead to develop well-specified and full-fledged alternative scenarios to analyze risks.

42. **Methodologies could be developed to generate confidence intervals for countries where data remain inadequate, although care should be taken in this regard.** One approach would be to exploit cross-country experiences by estimating models using panel data for broadly similar countries. A number of issues would need to be addressed to assess the technical and procedural feasibility of this approach, including the classification of countries with similar attributes (such as reliance on concessional resources, exchange rate regime, and dependence on commodity exports). Such an approach could allow for some

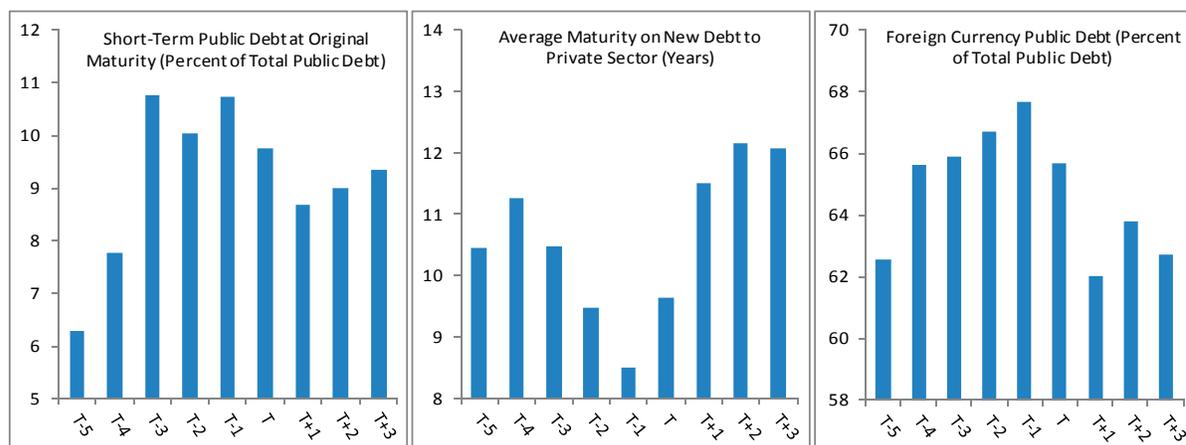
³³ One possible approach to address this issue would be to ensure that confidence intervals are broadly consistent with the historical record of forecast errors based on the WEO projection database. This would alleviate the risk of over-fitting empirical models (data mining), leading to a bias toward understating the risks.

country-specific attributes (notably volatility), while constraining other attributes that are more difficult to estimate robustly at the country level (correlation between the shocks, for example).

VI. VULNERABILITIES ASSOCIATED WITH THE PROFILE OF PUBLIC DEBT

43. **Debt vulnerabilities are associated not only with the level of debt, but also with its profile.** Debt structure characteristics—maturity, currency composition, and the creditor base—have received much attention in the analysis of debt distress.³⁴ A high share of short-term debt at original maturity, which may reflect the inability of certain sovereigns to issue long-term debt, increases vulnerability to rollover and interest rate risks. A high share of foreign currency-denominated debt increases vulnerability to exchange rate risk and can put pressure on foreign exchange reserves. Debt distress events have typically been preceded by an increase in the shares of short-term debt and foreign-currency denominated debt (Figure 6a).³⁵ The nature of the creditor base—for example, whether it is diversified, reliable, captive, domestic, or foreign— also matters for rollover risk.³⁶

Figure 6a. Debt Structure Indicators around Debt Distress Events



T - Year of debt distress event.

Source: IMF staff calculations, based on annual data.

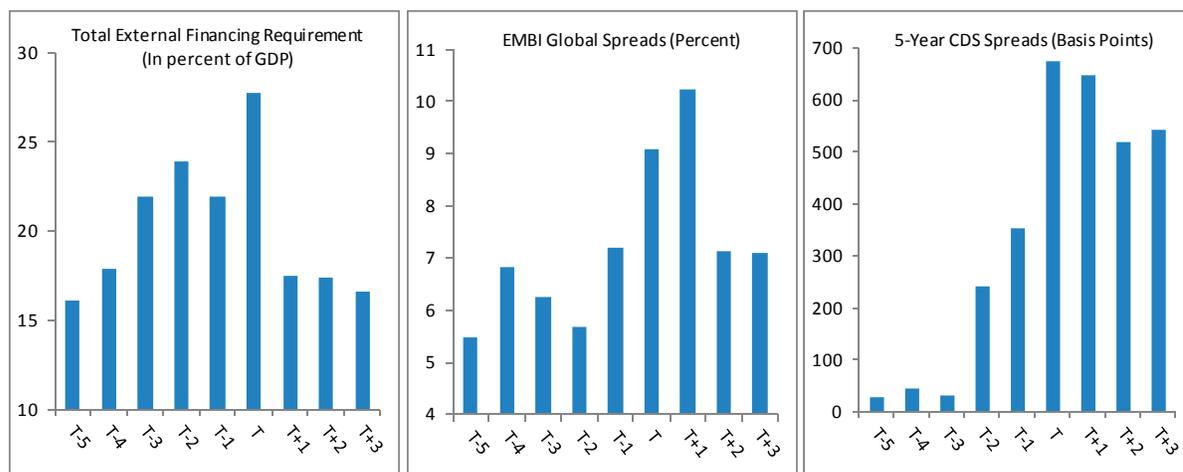
³⁴ See for example Deutsche Bank (2011), IADB (2007), Eichengreen and Hausman (2005).

³⁵ Short-term debt at remaining maturity highlights the bunching of refinancing needs, and thus captures different risks than short-term debt at original maturity. Indeed, the latter could be seen as an early warning of liquidity problems.

³⁶ The absence of comparable cross country data on the creditor base does not allow for an examination of its behavior around debt distress episodes. However, its importance has been amply recognized and discussed. See for example, *Managing Sovereign Debt and Debt Markets through a Crisis- Practical Insights and Policy Lessons*, Das et al (2010), JPMorgan (2011), and IMF and World Bank (2001).

44. **Additional indicators associated with the debt profile, such as external financing needs and risk pricing, may also provide useful information on the risk of debt distress** (Figure 6b). External financing needs, which increase pressure on existing foreign exchange reserves, tend to rise before episodes of sovereign debt distress. Similarly, bond and CDS spreads tend to increase before debt distress episodes. Fluctuations in spreads may be related to a number of underlying factors associated with country-specific macroeconomic fundamentals and political risk, as well as other factors related to international financial conditions and investors' preferences. Given the significant noise in spreads, only sustained increases in spreads, which is likely to be difficult to ascertain a priori, may be relevant for assessing vulnerabilities.

Figure 6b. Liquidity and Risk Pricing Indicators around Debt Distress Events

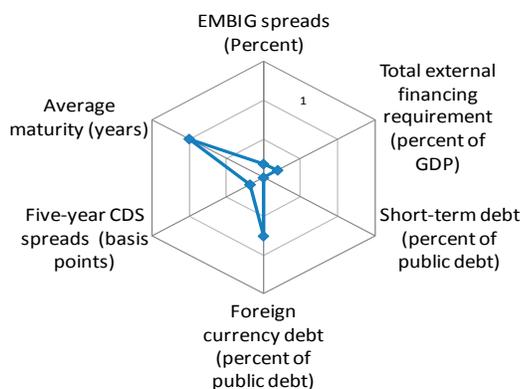


T - Year of debt distress event.

Source: IMF staff calculations, based on annual data.

45. **This suggests that the analysis of debt vulnerabilities can be improved by a greater focus on debt structure and liquidity indicators.** Staff proposes to add to the public DSA framework the six indicators shown in the previous figures, together with an associated benchmark level for each of them based on its ability to signal debt distress events (Figure 7 and Box 3).³⁷ The purpose of the benchmarks would be to facilitate staff analysis rather than rate countries in terms of likelihood of debt distress or provide an early

Figure 7. Country: Debt Profile Vulnerabilities



³⁷ A value of one means that an indicator is at the threshold level. The closer the indicator is to the center, the lesser the vulnerability along this dimension.

warning regarding access to market financing. This assessment would be undertaken in a flexible manner for MACs where data are available; in certain countries, some of the indicators may not be relevant or applicable. With regard to the creditor base, the lack of systematic data precludes a similar analysis as the one done for other indicators. Where relevant, it would be useful to provide information on this issue, including on the breakdown between domestic and foreign creditors, in DSAs.

46. **The analysis of risks arising from debt profile need not be confined to these indicators and the associated benchmarks.** Other factors such as the exchange rate regime, the role the central bank can play in mitigating short-term liquidity constraints, capacity of the market to absorb debt, and the projected path of underlying benchmark rates have a bearing on the analysis. The underlying reasons for debt profile vulnerabilities, including contagion, incomplete credit markets, and weak debt management practices, may also be important in this regard.³⁸

Box 3. Defining Indicative Benchmarks for Debt Vulnerability Indicators

Indicators of debt profile vulnerability were selected by examining the recent experience of 49 market access countries, mostly EMs. Thirty-eight debt distress events that occurred in 32 countries between 1993 and 2010 were identified. Initial work on early-warning models identified sovereign debt distress as cases in which a default or a restructuring took place. Manasse, Roubini, and Schimmelpfenning (2003) extended the analysis to include cases in which a default was avoided thanks to official financing. The criteria to select debt distress events were refined in this exercise by including IMF financing only when used to address sovereign debt difficulties (excluding programs that were precautionary and associated with natural disasters, economic transition, and current account crises).

Debt Profile Vulnerabilities - Indicators				
Variable	Indicative benchmarks	Noise-to-signal ratios	Direction to be safe	
EMBI Global spreads (Basis Points)	1,175	26	<	
Five-Year CDS spreads (Basis Points)	812	35	<	
External Financing Requirement (Percent of GDP)	31	41	<	
Public Debt in Foreign Currency (Percent of total)	68	75	<	
Short-term Public Debt at Original Maturity (Percent of total)	14	76	<	
Average Maturity of Debt to Private Sector (Years)	6	97	>	

Indicative benchmark values for six indicators were calculated to help assess debt vulnerabilities.

We use the signal approach based on annual information to derive a benchmark for each indicator by minimizing the noise-to-signal ratio. Benchmarks should be used as reference point for analysis, rather than a precise indication of the presence or absence of vulnerabilities.

³⁸ See [Managing Sovereign Debt and Debt Markets through a Crisis- Practical Insights and Policy Lessons](#) and Borensztein et al (2004) for further details.

VII. COVERAGE OF FISCAL BALANCE AND PUBLIC DEBT

47. **Defining the concept of public debt is critical to capturing adequately fiscal risks in DSAs.** The definition of public debt raises several questions: (i) what is the appropriate coverage of government, e.g., central or general government? (ii) how should long-run spending pressures be included in DSAs? and (iii) should assets be integrated in the analysis? This section looks at these three issues. While the answers to these analytical questions are relatively straightforward, data availability is a critical constraint for implementation in some cases.³⁹ A flexible approach to implementation of good practices in fiscal and public debt coverage would therefore be required.⁴⁰

A. Expanding the Coverage of the Fiscal Accounts

48. **In line with GFSM 2001 and the Manual on Fiscal Transparency, the concept of general government should be used in DSAs.** An increasingly decentralized fiscal framework has given sub-national governments greater room for creating debt and discretionary power to partially offset a country's fiscal adjustments efforts. This is particularly the case when decentralization is not accompanied by greater transparency, monitoring and reporting mechanisms, and clear fiscal rules (e.g., fiscal responsibility laws, debt ceilings on local governments). Historically, the poor fiscal performance of sub-national governments led to central government bailouts and, in some cases, at large costs. Thus, country teams should seek to include all relevant information on general government entities in the DSA.

49. **Recent episodes of significant debt increases arising from off-budget entities or "peripheral sectors" point to the value of widening the coverage of the fiscal accounts even beyond the general government.**⁴¹ To the extent possible, where data are readily available, wider aggregates should be reported, in particular covering public corporations that impose large fiscal risks to the government (including those belonging to sub-national governments). A wider and enhanced view of the SOE sector and its intertwined operations with the government would help improve the risk assessment of its overall impact on debt sustainability. Reclassifications of SOEs and PPPs into the general government in Europe (e.g., Greece, Hungary, and Portugal) are recent examples of how off-budget entities may end up affecting public debt. In the case of Portugal, the reclassifications increased the reported debt level by 10 percentage points of GDP in 2010.

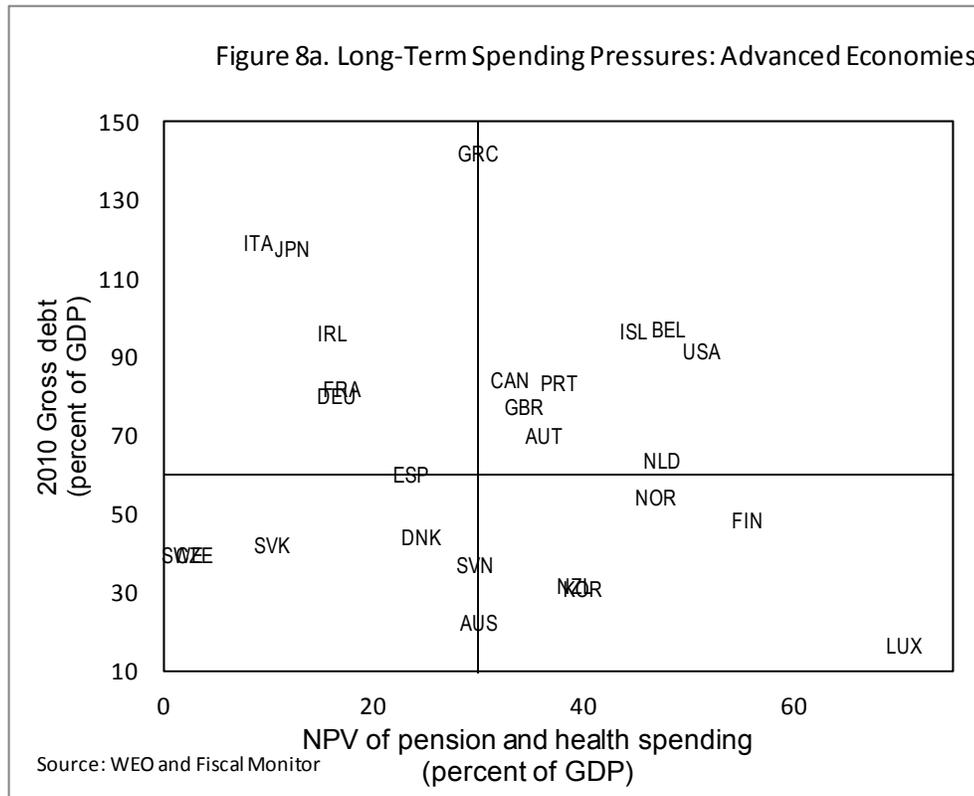
³⁹ Implementation of internationally accepted standards for government finance (*Government Finance Statistics Manual 2001* (<http://www.imf.org/external/pubs/ft/gfs/manual/>)) and public sector debt data (*Public Sector Debt Statistics Guide* <http://www.tffs.org/PSDStoc.htm>) to make progress in the consistency and cross-country comparability of data should continue to be encouraged.

⁴⁰ 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.

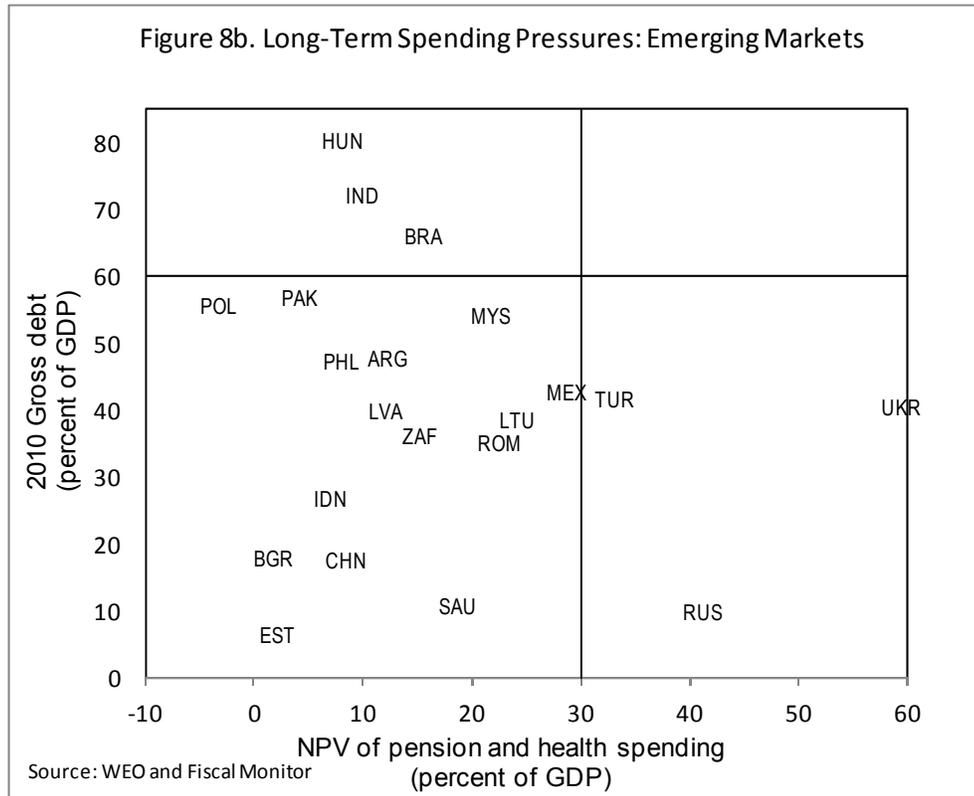
⁴¹ After their stabilization programs in the 1990s, Latin American countries have gone beyond the concept of general government to measure the non-financial public sector.

B. Integrating Long-Run Spending Pressures into DSA

50. **Fiscal pressures stemming from age-related and health care spending can have a significant impact on primary balances and debt sustainability.** In AEs, the combined annual spending on old-age pensions and health care is expected to increase by an average of 4 percent of GDP by 2030 (Clements et al, 2010). These pressures pose serious debt sustainability concerns in particular for AEs that already face high debt levels, such as Belgium, Iceland, and United States (Figure 8a). Against this backdrop, some AEs have been producing long-run fiscal projections showing that the inclusion of population aging costs may turn an original downward debt trajectory into an unsustainable debt path.⁴² For EMs, spending on pension and health care is projected to increase by 2 percent of GDP on average over the next two decades and additional pressures are likely to emerge beyond 2030. However, EMs facing higher debt have low long-term pressures (e.g., Brazil, Hungary, India), while those facing higher present values of long-term pressures have a debt position below 40 percent of GDP (e.g., Russia, Turkey, Ukraine) (Figure 8b).



⁴² See for example, U.S. Congressional Budget Office (2010).



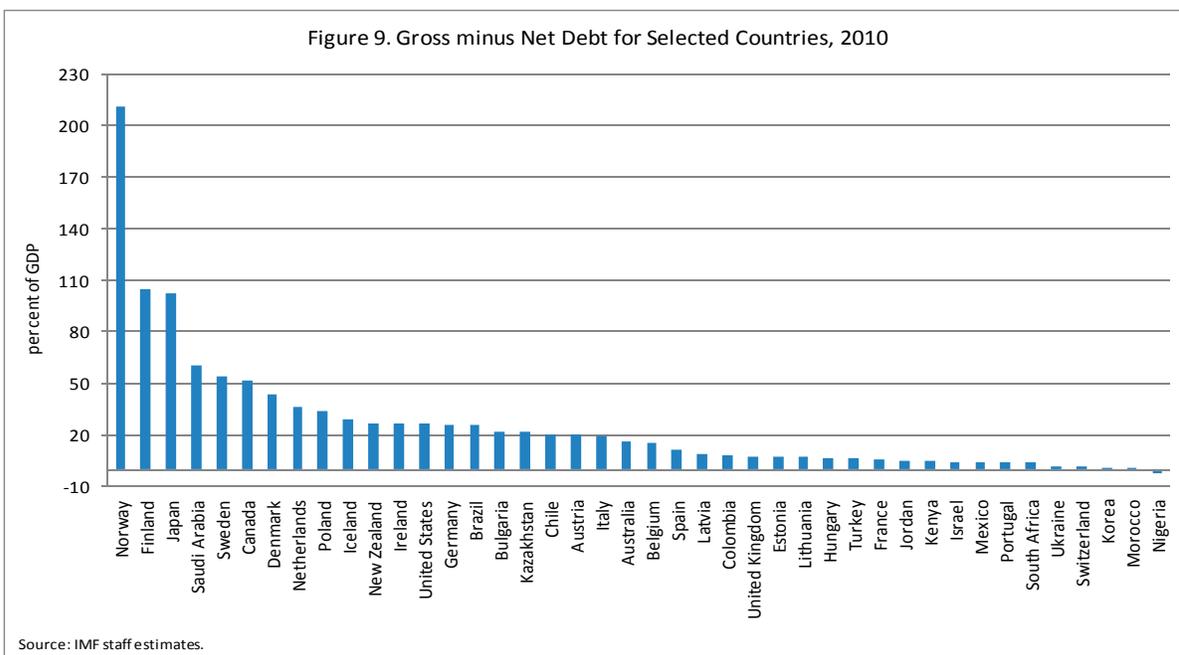
51. **DSAs should reflect these long-term spending pressures.** The current five-year projection horizon of the DSA for MACs constrains the ability to include the impact of pension and health-related spending increases which are expected to materialize over a longer horizon. Expanding the projection horizon may be useful in cases where these spending pressures are expected to materialize relatively quickly.⁴³ In such cases, which will likely consist mostly of AEs, country teams should be encouraged to exercise flexibility in lengthening the projection horizon. In other cases, a memo item such as the present value of pension and health care costs as a percent of current GDP should be added.⁴⁴ For all countries where these spending pressures are significant, an assessment of their impact on debt sustainability and potential reforms to address such pressures should be discussed.

⁴³ Expanding the projection horizon may be useful also in cases where there is room to accumulate more debt for a few years (e.g., to stimulate the economy or implement high priority investment projects) before returning to a downward path.

⁴⁴ Adding directly the present value of pension and health care costs to existing public debt would not be appropriate, as it is of a different nature. In particular, it does not add to rollover needs or interest payments.

C. Assessing Gross and Net Debts

52. **The assessment of the public debt may differ substantially depending on whether a gross or net debt measure is considered (Annex V).**^{45 46} Differences arise both in the level of the debt – due to large assets held by some governments (e.g., Norway, Finland, and Japan) (Figure 9) – and its evolution over time, which depends on whether the increase in gross debt is accompanied by an increase in assets (Figure 10). As government financial assets can be disposed to help finance budget deficits or pay debt, the level of net debt should be discussed explicitly in the analysis, particularly for countries with high levels of gross debt (e.g., above the 60 percent mark discussed in Section III). At the same time, rollover risks and risks associated with the overall debt burden may be better captured by looking at gross debt.

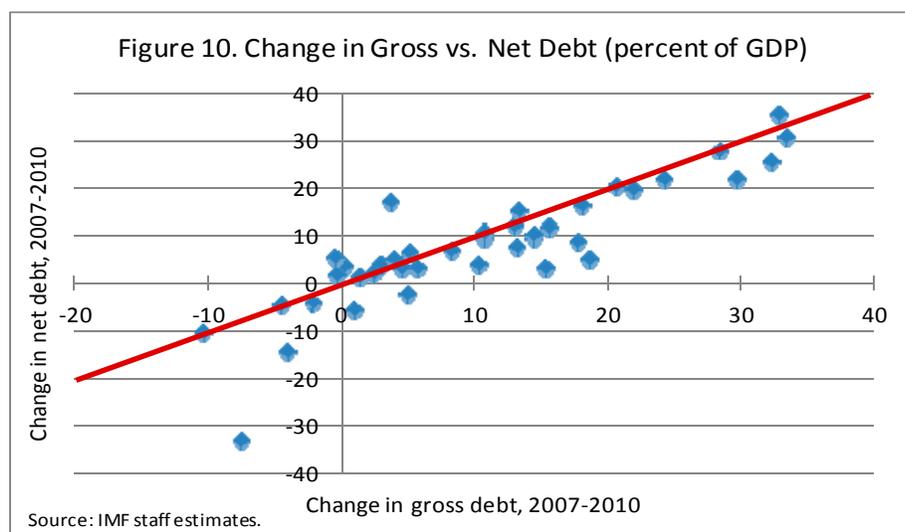


53. **Currently, gross debt is the most widely reported debt concept and should continue to be the basis for public DSA.** Gross debt permits cross-country comparisons

⁴⁵ The *Public Sector Debt Statistics Guide* (<http://www.tffs.org/PSDStoc.htm>) provides standard concepts to address the substantial differences in institutional coverage, consolidation, valuation, and instrument coverage in available data.

⁴⁶ This issue is particularly relevant for commodity exporters which, in addition to large liquid assets, may have large illiquid ones in the form of commodities in the ground. This commodity wealth raises issues for the design of fiscal policy that the DSA template is not designed to address. For such countries, complementary analysis is likely to be required.

with the greatest degree of reliability and coverage.⁴⁷ Net debt data, in contrast, limit the scope for comparison because of differences in the types of assets reported by different countries.



54. **Nevertheless, whenever reliable data on government assets are available, net debt should be used to complement the assessment based on gross debt.** Moving forward, AEs should be encouraged to report *net debt* and *net financial liabilities* data on a more systematic basis. For LICs and EMs, data availability and reliability are important constraints, but reporting a narrower net debt definition should be pursued. For example, when data are available and financial assets and liabilities in the form of non-debt instruments are significant, it would be relevant for a country to use *net financial liabilities*. In case where data are either not reliable or partial, a measure such as *debt net of liquid assets* would instead be considered.⁴⁸ In some cases, the relevant set of assets to be considered in the net debt definition may need to be tailored to each country, creating an additional layer of complexity to the analysis as the type of assets considered by each country might be different.⁴⁹

⁴⁷ At end-2010, the IMF and World Bank launched a public sector debt database that includes data on general government debt with maturity, currency, and foreign/domestic creditor breakdowns.

⁴⁸ Importantly, when a net debt concept is explicitly introduced, yields on assets should be stripped away from the calculation of the primary balance definition.

⁴⁹ This difficulty may be partially circumvented with the provision of a benchmark analysis using the concept of debt net of liquid assets, which should be widely available, thus providing a homogenous basis to undertake comparisons.

VIII. A RISK-BASED APPROACH TO DSAs - IMPLEMENTATION

55. **To implement the ideas presented in previous sections of the paper, staff proposes moving towards a risk-based approach to DSAs and away from standardization of most DSA elements.** The depth of the DSA would depend on the extent of identified vulnerabilities including from the debt level, fiscal risks, and debt profile. Box 4 provides an illustration of what an extensive and a lighter DSA would entail.

- A reasonable amount of standardization would be maintained, including provision of a limited set of debt indicators, a baseline scenario, comparisons with historical and “no policy change” scenarios, and a few bound tests.
- A thorough assessment of the realism of baseline projections would be necessary particularly where a large fiscal adjustment or a large primary surplus is required to safeguard debt sustainability, with attention also being paid to long-term spending pressures due to population aging.
- The depth of the DSA would depend upon the level of public debt, generally evaluated against a reference point of 60 percent of GDP but also taking into consideration country-specific factors such as the debt structure and other sources of fiscal risk (see below) that would suggest heightened concerns at lower debt levels.
- The depth of the DSA would also depend upon the level of fiscal risks (which should always be assessed), particularly elements pointing to the extent of risks stemming from currency valuation (e.g., CGER measures), financial sector developments (e.g., evolution of banking sector credit, FSAP stress tests, liquidity and debt profile indicators, and balance sheet vulnerabilities where available), and off-balance-sheet public liabilities (e.g., size and experience with PPPs, and SOEs).
- Where public debt is relatively high or fiscal risks are significant, customized bound tests and/or alternative scenarios would be expected. Their design would be based on identification of the most important country-specific fiscal risks. Also, the analysis would include where available a brief discussion of fiscal risk mitigation and management strategies (e.g., restructuring and/or privatization of SOEs, strengthening of regulatory frameworks).
- Use of stochastic simulation methods would be encouraged to improve understanding of uncertainty surrounding baseline projections. This could be facilitated by centralized generation of confidence intervals.

Box 4. Implementation of the Proposed Framework

The implementation of the proposed DSA framework is illustrated below with two extreme cases that show how the depth and breadth of the DSA would depend on the extent of risks and vulnerabilities. The DSA for Country A would entail a more detailed analysis of a wide range of issues, while that for Country B would be expected to be relatively light. The presentational set-up will be developed further as the framework becomes operational.

Country A

Background. Public debt increased from around 50 percent of GDP in 2000 to close to 100 percent of GDP in 2010 due to a combination of sluggish growth and expansionary fiscal policies.

Vulnerabilities associated with the debt level. Public debt is projected to stabilize at roughly 120 percent of GDP in the medium term. This high level of debt (well above 60 percent of GDP) is a source of significant vulnerability and calls for a more detailed analysis of risks.

Realism of the baseline projections. The baseline scenario is based on a large adjustment of the primary balance, which is projected to improve from a deficit of about 6 percent of GDP in 2010 to a surplus of 2 percent of GDP in the medium term. Given the large size of this adjustment, the realism of the baseline scenario should be discussed vis-à-vis historical experiences of large fiscal adjustment, the authorities' commitment to adjustment effort, specificity and design of fiscal measures, and the need for technical assistance to improve fiscal institutions. Alternative scenarios (no policy change and historical scenarios) would show the extent to which sustainability depends on baseline assumptions.

Fiscal risks. The main risks to the baseline scenario are associated with (i) economic growth; and (ii) contingent liabilities. The DSA would be expected to include a detailed analysis of each main source of risk. For example,

- Lower-than-projected growth would lead the debt to increase and not stabilize.
- About half of SOE debt (approximately 20 percent of GDP) is explicitly guaranteed by the government and SOE financial position is generally weak and likely to be aggravated by the projected economic contraction.
- PPPs are very large (roughly 20 percent of GDP) and some PPPs are in need of government bailout.
- The banking sector has a very high loan-to-deposit ratio and credit to the corporate sector has been contracting, posing additional vulnerabilities as banks start deleveraging.

Assessing the impact of fiscal risks. In addition to a fan chart, bound tests would be presented for the main risks identified above. In this case, the DSA could include a contingent-liability shock of 15 percent of GDP given the size of debt guarantees to SOEs and fiscal risks associated with PPPs. A larger contingent-liability shock could be envisaged to account for banking sector vulnerabilities (based on stress tests of the financial sector, if available). Given the vulnerability to lower growth, a full-fledged alternative scenario with lower growth which takes into account impact of lower growth on other macroeconomic variables could be undertaken.

Vulnerabilities associated with debt profile. Four indicators associated with the debt profile show vulnerabilities. A discussion of these vulnerabilities and possible mitigating factors would be expected.

Coverage of the debt. Given the risks arising from SOEs and PPPs, a discussion of their coverage would be warranted. In addition, the analysis would be expected to highlight any large spending pressures arising from pension and health care costs while acknowledging, in this case, the relatively low level of government financial assets.

Mitigation strategies. The authorities are committed to a number of actions to address fiscal risks arising from SOEs and PPPs (such as SOE privatization, and re-assessment of PPP contracts). Financial sector policies would support the immediate challenge of managing tight liquidity. Structural reforms to boost potential growth (e.g., labor and housing sector reforms) and to enhance efficiency of key sectors (e.g., health) are also a major component of the authorities' program.

Box 4. Implementation of the Proposed Framework (continued)

Country B

Background. The general government *gross* debt declined from a peak of 60 percent of GDP in 2006 to about 50 percent in 2010. The rapid accumulation of assets in the country's sovereign wealth fund (from oil receipts) has increased the government's net asset position from roughly 140 percent of GDP to 160 percent over the same period.

Vulnerabilities associated with the level of debt. Although the level of gross debt is close to 60 percent, it is not likely to give rise to significant vulnerabilities. The government's net asset position is expected to continue increasing over the medium term, and unwind gradually over the longer term as oil production declines and fiscal pressures associated with an aging population mount.

Realism of the baseline projections. An assessment of the realism of the primary balance projection may not be necessary. Sizeable general government overall surpluses are expected over the medium term even in the event of a modest decline in world oil prices; adequate fiscal guidelines are in place.

Fiscal risks. Risks are relatively low and are not likely to jeopardize debt sustainability. The government's net asset position is likely to be resilient to adverse macroeconomic and financial developments. Stress tests show that banks would remain well capitalized under tail risks scenarios.

Assessing the impact of shocks. Standard bound tests would be expected in this case, with a possible customized scenario to reflect the impact of a decline in oil prices. A fan chart may not be necessary.

Vulnerabilities associated with debt profile. This analysis may not be necessary. Given the liquid net asset position of the government, it is not likely that the debt profile would present vulnerabilities.

Coverage of the debt. Public debt is measured using the general government definition. SOEs and PPPs do not pose serious vulnerabilities to the government. Given the impending fiscal pressures associated with an aging population, a chart could illustrate the potential implications of curtailing expenditure growth in pension and health care benefits for the government's net asset position.

Mitigation strategies. Not necessary.

56. **This risk-based approach would help reconcile the need for deeper debt sustainability analyses in certain cases with the severe constraints on staff resources.** In countries where fiscal policy and public debt sustainability is of concern, additional resources may well be needed to analyze this key issue. In countries where it is not, the risk-based approach can ensure that resources are not unnecessarily diverted from analysis of more pressing matters. In addition, customization of the DSA shock and alternative scenario analysis (which may carry cost to set up when the new proposed framework is first implemented) is not expected to change considerably from year to year if a country's circumstances remain broadly unchanged. More specific guidance would be developed to implement this risk-based approach without overburdening staff resources. This guidance would clarify further a number of the proposals made in this paper to facilitate country team work and ensure adequate implementation.

IX. ISSUES FOR DISCUSSION

- Do Directors agree that there is a need to modernize the framework for fiscal policy and public debt sustainability analysis?
- Do Directors agree with the broad areas for improvement proposed by staff, which includes assessing more closely the realism of baseline projections, improving the analysis of fiscal risks, and integrating the analysis of the debt profile into the DSA framework? Do Directors see other areas that need greater attention?
- Do Directors support the use of reference levels for certain debt indicators (on level and profile) to trigger additional discussion of debt sustainability risk, as discussed in paragraphs 19 and 45? Do they agree that different existing tools and analyses (e.g., vulnerability exercises and FSAP) could be used as inputs to identify and quantify macroeconomic risks and contingent liabilities (paragraphs 28–35)?
- Do Directors agree to move to a risk-based approach to DSA for all market-access countries, where the depth and extent of analysis would be commensurate with concerns regarding sustainability, while a reasonable level of standardization would be maintained?

Annex I: Debt Sustainability Analysis in Selected Countries

The countries discussed below each experienced a rapid increase in public debt to GDP over the period 2007–2010, ranging from 15 percent (Italy) to 68 percent (Iceland). A review of Article IV staff reports for these countries, issued between 2006 and 2008, reveals that public and external DSAs were not systematically included, and that, in most cases, the magnitude of the subsequent increase in public debt was not anticipated, even under stress tests. Table A1 summarizes the findings.

Table A1. Public debt-to-GDP projections in pre-2009 Article IV staff reports for selected countries

Country	Debt-to-GDP ratio (actual)		Debt-to-GDP projections				DSA included?	
	2007	2010	Baseline	Most Extreme Shock	By year	Year of Art. IV	Public	External
Greece	105	142	72	98	2013	2007	Yes	No
Iceland ^{1/}	29	97	36	-	2013	2008	No	Yes
Ireland ^{2/}	12	57	6	16	2012	2007	Yes	No
Italy	104	119	111	122	2013	2008	Yes	No
Latvia ^{3/}	8	40	-	-	-	2006	No	Yes
Portugal ^{1/}	63	83	62	-	2013	2008	No	Yes
Ukraine	12	40	14	39	2011	2006	Yes	Yes
United Kingdom	44	77	43	53	2012	2008	Yes	No
United States	62	92	55	67	2013	2008	Yes	Yes

Sources: WEO and Article IV consultation staff reports.

1/ Iceland and Portugal's Article IV staff reports did not include debt-to-GDP projections under bound tests.

2/ Central government net debt. The figure for 2010 is the end-November provisional figure.

3/ Latvia's Article IV staff report did not include any debt-to-GDP projections.

GREECE

In the 2007 Article IV staff report, staff indicated that fiscal consolidation should be sustained over the medium term given a high level of public debt and projected increases in pension and health care costs related to population aging. The report included a public DSA (charts with standard bound tests), together with a brief discussion in the main body of the staff report. In the baseline scenario, public debt to GDP was projected to fall from 93 percent in 2007 to 72 percent in 2013. All but one bound test showed debt on a declining path over the medium term. In the growth shock scenario, debt was projected to rise to 98 percent of GDP by 2013. Two years later, staff warned that public debt could rise to 115 percent of GDP by 2010—even after factoring in fiscal consolidation measures implemented by the authorities—and recommended further adjustment to place public debt on a declining path.

ICELAND

The 2008 Article IV staff report recommended a tighter fiscal stance given the risk of further depreciation of the króna and growing concerns about the banking sector. Iceland's gross external debt had ballooned in the preceding years, reaching about 560 percent of GDP at end-2007, largely due to external borrowing by domestic banks. Both the 2007 and 2008 Article IV staff reports included a full external DSA (charts with standard bound tests, a table, and a written discussion). The 2008 external DSA projected, in the baseline scenario, a gradual decrease in net external debt to 229 percent of GDP in 2013 from 252 percent in 2007. Bound tests suggested that the external debt outlook was most vulnerable to a real exchange rate depreciation shock. The report noted that, despite minimal public sector debt (less than 30 percent of GDP in 2007), the sovereign faced a significantly increased risk premium, likely reflecting concerns about its potential liabilities in the event of banking problems. Nevertheless, the report did not include a public DSA. Following the government's intervention in the banking sector in 2008, public debt jumped to 72 percent of GDP by year-end.

IRELAND

The 2007 Article IV staff report included a public DSA, which showed that government net debt (defined as gross debt minus the assets of the National Pensions Reserve Fund and the Social Insurance Fund) was low and declining. In the baseline scenario, net debt was projected to fall from 12 percent of GDP in 2006 to 6 percent of GDP by 2012. The medium-term debt position was judged to be resilient to a variety of shocks. The worst outcome—a rise in net debt to 16 percent of GDP in 2012—occurred in a growth shock scenario. Staff identified age-related spending pressures as the most significant threat to the long-run debt outlook. The report noted that, although banks had large exposures to the property market, stress tests suggested that cushions were adequate to cover a range of shocks. Net debt to GDP subsequently increased nearly fivefold from 2007 to 2010, owing to a sharp GDP contraction and large fiscal deficits linked mainly to bank recapitalization costs.

ITALY

The 2008 Article IV staff report suggested that the authorities would have to strike a balance between the need to address the recession through counter-cyclical fiscal measures and the need to maintain debt sustainability, given high debt levels and widening sovereign spreads. The report included a public DSA (charts with standard bound tests, plus a table). In the baseline scenario, public debt was projected to rise to 111 percent of GDP in 2013 from 104 percent in 2007. The most extreme shock scenario (contingent liabilities shock) suggested that the debt could rise to 122 percent over the same period. Despite the authorities' expenditure-based fiscal adjustment plan, which targeted a broadly-balanced budget and a falling ratio of public debt to GDP, staff indicated that public debt to GDP would likely rise further based on more realistic macroeconomic assumptions and possible

bank support operations. The staff report discussed concerns over long-term debt sustainability (beyond the five year projection horizon in the DSA) under unchanged policies. The fiscal position deteriorated sharply in 2009, contributing to a significant increase in public debt, which stood at 119 percent of GDP at end-2010.

LATVIA

In the [2006 Article IV](#) staff report, staff warned of risks of overheating and recommended a sizable front-loaded fiscal consolidation. The report included an external DSA (charts with standard bound tests, plus a table), but no public DSA given that public debt was low (10 percent of GDP) and ,even in the event of an extreme shock, did not seem to pose a threat to debt sustainability. The external DSA projected, in the baseline scenario, that external debt would rise to 118 percent of GDP in 2011 from 101 percent in 2005. In the most extreme shock scenario (real depreciation shock), external debt was projected to rise to 170 percent of GDP over the same period. Staff nevertheless cautioned that a rapid deterioration in the underlying fiscal stance in recent years had been masked by substantial inflows of EU grants and strong cyclical conditions, thereby keeping fiscal balances in check. Staff also warned that imbalances in the economy, if left unaddressed, could lead to a hard landing. In the event, real GDP fell 4 percent in 2008 and 18 percent in 2009—the largest contraction in the world. Public debt increased rapidly and substantially as a result of borrowing from official sources to address the effects of the crisis, especially the collapse in cyclically strong revenue, and the sharp decline in GDP.

PORTUGAL

The [2007](#) and [2008](#) Article IV staff reports highlighted that the fiscal position was weak but improving, and that private debt was high and growing. The 2007 report said recent pension reforms had substantially improved long-term fiscal sustainability. The report included a chart on fiscal sustainability risks that looked at different paths for government debt to GDP under alternative scenarios. Staff projected that public debt would fall below 60 percent of GDP in 2011 and remain below 60 percent through 2040, taking into account the pension reforms, and assuming the government achieved its medium-term objectives for growth and the primary surplus. In 2008, staff acknowledged that decisive action by the authorities had put the fiscal accounts on a stronger footing, but urged further fiscal consolidation in light of high public debt, and to ensure the credibility of achieving medium-term objectives. Both the 2007 and 2008 reports contained an external DSA table, but with no charts, bound tests, or accompanying discussion. The 2008 external DSA projected that external debt would rise to 220 percent of GDP in 2013 from 194 percent in 2007.

UKRAINE

The [2006 Article IV](#) staff report noted that public debt had plunged thanks to the authorities' success in meeting low fiscal targets. Staff, however, cautioned that contingent liabilities

remained high at some 30 percent of GDP. The report included both an external and a public DSA (charts with standard bound tests, plus a table), along with a brief discussion. Staff emphasized risks to external debt sustainability and projected that gross external debt would rise to uncomfortably high levels under various adverse shocks. The public debt outlook, on the other hand, was thought to be more benign, although staff warned that the realization of large scale contingent liabilities could cause public debt to spike. The public DSA included a customized shock scenario that entailed the realization of contingent liabilities linked to so-called “lost savings deposits.” Under this scenario, public debt to GDP increased from 17 percent in 2006 to about 45 percent in 2007. In the years that followed, Ukraine’s public debt more than tripled, reaching an estimated 40 percent in 2010, reflecting government financial support to the national energy company, bank recapitalization, and the accumulation of VAT refund arrears.

UNITED KINGDOM

In the 2008 Article IV staff report, staff broadly agreed with the authorities that fiscal adjustment was required in coming years and that the authorities should maintain net public debt below a ceiling of 40 percent of GDP. Staff warned that, using weaker projections for growth and revenues in 2008, net public debt could breach the ceiling as early as 2009, even if the planned fiscal adjustment was implemented. The report included a public DSA (charts with standard bound tests), but with no accompanying written discussion. The bound tests showed that (gross) public debt could rise to 53 percent of GDP by 2012 in the most extreme scenario (contingent liabilities shock). The recession subsequently resulted in an unprecedented deterioration of the fiscal position, and public debt reached 77 percent of GDP in 2010.

UNITED STATES

The 2007 and 2008 Article IV staff reports discussed the need for medium-term fiscal consolidation to restore fiscal sustainability, but did not include a detailed discussion of public debt. Both reports contained a public DSA (charts with standard bound tests), but with no accompanying written discussion. The bound tests did not anticipate the surge in public debt (from 62 percent of GDP in 2007 to 92 percent in 2010) that occurred following the crisis. In the baseline scenario of the 2008 DSA, public debt was projected to rise to 55 percent of GDP by 2013. In the most extreme shock (constant primary balance), debt rose to 67 percent of GDP over the same time frame. The report characterized general government debt as “manageable,” but cautioned that the authorities’ medium-term adjustment plans were premised on unrealistic assumptions.

Annex II. Overview of Current Framework for Public DSA in Market-Access Countries

The framework for MACs was introduced in 2002 and refined in 2003 and 2005—see Assessing Sustainability (<http://www.imf.org/external/np/pdr/sus/2002/eng/052802.htm>), Information Note on Modifications to the Fund's Debt Sustainability Assessment Framework for Market-Access Countries (<http://www.imf.org/external/np/pp/eng/2005/070105.htm>), and Sustainability Assessments – Review of Application and Methodological Refinements (<http://www.imf.org/external/np/pdr/sustain/2003/061003.htm>). The framework for low-income countries was developed jointly with the World Bank in 2005—see Operational Framework for Debt Sustainability Assessments in Low-Income Countries—Further Considerations (<http://www.imf.org/External/np/pp/eng/2005/032805.htm>). The framework is implemented by country teams using a standardized DSA template that generates tables and charts with the following main elements.

The analysis is presented with reference to a baseline scenario for the debt-to-GDP ratio over a five-year projection horizon. The sensitivity of the baseline scenario is examined with reference to two alternative scenarios, along with a series of six bound tests.

Alternative scenarios

A1. Key variables (real GDP growth, real interest rate, and primary balance) at *historical averages* (calculated over a 10-year period)

A2. *No policy change* – constant primary balance / GDP (fixed at level projected in first year)

Both scenarios help illustrate to what extent the assumptions made for the future diverge from historical macroeconomic experience (A1) or the current fiscal stance (A2). In this regard, they allow the reader to gauge the degree of optimism or pessimism of the projections, and therefore they act as a disciplining device on staff.

Bound tests

- Permanent shocks to three key variables each set at *one-half* of a standard deviation calculated over a historical period (ten years):
 - B1. real interest rate;
 - B2. real GDP growth rate; and
 - B3. primary balance / GDP.
- Permanent shock to all three variables *combined*, each set at *one-quarter* of a standard deviation:
 - B4. real interest rate; real GDP growth rate and primary balance / GDP.

- Large exchange rate shock:
 - B5. 30 percent permanent exchange rate depreciation.
- Contingent liability shock:
 - B6. 10 percent permanent increase in “other debt creating flows.”

The exchange rate shock illustrates the valuation effect on the portion of public debt that is denominated in foreign currency and indexed to the exchange rate, which varies across countries. By contrast, the contingent liability shock raises public debt by ten percent of GDP in all countries.

The template generates a series of charts that compare the baseline and alternative scenarios and illustrate the impact of the bound tests on the baseline projection, along with a chart showing gross financing needs under the baseline (in percent of GDP).

Customized scenarios

These are “full-fledged scenarios,” in that they capture interaction between key macroeconomic and fiscal policy variables, in contrast to the bound tests which allow limited or no interaction between the shocked variable and other economic variables. Customized scenarios are not common in staff reports.

Public DSA in LICs

The framework used to assess public debt sustainability in *low-income* countries (LIC) differs from that outlined above for MACs in several ways. In addition to the inclusion of thresholds for external debt indicators:

1. Debt is measured in present value as opposed to nominal terms;
2. The projection horizon is 20 years (compared to five years used for MACs);
3. The bound tests do not include a real interest rate shock;
4. The shocks in the bound tests persist for two years, but have larger magnitudes (one SD for individual shocks; one-half SD for combined shock);
5. An additional alternative scenario characterized by permanently lower growth is included;
6. Alternative scenarios and bound tests are also shown for debt-to-revenue and debt service-to-revenue indicators; and
7. Charts and tables report grant-equivalent financing and grant element of new borrowing.

Annex III. Estimation of Indicative Public Debt Thresholds

This annex provides a brief overview of the theoretical and empirical literature on the concept of sustainable public debt level. It also describes the methodologies used in this paper to estimate public debt thresholds for EMs based on recent data. The methodologies build on the September 2003 WEO Report, and incorporate the recent work by Ostry et al. (2010).

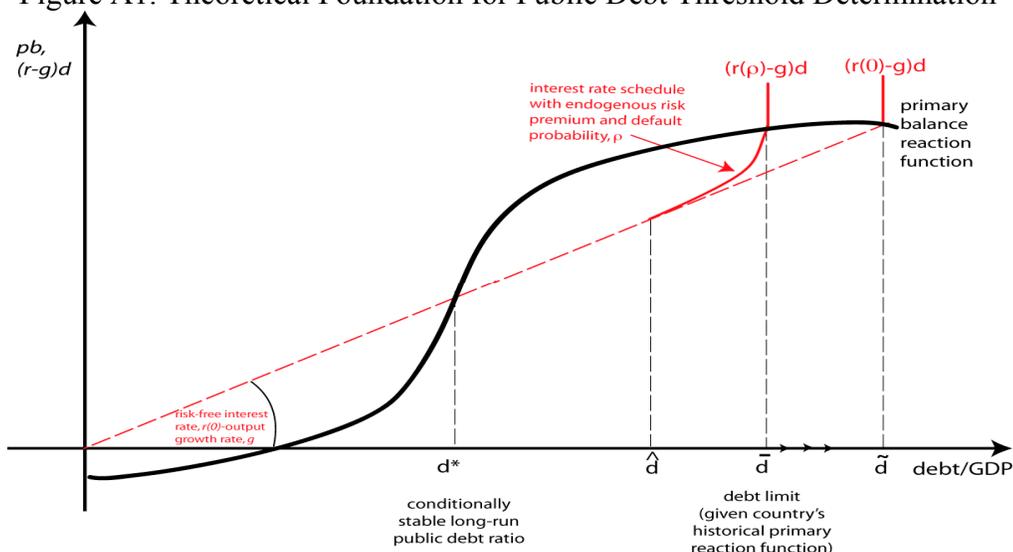
Theoretical underpinnings

The theoretical literature relies mostly on a partial equilibrium framework to explain public debt sustainability. The formal basis for an analysis of public debt analysis was proposed by Domar (1944) who developed a model defining a necessary condition for sustainability. A sufficient condition was not defined because the interest rate and the rate of growth of GDP were set exogenously. Blanchard et al. (1990) building on Buitier (1985) formalized the model based on the government intertemporal budget constraint, and introduced two conditions for public debt sustainability: (i) the ratio of debt to GDP should converge in the long run to its initial level, and (ii) the present value of the ratio of the primary budget deficit to GDP should be equal to the negative of the current level of public debt to GDP.

There is also, however, an expanding literature based on a general equilibrium framework. It is based on Diamond (1965) who employed the overlapping generations model to analyze the effect of a positive stock of debt on the long-term competitive equilibrium of an economy with neoclassical technology. Diamond showed that government debt causes a decrease in utility when the economy is dynamically efficient, whereas utility may be increased if the economy is dynamically inefficient. Rankin and Roffia (2003) adapted the Diamond overlapping generation setting to explicitly model sustainable public debt. Brauning (2005) and Yakita (2008) have built on the Rankin-Roffia model, employing an endogenous growth setting, but they do not explicitly model sustainable public debt.

Ghosh et al. (2011) recently proposed a new framework to model explicitly sustainable public debt. Default is modeled as a problem of inability-to-pay, triggered by an inability to roll-over debt in the face of rising interest rates and stochastic shocks. The framework makes a clear distinction between *long-run public debt* and *maximum sustainable public debt* concepts. The long-run debt level is the level to which the economy normally converges (d^* in Figure A1). If a shock raises debt above this level, the primary balance in subsequent periods should more than offset the higher interest payments, returning the debt to its long-run average. The maximum sustainable debt level is in turn defined by the point at which interest rate approaches infinity (\bar{d} in Figure A1). Beyond this point, there is no sequence of positive shocks to the primary balance that would be sufficient to offset the rising interest payments, as interest rate effectively becomes infinite (i.e., the country loses market access). Financial markets do not however wait until the maximum sustainable debt level is breached and start charging higher interest rates at lower debt levels.

Figure A1. Theoretical Foundation for Public Debt Threshold Determination



Source: Ostry et al (2010)

Empirical evidence

The empirical literature on sustainable public debt is based primarily on the **partial equilibrium framework**. The 2003 WEO calculates public debt thresholds for AEs and EMs, building on Buiter (1985) and Blanchard et al. (1990). Expected future primary balances, interest rates, and growth rates are approximated by historical averages, on the assumption that a past policy track record is the best guide to what a country can be expected to achieve in the future. The concept of sustainable public debt level is according to this approach closer in spirit to the concept of long-run public debt. The threshold for AEs (respectively EMs) is estimated at 75 (respectively 25) percent. Mendoza and Oviedo (2003) extend this approach by incorporating uncertainty through the assumption that a government needs to be credibly committed to servicing its debts in all circumstances. Such a government would need to take into account the fact that its future revenues are uncertain, and that it could be faced with the possibility of a long period of low revenues in the future. The concept of sustainable public debt level is according to this approach closer in spirit to the concept of maximum sustainable public debt. The application of this approach in the 2003 WEO suggests that the threshold for a representative AE is within the 100–150 percent of GDP range, while that for a representative EM is within the 35–75 percent of GDP.

There is also a growing strand of the empirical literature building on the **model-based approach to sustainability of public debt**. According to the approach developed by Bohn (1998), satisfaction of the intertemporal budget constraint requires that an increase in public debt should elicit an increase in the primary surplus to ensure that public debt is not on an explosive path. The primary fiscal balance is assumed to respond positively to public debt, but it is also assumed to be affected by other factors, including the level of economic activity. The estimates obtained in the 2003 WEO point to a threshold of 80 percent for AEs and 50 percent for EMs, with the latter confirmed by Abiad and Ostry (2005). Mendoza and Ostry (2008) extend the study on the 2003 WEO with a larger sample and time coverage and control for autocorrelation. The authors find that the marginal response of the primary

balance to debt is significantly weaker at high levels of debt than at more moderate levels. The concept of sustainable public debt level is according to this approach close in spirit to the concept of maximum sustainable public debt. The results for the sample combining AEs and EMs suggest a threshold of 48 percent.

A unifying empirical framework for the partial equilibrium-based approach and the model-based approach has been recently proposed by Ostry et al (2010). The framework building on the theoretical model by Ghosh et al. (2011) combines the non-linear nature of the relationship between the primary balance and debt with uncertainty related to potential adverse shocks, quantifying long-run public debt and maximum sustainable public debt levels for AMs. To implement it, the authors proceed in three steps: they (i) estimate the primary balance reaction function; (ii) determine the appropriate interest rate-growth rate differential; and (iii) calculate each country's debt limit, and associated fiscal space. The results for the long-run public debt ratio based on historical market interest rates suggest a median debt ratio of 50 percent, while that based on projected interest rates yields a median debt ratio of 63 percent. The results for the maximum sustainable public debt ratio based on historical market interest rates indicate a median of 192 percent, while that based on projected interest rates gives a median debt of 183 percent.

A separate strand of the empirical literature uses the **signal approach** developed by Kaminsky et al. (1998). In general, the approach defines thresholds and assesses efficiency of the indicators as early warning of debt distress. Specifically, when an indicator deviates from its level beyond a certain threshold, this is taken as a signal of possible debt distress within a predefined period of time. A signal that is followed by a crisis is called a good signal, while one not followed by a crisis is a false signal, or noise. By minimizing noise-to-signal ratios, optimal thresholds are defined and the indicators ranked in their capacity to predict debt distress. An application of the signal methodology to make a determination of debt distress in EMs is done by Hemming et al. (2003). The concept of sustainable public debt level is according to this approach close in spirit to the concept of maximum sustainable public debt. The results obtained suggest the threshold for EMs at 77 percent.

The performance of various approaches in predicting crises is mixed. Berg and Patillo (1999) and Berg et al (2005) assess the performance of different models in terms of their ability to predict crises through out-of-sample and in-sample criteria. The forecasts based on the signal approach are statistically and economically significant predictors of actual crises, with forecast accuracy in the out-of-sample period only slightly inferior to the accuracy in the estimation period. The forecasts based on the parametric approach indicate that this approach performs substantially worse out of sample than in sample. Overall, the signal approach outperforms the parametric approach in terms of out-of-sample criterion, but performs worse in terms of in-sample criterion.

Estimating public debt thresholds for EMs

Given that in the literature estimates for public debt thresholds for EMs are based on data up to the early 2000s, staff has re-estimated them using more up-to-date data. This was not done for AEs because existing estimates are based on relatively recent data.

A mix of approaches described above is used here. The **long-run debt level** is estimated based on the partial equilibrium framework (see Ostry et al (2010)). The **maximum sustainable debt** level has been estimated based on a parametric approach (see Abiad and Ostry (2005) and a non-parametric or signal approach (Hemming et al (2003)).

The dataset covers 50 EMs over the period 1993–2009: Albania, Algeria, Argentina, Armenia, Bosnia and Herzegovina, Brazil, Bulgaria, Chile, China, Colombia, Costa Rica, Croatia, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Georgia, Guatemala, Hungary, India, Indonesia, Israel, Jamaica, Jordan, Kazakhstan, Latvia, Lebanon, Lithuania, Macedonia, Malaysia, Mexico, Morocco, Pakistan, Panama, Peru, Philippines, Poland, Romania, Russia, Serbia, South Africa, Sri Lanka, Thailand, Tunisia, Turkey, Ukraine, Uruguay, Venezuela, and Vietnam. The source of the data is the Vulnerability Exercise for EMs and the WEO.

Long-run debt levels

The underlying concept for the long-run debt hinges on the partial equilibrium framework. To operationalize this concept, (i) expected future primary fiscal balances are approximated by their average over the sample period; and (ii) future interest rates and growth are also assumed to equal their historical averages. The formula assuming a constant path for these variables is as follows:

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

where d^* is long-run level of debt, p is historical average primary balance, r is historical average interest rate, and g is historical average GDP growth rate.

The long-run debt level is estimated on average at 58 percent of GDP. Following the work by Ostry et al (2010), the discount rate is also calculated based on the average projected interest rate in the WEO, yielding the long-run debt level of 49 percent of GDP, on average. The results are however sensitive to macroeconomic assumptions.

Maximum sustainable debt levels: a parametric method

The first approach to the maximum sustainable debt is based on a parametric method. Employing the methodology proposed by Bohn (1998), fiscal reaction functions capturing the relationship between fiscal policy instruments and objectives are estimated. The primary fiscal balance is considered the key operational target of the fiscal authorities, which is reflected in the fiscal reaction function formulation:

$$p_{it} = \alpha_i + \sum_{j=1}^J \beta_j X_{jit} + b_{it-1} + \varepsilon_{it}$$

where p_{it} is the primary balance in country i at time t , α_i is a country-specific intercept accounting for heterogeneity in the group of countries under consideration, b_{it-1} is the public debt level at the end of the previous period, ε_{it} is an error term, and X_j is a vector of macroeconomic variables explaining changes in the primary balance unrelated to the solvency requirement. The primary fiscal balance is assumed to respond positively to public debt, but it is also affected by temporary factors such as the level of economic activity.

The results show that primary surpluses respond positively to increases in public debt, suggesting that the intertemporal budget constraint is satisfied. The reaction gets even stronger when public debt crosses a 78% threshold, which suggests that fiscal policy is tightened after crossing the threshold. The other variables have expected signs and are also statistically significant.

Table A2. Fiscal Policy Reaction Functions

	Dependent variable: primary balance				
	1	2	3	4	5
Debt/GDP	0.03 (3.77)***	0.03 (3.96)***	0.03 (3.52)***	0.03 (3.95)***	0.02 (2.58)***
Spline at 78%	0.08 (5.07)***	0.08 (5.30)***	0.08 (5.31)***	0.08 (5.30)***	0.08 (5.35)***
Revenue/GDP		30.07 (5.28)***	29.43 (5.11)***	24.65 (4.45)***	25.66 (4.69)***
Economic activity			0.12 (3.38)***	0.09 (2.48)***	0.11 (2.92)***
Terms of Trade				0.06 (4.76)***	0.07 (4.76)***
Inflation					0.03 (2.11)**
No. of countries	50	50	50	50	50
Observations	696	619	619	607	607
Adj. R-squared	0.58	0.64	0.65	0.68	0.68

Note: All equations allow for individual and time effects. Absolute values of robust t-statistics are in paranthesis.

Maximum sustainable debt levels: signal approach

The second approach to the maximum sustainable debt is based on a non-parametric method, or signal approach to analyzing debt distress. The maximum sustainable debt level is estimated at 63 percent of GDP. The noise-to-signal ratio is well below one and other efficiency indicators also point to relatively high predictive power of this indicator.

Table A3. Performance Indicators

	Number of countries	Number of crisis	Good signals	Bad signals as	Noise/signal [B/(B+D)]/ [A/(A+C)]	P(crisis/ signal) A/(A+B)	P(crisis/ signal)- P(crisis)
			as percentage of possible good signals A/(A+C)	percentage of possible bad signals B/(B+D)			
Gross Public Sector Debt (in percent of GDP)	30	38	21	9	43	69	20

Table A4. Public debt thresholds in advanced economies and emerging market economies

	Long-run debt	Maximum sustainable debt	Maximum sustainable debt	Maximum sustainable debt	Long-run debt and Maximum sustainable debt
Authors	IMF, 2003, WEO	IMF, 2003, WEO	IMF, 2003, WEO	Hemming et al 2003	Ostry et al 2010
Concept	direct intertemporal budget constraint test	model-based sustainability test	direct intertemporal budget constraint test incorporating volatility	model-based sovereign debt crisis test	direct intertemporal budget constraint test + model-based sustainability test
Debt distress event	no debt distress events included explicitly	no debt distress events included explicitly	debt distress events included explicitly: -revenues kept at the crisis level -expenditures adjusted downward after the crisis	debt distress events included explicitly: -debt default -debt restructuring -arrears on external private and public debt to commercial creditors	no debt distress events included explicitly
Methodology	deterministic method	parametric method: panel data estimations of fiscal reaction function	deterministic method	non-parametric method: signal approach	deterministic method + panel data estimations of fiscal reaction functions
Sample	1970 – 2002 AEs and Ems	1990 – 2002 AEs and EMs	1990 – 2002 AEs and EMs	1970 - 2000 EMs	1970 - 2007 AEs
Results: cross-country median	AEs: 75 percent EMs: 25 percent	AEs: 80 percent EMs: 50 percent	AEs: 100-150 percent EMs: 35-75 percent	EMs: 77 percent	LRD: 50-63 percent MSD: 183-192 percent
Results: individual country estimates					LRD: 50-111 MSD: 150-263

LRD - long run debt; MSD - maximum sustainable debt.

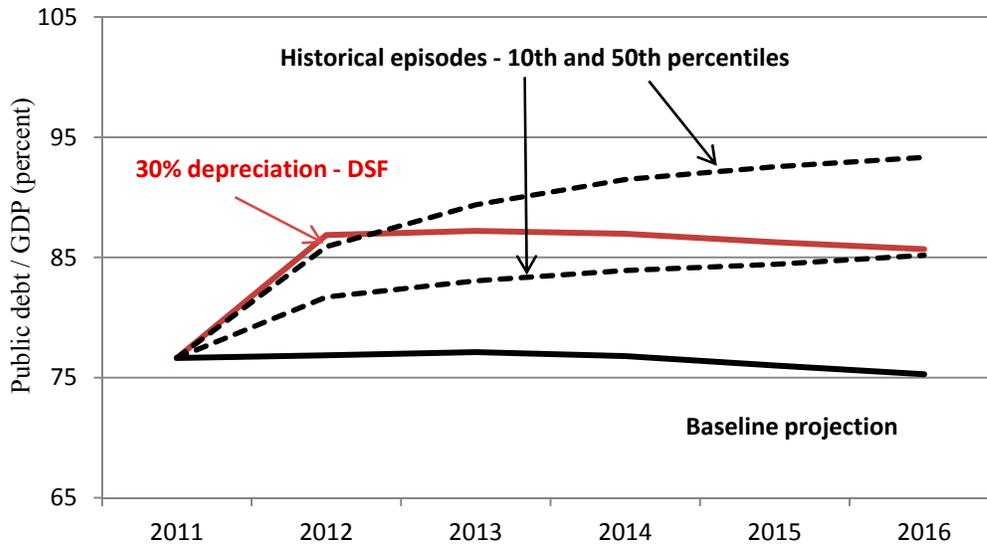
Annex IV. Using Historical Episodes to Calibrate Tail Risks

This annex outlines the methodology used to specify stress tests for tail risks based on historical episodes where debt indicators increased significantly. The methodology takes into account linkages between the underlying macro variables to provide a more realistic depiction of episodes where the debt outcome has deteriorated in the wake of large, infrequent shocks. In a sample of 127 countries over the period 1970–2008, there are 166 episodes where public debt increased by more than 20 percent of GDP over a five-year period. Currency and banking crises have played a prominent role in such episodes, as have large, persistent declines in output growth (“growth collapses”) and large deteriorations in the terms of trade. Although the four types of episodes are often intertwined, they provide a basis for specifying key macroeconomic developments that underlie large debt accumulation episodes.

In the case of currency crises, the current framework includes a permanent 30 percent exchange rate depreciation that affects debt solely through the valuation effect (by increasing the value of foreign currency-denominated debt). To provide insight into how additional channels might affect debt dynamics, we examined 104 episodes where the nominal exchange rate depreciated by 30 percent or more in one year against the US dollar. Although there is a lot of diversity across such episodes, a few empirical regularities surface from the analysis. In most cases, the domestic inflation rate increased significantly (largely stemming from the sharp exchange rate depreciation) and real GDP growth declined relative to its historical average. Empirical regularities observed across episodes are used to calibrate shocks that are consistent with the range of outcomes.

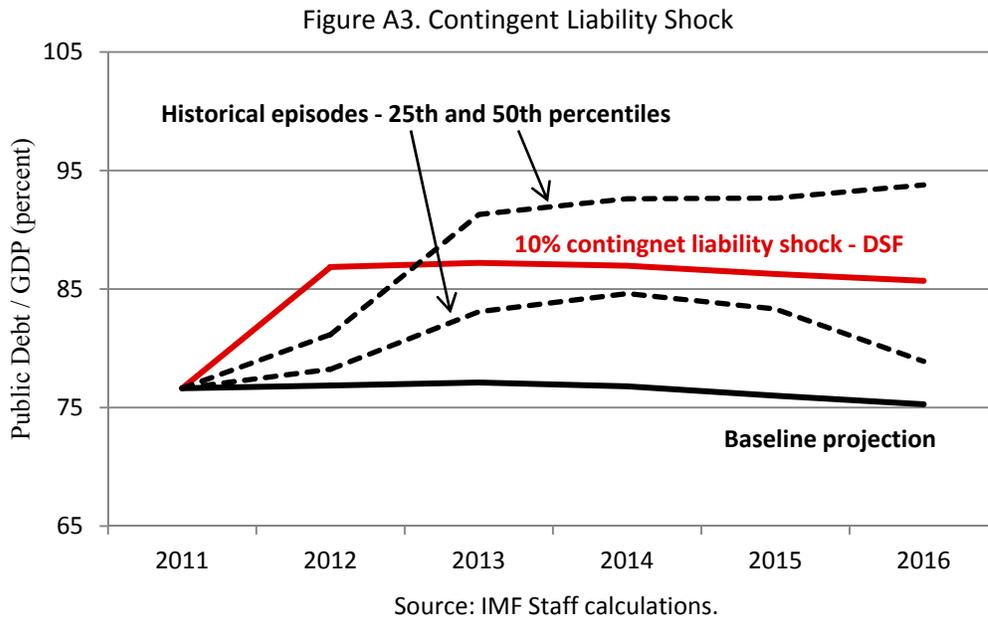
To illustrate, the range of outcomes observed over historical episodes is captured by calibrating shocks to the nominal exchange rate, real GDP growth, and inflation to be consistent with outcomes across the 104 currency crises episodes. The median outcome (50th percentile) entails a 56 percent depreciation in just one year. The upper and lower quartiles (25th and 75th percentiles) span the range of 39 to 99 percent. This range of outcomes is used to specify the magnitude of the exchange rate shocks for the tail risks. A similar approach is used to specify a range of outcomes for output and inflation shocks. The combined shocks to the exchange rate, real GDP, and inflation are transmitted to debt through conventional debt accumulation accounting identities. This produces the range of outcomes for the public debt-to-GDP ratio shown in Figure A2. The large depreciation shock in the current framework has an initial impact on the public debt-to-GDP ratio that is close to the 50th percentile (median) outcome across the 104 historical episodes and close to the 10th percentile by the end of the five-year projection period. This partly reflects the fact that the range of outcomes for exchange rate depreciations over the historical period—quartiles span the 39 to 99 percent range—exceed that used in the framework (30 percent). The 10th percentile of exchange rate changes (31 percent), output losses, and inflation increases results in a similar accumulation of debt over the medium term, but with a more gradual response.

Figure A2: Large Exchange Rate Depreciation

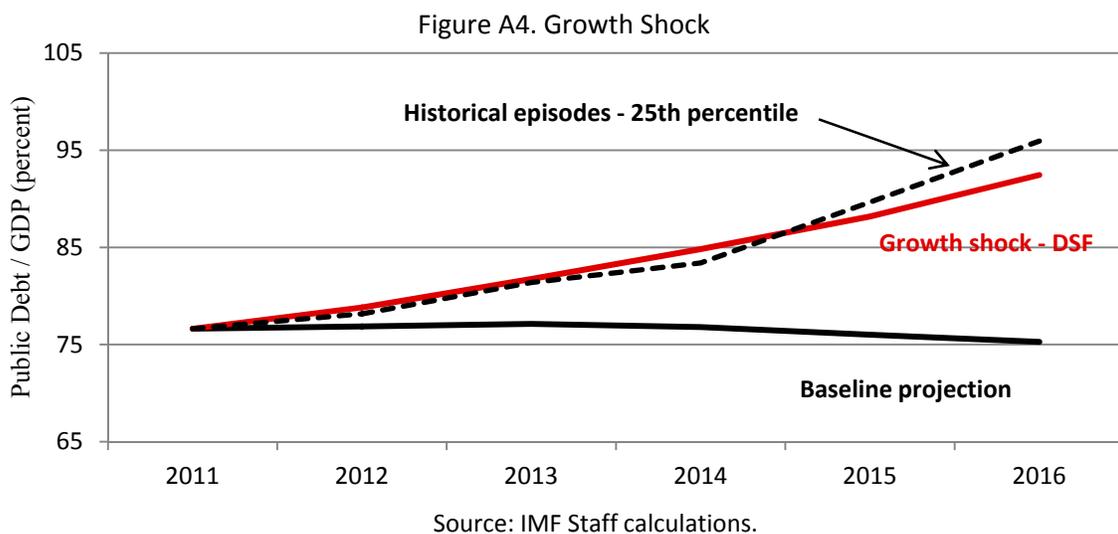


Source: IMF Staff calculations.

A similar methodology was used to analyze the contingent liability shock. The current framework includes a permanent 10 percent increase in contingent liabilities, keeping all other variables unchanged. Analysis of 97 banking crises identified by Laeven and Valencia (2010) revealed that such episodes tend to coincide with large output losses, exchange rate depreciations and higher inflation. Shocks to real GDP, the exchange rate, and inflation were calibrated to be consistent with the range of outcomes calculated across the 97 episodes. In addition, calibration of the historical episodes also takes into account direct fiscal costs incurred in the wake of banking crises with a median outcome of 10 percent of GDP (Laeven and Valencia 2010, Table 4). The contingent liability shock in the current framework has an initial impact above the median (50th percentile) outcome, but stabilizes below the median over the remainder of the five-year projection period (Figure A3). This indicates that public debt has tended to increase gradually in the wake of banking crises, exceeding 18 percent of GDP in one half of the episodes (the median outcome), well above the 10 percent of GDP shock in the current framework.

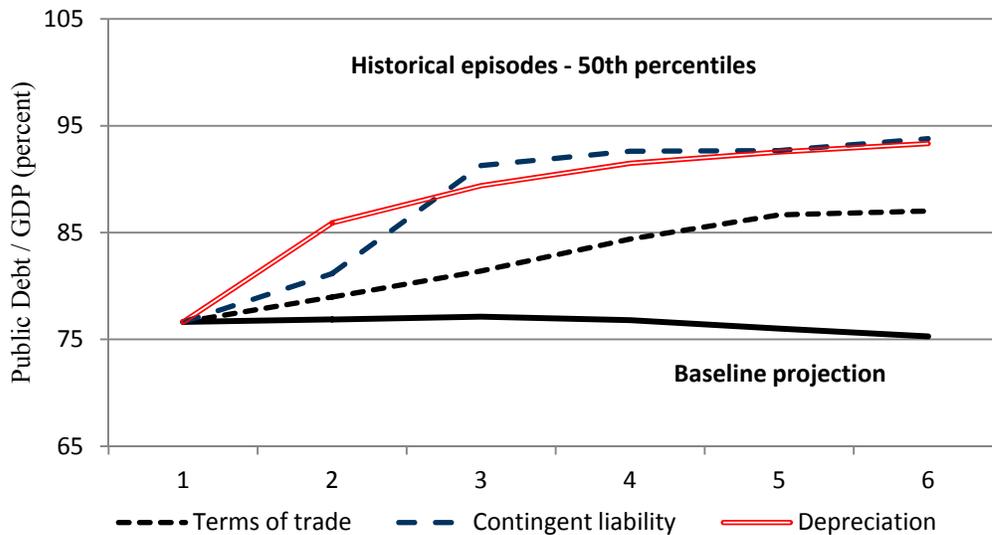


Growth collapses—defined as episodes where real GDP growth was negative over a five-year period—have tended to coincide with large exchange rate depreciations and higher inflation, which taken together imply a significant increase in the public debt-to-GDP ratio. The range of outcomes for real GDP growth, exchange rate changes and inflation observed over 99 growth collapse episodes were used to generate a range of outcomes for the public debt-to-GDP ratio. The effect of the growth shock in the current framework is quite close to the 25th percentile of outcomes (Figure A4), implying that three-quarters of the growth collapse episodes entailed larger output losses than the growth shock.



Terms of trade shocks do not play an explicit role in the current framework, despite the fact that they are generally believed to play a prominent role in debt accumulation events, especially in countries that depend on a narrow range of commodity for export receipts. This is borne out by the empirical analysis which indicates that large deteriorations in the terms of trade tend to coincide with significant increases in public debt. Applying the methodology outlined above to generate a range of outcomes for exchange rate changes, output, and inflation during such episodes implies a median (50th percentile) increase in the public debt-to-GDP ratio of almost 12 percent, below the 18 percent increase for the contingent liability and depreciation shocks (Figure A5).

Figure A5. Terms of Trade, Contingent Liability and Large Depreciation Shocks



Source: IMF Staff Calculations

Annex V. Defining Gross and Net Debt¹

Gross debt includes only those liabilities that are in the form of debt instruments. Conceptually, they refer exclusively to financial claims that exist and require the payment of principal and interest to creditors. The related concept of net debt is derived by stripping away a number of specific financial assets from the gross debt definition.

A broader concept to assess government indebtedness is that of total financial liabilities, which adds a number of specific public sector obligations to the gross debt measure such as equity, investment fund shares and financial derivatives. This definition may be better suited to understand the overall balance sheet exposure of the government when liabilities in the form of equity and derivatives are significant. Similarly, the concept of total financial assets can be derived considering those assets that are equivalent in scope to the obligations included in the total financial liabilities definition. Other assets, such as non-financial assets, are difficult to value and thus are generally excluded from the analysis of the government's balance sheet position.

In some circumstances data availability may point toward the use of debt measures that are less stringent in terms of the information required on government's assets. A particular case is that of highly liquid assets, which in general are readily available to assess at least partially the balance sheet position of the government. In this regard, netting out highly liquid assets from gross debt gives rise to the definition of debt net of liquid assets, which becomes a useful concept when data are either scarce or not reliable. Liquid assets are those that can be liquidated at short notice without a significant loss in value, such as government's deposits. Conversely, when data availability is not a major constraint, the broader concept of net financial liabilities may be computed as the difference between total financial liabilities and assets. This definition is essentially equivalent to that of net financial worth, as specified in the *Government Finance Statistics Manual 2001 (GFSM 2001)*, but with reversed signs.

Difficulties in cross-country comparisons may arise because: (i) the categories of reported assets differ substantially across countries and do not necessarily conform to international statistical definitions to compute net debt; (ii) certain countries only report information on the most liquid assets (government's deposits), thus narrowing the definition of net debt in an ad-hoc basis; and (iii) information on total financial assets and liabilities is only provided by a few countries, whose method of valuation may not be fully consistent across them.

¹ For further information, see *Public Sector Debt Statistic Guide* (<http://www.tffs.org/PSDStoc.htm>).

References

- Abbas, S. M. A. and J. E. Christensen, 2007, "The Role of Domestic Debt Markets in Economic Growth: An Empirical Investigation for Low-Income Countries and Emerging Markets," IMF Working Paper No. 07/127 (Washington: International Monetary Fund).
- , O. Basdevant, S. Eble, G. Everaert, J. Gottschalk, F. Hasanov, J. Park, C. Sancak, R. Velloso, and M. Villafuerte, 2010, "Strategies for Fiscal Consolidation in the Post-Crisis World," IMF Departmental Paper No. 10/04 (Washington: International Monetary Fund).
- Abiad, A., 2003, "Early Warning Systems: A Survey and a Regime-Switching Approach," IMF Working Paper No. 03/32 (Washington: International Monetary Fund).
- , and Jonathan D. Ostry, 2005, "Primary Surpluses and Sustainable Debt Levels in Emerging Market Countries," IMF Policy Discussion Paper No. 05/6 (Washington, International Monetary Fund).
- Allen, M., C. Rosenberg, C. Keller, B. Setser, and N. Roubini, 2002, "A Balance Sheet Approach to Financial Crisis," IMF Working Paper No. 02/210, (Washington, International Monetary Fund).
- Bartolini, L. and C. Cottarelli, 1994, "Government Ponzi Games and the Sustainability of Public Deficits under Uncertainty," *Ricerche Economiche*, Vol. 48, pp. 1–22.
- Berg, A. and C. Pattillo, 1999, "Are Currency Crises Predictable? A Test," *Staff Papers*, International Monetary Fund, Vol. 46 (June), No. 2.
- , E. Borensztein, and C. Pattillo, 2005, "Assessing Early Warning Systems: How Have They Worked in Practice?" *Staff Papers*, International Monetary Fund, Vol. 52, No. 3.
- , J. D. Ostry, and J. Zettelmeyer, 2008, "What Makes Growth Sustained?" IMF Working Paper No. 08/59, (Washington, International Monetary Fund).
- Blanchard, O., J. C. Chouraqui, R. P. Hagemann, and N. Sartor, 1990, "The Sustainability of Fiscal Policy: New Answers to an Old Question," *OECD Economic Studies*, 15.
- Bohn, H., 1998, "The Behavior of U.S. Public Debt and Deficits," *Quarterly Journal of Economics*, 87.
- , 2008, "The Sustainability of Fiscal Policy in the United States, in Sustainability of Public Debt," ed. by R. Neck and J-E Sturm, *MIT Press*.

- Bolle, R., and I. Hakobyan, 2006, “The Level and Composition of Public Sector Debt in Emerging Market Crises,” IMF Working Paper No. 06/186 (Washington: International Monetary Fund).
- Bornhorst, F., N. Budina, G. Callegari, A. ElGanainy, R. Sirera, A. Lemgruber, A. Schaechter, and J. Shin, 2010, “A Status Update on Fiscal Exit Strategies,” IMF Working Paper No. 10/272 (Washington: International Monetary Fund).
- Borensztein, E., M. Chamon, O. Jeanne, P. Mauro, and J. Zettelmeyer, 2004, *Sovereign Debt Structure for Crisis Prevention*, IMF Occasional Paper 237 (Washington: International Monetary Fund).
- Brauninger, 2005, “The Budget Deficit, Public Debt, and Endogenous Growth,” *Journal of Public Economic Theory*, 5.
- Broner, F., G. Lorenzoni, and S. Schmukler, 2004, “Why Do Emerging Economies Borrow Short Term?” World Bank Working Paper No. 3389 and MIT Department of Economics Working Paper.
- Buiter, W., 1985, “A Guide to Public Sector Debt and Deficits,” *Economic Policy*, 1.
- Cebotari, A., 2008, “Contingent Liabilities: Issues and Practice,” IMF Working Paper No. 08/245 (Washington: International Monetary Fund).
- , Jeffrey Davis, Lusine Lusinyan, Amine Mati, Paolo Mauro, Murray Petrie, and Ricardo Velloso, 2009, “Fiscal Risks—Sources, Disclosure, and Management,” IMF, Fiscal Affairs Department (Washington: International Monetary Fund).
- Celasun, O., X. Debrun, and J. D. Ostry, 2006, “Primary Surplus Behavior and Risks to Fiscal Sustainability in Emerging Market Countries: A “Fan-Chart” Approach,” *IMF Staff Papers*, Vol. 53, No. 3, pp. 401–425.
- Clements, B., V. Perry, and J. Toro, 2010, “From Stimulus to Consolidation: Revenue and Expenditure policies in Advanced and Emerging Economies,” IMF Departmental Paper No. 10/03 (Washington: International Monetary Fund).
- Congressional Budget Office, 2010, *The Long-Term Budget Outlook*, (Washington) U.S. Government Printing Office.
- Das, U. S., M. Papaioannou, G. Pedras, F. Ahmed, and J. Surti, 2010, “Managing Public Debt and its Financial Stability Implications,” IMF Working Paper No. 10/280 (Washington: International Monetary Fund).
- Detragiache, E., and A. Spilimbergo, 2001, “Crises and Liquidity: Evidence and Interpretation,” IMF Working Paper No. 01/02 (Washington: International Monetary Fund).

- Deutsche Bank, 2011, “Public Debt in 2020: Structure Matters!”
- Diamond, P., 1965, “National Debt in a Neoclassical Growth Model,” *American Economic Review*, Vol. 55.
- Domar, E., 1944, “The Burden of the Debt and the National Income,” *American Economic Review*, December.
- Everaert, G., M. Fouad, E. Martin, and R. Velloso, 2009, “Disclosing Fiscal Risks in the Post-Crisis World.” IMF Staff Position Note No. 09/18 (Washington: International Monetary Fund).
- Gapen, M. T., D. F. Gray, C. H. Lim and Y. Xiao, 2005. “Measuring and Analyzing Sovereign Risk with Contingent Claims,” IMF Working Paper No. 05/155 (Washington: International Monetary Fund).
- Goldstein, M., G. Kaminsky, and C. M. Reinhart, 2000, “Assessing Financial Vulnerability: An Early Warning System for Emerging Markets,” Institute for International Economics (Washington).
- Ghosh, A. R., J. I Kim, E. G. Mendoza, J. D. Ostry, and M. S. Qureshi, 2011, “Fiscal Fatigue, Fiscal Space and Debt Sustainability in Advanced Economies,” NBER Working Paper 16782.
- Guidotti, P. and M. Kumar, 1991, *Domestic Public Debt of Externally Indebted Countries*, IMF Occasional Paper 80 (Washington: International Monetary Fund).
- Hemming, R, M. Kell, and A. Schimmelpfening, 2003, *Fiscal Vulnerability and Financial Crises in Emerging Market Economies*, IMF Occasional Paper 218 (Washington: International Monetary Fund).
- Hemming, R., 2006, *Public-Private Partnerships, Government Guarantees, and Fiscal Risk*, IMF Occasional Paper 218 (Washington: International Monetary Fund).
- International Monetary Fund, 2003, “Public Debt in Emerging Markets,” *World Economic Outlook, September 2003*, Chapter 3 (Washington).
- , 2010, “Will It Hurt? Macroeconomic Effects of Fiscal Consolidation,” *World Economic Outlook, October 2010*, Chapter 3 (Washington).
- , 2011, *Fiscal Monitor*, April 2011 (Washington).
- , and World Bank, 2001, “Developing Government Bond Markets: A Handbook,” (Washington).
- Irwin, T. C., 2007, “Government Guarantees: Allocating and Valuing Risk in Privately Financed Infrastructure Projects,” The World Bank (Washington).

- Jeanne, O., 2000, "Foreign Currency Debt and the Global Financial Architecture," *European Economic Review*, Vol. 44, pp. 719–727.
- , 2000, "Debt Maturity and the Global Financial Architecture," CEPR Discussion Papers 2520.
- , 2003, "Why Do Emerging Market Countries Borrow in Foreign Currency?" IMF Working Paper No. 03/177 (Washington: International Monetary Fund).
- JPMorgan, 2011, "Local Markets Guide," Emerging Market Research, 7th Edition.
- Kaminsky, G., S. Lizondo, and C. Reinhart, 1998, "Leading Indicators of Currency Crisis," IMF Staff Papers, Vol. 45, No. 1, pp. 1–48 (Washington: International Monetary Fund).
- , 1999, "Currency and Banking Crises: The Early Warnings of Distress," IMF Working Paper No. 99/178 (Washington: International Monetary Fund).
- Kumar, M. S., and J. Woo, 2010, "Public Debt and Growth," IMF Working Paper No. 10/174 (Washington: International Monetary Fund).
- Laeven, L., and F. Valencia, 2008, "Systemic Banking Crises: A New Database," IMF Working Paper No. 08/224 (Washington: International Monetary Fund).
- , 2010, "Resolution of Banking Crises: The Good, the Bad, and the Ugly," IMF Working Paper No. 10/146 (Washington: International Monetary Fund).
- Lima, J. M., E. Montes, C. Varela, and J. Wiegand, 2006, "Sectoral Balance Sheet Mismatches and Macroeconomic Vulnerabilities in Colombia, 1996–2003," IMF Working Paper No. 06/5 (Washington: International Monetary Fund).
- Manasse, P., and N. Roubini, 2005, "'Rules of Thumb' for Sovereign Debt Crises," IMF Working Paper No. 05/42 (Washington: International Monetary Fund).
- , and A. Schimmelfennig, 2003, "Predicting Sovereign Debt Crises," IMF Working Paper No. 03/221 (Washington: International Monetary Fund).
- Mathisen, J., and A. Pellechio, 2006, "Using the Balance Sheet Approach in Surveillance: Framework, Data Sources, and Data Availability," (April) IMF Working Paper No. 06/100 (Washington: International Monetary Fund).
- Mauro, P., (ed.), 2011, *Chipping Away at Public Debt: Sources of Failure and Keys to Success in Fiscal Adjustment*, Wiley.
- Mendoza, E., and P. Oviedo, 2003, "Public Debt Sustainability under Uncertainty," mimeo.

- , and J. Ostry, 2008, “International Evidence on Fiscal Solvency: Is Fiscal Policy Responsible?” *Journal of Monetary Economics*, 55 (6).
- , and M. E. Terrones, 2008, “An Anatomy of Credit Booms: Evidence from Marco Aggregates and Micro Data,” NBER Working Paper No. 14049.
- Moody’s Investors Service, 2010, “The Causes of Sovereign Defaults: Ability to Manage Crises Not Merely Determined by Debt Levels,” Special Comment.
- Ostry, J. D., A. R. Ghosh, J. I. Kim, and M. S. Qureshi, 2010, “Fiscal Space,” IMF Staff Position Note, 10/11.
- Rankin, N., and B. Roffia, 2003, “Maximum Sustainable Government Debt in the Overlapping Generations Model,” *The Manchester School*, 71 (3).
- Reinhart, C., K.S. Rogoff, and M. Savastano, 2003, “Debt Intolerance,” NBER Working Paper No. 9908.
- , and K. S. Rogoff, 2009, “This Time Is Different: Eight Centuries of Financial Folly,” Princeton, New Jersey: *Princeton University Press*.
- Rosenberg, C., I. Halikias, B. House, C. Keller, J. Nystedt, A. Pitt, and B. Setser, 2005, *Debt-Related Vulnerabilities and Financial Crises: An Application of the Balance Sheet Approach to Emerging Market Countries*, IMF Occasional Paper 240 (Washington: International Monetary Fund).
- Roubini, N. and B. Setser, 2004, “Bailouts or Bail-ins? Responding to Financial Crises in Emerging Economies,” (Washington: Institute for International Economics).
- Sachs, J., A. Tornell, and A. Velasco, 1996, “Financial Crises in Emerging Markets: The Lessons from 1995,” *Brookings Papers on Economic Activity*, No. 1.
- Timmermann, A., 2006, “An Evaluation of the World Economic Outlook Forecasts,” IMF Working Paper No. 06/59 (Washington: International Monetary Fund).
- Topalova, P., and S. Nyberg, 2010, “What Level of Public Debt Could India Target?” IMF Working Paper No. 10/7 (Washington: International Monetary Fund).
- Yakita, A., 2008, “Sustainability of Public Debt, Public Capital Formation, and Endogenous Growth in an Overlapping Generations Setting,” *Journal of Public Economics*, 92.