VIII. Chapter Eight: What is Debt Sustainability Analysis?

Debt sustainability analysis (DSA) asks if, under current policies, a country or a government will be able to service its debts in the medium and long run without renegotiating or defaulting, and without having to undertake policy adjustments that are implausibly large economically and politically. DSA frameworks provide an intertemporal consistency check by testing whether macroeconomic plans are viable not only from a "flow balance" perspective but also from a "stock balance" point of view. They may also help dissuade policymakers from pursuing policies that deliver short-term benefits at the cost of creating unsustainable debts in the future.

In recent years, the IMF developed an approach to debt sustainability that is now used in surveillance and lending decisions.[142] These DSAs help the IMF and policymakers assess the risks associated with short-run macroeconomic forecasts and the policies on which such forecasts are based. A first risk, as discussed in detail in Chapters 9 and 10, is that projections of external or public debt may not be always grounded on sufficiently conservative assumptions. For instance, some IMF-supported programs have been based on assumptions about growth in export volumes and prices that proved to be optimistic, contributing to excessive borrowing. A second key risk to the realism of forecasts is the assumed path of the real exchange rate. Countries may be able to sustain relatively large stocks of foreign-currency denominated debt through real exchange rate appreciation over the medium term. As discussed in Chapter 4, moreover, it may be reasonable to assume that some countries will experience secular real appreciation as an equilibrium phenomenon due to catch-up growth. While the assumption of real appreciation may be defended in some circumstances, experience in several countries that underwent substantial real depreciations following crises suggests that it is risky to base policies on the assumption that real appreciation will continue indefinitely.

DSAs also allow policymakers to identify the economic sectors responsible for excessive debt accumulation, be they the national government (as in a number of African countries in the 1990s), subnational governments and state enterprises (as in some transition economies), or the private sector (as in the Asian crisis countries).

In many emerging market countries, debt ratios may be moderate and the main risk to sustainability may arise from liquidity problems. In some cases, countries do not have sufficient liquidity to cover maturing obligations even when they can be considered solvent, i.e., have relatively low and declining external debt-to-GDP ratios. Concerns about liquidity may arise, for instance, if the sovereign or private sector needs to make large amortization payments to creditors in the near future and foreign exchange or government revenues are insufficient. In such cases of temporary illiquidity, much depends on the willingness of

[142] See, "Assessing Sustainability," IMF (2002, 2003).

creditors to maintain or increase their exposure in the short run. Market confidence is a crucial ingredient, and the vulnerability to confidence crisis needs to be evaluated and addressed alongside long-term sustainability.

For low-income countries that do not borrow from private capital markets, the sustainability of the public debt is largely de-linked from the sentiments of the market. It depends, instead, on the willingness of official creditors and donors to continue providing positive net transfers through concessional loans and grants.[143] For low-income countries that have high debt ratios, solvency is more of a concern than liquidity. DSAs allow a study of the exposure of the IMF and other multilateral creditors to individual borrowers.

Finally, DSAs are also useful to assess the impact of—and response to—powerful technological and demographic changes that constrain government policies in the long run. Fiscal DSAs help quantify the fiscal impact of population aging, immigration, and other long-run population changes.

The IMF's DSA framework presented in Chapters 9 and 10 is a simple quantitative model of the evolution of (external or public) debt. It is based on the intertemporal accounting identity linking external or fiscal deficit flows to the accumulation of the corresponding debt stocks over time. In building any DSA framework, analysts must make baseline assumptions about the time paths of a number of macroeconomic variables – real GDP growth, inflation, interest and exchange rates, budget and external debts and deficits. In the IMF's DSA framework, the choice of baseline is a judgment made by the country team on the basis of consultations with country authorities and other IMF staff through the internal review process. The baseline projection is then stress-tested by subjecting it to plausible macroeconomic shocks. To be useful, stress tests must choose shocks of reasonable type, size, and cross-correlation. What "plausible" shocks are is a matter of judgment and depends on the specifics of the country's situation and outlook. As Chapters 9 and10 will explain, to make DSAs more systematic and disciplined, the stress tests in the IMF's framework are derived from the country's past history of shocks. Sometimes the country teams complement the mechanical, history-based scenarios with alternative scenarios that assume more adverse external conditions and/or suboptimal policies.

While they are an extremely valuable tool, DSAs have certain limitations. For one thing, DSAs do not assign explicit probabilities to the likelihood of crises. While desirable in principle, probabilistic approaches are more difficult to implement, especially for countries in which limited data or rapid structural change make it difficult to estimate these probabilities. A second limitation of existing DSA approaches, including the IMF's, is that they abstract from second-round behavioral responses of economic agents to shocks. For example, shocks to GDP do not affect the government's tax collections or spending plans.

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[143] For treatment of debt sustainability in low-income countries, see IMF,(2004, 2004a).

The literature has begun to incorporate such effects by estimating fiscal reaction functions that endogenize the economy's response to shocks (Celasun and others, 2006).

A third limitation of DSA analyses is that they focus mainly on debt dynamics rather than threshold levels of debt. DSAs regard debt paths as sustainable so long as the debt-to-GDP ratio declines. While this is, in principle, correct in the sense that it meets the intertemporal budget constraint, it may be problematic to assume sustainability if the debt ratio is stabilized at a high level. Clearly, stabilizing the debt-to-GDP ratio at 30 percent is different from stabilizing it at 90 percent. Some industrial countries—including Greece, Italy, Belgium, and Japan—have been able to sustain debt-to-GDP ratios that exceed 100 percent for decades without having to pay high interest rates. Developing or emerging market economies, on the other hand, often do not have such luxury. For example, in the case of Argentina during the pre-2001 crisis period, the debt-to-GDP ratio was approximately 50 percent, not high by international standards.[144]

A fourth limitation of DSAs is that they focus more on debt dynamics and less on liquidity risk. As noted earlier, the risk that maturing debt cannot be refinanced may arise even in solvent countries. The IMF's DSA templates provide gross financing needs and other information on rollover risks. On the other hand, a full evaluation of these risks requires more disaggregated—and higher frequency—data on the debt stock.

Finally, a word of caution is in order. With the benefit of 20/20 hindsight, the path to many of the recent crises and episodes of unsustainable debt dynamics now seems obvious. And yet most observers failed to spot the initial policy mistakes that eventually led to these crises. Why is it so difficult to diagnose sustainability problems? No simple or sophisticated model will be able to predict crises well in advance while avoiding false alarms. The main problem with all approaches, including DSAs, is two-fold: first, changes in the external environment are difficult to predict beyond a short-term horizon, and a single set of policies can result in very different outcomes depending on external events; second, the reaction of domestic and foreign investors and the public is difficult to gauge, especially when information is scarce, perhaps owing to lack of policy transparency, and economic agents act in "herd-like" manner. Economists can at best prepare DSAs or other model scenarios and explore the circumstances under which crises or debt problems are more or less likely to develop.

[144] IMF (2003) takes a closer look at how these debt ratios can be interpreted, and concludes that for emerging markets a total debt above 40–60 percent of GDP leads to sharply higher crisis probabilities (the more so the more closed the country is to foreign trade).

IX. CHAPTER NINE: FISCAL SUSTAINABILITY

This section examines public debt dynamics. Starting from the government's cash-flow constraint, it examines the factors affecting fiscal sustainability and shows how a stream of budget deficits can, over time, lead to unsustainable public debt levels and their macroeconomic consequences. Both the closed and open economy cases are considered.

9.1 Debt Dynamics in a Closed Economy

Consider first an economy that does not trade with the rest of the world. Denote by Y_t the economy's real GDP in year t and P_t the GDP deflator. Nominal GDP is the product P_tY_t.

Let π_t denote the rate of increase in prices between years t-1 and t, expressed as $\pi_t = \frac{P_t}{P_{t-1}} - 1$.

Similarly, let g_t denote the real growth rate of output, expressed as $g_t = \frac{Y_t}{Y_{t-1}} - 1$.

Let M_{t-1} denote the stock of money at the end of year t-1 and assume, for simplicity, that all interest-bearing government debt has one-year maturity. Denote by D_{t-1} the stock of one-period government bonds outstanding at the end of year t-1.The average nominal interest rate on government debt issued at t-1 is i_t. The government's expenditure in year t consists of two components, non-interest spending, denoted G_t, and interest payments on the debt, i_tD_{t-1}.

Next consider the government's cash-flow constraint in year t. As a matter of accounting, government expenditure must be financed by raising tax and nontax revenues net of transfers to the private sector, denoted R_t, through money issuance, $M_t–M_{t-1}$ $(=\Delta M_t)$, and by issuing interest-bearing securities, $D_t–D_{t-1}$.

$$G_t + i_tD_{t-1} = R_t + (D_t-D_{t-1}) + (M_t-M_{t-1}). \tag{9.1}$$

The government's overall budget balance is the difference between revenue and expenditure, $R_t–(G_t + iD_{t-1})$. The primary budget balance, PB_t, is the difference between revenue and non-interest expenditure, $R_t - G_t$. As we are interested in the evolution of the stock of interest-bearing public debt, we solve (9.1) for D_t, yielding

$$D_t = (1+i_t)D_{t-1} - (PB_t + \Delta M_t). \tag{9.2}$$

To derive an expression for the stock of public debt in relation to GDP, we divide equation (9.2) by nominal GDP:

$$\begin{aligned}\frac{D_t}{P_tY_t} &= \frac{(1+i_t)D_{t-1}}{P_tY_t} - \left(\frac{PB_t}{P_tY_t} + \frac{\Delta M_t}{P_tY_t}\right) \\ &= \frac{(1+i_t)}{(1+g_t)(1+\pi_t)}\frac{D_{t-1}}{P_{t-1}Y_{t-1}} - \left(\frac{PB_t}{P_tY_t} + \frac{\Delta M_t}{P_tY_t}\right).\end{aligned} \tag{9.3}$$

Denote by lower-case letters the stock of debt, primary balance, and seignorage expressed as shares of GDP: $d_t \equiv D_t / P_tY_t$, $d_{t-1} \equiv D_{t-1} / P_{t-1}Y_{t-1}$, $pb_t \equiv PB_t / P_tY_t$, and $\mu_t \equiv \Delta M_t / P_tY_t$. The parameter multiplying d_{t-1}, denoted ϕ_t, is key in debt sustainability analysis.

Use the Fisher equation linking the nominal and real interest rate, $1+r_t \equiv (1+i_t)/(1+\pi_t)$, to write ϕ_t as the ratio of one plus the real rate of interest on government debt over one plus the real rate of GDP growth:

$$\phi_t \equiv (1+i_t)/[(1+g_t)(1+\pi_t)] = (1+r_t)/(1+g_t). \tag{9.4}$$

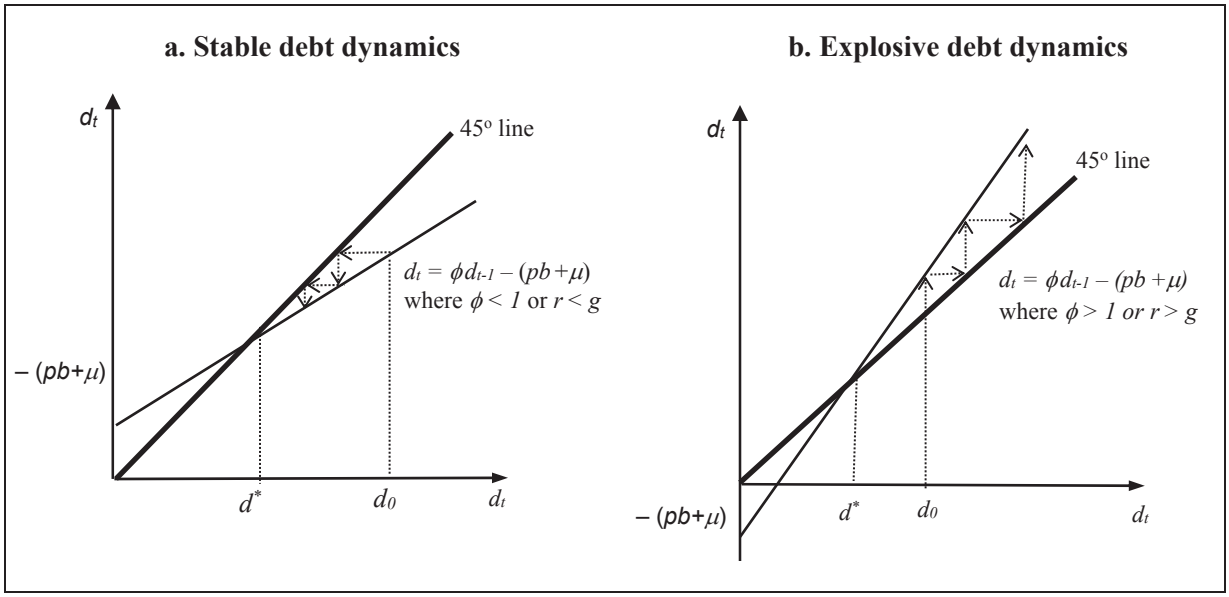
With this notation, the government budget constraint can now be rewritten as:

$$d_t = \phi_t d_{t-1} - (pb_t + \mu_t). \tag{9.5}$$

We can draw equation (9.5) in a phase diagram as shown in Figure 9.1 to examine how the debt-to-GDP ratio evolves over time. The horizontal axis plots the debt-to-GDP ratio in year *t-1*, d_{t-1}, while the vertical axis shows the resulting value of d_t in year *t*. The 45° line shows debt-to-GDP ratios that do not change over time. Suppose, for simplicity, that the parameters ϕ_t, pb_t, and μ_t are constant over time at ϕ, pb, and μ, respectively, so that d_t and d_{t-1} have a linear relationship.

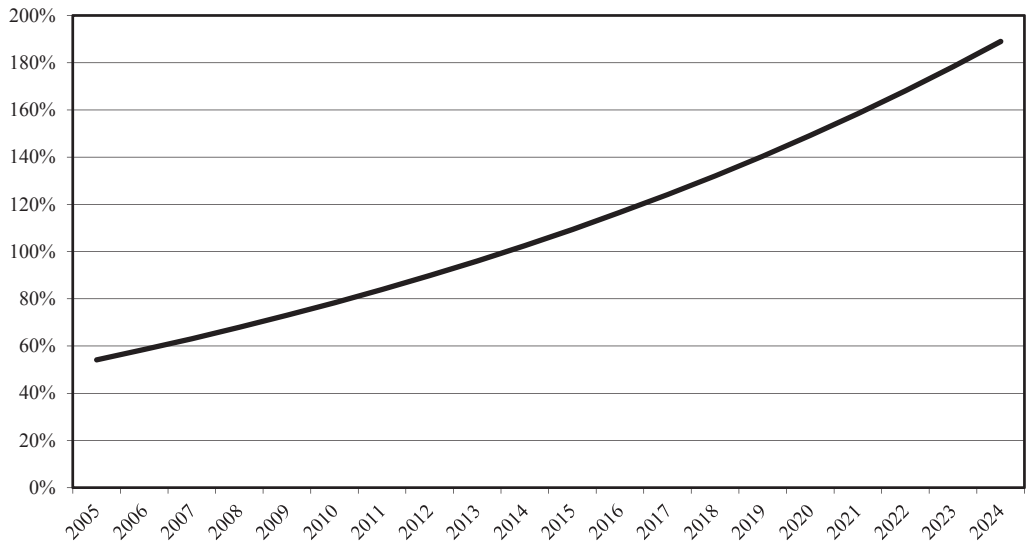
Whether the public debt-to-GDP ratio is explosive or not depends on the value of the parameter ϕ. The non-explosive case $\phi < 1$ is shown on the left-hand side panel of Figure 9.1. In this case, the initial level of debt-to-GDP ratio d_0 eventually falls to d^* and stays at that level forever. The explosive debt case $\phi > 1$ is shown on the right-hand side panel of Figure 9.1. Here, the real interest rate r_t which the government pays on its debt exceeds the real GDP growth rate g_t. Starting from any positive initial level of debt-to-GDP ratio $d_0 > d^*$ in year 0, the debt to GDP ratio grows without bound, which is obviously unsustainable.

Figure 9.1 Debt Dynamics



The speed at which debt can explode in realistic cases is surprisingly fast. Suppose the public debt-to-GDP ratio is initially $d_0 = 50$ percent. Assume a nominal interest rate, $i = 14$ percent, real GDP growth rate $g = 4.0$ percent, annual inflation $\pi = 4.3$ percent, primary deficit pb = -2.7 percent of GDP, and seignorage, $\mu = 1.1$ percent of GDP. Applying the Fisher equation, the real interest rate is 9.3 percent (= $(1.14/1.043\text{-}1) \times 100$ percent), which exceeds real GDP growth, implying $\phi > 1$. The debt-to-GDP ratio is explosive (see Figure 9.2) and reaches 80 percent of GDP—sometimes considered the threshold for "severe" indebtedness—in about five years.

Figure 9.2 The Debt-to-GDP Ratio in a Closed Economy



The explosive nature of the government's debt dynamics can also been seen by differencing equation (9.5) to calculate the change in the debt-to-GDP ratio, $\Delta d_t = d_t - d_{t-1}$. Subtracting d_{t-1} from both sides of equation (9.5) yields the following

$$\Delta d_t = \left(\phi_t - 1\right) d_{t-1} - \left(pb_t + \mu_t\right). \tag{9.6}$$

Equation (9.6) underscores the factors that affect the change in the debt-to-GDP ratio: the size of the primary budget balance pb_t, seignorage μ_t, and the built-in momentum of debt, $\left(\phi_t - 1\right) d_{t-1}$. If the real interest rate on government debt exceeds real GDP growth, debt becomes explosive. Primary surpluses are then needed to offset the automatic debt dynamics. The size of the primary surplus in relation to GDP, pb_t, is a good indicator of the government's fiscal adjustment effort.[145] Equation (9.6) is useful in calculating the primary surpluses needed to achieve specific objectives, such as stabilizing the debt at its existing level or even reducing it to a lower level, as needed, for example, to meet the criteria of the Maastricht Treaty for European Union member countries.

As a first step to fiscal sustainability, the authorities may pick fiscal targets with a view to halt further increases in the public debt to GDP ratio. This requires raising the primary balance to GDP ratio sufficiently to stabilize the debt-to-GDP ratio. To obtain the debt-stabilizing primary balance, set $\Delta d_t = 0$ in equation (9.6) to obtain:

$$pb_t = \left(\phi_t - 1\right) d_{t-1} - \mu. \tag{9.7}$$

Continuing with our earlier example, if the country is to avoid the ever-rising debt path shown in Figure 9.2, the primary balance surplus needs to be at least 1.45 percent of GDP $\{[((1.093 - 1.04)/1.04) \times 0.5] - 0.011\} \times 100$ percent instead of 2.7 percent of GDP in deficit.

The debt-stabilizing primary balance depends on several factors. First, if the existing level of debt is large, large primary surpluses are needed to prevent it from growing further. Second, if the difference between the real interest rate and real GDP growth is large, then the primary surplus also needs to be large. Third, if seignorage or other sources of government finance are available (such as privatization receipts), these can be used to pay off the debt and will result in lower debt-stabilizing values for the primary surplus. Of course, many countries likely would like to reduce their stock of debt relative to GDP, rather than just stabilize it. Those countries must then achieve a primary surplus in excess of the debt-stabilizing level.

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[145] The government can manipulate the money growth rate to increase revenue from money creation, or *seignorage*. But raising money growth and inflation leads to currency substitution, which places limits on the amount of real resources the government can obtain from seignorage.

9.2 Debt Dynamics in an Open Economy

The analysis of public debt sustainability is similar when the government can borrow from international financial markets to cover part of its budget deficit. Under these conditions, public debt sustainability depends on the path of the nominal and real exchange rate and foreign interest rates.

When the government borrows abroad, a distinction needs to be made between domestic currency-denominated debt D_t^h and foreign-currency denominated debt D_t^f. Letting e_t be the nominal exchange rate (local currency per unit of foreign currency), the debt stock is $D_t = D_t^h + e_t D_t^f$ and the government budget constraint can be written

$$D_t = \left(1 + i_t^*\right) D_{t-1} - \left(PB_t + \Delta M_t\right). \tag{9.8}$$

In equation (9.8), i_t^*, the effective nominal interest rate, is a weighted sum of the domestic and foreign interest rates i_t^h and i_t^f, and also depends on the exchange rate

$$i_t^* = \left(\left(1-\alpha\right) i_t^h + \alpha i_t^f\right) + \alpha\varepsilon_t\left(1 + i_t^f\right), \tag{9.9}$$

where $\alpha = \left(e_t D_t^f\right) / D_t$ is the portion of foreign currency denominated debt, and ε_t is the rate of depreciation of the currency. It can be shown that the public debt to GDP ratio evolves according to the following equation, which is analogous to (9.5):

$$d_t = \phi_t^* d_{t-1} - \left(pb_t + \mu_t\right), \tag{9.10}$$

In equation (9.10), $\phi_t^* \equiv \left(1 + i_t^*\right) / [(1 + g_t)\left(1 + \pi_t^*\right)]$ is analogous to ϕ_t, and π_t^*, the GDP deflator, depends on domestic inflation π_t^h, foreign inflation π_t^f, and exchange rate movements:

$$\pi_t^* = \left(\left(1-\beta\right)\pi_t^h + \beta\pi_t^f\right) + \beta\varepsilon_t\left(1 + \pi_t^f\right), \tag{9.11}$$

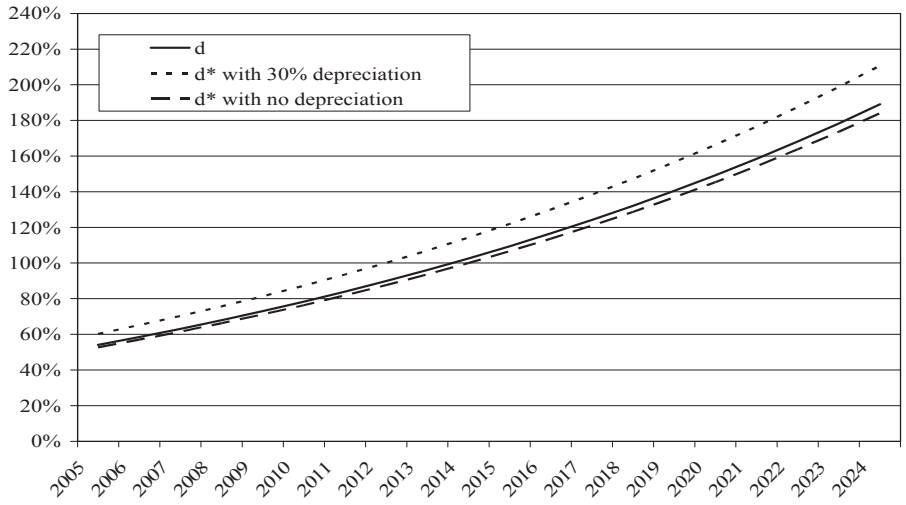
where $\beta = \left(e_t P_t^f Y_t^f\right) / P_t Y_t$ is the output share of tradables in GDP.

The intuition discussed in the closed economy case still holds: Debt dynamics are explosive if the real interest rate $r_t^* \equiv \left(1 + i_t^*\right) / \left(1 + \pi_t^*\right) - 1$ is greater than real GDP growth g_t. In the open economy the interest rate relevant for the DSA calculation depends on domestic and foreign interest rates and inflation, on exchange rate movements, and on the size of foreign borrowing and foreign trade.

In terms of our earlier example, suppose i^d =14 percent, i^f =8 percent, α =0.5, β =0, and ε =0. Then the effective nominal interest rate i^* is 11 percent = (0.5 × 14 percent + 0.5 ×

8 percent)+0.5×0×1.08), and the effective real interest rate r^* is 6.4 percent (= (1.11/1.043-1)×100 percent), which is greater than the real GDP growth rate of 4.0 percent. As in the closed economy case, the debt-to-GDP ratio is explosive (see Figure 9.3). Moreover, if the exchange rate depreciates by 30 percent, the effective nominal interest rate and the effective real interest rate become as high as 27.2 percent and 22.0 percent. The debt-to-GDP ratio rises much more rapidly and exceeds the 80 percent threshold in less than 5 years, assuming a crisis does not force an adjustment first (see Figure 9.3). The debt stabilizing primary balance in this case rises to 7.6 percent of GDP (= (22.0 percent – 4.0 percent)/1.04 ×0.5–1.1 percent).

Figure 9.3 The Debt-to-GDP Ratio in an Open Economy



9.3 The IMF's Approach to Public Debt Sustainability

Basic macroeconomic assumptions

In this section, we focus on public DSAs relevant for countries with access to international capital markets. The fiscal DSA framework consists of a baseline scenario and sensitivity tests of debt dynamics to a number of assumptions.

There are many difficulties in constructing realistic projections of public debt and debt service. In particular, three important risks need to be assessed. A first risk comes from contingent liabilities (Box 9.1). Many contingent liabilities, by nature, go unnoticed in normal times but are more likely to emerge in crises. Contingent liabilities are exceedingly difficult to measure in practice, both because the amounts involved are often unknown and because the precise circumstances under which they would turn into actual liabilities are often unknowable.

Box 9.1 Contingent Liabilities

The government's contingent liabilities are potential claims on the government that may or may not be incurred depending on macroeconomic conditions and other events. Unlike direct liabilities, such as pension obligations, which are predictable and will arise in the future with certainty, contingent liabilities are obligations triggered by discrete but uncertain events. By nature, contingent liabilities are difficult to measure. While information is usually available on debt formally guaranteed by the central government, debt not explicitly guaranteed has often been an important contributor to public debt build-up.

Contingent liabilities, especially those arising from the need to rescue banks, were responsible for large jumps in the public debt to GDP ratio in several countries affected by past financial crises. Capturing the hidden fiscal risks arising from contingent liabilities is therefore an important task for public DSAs. One of the stress tests in the public debt sustainability template examines the effect on the public debt dynamics of the realization of contingent liabilities, specified as an exogenous increase in the debt ratio of 10 percent of GDP. This shock is exogenous and is not linked to the country's financial sector vulnerabilities and other shocks examined in the template (e.g., to growth, interest rates, or the exchange rate).

Explicit liabilities are those recognized by a law or contract, such as government guarantees for non-sovereign borrowing and obligations issued by subnational governments and public or private sector entities or trade and exchange rate guarantees. *Implicit liabilities* are obligations that may be assumed by government due to public and interest-group pressures, such as financial sector bailouts, or bailouts of non-guaranteed social insurance funds.

A second risk is an abrupt change in financing conditions in international markets affecting both the availability and the cost of funds. Such changes may reflect developments in the financial markets, such as contagion, or funding difficulties specific to the country. These changes may give rise to a liquidity crisis if the country is unable to rollover its maturing obligations or result in sharply higher interest rates, calling into question the long-term solvency of the borrower.

A third risk is a depreciation of the exchange rate, possibly in the aftermath of the collapse of an exchange rate peg, which increases the domestic currency value of the stock of external public debt. A key factor in determining the post-crisis evolution of the exchange rate is the extent of initial overvaluation and the extent of possible exchange rate overshooting. As some cases have shown, once a crisis erupts, the capital outflows can result in exchange rate adjustments far in excess of any initial estimates of overvaluation.

To stress test the baseline projections against these and other risks, the IMF DSA:

- calibrates the size of shocks (reasonable but not extreme; use historical standard deviations or absolute deviations for global shocks),
- assesses interdependencies (perturb correlated parameters at the same time),
- sets durations of shocks (use shock sequences for serially correlated parameters), and

- assesses the effect of other debt-creating flows (e.g., contingent liabilities). [146]

The public sector DSA template

The public sector debt template tracks the behavior of the gross debt-to-GDP ratio shown in equation (9.9). The definition of debt used in the IMF's DSA is based on gross liabilities—that is, public sector liquid or other assets are not netted out. The coverage of public debt is as broad as possible and it includes public enterprises as well as local governments.

Based on equation (9.9), the template identifies the different channels that contribute to the evolution of the debt to GDP ratio, including the primary deficit and endogenous/automatic factors related to interest rates, growth rates and exchange rate changes. The template also includes other debt-creating operations, such as would result from the recognition by the government of contingent liabilities, as well as debt-reducing operations, such as privatizations whose proceeds are used to pay down public debt.

The gross financing needs of the public sector are defined as the sum of the public sector deficit and all debt maturing over the following 12 months. The template also calculates the debt-stabilizing primary balance which would be needed to keep the debt-to-GDP ratio constant if all the variables in the debt dynamics equation remained at the level reported in the last year of the projection.

As discussed in Chapter 8, in the IMF's public debt sustainability framework, the baseline paths of the public debt-to-GDP ratio and the variables on which it depends are projected by IMF staff in consultation with country authorities. The baseline projections are conditional in the sense that they assume that the authorities will fully implement the announced fiscal, monetary, exchange rate, and structural policies.

In addition, the public debt sustainability template presents projections under a historical scenario. This is an alternative path of the debt ratio, constructed under the assumption that all key variables stay at their historical averages throughout the projection period. This scenario is a test of the "realism" of baseline projections: if the deviations of assumed policies and macroeconomic developments in the baseline are very different from those in the historical scenario, these will need to be justified by referring to credible changes in policies.

The template also contains a no-policy-change scenario. This is derived under the assumption that the primary balance is constant in the future and equal to the projection for the current year. The no-policy-change scenario can be modified to assume an unchanged cyclically

[146] In 2005, the IMF reviewed its DSA framework and revised the size and duration of the shocks used in the stress tests. The new approach considers the effects of smaller but more persistent shocks.

adjusted primary position, or to make adjustments for the expiration of one-off measures, as necessary.

The baseline scenario is also stress-tested using different assumptions on key parameters. Permanent shocks equal to one-half standard deviation are applied to the baseline projections of each of the parameters, and paths of debt ratios are then derived. One-quarter standard deviation shocks are applied in the combined shock test. These shocks are applied to the interest rate, growth rate, and primary balance. In addition, the template examines the debt trajectory in the case of a 30 percent depreciation of the local currency and a contingent liabilities shock of 10 percent of GDP. The latter is presented as a rough measurement of an increase in debt-creating flows, given the difficulties in discussing contingent liabilities risk. If better measures are available, the staff is encouraged to use them in stress tests.

Table 9.1 lists the data inputs needed to calculate the debt-to-GDP ratio in the IMF's DSA.

Table 9.1 Data Input Requirements for DSA

Fiscal Variables	Macroeconomic Variables
Public sector debt, Public sector balance, Public sector expenditure, Public sector interest expenditure, Public sector revenue (and grants), Foreign-currency denominated debt (expressed in local currency), Amortization on medium- and long-term public sector debt, Short-term public sector debt, Interest payments on foreign debt	Nominal GDP, Real GDP, Exchange rate, national currency per U.S. dollar, end of period, Exchange rate, national currency per U.S. dollar, period average, GDP deflator

It is also desirable to have data on privatization receipts, recognition of implicit or contingent liabilities, and other liabilities (e.g., bank recapitalization). While this data is much harder to collect, it greatly improves the quality of the baseline projection and the stress tests.

Once input data are filled in, the baseline and stress test results are automatically calibrated and presented in a summary table and in charts representing the outcomes of the stress tests, also known as bound tests. See Table 9.2 and Figure 9.4 for an example.

Table 9.2 summarizes the baseline scenario. Lines 1 and 2 show how the debt-to-GDP ratio evolves over time. The key macroeconomic assumptions underlying the baseline are reported at the bottom of the table. The different channels that contribute to the evolution of the debt-to-GDP ratio are: the primary deficit (line 4), the automatic debt dynamics (line 7), and other

identified debt-creating flows (line 12), which include privatization receipts, recognition of implicit or contingent liabilities, and other obligations such as bank recapitalization. These flows are assumed zero in this particular example.

The automatic debt dynamics, in turn, is broken down into contributions from the real interest rate, real GDP growth, and exchange rate. This decomposition allows an assessment of the importance of different factors in the buildup of public debt and also serves as the basis for stress tests, the results of which are summarized together with the baseline projections in Figure 9.3.

Changes in gross debt arising from other below-the-line operations, such as repayment of debt financed by a reduction in financial assets, and cross-currency movements are included in a residual (line 16). It is critical to monitor the behavior of this residual, as it may highlight errors in implementing the approach. A large residual may, in particular, signal a breach of the flow-stock identity linking the deficit to changes in debt. The residual should be small unless it can be explained by specific factors. The gross financing needs of the public sector, in percent of GDP and in billions of dollars, are also calculated.

Table 9.2 also reports the paths of debt to GDP ratio under the historical scenario and under the no-policy-change scenario. These scenarios test the realism of the baseline scenario. Finally, the template also calculates the debt-stabilizing primary balance (last column of Table 9.2).

Table 9.2 Country: Public Sector Debt Sustainability Framework, 2000-2010

Table 9.2. Country: Public Sector Debt Sustainability Framework, 2000-2010

(In percent of GDP, unless otherwise indicated)

	Actual					Projections						
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Debt-stabilizing primary balance 9/
1 **Baseline: Public sector debt 1/**	47.7	51.8	60.0	56.3	49.4	**49.5**	**48.3**	**47.2**	**45.3**	**43.3**	**41.3**	**0.5**
o/w foreign-currency denominated	26.3	28.5	31.9	29.9	24.4	24.7	24.4	24.0	22.9	22.0	21.2	
2 Change in public sector debt	6.4	4.1	8.2	-3.7	-6.9	0.1	-1.1	-1.1	-1.9	-2.0	-2.0	
3 Identified debt-creating flows (4+7+12)	1.9	0.9	7.1	-4.1	-7.1	-1.5	-2.1	-2.2	-2.4	-2.4	-2.3	
4 Primary deficit	-0.9	-1.3	-0.5	-2.0	-2.9	-2.7	-2.7	-2.7	-2.7	-2.7	-2.7	
5 Revenue and grants	28.0	29.5	29.3	30.6	32.5	32.9	32.3	32.1	32.3	32.2	32.1	
6 Primary (noninterest) expenditure	27.1	28.2	28.9	28.6	29.6	30.2	29.5	29.5	29.6	29.6	29.5	
7 Automatic debt dynamics 2/	3.3	2.3	7.5	-2.2	-4.3	1.2	0.6	0.5	0.4	0.2	0.3	
8 Contribution from interest rate/growth differential 3/	-1.1	1.6	0.4	-1.3	-0.2	1.2	0.6	0.5	0.4	0.2	0.3	
9 Of which contribution from real interest rate	-0.1	2.2	1.3	0.8	1.7	3.0	2.4	2.3	2.1	1.9	1.9	
10 Of which contribution from real GDP growth	-1.0	-0.7	-0.9	-2.1	-2.0	-1.8	-1.8	-1.8	-1.8	-1.7	-1.6	
11 Contribution from exchange rate depreciation 4/	4.4	0.7	7.1	-0.9	-4.1	...	...	...	...	...	...	
12 Other identified debt-creating flows	-0.5	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
13 Privatization receipts (negative)	-0.5	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
14 Recognition of implicit or contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
15 Other (specify, e.g. bank recapitalization)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
16 Residual, including asset changes (2-3) 5/	4.5	3.1	1.1	0.4	0.3	1.6	1.0	1.1	0.5	0.4	0.3	
Public sector debt-to-revenue ratio 1/	170.3	175.4	204.4	184.1	151.8	150.6	149.9	147.1	140.3	134.5	128.5	
Gross financing need 6/	5.9	6.3	8.4	7.5	3.7	5.2	4.6	4.4	4.1	3.9	3.8	
in billions of U.S. dollars	5.0	5.1	6.8	6.0	3.5	5.6	5.0	4.9	4.8	4.7	4.9	
Scenario with key variables at their historical averages 7/						**49.5**	**48.6**	**47.8**	**46.6**	**45.3**	**43.9**	**-1.0**
Scenario with no policy change (constant primary balance) in 2005-2010						**49.5**	**48.4**	**47.3**	**45.4**	**43.4**	**41.4**	**0.5**
Key Macroeconomic and Fiscal Assumptions Underlying Baseline												
Real GDP growth (in percent)	2.9	1.5	1.9	3.8	3.8	4.0	4.0	4.0	4.0	4.0	4.0	
Average nominal interest rate on public debt (in percent) 8/	12.3	11.3	9.4	9.0	9.1	11.1	10.6	9.1	8.1	7.7	7.9	
Average real interest rate (nominal rate minus change in GDP deflator, in percent)	0.2	5.1	2.9	1.7	3.6	6.8	5.5	5.3	4.9	4.7	4.9	
Nominal appreciation (increase in US dollar value of local currency, in percent)	-15.9	-2.7	-20.0	3.1	16.3	...	...	...	...	...	...	
Inflation rate (GDP deflator, in percent)	12.1	6.2	6.4	7.2	5.5	4.3	5.1	3.8	3.2	3.0	3.0	
Growth of real primary spending (deflated by GDP deflator, in percent)	-5.5	5.5	4.5	2.8	7.6	6.0	1.7	3.7	4.5	3.9	3.7	
Primary deficit	-0.9	-1.3	-0.5	-2.0	-2.9	-2.7	-2.7	-2.7	-2.7	-2.7	-2.7	

1/ Indicate coverage of public sector, e.g., general government or nonfinancial public sector. Also whether net or gross debt is used.

2/ Derived as $[(r - \pi(1+g) - g + \alpha\varepsilon(1+r)]/(1+g+\pi+g\pi))$ times previous period debt ratio, with r = interest rate; π = growth rate of GDP deflator; g = real GDP growth rate; α = share of foreign-currency denominated debt; and ε = nominal exchange rate depreciation (measured by increase in local currency value of U.S. dollar).

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

4/ The exchange rate contribution is derived from the numerator in footnote 2/ as $\alpha\varepsilon(1+r)$.

5/ For projections, this line includes exchange rate changes.

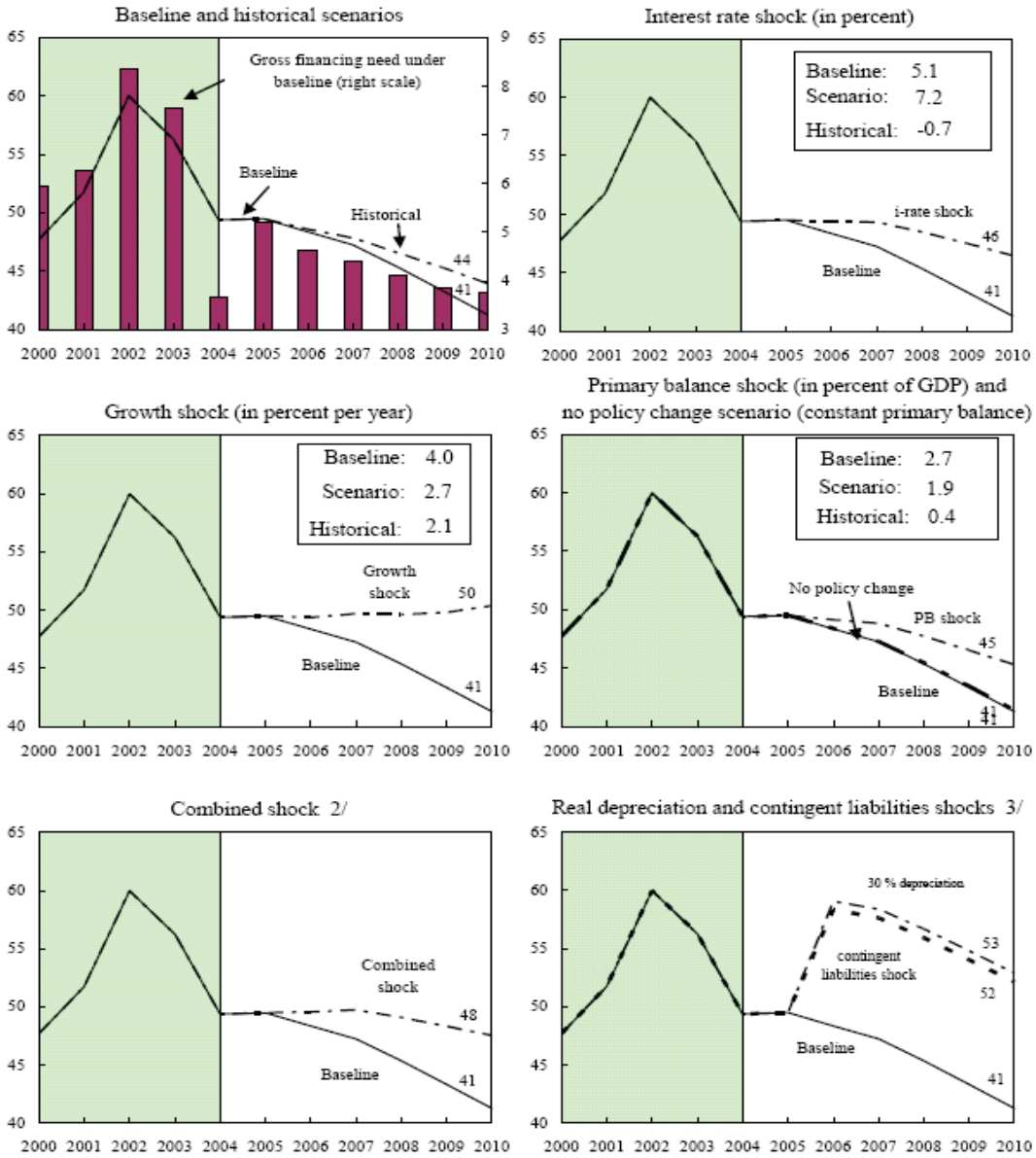
6/ Defined as public sector deficit, plus amortization of medium and long-term public sector debt, plus short-term debt at end of previous period.

7/ The key variables include real GDP growth; real interest rate; and primary balance in percent of GDP.

8/ Derived as nominal interest expenditure divided by previous period debt stock.

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

Figure 9.4 Country: Public Debt Sustainability: Bound Test [1]
(Public debt in percent of GDP)



Sources: International Monetary Fund, Country desk data, and staff estimates.
1/ Shaded areas represent actual data.Individual shocks are permanent one-half standard deviation shocks. Figures in the boxes represent average projections for the respective variables in the baseline and scenario being presented. Ten-year historical average for the variable is also shown.
2/ Permanent 1/4 standard deviation shocks applied to real interest rate, growth rate, and primary balance.
3/ One-time real depreciation of 30 percent and 10 percent of GDP shock to contingent liabilities occur in 2006, with real depreciation defined as nominal depreciation (measured by percentage fall in dollar value of local currency) minus domestic inflation (based on GDP deflator).

X. Chapter Ten: External Sustainability

Foreign financial resources can be important to growing economies, as they supplement domestic savings to finance investment, help smooth income fluctuations and, in the case of direct foreign investment, facilitate technology transfer. Access to foreign finance, however, has in the past also led a number of countries to accumulate unsustainable foreign debts, which they were unable to honor in full. Although excessive debt obligations can be renegotiated with creditors in principle, the process is neither smooth nor costless in practice, not least because creditors are multiple and fragmented. Sometimes an initial round of debt reduction needs to be followed by further debt forgiveness. In the meantime, the country typically loses access to foreign financing for a sustained period, its currency depreciates strongly in nominal and real terms, and imports and other foreign spending are compressed. In some instances, as discussed in Chapter 6, balance sheet effects lead to insolvency of domestic firms and depositor runs against the banking system. The effects of financial convulsions on the real economy may be severe, with inflation, interest rates, and unemployment spiking up and output contracting.

Unsustainable foreign debts are thus costly to a country and disrupt the smooth functioning of international capital markets. However, while there is a large payoff to preventing these situations, identifying dangerous imbalances and correcting them as they are building up has proven difficult. The purpose of external debt sustainability analysis (DSA) is to help policymakers in these endeavors.

This chapter presents the analytical and operational considerations relevant to the analysis of external sustainability.

10.1 The IMF's External Debt Sustainability Framework

External sustainability requires a country to be able to fully service its outstanding debt to foreign residents both in the short run and in the long run. To be viewed as sustainable, debt should be serviceable without assuming unrealistically large policy corrections in the future. In contrast with fiscal sustainability, which focuses on debt owed by the national government to either domestic or foreign residents, external debt sustainability considers the total indebtedness of the economy (including debt of the government, the financial sector, the non-financial corporate sector, and households) vis-à-vis foreign residents.

To assess external sustainability, DSAs evaluate the path of a country's external debt stock over time in relation to GDP, exports, or some other indicator of capacity to repay external debt. Sustainability requires that these ratios stabilize at reasonable levels eventually—by the end of the projection period at the latest—and that they do not become explosive thereafter. The time path of the external debt-to-GDP ratio depends on domestic macroeconomic

conditions, the country's macroeconomic and structural policies, and on global trade and capital market conditions. If, under reasonable macroeconomic assumptions, the ratio of external debt to GDP or exports does not stabilize at a prudent level, this will raise alarm bells about the ability of the country to service its foreign debt in the future.

The IMF's assessments of external sustainability proceed in two steps. First, the IMF team working on a country, in cooperation with country authorities, makes projections of the path of policy and endogenous variables. The projections use the intertemporal budget constraint that links the external debt flows needed to finance a country's current account deficits to the stock of external debt at the end of the projection period. A key objective of the DSA is to determine the path of the external debt-to-GDP ratio during the projection period.

These projections involve many judgments about macroeconomic developments, such as economic growth, inflation, nominal and real interest rates, and exchange rates; the portion of the current account deficit that can be financed through non-debt flows; and the extent of official inflows. These macroeconomic assumptions are not standardized but are adapted to the circumstances of the country. They must be scrutinized to ensure that they are internally consistent and conform to developments in the international economy, including likely growth rates and inflation of trading partners and international interest rates.

As in the case of fiscal DSA, sensitivity tests are performed on the baseline to examine the effects on the external debt profile of alternative assumptions about the time paths of key variables.

10.2 The External Sustainability Template

The template summarizes the DSA's baseline assumptions and its implications for external debt dynamics.[147] The starting point is the accounting identity linking the economy's transactions with the rest of the world (see Chapter 4).

Let TB be the sum of the non-interest current account balance, NITB, and non-debt generating capital inflows. Also let D_t denote the stock of external debt at the end of year t and i_t^w the nominal effective foreign-currency interest rate the country pays on its external debt. The increase in the stock of external debt over time is

$$D_t - D_{t-1} = i_t^w D_{t-1} - TB_t , \tag{10.1}$$

which is equivalent to

[147] External debt obligations should include public sector external debt, non-financial private external debt, and financial sector external debt.

$$D_t = \left(1 + i_t^w\right) D_{t-1} - TB_t \,. \tag{10.2}$$

It is useful to express the stock of a country's external liabilities in relation to GDP. This requires that we obtain the foreign currency value of the country's GDP where for purposes of illustration, we assume that the foreign currency in which debt is denominated is the U.S. dollar. Let *P* denote the GDP deflator, *Y* denote GDP, and let *e* define the exchange rate in units of domestic currency per U.S. dollar. Then GDP in U.S. dollar terms can be written as *PY/e*. Dividing both sides of (10.1) by *PY/e* yields the external debt-to-GDP ratio. The country's external debt dynamics becomes

$$\frac{D_t}{\left(P_t Y_t / e_t\right)} = \left(1 + i_t^w\right) \frac{D_{t-1}}{\left(P_{t-1} Y_{t-1} / e_{t-1}\right)} \frac{\left(P_{t-1} Y_{t-1} / e_{t-1}\right)}{\left(P_t Y_t / e_t\right)} - \frac{\left(P_t^x X_t - P_t^m M_t\right)}{\left(P_t Y_t / e_t\right)} + \frac{OI_t}{\left(P_t Y_t / e_t\right)}, \tag{10.3}$$

where P^X is the price of exports, *X* is exports, P^M is the price of imports in foreign currency, and *M* is imports.

The above equation can also be expressed as

$$d_t = \frac{\left(1 + i_t^w\right)\left(1 + \rho_t\right)}{\left(1 + \pi_t\right)\left(1 + g_t\right)} d_{t-1} - tb_t \,, \tag{10.4}$$

where *d* is the debt-to-GDP ratio, π is the growth rate in the GDP deflator, *g* is the real GDP growth rate, ρ is the rate of nominal exchange rate appreciation, and *tb* is the debt-creating component of the balance on goods and non-interest services in percent of GDP. The baseline medium-term projection of external sustainability is obtained by extending this equation to project the growth rates and balance of payments several years into the future.

To compute the evolution of the debt to GDP ratio, we need starting values for the initial stock of public and private external debt, its maturity profile and schedule of interest payments. To compute future interest payments, an estimate of future external interest rates must be made. The standard practice is to assume one interest rate that applies to both public and private external debt. An alternative approach would be to use a separate interest rate for the public and private sector and interpret the external interest rate as the weighted average external interest rate. Forecasts of growth rates of real exports and imports, along with forecasts of their relevant nominal price growth in foreign currency are needed to compute the relative contribution of the trade balance to external resource needs. Finally, to compute external debt to GDP ratios, we need forecasts of the path of real GDP growth, the GDP deflator, and the nominal exchange rate. Table 10.1 provides an example of the standard template for external sustainability analysis.

The baseline scenario for external sustainability should be constructed with a reasonable set of forecast variables. In other words, the baseline scenario should not achieve sustainability by assuming abnormally high growth rates, abnormally low interest rates, or unreasonable rates of appreciation. The economic performance of the country during the last five to ten years is important in making realistic assumptions. The underlying assumptions should be transparent, and optimism or pessimism can be incorporated by subjecting the baseline projection to a set of alternative assumptions. A separate program scenario that includes an active policy response can then be constructed in a separate step, allowing the authorities to evaluate sustainability under active and passive policy stances.

Determinants of external debt accumulation

Equation (10.4) is composed of two parts. The first component is the effect of changes in economic variables on the existing external debt-to-GDP ratio. This component is the automatic debt dynamics since the changes in the economic variables are automatically applied to the pre-existing stock of external debt. The external debt-to-GDP ratio rises if the nominal external interest rate rises or if the domestic currency depreciates vis-à-vis foreign currencies. An increase in interest rates causes debt service costs to rise, some of which may be rolled over into additional new debt. A depreciation reduces the foreign-currency value of domestic GDP. However, increases in the growth rate of the GDP deflator and/or real GDP itself cause the external debt-to-GDP ratio to decline.

The second component of external debt dynamics is the debt-creating component of the balance on goods and non-interest services. In the external sustainability template, the starting point is the current account deficit, excluding interest payments. The current account deficit, excluding interest payments, is then adjusted by the level of net non-debt creating capital inflows from the balance of payments. The non-debt-creating capital flows are net foreign direct investment and other net equity investment by firms and households. Net positive inflows on non-debt creating capital flows reduce the need for external resources and are, therefore, recorded as a negative value in the template.

The evolution of external debt over time is influenced by many factors, including decisions of the government and the private sector. Government can clearly control its own rate of external debt accumulation. But its policies must also target actions and expectations of the private sector and aim at overall economic stability. The external balance, for instance, is affected by the private sector's demand for imports and the rest of the world's demand for exports, the real exchange rate, competitiveness considerations, and domestic and foreign income and demand. The evolution of external debt is also influenced by the volume of non-debt inflows, principally FDI and equity investment. The volume of these inflows is determined by international investors who look at the marginal productivity of domestic projects relative to the return available in other markets, the country's business climate, and other considerations. Thus, several sectors jointly help determine the size of the current

account balance and the level and composition of capital inflows that finance it. A loss of confidence that results in rising interest rates and exchange rate depreciation could negatively influence the external debt dynamics of the economy.

External debt stabilization and threshold levels of debt

As in the analysis of fiscal sustainability (Chapter 9), we may calculate the non-interest primary balance needed to stabilize the external debt to GDP ratio. Setting $d_t=d_{t-1}$ in (10.4) yields

$$tb_t = \left[\frac{\left(1+i_t^w\right)\left(1+\rho_t\right)}{\left(1+\pi_t\right)\left(1+g_t\right)}-1\right]d_{t-1}, \tag{10.5}$$

which is the level of non-interest CAB and non-debt generating inflows needed to keep the external debt to GDP ratio from rising. Improvements in the public finances can help improve the external current account and arrest the accumulation of external debt. These must normally be complemented by structural measures and financial sector reforms, with the aim of improving the supply side of the economy, raising the efficiency of intermediation, deepening local capital markets, and attracting more non-debt inflows. Deeper local capital markets increase the amount of domestic currency financing available and help reduce the dependence on foreign currency finance. Improving the currency composition of public and private sector balance sheets and increasing the types of securities available, including derivatives and options, allows private sector borrowers to better hedge currency fluctuations.

Policy may need to do more than stabilize external debt ratios. The authorities may target a "safe" level of external debt and increase international reserves and fiscal cushions to deal with liquidity shocks. They may also improve the structure of the public sector's external debt profile, either by substituting domestic currency borrowing for external borrowing or by lengthening the maturity of external debt. If policy is not successful in stabilizing the external debt dynamics, then the public sector may need to restructure the debt profile to restore sustainability.

Stress tests

In addition to the baseline projection, the standard framework includes a set of standard sensitivity tests. These stress tests examine the implications of alternative assumptions about policy variables, macroeconomic developments, and costs of financing.

The first sensitivity test details the ambitiousness of the baseline projection relative to historical experience. As in the fiscal DSA, key variables—the rate of growth, interest rate,

etc.—are set to their historical averages to test whether the baseline is consistent with the country's historical norm. The other sensitivity tests include: a two-standard deviation adverse shock lasting two years to each of the key parameters; and a one-standard deviation combined shock. These standard deviations are computed using historical data for the country.

The combined shock assumes that each of the variables moves against external debt sustainability (e.g., interest rate increases and exchange rate depreciations simultaneously). The combined shock is also repeated using standard deviations obtained from cross-country studies as a robustness check. Finally, country specific shocks can be tailored to specific features of the economy. For example, in a country that has a fixed exchange rate regime, the volatility of the exchange rate may have been low historically. This would justify a scenario in which there is a large exchange rate depreciation.

An important consideration in the implementation of DSAs concerns the length of the historical series used to compute the historical averages and standard deviations. Long horizons help guard against excessive euphoria or excessive pessimism about, say, growth prospects. Conversely, structural change may limit the relevance of the distant past. The IMF DSA framework normally uses the previous ten years to calculate averages and standard deviations. A five-year period is used in countries that experienced structural changes, such as transition from central planning, or large shocks, such as hyperinflation or currency crisis. Finally, if the data available for a country is too short, cross-country parameters can be substituted instead.

Another key judgment in DSAs is the length and serial correlation properties of the shocks. Low growth in one year may signal a recession, suggesting a positive serial correlation in the level of output, although it is unlikely that there would be repeated negative shocks to output growth. The standard template for external sustainability conducts sensitivity tests based on a two-year sequence of shocks followed by a return to the mean growth rates for the rest of the projection period. The country-specific shocks can be modified to consider shorter or longer intervals.

10.3 An Example: Mexico

The external DSA template was applied recently to Mexico (see Table 10.1). In the baseline, the external debt-to-GDP ratio was projected to decline from 26.1 percent in 2003 to 23 percent in 2009. Despite a slight moderation in GDP growth assumed in the baseline, the sound public finances and healthy non-debt creating capital inflows were expected to cover Mexico's external resource needs. Hence, Mexico's external debt position appeared sound under the baseline.

Table 10.1 also describes the results of stress tests to the baseline. The first alternative scenario (Table 10.1, A1) uses the ten-year historical average for the key macroeconomic variables. The second alternative scenario (Table 10.1, A2) uses a country-specific shock—in this case a negative shock to oil prices. In addition, the stress tests consider two-standard deviation shocks to interest rates, GDP growth, inflation, and the current account that last for two periods (Table 10.1, B1-B4). Finally, a one-standard deviation shock to the combined variables combined with a one-time, one-year, 30 percent nominal depreciation were considered (Table 10.1, B5 and B6).

Mexico's external vulnerability remains low in the higher interest rate-lower oil price scenario. The external debt-to-GDP ratio remains in the 23–26 percent of GDP range throughout the forecast period. The outcome of the stress tests is different under an extreme combination of shocks, namely a peso depreciation by two standard deviations, or 24 percent in 2005 and 2006, and a mix of higher nominal interest rates, lower GDP growth rates, and exchange rate depreciation by one standard deviation. In this scenario, Mexico's external situation would worsen dramatically. External debt would approach 40 percent of GDP.

Table 10.1. Mexico: External Debt Sustainability Framework, 1999–2009
(in percent of GDP, unless otherwise indicated)

	Actual							Projections						
	1999	2000	2001	2002	2003			2004	2005	2006	2007	2008	2009	
								I. Baseline Projections						Debt-stabilizing non-interest current account 7/
External debt	36.9	28.4	26.1	25.2	26.1			**24.5**	**24.2**	**23.9**	**23.6**	**23.4**	**23.0**	**-0.7**
Change in external debt	-2.1	-8.5	-2.3	-0.8	0.9			-1.7	-0.2	-0.3	-0.3	-0.3	-0.4	
Identified external debt-creating flows (4+8+9)	-4.2	-5.1	-2.3	-0.8	1.0			-1.5	-1.1	-0.8	-0.7	-0.4	-0.3	
Current account deficit, excluding interest payments	0.2	0.8	0.9	0.7	-0.1			-0.6	-0.5	-0.3	-0.3	0.0	-0.1	
Deficit in balance of goods and services	1.5	1.8	2.2	1.8	1.6			1.6	1.5	1.7	1.7	1.9	1.8	
Exports	20.3	20.4	18.2	17.6	18.7			20.8	21.3	21.3	21.5	21.5	21.4	
Imports	21.8	22.2	20.4	19.4	20.3			22.4	22.8	23.0	23.2	23.4	23.3	
Net non-debt creating capital inflows (negative)	-2.2	-1.8	-3.2	-2.0	-1.3			-1.6	-1.6	-1.6	-1.6	-1.5	-1.5	
Automatic debt dynamics 1/	-2.1	-4.0	0.1	0.5	2.4			0.6	1.0	1.1	1.1	1.1	1.3	
Contribution from nominal interest rate	2.7	2.4	2.0	1.4	1.5			1.6	1.8	1.8	1.8	1.8	2.0	
Contribution from real GDP growth	-1.2	-2.0	0.0	-0.1	-0.3			-1.0	-0.8	-0.7	-0.7	-0.7	-0.7	
Contribution from price and exchange rate changes 2/	-3.6	-4.4	-2.0	-0.8	1.2			...	...	...	...	...	...	
Residual, incl. change in gross foreign assets (2-3) 3/	2.0	-3.5	0.0	0.0	-0.1			-0.1	0.8	0.5	0.5	0.2	-0.1	
External debt-to-exports ratio (in percent)	181.9	139.3	143.3	143.3	139.8			117.6	113.8	112.2	109.9	108.8	107.3	
Gross external financing need (in billions of US dollars) 4/	59.2	72.4	71.1	60.1	52.2			43.2	46.7	51.3	56.6	61.0	64.3	
in percent of GDP	12.3	12.5	11.4	9.3	8.2	10-Year Historical Average	10-Year Standard Deviation	6.4	6.6	6.9	7.2	7.4	7.4	
Key Macroeconomic Assumptions														Projected Average
Real GDP growth (in percent)	3.6	6.6	0.0	0.6	1.3	2.7	3.9	4.0	3.2	3.3	3.2	3.1	3.1	3.3
GDP deflator in US dollars (change in percent)	10.1	13.4	7.4	3.3	-4.7	2.5	12.2	2.3	1.5	2.0	2.1	2.1	2.2	2.0
Nominal external interest rate (in percent)	7.9	7.7	7.7	5.7	5.9	7.8	1.2	6.7	7.7	7.8	8.0	8.0	9.0	7.9
Growth of exports (US dollar terms, in percent)	13.0	21.3	-4.2	0.6	3.8	10.6	9.8	18.3	7.3	5.4	6.3	5.1	5.1	7.9
Growth of imports (US dollar terms, in percent)	10.3	22.6	-1.4	-0.7	2.0	8.8	14.8	17.5	6.7	6.0	6.2	6.3	4.7	7.9
Current account balance, excluding interest payments	-0.2	-0.8	-0.9	-0.7	0.1	0.1	2.4	0.6	0.5	0.3	0.3	0.0	0.1	0.3
Net non-debt creating capital inflows	2.2	1.8	3.2	2.0	1.3	2.5	0.8	1.6	1.6	1.6	1.6	1.5	1.5	1.6
								II. Stress Tests for External Debt Ratio						Debt-stabilizing non-interest current account 7/
A. Alternative Scenarios														
A1. Key variables are at their historical averages in 2005-09 5/								**24.5**	**23.6**	**22.5**	**21.3**	**19.8**	**18.1**	**-2.1**
A2. Country-specific shock of a fall in oil prices 6/								**24.5**	**26.3**	**26.4**	**26.1**	**25.8**	**25.5**	**0.0**
B. Bound Tests														
B1. Nominal interest rate is at historical average plus two standard deviations in 2005 and 2006								**24.5**	**24.8**	**25.1**	**24.9**	**24.6**	**24.3**	**-0.7**
B2. Real GDP growth is at historical average minus two standard deviations in 2005 and 2006								**24.5**	**26.4**	**28.4**	**28.1**	**27.8**	**27.4**	**-0.9**
B3. Change in US dollar GDP deflator is at historical average minus two standard deviations in 2005 and 2006								**24.5**	**31.6**	**41.0**	**40.7**	**40.2**	**39.7**	**-1.2**
B4. Non-interest current account is at historical average minus two standard deviations in 2005 and 2006								**24.5**	**29.3**	**34.1**	**34.0**	**34.0**	**34.0**	**-0.3**
B5. Combination of 2-5 using one standard deviation shocks								**24.5**	**31.7**	**40.1**	**39.9**	**39.7**	**39.5**	**-0.7**
B6. One time 30 percent nominal depreciation in 2005								**24.5**	**34.1**	**33.8**	**33.5**	**33.1**	**32.7**	**-1.0**

1/ Derived as $[r - g - \rho(1+g) + \varepsilon\alpha(1+r)]/(1+g+\rho+g\rho)$ times previous period debt stock, with r = nominal effective interest rate on external debt; ρ = change in domestic GDP deflator in US dollar terms, g = real GDP growth rate, e = nominal appreciation (increase in dollar value of domestic currency), and a = share of domestic-currency denominated debt in total external debt.

2/ The contribution from price and exchange rate changes is defined as $[\rho(1+g) + \varepsilon\alpha(1+r)]/(1+g+\rho+g\rho)$ times previous period debt stock. ρ increases with an appreciating domestic currency ($\varepsilon > 0$) and rising inflation (based on GDP deflator).

3/ For projection, line includes the impact of price and exchange rate changes.

4/ Defined as current account deficit, plus amortization on medium- and long-term debt, plus short-term debt at end of previous period. This definition differs from that used in Table 3 of the Staff Report, as it does not reflect the financing requirement resulting from gross reserve accumulation.

5/ The key variables include real GDP growth; nominal interest rate; dollar deflator growth; and both non-interest current account and non-debt inflows in percent of GDP.

6/ The implied change in other key variables under this scenario is discussed in the text.

7/ Long-run, constant balance that stabilizes the debt ratio assuming that key variables (real GDP growth, nominal interest rate, dollar deflator growth, and both non-interest current account and non-debt inflows in percent of GDP) remain at their levels of the last projection year.

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