

The "How to" of Fiscal Sustainability

A Technical Manual for Using the Fiscal Sustainability Tool¹

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Abstract

Fiscal sustainability analysis is an important component of macroeconomic analysis for many developing countries. To further enhance understanding of fiscal policy and the constraints faced by policy makers, we develop a toolkit for fiscal sustainability analysis (FSA) in middle-income countries, which builds on previous work in this area and on new developments in dealing with uncertainty. The FSA toolkit includes an excel-based FSA tool and a technical manual accompanying it. The FSA tool is standardized and simple, but at the same time flexible enough to allow for user-defined country specifics. This manual provides step-by-step technical instructions for running the FSA tool, and includes mathematical appendices and a glossary.

World Bank Policy Research Working Paper 4170, March 2007

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¹ A companion background paper, published as WPS 4169 surveys various FS approaches that have been incorporated in the FS tool and presents an application of this tool for Turkey.

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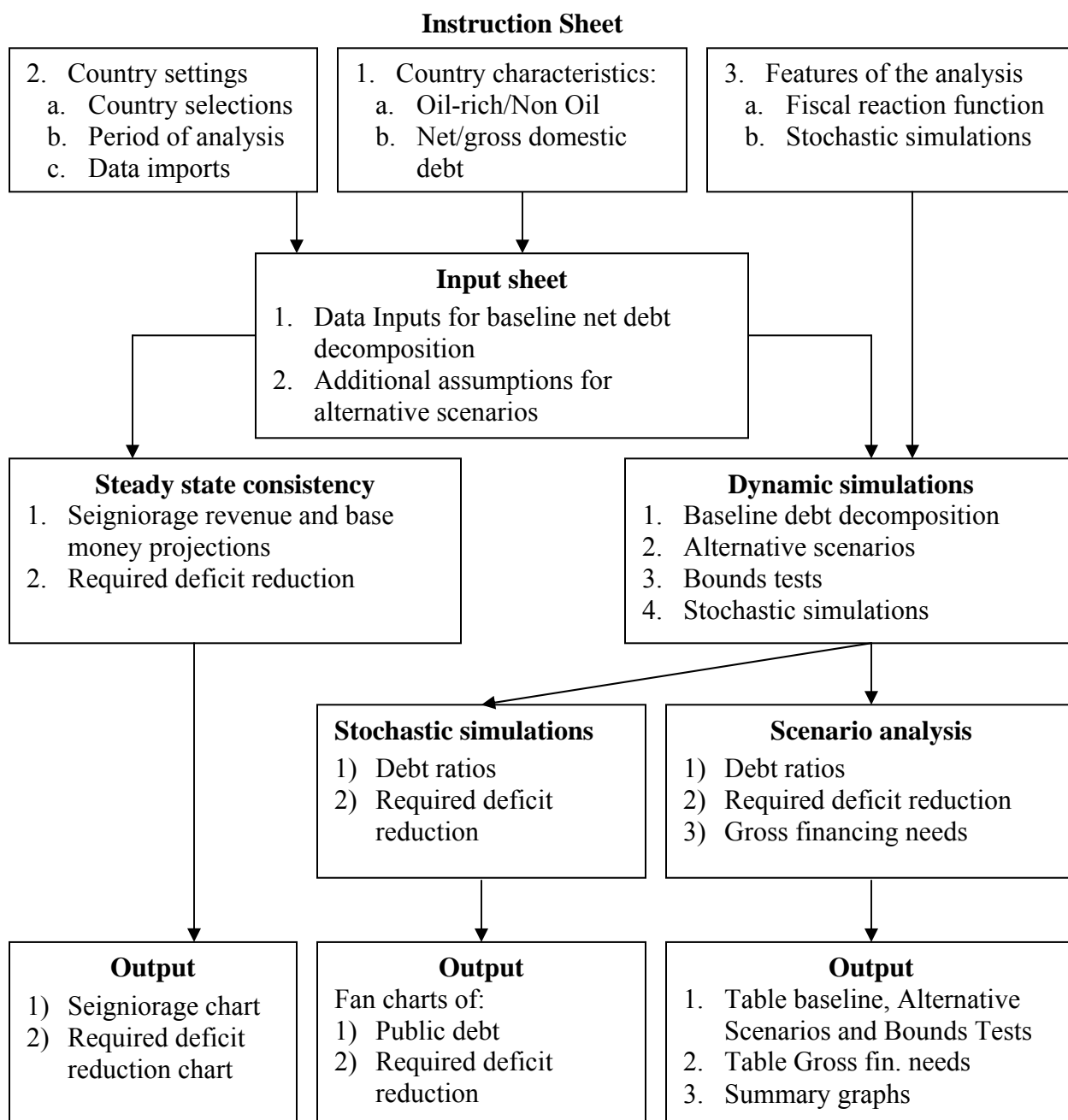
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1. Structure of the Fiscal Sustainability Tool

This manual gives a technical description and instruction for running the Fiscal Sustainability Analysis (FSA) template. First, it presents all the model blocks. Second, it lists all the data requirements to implement the model. Third, it gives detailed instructions on how to run the model and how to perform stochastic simulations and various stress tests. Finally, this note also gives some guidance on how to read output tables and graphs.

Figure 1. A Stylized Presentation of the FSA Template for MICs



The template has 6 sections: i) the instruction sheet to select the country and various options to perform the analysis, ii) the input sheet, iii) the seigniorage sheet containing the base money and seigniorage projections, iv) a baseline scenario sheet for the calculation of the baseline debt decomposition, v) build-in sheets for three types of alternative scenarios and five standardized bound tests and a sheet to perform stochastic simulations, and vi) four output sheets containing summary tables and graphs of all scenarios and fan charts for stochastic simulations (Figure1). As the model enforces consistency between different parts, the user should never change formulas. Doing so may introduce inconsistencies. In what follows we discuss the model block by block.

2. The Instruction Sheet

The instruction sheet contains three buttons that will help the user with configuring the workbook, importing data, selecting different features of the analysis and making fan charts. In addition to the buttons there is also a “sheet control panel” which allows the user to manage the hidden/visible sheets and enable functions for oil rich countries. The settings configured and the data imported by the buttons are stored in the "input_fiscal" sheet and are used to configure automatically all working and output sheets. Not all data might have been imported successfully by using these buttons; for example Life Databases (LDB) variables might have missing values. Therefore, after completing the menus in the instructions sheet, the “input_fiscal” sheet needs to be carefully checked for missing values.

Once "input_fiscal" is filled in correctly, the baseline and stress test results are automatically calibrated and summarized in the output tables in sheets "Table_SR" (debt ratios) and "Table_GF" (gross financing need). The panel chart in sheet "Figure" is automatically populated. If stochastic simulations are run, fan charts are also created.

FSA template V1.00

Turkey

Definition of domestic debt: Net

Historical period: 1994/2005

Projection period: 2006/2011

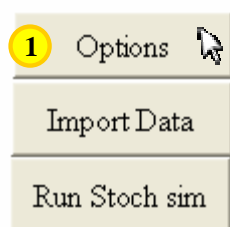
Options
Import Data
Run Stoch sim

sheet control	
Visible sheets	Hidden sheets
Input_fiscal	B7_Revenue
Seigniorage	
Table	
StochSim	
Table_SR.	
Table_GF.	
A1_historical.	
A2_npc.	
A3_alternative.	
<input type="checkbox"/> Enable oil rich country functions	

2.1 Configuring the FS tool: the Options Menu

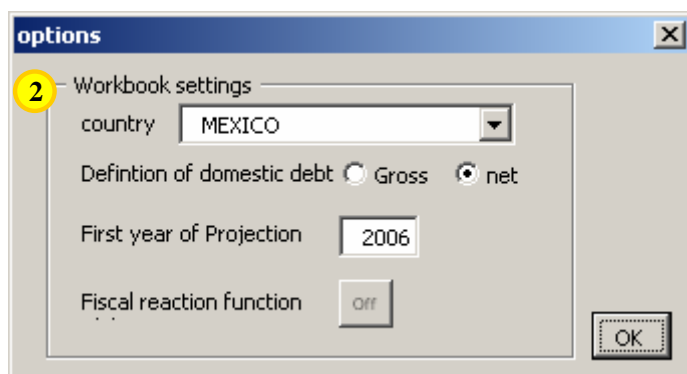
To configure the workbook, parameters and other input values need to be set through the “options” menu. All settings will be stored in the “input_fiscal” sheet and affect the entire workbook. The values are transferred through formula linkages. As the model enforces consistency between different parts, the user should never change formulas or add/delete columns/rows.

Step by step walkthrough



Step 1: Getting started

To start the **options menu** click on the button that is located in the instruction sheet.



Step 2: Configuring the options

a. Select a **country** from the combo box pull-down list which contains all Middle Income Countries.

b. Choose the definition of **domestic debt** by selecting one of the two radio buttons. Gross debt excludes the Central Bank from the definition of the public sector, and does not account for its holdings of public debt. If the option “net debt” is chosen, the Central Bank

is included in the definition of the public sector and the debt stock nets out the Central Bank’s net holdings of Government debt. The tool of analysis requires that interest payments be consistent with the definition of gross (net) domestic debt to calculate the correct nominal and real domestic interest rate (see section 3. The Input Sheet, point 7 for a more detailed description).

c. The historical and **projections** periods are automatically set throughout the template by specifying the first year of projections. The tool of analysis requires 10 years of historical data and 5 years of projections.

d. The **fiscal reaction function** characterizes the fiscal behaviour of the government. The tool for FSA allows for an endogenous fiscal policy response of the primary balance to past public debt developments. If the fiscal reaction function option is switched on it will affect the stochastic simulations and all the alternative scenarios and bound tests. The policy reaction function is defined as

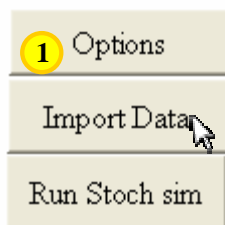
$$pd_t^i = pd_t - \alpha \cdot (b_{t-1}^i - b_{t-1})$$

With pd_t^i as the fiscal deficit in percent of GDP in the i-th scenario, which differs from the primary deficit pd for a fraction α of the additional debt to GDP ratio b_t^i in the i-th scenario in period t-1 with respect to the debt to GDP ratio b in the baseline scenario in period t-1. The magnitude of the

plausible fiscal adjustment α is country specific and depends not only on the outstanding public debt or the cyclical fluctuations of the output with respect to its potential trend, but also on the quality of policies and institutions. The user should determine separately the size of the adjustment and use the FSA tool to obtain consistent results over the projection period. A normal value for the adjustment coefficient α would be between 0 and the real interest rate, such that the primary deficit would be reduced to pay at least some of the additional real interest burden. Such a value guarantees solvency. The default value for α is 0.

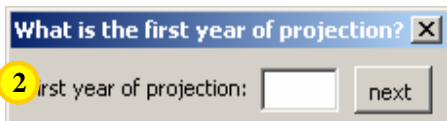
2.2 Importing new data: Import Data menu

Step by step walkthrough



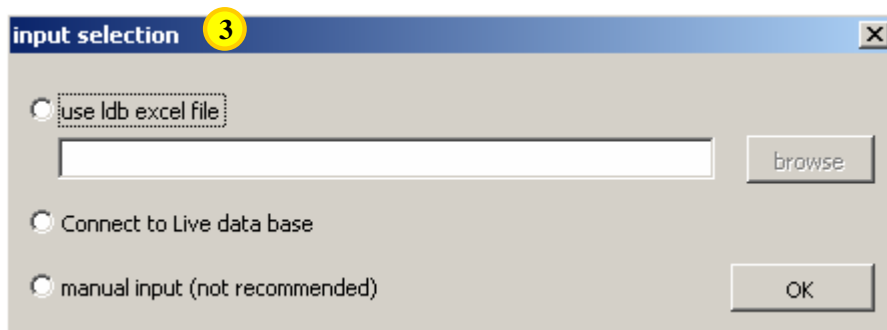
Step 1: Getting started

To start the **input selection menu** click on the “import data” button that’s located in the instructions sheet.



Step 2: Configuring the year range

The default value for the first year of projections is the year earlier configured in the settings menu. If needed, change the first year of the projection period to adjust the year range. This causes all years in the entire workbook to update. Press next.



Step 3: Input selection

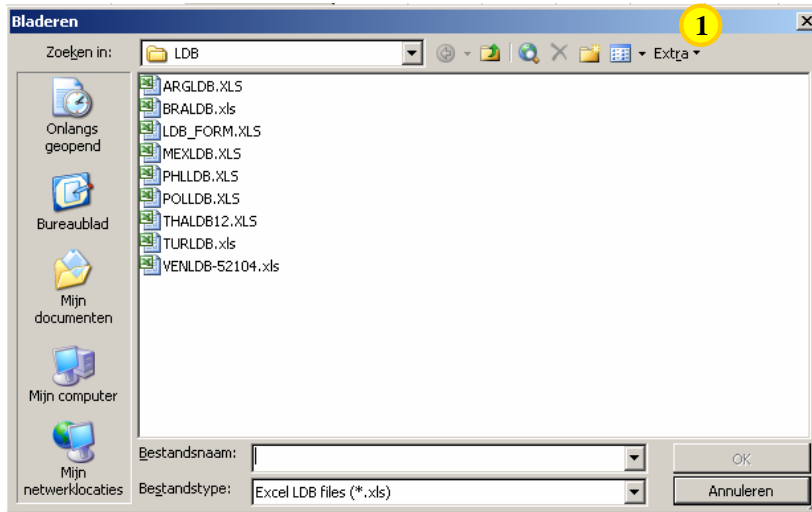
The tools can be populated in three alternative ways:

1. To use data from a **LDB excel file** turn on “use LDB excel” radio button and press browse to select a valid LDB file. Please refer to the **LDB excel file** section below.

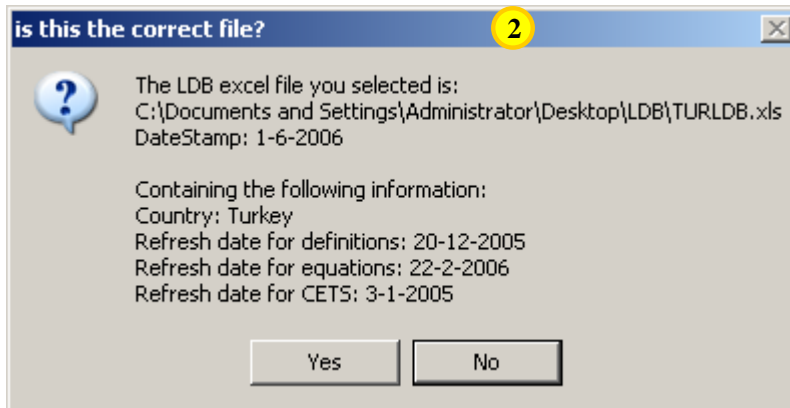
2. To connect to the LDB web service turn on “Connect to Live Data Base” radio button and press okay. Please refer to **Live database web service** below.

3. To populate the input sheet manually from a user defined file, turn on the “manual input” radio button and press okay. This will close the window and activate the “Input_fiscal” sheet, where all cells marked in **yellow** need to be filled.

2.2.1 Populating the template from an LDB Excel file

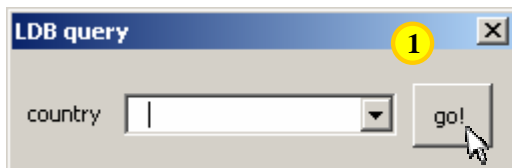


Step 1: Locating a valid LDB file.
After pressing browse a dialog box will popup to help you locate your LDB excel file. Select the desired file and press ok.



Step 2: Confirming the choice
If the file is a valid LDB file a dialog box will display a content summary. Check the summary and confirm if this is the right file by pressing “yes” or “no”. If yes is selected, the “input selection” dialog box 1 will show the path of the selected file, press OK to import data from the selected file. If no, select the correct file.

2.2.2. Populating the template from the LDB web service

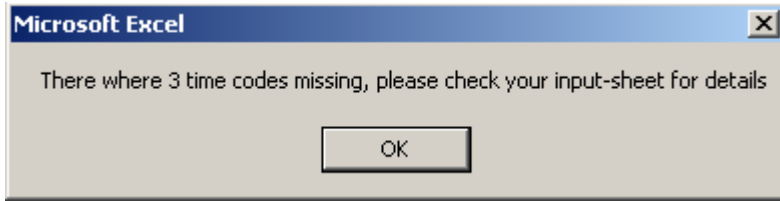


Step1: Confirming the country setting
The country configured in the options menu is already selected from the pull-down combo box as default value. Change the setting if needed and press the “Go!” button to retrieve country fiscal data from LDB web service. Note that the computer must be connected to the World Bank intranet to access the LDB web service.

2.2.3. The LDBd worksheet

After collecting data from LDB web service or LDB file the program switches to the “LDBd” sheet and populates it. This is not the “Input_fiscal” sheet where imported data eventually are inserted, but a temporary sheet to check the data that have been imported from the selected source.

Depending on data availability in the selected source, time codes or time code values per year may be missing. The Import Data program will display the missing time codes in a dialog box.



Rows correspondents to the missing time codes are set in red to indicate missing values. If the time code is available, the value for each year will be imported from the selected source even if this is not the correct value.

Therefore all data needs to be carefully checked before copying it to the “Input_fiscal” sheet. Once data are checked, to import them into the “Input_fiscal” sheet press the **copy to input sheet** button. To change the first year of projection or import data from a different data source press the **Refresh Data** button to start over.

2.3. The Stochastic Simulations menu

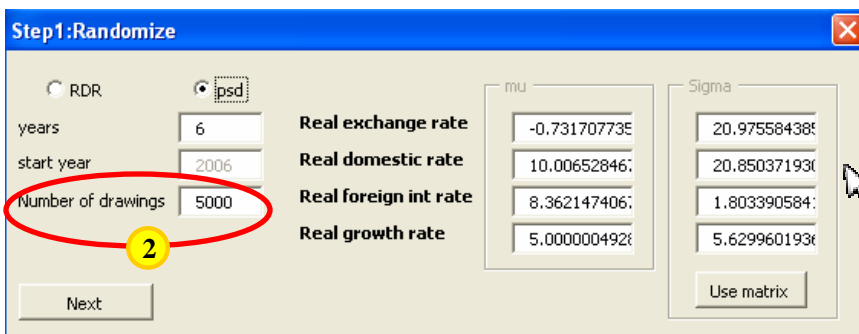
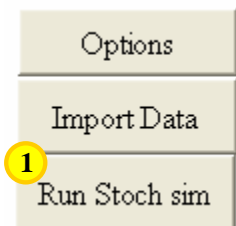
This menu is used to configure stochastic simulations of the public debt to GDP ratios over the 5-year projection period and to represent the outcome with a fan chart. The simulator generates random realizations for the four variables determining the effects of interest rates and growth on the debt ratios: the real exchange rate (% change), the real domestic interest rate (%), the real foreign interest rate (%) and the real growth rate (% change). Each of these variables is assumed to be normally distributed with mean and variance defined by the user. The number of simulations is set at 500 but accurate results require at least 5000 simulations. The start year value is set as the first year of projections in the “Input_fiscal” sheet³.

All parameters, input values and data generated in this menu will be stored in the following sheets: “StochSim, RDRim, Simout, SIM PSD Sheets”. If they are needed in another sheet, the values are transferred through formula linkages. As the model enforces consistency between different parts, the user should never change formulas or add columns/rows.

2.3.1 Step by step walkthrough

Step 1: Open the Stochastic Simulations menu.

To start the **stochastic simulations menu** click on “Run Stoch Sim” button in the instructions sheet. A dialog box will pop up.



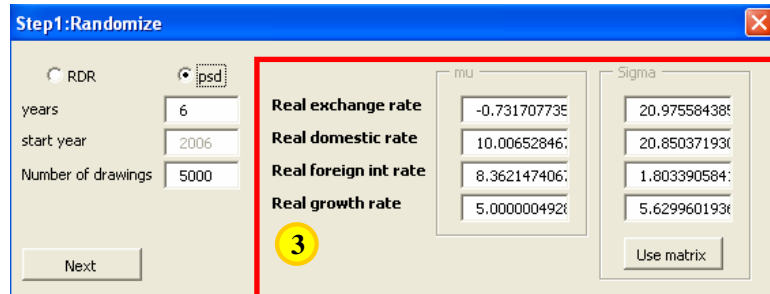
Step 2: Define the output variables.

Select which output variable you want to see reported by turning on the respective radio button:

- 1) RDR (for “Required Deficit Reduction”); or
- 2) PSD (for “Public Sector Debt”).

³ In the next release, the user will be able of selecting the length of the simulation period.

The first option, RDR, lists for each year the deficit reduction required to maintain the public debt to GDP ratio at the value it had in the beginning of that year. The second option, PSD, lists the ratio of public sector debt to GDP in each year. Either one or both options can be chosen in sequence.

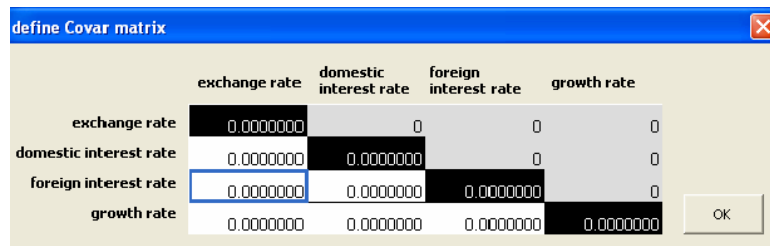


Step 3: Define the distribution parameters of the random variables.
The user can assume the random variables as independently distributed or specify a joint probability function.

3.1) Independent variables.

Distributions of all four random variables need to be configured by

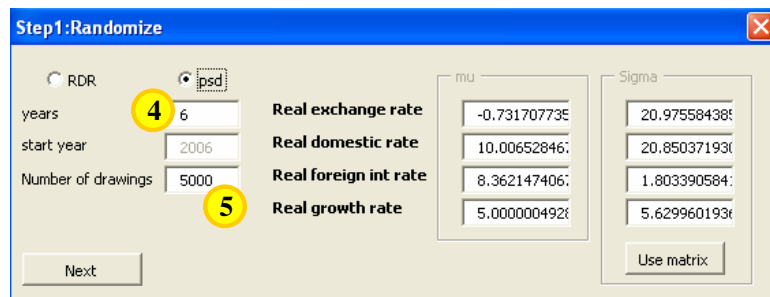
entering values for the average μ and the standard deviation σ that will be used in the simulation period. The default value for each μ is the average over the 5-year projection period of the baseline located in the “Table” sheet. The default value for the σ is the 10-year historical standard deviation also located in the “Table” sheet. The StochSim macro (i) generates random numbers with a uniform distribution over the range [0,1], (ii) applies an inverse normal cumulative distribution to transform these random numbers in normally distributed realizations with mean 0 and variance 1. (iii) Then the variables are multiplied by their respective values for sigma, and mu is added, transforming them in normal variates with mean $\mu(i)$ and sd $\sigma(i)$ for all four values of i .



3.2. Variables with a joint distribution.

The user also has the option to supply a full covariance matrix with off-diagonal elements representing covariances between the variables. The matrix is activated by clicking on “Use matrix” at the bottom of the

“Randomize” panel. The program then applies a Cholesky decomposition to the covariance matrix and uses the resulting Cholesky matrix to generate 4 random variables with the same covariance matrix as the one supplied by the user, introducing dependence between the four variables (see annex A.2 for details). By default the covariances are zero so that the variables are independent.

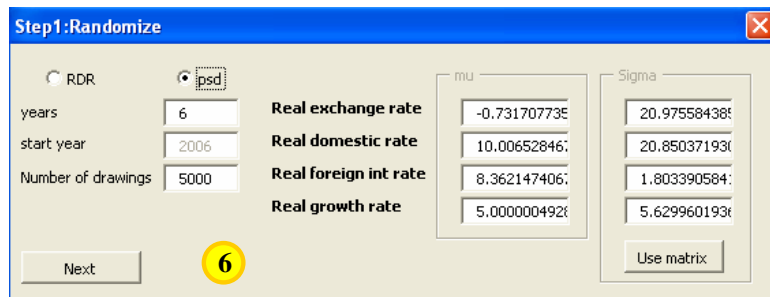


Step 4: Setting the length of the simulation period.

Currently not active, the simulation period is 6 years, starting from the first year of projections as defined in the “Input_fiscal” sheet.

Step 5: Setting the number of random simulations.

The simulation takes about one minute per 1000 runs depending on the speed of the computer. The number of simulations is set at 500 but accurate results require at least 5000 simulations.

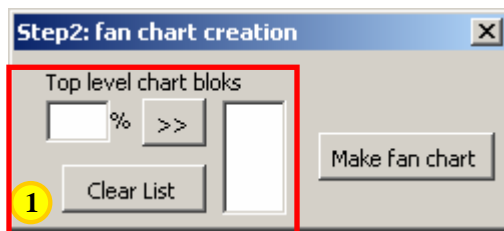


Step 6. Starting the simulations.
Now to start the stochastic simulation press “Next”.

2.3.2. The Fan Chart

After the StochSim macro has generated the distribution(s) of the selected output variable(s), the fan chart will show the distribution of the output variables graphically.

Step by step walkthrough

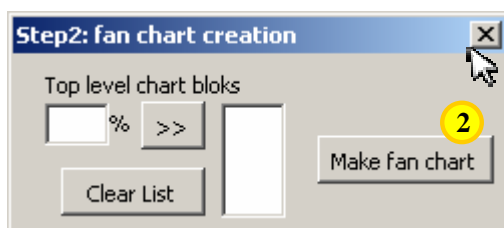


Step 1: Defining the percentile.

The top and bottom lines of the fan chart represent 2.5 percentiles; i.e. the area between the top and bottom lines contains the middle 95% of the values generated in each period by the stochastic simulations.

Other percentiles can be chosen by the user by entering them consecutively in ascending order in the top-left box

and pushing the enter button **>>**. Note that the percentiles must be in ascending order (e.g. 5, 10, 25) and must be larger than 2.5 and smaller than 50. The graph will show both the upper percentiles and the corresponding lower percentiles (hence the requirement to enter numbers lower than 50). The percentiles are not cumulative; so 10 represents the top 10th percentile, 25 the top 25th percentile, etc.

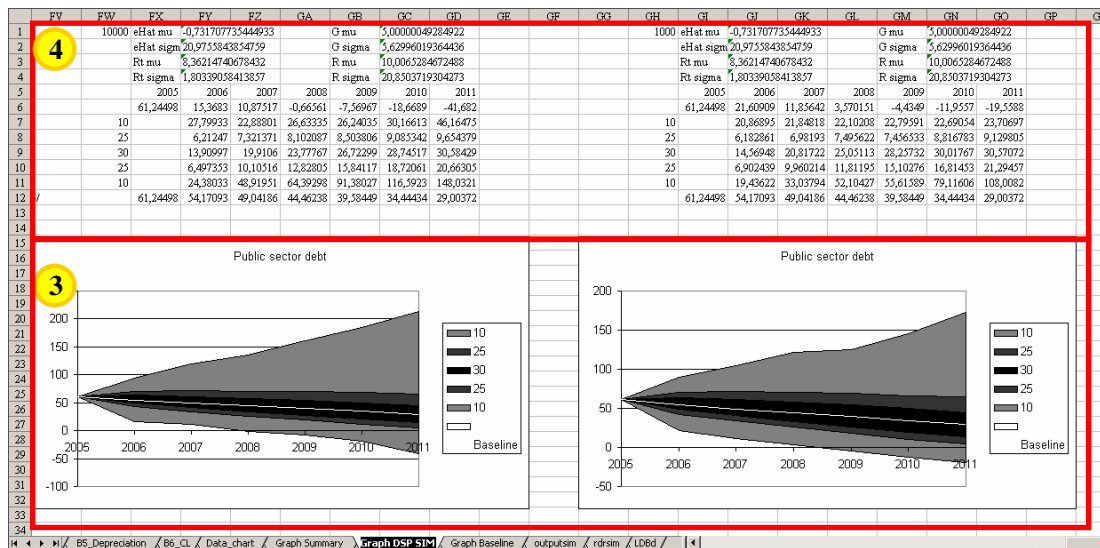


Step 2: Producing the fan chart.

When all chart areas are defined, press the “Make fan chart” button that will automatically switch to the “Graph DSP SIM” sheet where the fan charts and chart tables are reported.

Step 3: Interpreting the fan charts.

Multiple fan charts can be produced to use all the options of the FSA tool. The fan charts and chart tables are added after the last used column in sheet “Graph DSP SIM” as shown. The fan charts report the baseline projections of public debt or required deficit reduction in percent of GDP with a white line. The results of the stochastic simulations are shown according to the percentiles selected in **1**, in the shaded areas.



Step 4: Content of the chart tables.

The chart tables report the number of simulations (top left in row 1), the average values μ and the standard deviation σ (rows 1 to 4) used to parameterise the distribution of the 4 stochastic variables, the bottom 2.5 percentile, and the values of the selected percentiles as difference from the bottom percentile (from row 6). The last line of data reports the baseline projections. If the fiscal reaction function option is selected, the chart tables report also the alternative scenarios and bound tests affected by the selection of the fiscal reaction function. The content of the chart table is reported in the table below.

Number of simulations	$\hat{e}-\mu$		$g-\mu$			
	$\hat{e}-\sigma$		$g-\sigma$			
	$r^*-\mu$		$r-\mu$			
	$r^*-\sigma$		$r-\sigma$			
	Last historical year	First year of projection	Second	Third	Fourth	Fifth
	Lowest num	Lowest num	Lowest num	Lowest num	Lowest num	Lowest num
Block n^{th} percentile		Block bottom	Block bottom	Block bottom	Block bottom	Block bottom
Block central percentile		Block centre	Block centre	Block centre	Block centre	Block centre
Block $100-n^{\text{th}}$ percentile		Block Top	Block Top	Block Top	Block Top	Block Top
	Baseline	Baseline	Baseline	Baseline	Baseline	baseline

3. The Input Sheet

The input sheet includes all the debt, macroeconomic data and assumptions needed to use the template (Figure 2). Parameters and imported or copied data are stored only in the input sheet. If they are needed in another sheet, the values are transferred through formula linkages. Refer to Section 2. The Instruction Sheet for information on how to set parameters and import data. Once "input_fiscal" is filled in correctly, the baseline and stress test results are automatically calibrated and summarized in the output tables in sheets "Table_SR" (debt ratios) and "Table_GF" (gross financing need). If stochastic simulations are enabled the default values of the average and standard deviation of the random variables are defined. If the fiscal reaction function is enabled, the stochastic simulations and all stress tests are consistent with the automatic fiscal rule.

In general, the implementation of this model requires 10 years of historical data as well as 5 years of projections for key macroeconomic indicators that are used in the FS template. However, in environments with sparse data, a shorter period of actual data could be accommodated (e.g. 5 years). Regarding macroeconomic projections, this model can be used in conjunction with a macro projection framework, or alternatively, could be populated using the live data base of the Bank.

The implementation of this model requires projections for all variables listed in below, except for the public debt stock, which is derived from public debt dynamics used in the FSA template. However, since we recognize that for many market access countries foreign borrowing maybe rationed by the markets, we allow the user to enter country-specific assumptions for allowable foreign borrowing, derived from any macroprojection framework. Since the change in public debt is derived from the public debt dynamics equation and the external foreign currency debt path is predetermined, the time path for domestic public debt is derived as a residual.

For all variables the following information is to be provided:

- 1) Unit of measurement: national currency, U.S. dollar, index number in column A
- 2) Scale: billions, millions, percent in column B
- 3) Database: source of data (LDB, GDF, other sources) in column C
- 4) Series Code, in case data are from a database in column D
- 5) Descriptor: eg. "External debt stock", in column E
- 6) Notes in column F.

Data requirements which need to be filled in the input sheet are divided in 6 main blocks (Figure 2):

- 1) Debt stock and debt service data
- 2) Fiscal data
- 3) GDP, prices and exchange rates
- 4) Monetary data
- 5) Other factors
- 6) Assumptions for baseline projections

For oil reach countries (ORCs), the FSA tool includes an additional block for oil revenues and prices.

Figure 2. Input Sheet: Baseline

Units	Scale	Database, chee	Series_Code	Descriptor	Notes	2004	2005	2006	2007	2008	2009
Debt stock								First year of projections			
National Currency	Billions	LDB,GFS	GB.DOD.TOTL.CN	General government, gross debt	Public sector debt	272,170,353.6	235,086,758.5				
National Currency	Billions	LDB,GFS	GB.DOD.FRGN.CN	o/w gross foreign-currency denominated debt	Foreign-currency denominated	36,191,223.3	103,470,637.1	115,206,557.8	118,818,545.6	120,323,419.8	125,608,115.1
National Currency	Billions	LDB,GFS	GB.DOD.DMSY.CN	o/w domestic debt to the monetary system		233,863,740.0	241,827,317.8				
National Currency	Billions	LDB,GFS	GB.DOD.DMSY.CN	o/w domestic debt to other		1,039.2	1,242.2				
National Currency	Billions	LDB,GFS	GB.DOD.DMSY.CN	o/w net domestic public debt	Net domestic public debt	197,027,100.6	212,453,546.5				
U.S. dollars	Millions	LDB,BoP	DT.AMT.DPPG.CD	Amortization on public external debt		7,000.1	12,400.0	13,254.8	13,364.4	13,240.8	13,176.5
National Currency	Billions	LDB,GFS	GB.DOD.DMSY.CN	Amortization on public domestic debt		120,300,000.0	138,400,000.0				
National Currency	Billions	LDB,GFS	GB.DOD.DMSY.CN	Holding of government securities by the Central Bank		23,224,486.0	614.0				
National Currency	Billions	LDB,Debt	DT.DOD.DSTC.CD	Short-term public sector debt							
Fiscal data											
National Currency	Billions	LDB,GFS	GB.BAL.OYRL.CN	General government balance	Public sector balance	-25,896,021.7	-22,129,288.4	-12,252,601.8	-6,474,414.4	-7,036,069.8	-7,646,448.9
National Currency	Billions	LDB,GFS	GB.XPD.INLD.CN	General government, expenditure and net lending	Public sector expenditure	314,839,157.0	346,050,170.3	365,893,373.0	390,527,463.1	424,405,727.0	461,222,323.8
National Currency	Billions	LDB,GFS	GB.XPC.INTD.CN	General government, expenditure, domestic interest	Public sector domestic interest	48,255,000.0	43,284,000.0	35,825,000.0	32,238,000.0	35,732,451.6	33,723,183.8
National Currency	Millions	LDB,GFS	GB.XPC.INTD.CN	Interest payments on foreign debt	Interest payments on foreign debt	7,730,000.0	10,116,000.0	11,372,000.0	12,537,000.0	12,391,844.6	13,222,097.3
National Currency	Billions	LDB,GFS	GB.REV.IGRT.CN	General government, total revenue and grants	Public sector revenue (and grants)	288,953,135.3	323,320,861.3	353,740,777.2	384,053,054.7	417,363,657.2	453,576,474.9
GDP, Prices and Exchange rates											
National Currency	Billions	LDB,SNA	NY.GDP.MKTP.CN	Gross domestic product, current prices	Gross domestic product, current prices	430,511,475.8	481,813,760.6	536,258,724.5	588,155,295.4	639,177,767.3	694,626,438.6
National Currency	Billions	LDB,SNA	NY.GDP.MKTP.CN	Non-Oil GDP, current prices	Non-Oil GDP, current prices	4,854.5	5,393.5	6,378.0	7,801.0	8,643.1	9,485.3
National Currency	Billions	LDB,SNA	NY.GDP.MKTP.KN	Gross domestic product, constant prices	Gross domestic product, constant prices	136,632.6	143,253.8	150,416.5	157,337.3	165,834.2	174,125.9
National Currency	Billions	LDB,SNA	NY.GDP.MKTP.KN	Non-Oil GDP, constant prices	Non-Oil GDP, constant prices	136,632.6	143,253.8	150,416.5	157,337.3	165,834.2	174,125.9
National Currency per U.S. Dollar	None	LDB,Prices	PE.NUS.FCAE	MARKET EXCHANGE RATE, PD, END	Exchange rate, national currency per U.S. Dollar	1,336,300.0	1,460,000.0	1,436,579.2	1,517,867.3	1,525,271.5	1,528,452.5
National Currency per U.S. Dollar	None	LDB,Prices	PA.NUS.FCRF	Exchange rate, national currency per U.S. Dollar	Exchange rate, national currency per U.S. Dollar	1,421,637.7	1,378,148.1	1,463,730.6	1,438,531.7	1,512,525.2	1,519,303.4
Index Number	None	LDB,Prices	FP.CPI.TOTL	Consumer Price Index	Consumer Price Index	401,424.3	428,683.5	454,404.5	474,647.3	491,043.1	508,235.8
Index Number	None	LDB,Prices	FP.CPI.TOTL	US Consumer Price Index	US Consumer Price Index	109.7	112.7	115.4	118.3	121.2	124.3
Monetary data											
National Currency	Billions	LDB,GFS	FA.LBL.RCUR.CN	Reserve Money		33,625,000.0	37,513,499.5				
National Currency	Billions	LDB,GFS	FA.LBL.RMON.CN	Currency in circulation							
National Currency	Billions	LDB,GFS	FM.AST.NIRV.CN	Net foreign assets		23,047,376.3	26,843,485.2	28,644,184.7	30,155,597.2	31,181,476.0	32,152,652.9
Other factors											
National Currency	Billions	LDB,GFS	GB.SOE.PRIV.CD	Privatization receipts (negative)		0.0	-1,957,671.0	-2,183,677.7	-2,382,363.4	0.0	0.0
National Currency	Billions	LDB,GFS	GB.SOE.PRIV.CD	Recognition of implicit or contingent liabilities							
National Currency	Billions	LDB,GFS	GB.SOE.PRIV.CD	Other (specify, e.g. bank recapitalization)							
Assumptions for baseline											
Net Domestic debt								220,766,323.9	226,645,323.9	246,307,464.3	267,674,636.8
Domestic interest payments								35,825,000.0	32,238,000.0	33,158,032.3	36,034,556.8
Real domestic interest rate								5.0			
Average Maturity of Domestic debt											

1) Debt stock and debt service data

Cell range G4:X12, Fig. 1.

Debt data include:

- Gross total public debt, defined as the sum of gross external and gross domestic debt for the past 10 (5) years and if available projections for the external public debt. Debt stocks are usually reported at the end of each calendar year.
- Gross or net domestic public debt, defined as gross domestic debt held by the public and the banking system, net of the central bank's holdings of treasury debt.
- Debt service data refer to interest payments and amortization of foreign and domestic public debt for the past 10 (5) years.
- Holding of government securities by the central bank.
- Short-term public sector debt.

2) Fiscal data Cell range G15:X19, Fig. 1

Fiscal data refer to the appropriate coverage of the public sector: total revenues and grants, total expenditure, interest expenditure and the overall balance. Interest payments on domestic debt have to be consistent with the adopted definition of domestic debt. See point 7 below for a discussion of how the FSA tool accommodates both a gross or net definition of interest payments on domestic debt.

Data from this block are used to report a liquidity indicator, gross financing needs, which measures how much cash the government has to have in hand to cover all the claims coming due in the current year (data for the past 10 (5) years are calculated in cells G79:X79; the input sheet). The gross financing need in the current year is measured as the sum of the amortization of foreign and domestic public debt coming due during the current year, the interest expenditure, and the primary deficit also for the current year. To calculate this indicator for the projection period, we use the available projections for external public debt and amortization of external debt from LDB or from the existing macroprojection framework. For domestic debt we allow the user to manually insert data for the projected average maturity of domestic debt. The default assumption in this version of the template is that the average maturity of domestic public debt will remain the same as in the base year (cells S54:X54 from the input sheet).

3) GDP, prices and exchange rates Cell range G22:X29, Fig. 1

This section includes data on gross domestic product in current and constant prices; average and end-of-period exchange rates with respect to the U.S. dollar; and domestic and foreign (US) consumer price index (CPI), average for the period. The average exchange rate is used to convert in U.S. dollar the gross financing need of the government and to simulated domestic debt payments in the alternative scenario. End of period exchange rate is used to estimate the contribution to debt dynamics of real exchange rate devaluation and of the real interest rate on foreign debt. By default, the template reports current WEO projections for the U.S. CPI.

For ORC only, the template requires the input of non-oil GDP in current and constant market prices.

4) Monetary data Cell range G32:X34, Fig. 1.

Monetary data include base money (defined as Reserve Money and Currency in circulation) and net foreign assets (NFA) of the Central Bank, end-of-period. The template assumes net debt decomposition, as public debt is net of the Central Bank credit to the government and the Central Bank's holdings of government paper and of NFAs. By default, NFAs are assumed to earn and interest rate equal to the LIBOR rate on the U.S. dollar: LIBOR rates can be retrieved from the *International Financial Statistics* or other financial databases.

5) Other factors Cell range G37:X39, Fig. 1.

Other factors refer to any other variable which have a direct impact on debt dynamics, other than the primary fiscal balance, the contribution of interest rate/growth differential and the exchange rate.

These factors can be considered as non-debt creating forms of financing of the government such as privatization receipts or the creation of new government liabilities as in the case of the recognition of implicit or contingent liabilities and the cost of bank recapitalization, which have not been included in the primary surplus definition.

Privatization receipts are inserted with the negative sign, as reducing net debt. Depending on the appropriate dimension of the public sector other factors could be increases in quasi-fiscal liabilities, such as deficits of extra-budgetary funds of line ministries or SOEs used to subsidize key economic sectors, or subsidies issued through the CB.

6) Oil revenues and prices (for oil rich countries) Cell range G42:X48, Fig. 3

For ORCs the debt decomposition assumes a fiscal rule, according to which the non-oil primary deficit is financed by oil revenues evaluated at a budget reference price and the change in the net public debt ratio also accounts for the accumulation of assets in a ring-fenced oil fund. The debt decomposition in ORCs requires additional data input. A section called “Oil revenues and prices” becomes available in the input sheet if ORCs function is enabled in the “Instruction” sheet (see section 2, the Instruction sheet).

This section includes 2 subsections:

- a) **Net oil revenues** include the oil revenue, net of oil related expenditure and transfers evaluated at the reference price used in the government budget; and the net accumulation of oil assets in the oil stabilization fund, equal to total net oil revenues at market price net of the reference price oil revenues.
- b) **Oil prices** used in the analysis are: oil market prices (consistent with WEO or DECPG projected oil prices); baseline reference prices, used to evaluate oil revenue in the fiscal budget; and alternative price level to assess the robustness of the oil revenue rule at possible drop in oil market prices.

Figure 3. Input Sheet: Oil Revenues and Prices

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	Units	Scale	Database	Series_Code	Descriptor	Notes	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
2	Country	Nigeria		Oil rich					First year of projections													
40																						
41	Oil revenues and prices																					
42	National Currency	Billions		n/a	Net oil revenues		2,899.9	4,117.3	5,686.7	6,044.2	6,304											
43	National Currency	Billions		n/a	Reference price-oil revenue	Oil revenues at Bu	1,814.5	2,395.0	2,957.9	3,148.7	3,331											
44	National Currency	Billions		n/a	Oil stabilization fund		1,085.3	1,732.4	2,728.8	2,895.5	2,973											
45					Oil prices																	
46	U.S. dollars	US\$/bbl		n/a	Market prices	WEO Average Oil	38.3	54.2	60.5	58.5	57											
47	U.S. dollars	US\$/bbl		n/a	Baseline	Budget prices	25.0	30.0	33.0	30.0	30											
48	U.S. dollars	US\$/bbl		n/a	Alternative scenario 1	Price at minimum		54.2	25.0	25.5	26											
49																						

With respect to the standard debt decomposition, the following changes are assumed in the “Input_fiscal” sheet:

- 1) Fiscal data: revenues refer to the non-oil revenues; total expenditure to the non-oil total expenditure.
- 2) GDP, prices and exchange rates: current and constant price non-oil GDP is required.
- 3) Monetary data: NFA are net of oil assets, reported in the oil-stabilization fund.

7) Assumptions for baseline projections

Cell range E50:X54, Fig. 1.

This section specifies the assumptions for the real interest rate and maturity structure of domestic debt. The template requires projections for stock, interest payments and amortization on external debt and calculates the implicit nominal and real interest rate and maturity structure of external debt. Similar projections for domestic debt might not be directly available. Therefore, the template allows the user to insert alternative assumptions to calculate the real interest on domestic debt:

- 1) Insert projections for domestic debt stock and interest payments (cells S39:X40). In this case, the implicit nominal interest rate is derived as interest payments in period t divided by domestic debt stock in the period $t-1$; The real interest rate is derived deflating the nominal interest rate by the domestic inflation rate;
- 2) Insert projections for the real domestic interest rate (cells S41:X41). In this case the real interest rate is exogenously determined by the user and the nominal interest rate is derived by the template.

To correctly calculate the implicit nominal and real interest rate, the user has to define whether data on domestic debt and domestic interest expenditure are reported on a gross or a net basis (cell E38 in the Input sheet). If the data are reported on a gross basis, then the template assumes that the interest rate paid on monetary debt (held by the Central Bank) is equal to that paid on non-monetary domestic debt (held by the public). If data on domestic debt and interest payments are reported on a net basis, then the template uses the net public domestic debt during the previous period to calculate the implicit average interest rates on public domestic debt.

The assumptions allow the user to specify the projected maturity structure of domestic debt, by inserting the average number of years needed to amortize the current stock of debt (cells S54:X54). By default, the template assumes that the maturity structure is constant and equal to the maturity calculated for the last year of actual data.

Box 1. Baseline Input Data Requirements

A. Baseline Input Data Requirements

$D_t = B_t + e_t B^*_t - e_t NFA^*_t$, public sector net debt, end of the period (eop), in local currency units (LCU)

B_t : domestic net/gross debt in LCU (excludes net credit to the government of the Central bank), eop

B^*_t : foreign debt in LCU (includes domestic debt issued in FX and any domestic debt linked to FX), eop

NFA^*_t : stock of net foreign assets in dollar terms, in LCU, eop

PRP^*_t : amortization on external MLT debt, in LCU

PRP_t : amortization on domestic MLT debt, in LCU

Int^*_t : interest payment on public foreign debt, in LCU

CBH_t : Holding of government securities by the Central Bank, in LCU, eop.

STD_t : Short term debt, in LCU eop.

E_t : nominal exchange rate LCU/\$, eop

$E_{t,av}$: nominal exchange rate LCU/\$, average (av)

M_t : monetary base at the eop, period t

$P_{t,AV}$: average CPI level for period t

Y_t : real GDP in period t in LCU

T_t : tax revenue, in LCU

G_t : total primary expenditure, in LCU

INT_t : Total public interest expenditure, in LCU

OB_t : Overall balance of the public sector, in LCU

i_t^l is the dollar nominal interest rate earned over reserves over the period t

i_t^d is the nominal interest rate on domestic debt paid over the period t (average)

i_t^f is the dollar nominal interest rate paid on foreign debt and reserves over the period (average)

B. Variables Calculated by the Template

$\pi_{t,AV} = (P_{t,AV} - P_{t-1,AV}) / P_{t-1,AV}$ is average consumer price inflation from year t-1 to year t

$\pi^*_{t,AV} = (P^*_{t,AV} - P^*_{t-1,AV}) / P^*_{t-1,AV}$, where P^*_t is the average U.S consumer price index.

$g_t = (Y_t - Y_{t-1}) / Y_{t-1}$, real GDP growth rate in the year t.

$s_t = (E_t - E_{t-1}) / E_{t-1}$, rate of change of the nominal exchange rate, LCU/1US\$, eop

$\hat{e}_t = (1 + s_t) * (1 + \pi^*_{t,AV}) / (1 + \pi_{t,AV}) - 1$ is the rate of change in bilateral real exchange rate, (LCU per 1 USD), where + denotes real depreciation, while – denotes real appreciation.

$PB_t = (T_t - G_t)$ - primary balance as a share of GDP

Maturity = $(B^*_t + B_t) / (PRP^*_t + PRP_t)$

Real interest rate on public

debt: $\alpha_t \cdot \left\{ \left[(1 + i_t^f) \cdot (1 + \hat{e}_t) / (1 + \pi_t^*) \right] - 1 \right\} + (1 - \alpha_t) \cdot \left\{ \left[(1 + i_t^d) / (1 + \pi_t) \right] - 1 \right\}$

Share of external public debt in total public debt, $\alpha_t = B^*_{t-1} / (B^*_{t-1} + B_{t-1})$

Gross Financing Needs = $-Pd_t + PRP^*_t + PRP_t + STD_t$

$\sigma_t = (M_t - M_{t-1}) / (P_t Y_t)$ is defined as seigniorage revenue as ratio to GDP.

OF_t are other exogenous factors of public debt accumulation that may increase or decrease the outstanding stock of net public debt such as privatization receipt or recognition of contingent liabilities – percent of GDP.

pd- primary balance as a share of GDP

T_t : total government revenues in LCU

G_t : total non-interest expenditure in LCU

4. The Seigniorage Sheet and Steady State Fiscal Consistency Approach (as in Anand and van Wijnbergen)

4.1. Seigniorage

The sheet “Seigniorage” calculates seigniorage for each year of the projection period and in the long run, assuming that real growth and inflation remain constant at their values as in last year of projection period. To account for link between seigniorage revenue and inflation, we benchmark seigniorage revenue using a Cagan money demand function, where nominal base money stock, M at the end of each period $t-1$ is a function of nominal income and expected average inflation during the period t :

$$\frac{M_{t-1}^{eop}}{P_t} = A \cdot Y_t \cdot e^{-\eta \cdot \pi_t}$$

Where M_{t-1}^{eop} is Base Money at the end of period $t-1$, $P_{t,AV}$ is the average CPI in year t , $\pi_{t,AV} = (P_{t,AV} - P_{t-1,AV}) / P_{t,AV}$, Y_t is the real GDP in year t , η is the semi-elasticity of money demand with respect to inflation and A is a constant term. In sheet “Seigniorage” (Fig. 3), data to calculate base money are reported in cells A9:I15. All data are linked to the input sheets.

The sheet “Seigniorage” also calculates the inflation maximizing seigniorage revenue for each year of the projection period, using the Cagan money demand formula and assuming a semi-elasticity of inflation of 0.3 (see cells B20:H20; Seigniorage sheet, Fig. 4):

$$SR_t = \frac{M_t - M_{t-1}}{P_t \cdot Y_t} = \frac{P_{t+1} Y_{t+1} e^{-\eta \pi_{t+1}} - P_t Y_t e^{-\eta \pi_t}}{P_t \cdot Y_t}$$

For the purpose of the derivation of the long –run sustainability condition at the end of the projection period, steady state seigniorage revenue σ is calculated, assuming that money demand grows at a constant rate, given that both inflation and real growth rate are at their constant long-run values: (cell I5:I23; Seigniorage sheet):

$$\sigma = A e^{-\eta \pi} (g + \pi + g \pi)$$

Figure 4. Seigniorage Sheet.

	A	B	C	D	E	F	G	H	I	J	
1	Inflation maximizing seigniorage										
2	Money demand is assumed to be modelled according a Cagan money demand, assuming unitary elasticity of real money balances to income										
3	η -Semi-elasticity of inflation	0.3									
4											
5		2005	2006	2007	2008	2009	2010	2011	Steady state growth rates		
6											
7											
8											
9	Base money (e.o.p.)	37,513,499.53	41,335,049.88	45,036,386.97	48,936,771.63	53,182,036.57	57,795,578.25	62,809,344.66			
10	Nominal GDP	481,813,760.59	536,258,722.46	588,165,326.04	638,903,475.65	694,328,352.16	754,561,336.71	820,019,532.67			
11	Real GDP	143253.8191	150416.5159	157937.3392	165834.207	174125.9174	182832.2132	191973.8239			
12	Real GDP growth rate	4.8%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	5.0%	
13	CPI Index (in percent)	428683.53	454404.53	474647.31	491049.13	508235.84	526024.10	544434.94			
14	Inflation rate	6.8%	6.0%	4.5%	3.5%	3.5%	3.5%	3.5%	3.5%	3.5%	
15	Scaling macro	0.071									
16											
17											
18	Base money in percent of GDP	6.11%	6.05%	6.01%	6.01%	6.01%	6.01%	6.01%	6.01%	6.01%	
19											
20	Projected seigniorage		0.71%	0.63%	0.61%	0.61%	0.61%	0.61%	0.61%	0.61%	
21	Maximum seigniorage		6.9%	9.3%	9.3%	9.3%	9.3%	8.7%	9.3%	9.3%	
22											
23	Inflation maximizing seigniorage		2.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	
24											
25	This block calculates seigniorage assuming	Seigniorage (GDP%)								Steady state seigniorage	
26	varying inflation rate for each period.	π_{t+1}									
27	The maximum seigniorage is reported in row 22.	0.000	2.0%	0.4%	0.4%	0.4%	0.4%	0.0%	0.4%	0.4%	
28	Inflation maximizing seigniorage reported in row 24.	0.050	2.2%	0.7%	0.7%	0.7%	0.7%	0.4%	0.7%	0.7%	
29		0.100	2.5%	1.1%	1.1%	1.1%	1.1%	0.7%	1.1%	1.1%	
30		0.150	2.7%	1.4%	1.4%	1.4%	1.4%	1.0%	1.4%	1.4%	
31		0.200	3.0%	1.7%	1.7%	1.7%	1.7%	1.3%	1.7%	1.7%	
32		0.250	3.2%	2.1%	2.1%	2.1%	2.1%	1.7%	2.1%	2.1%	
33		0.300	3.4%	2.4%	2.4%	2.4%	2.4%	2.0%	2.4%	2.4%	
34		0.350	3.6%	2.7%	2.7%	2.7%	2.7%	2.2%	2.7%	2.7%	
35		0.390	3.8%	2.9%	2.9%	2.9%	2.9%	2.5%	2.9%	2.9%	
36		0.450	4.0%	3.3%	3.3%	3.3%	3.3%	2.8%	3.3%	3.3%	
37		0.500	4.2%	3.5%	3.5%	3.5%	3.5%	3.1%	3.5%	3.5%	
38		0.550	4.3%	3.8%	3.8%	3.8%	3.8%	3.3%	3.8%	3.8%	
39		0.600	4.5%	4.0%	4.0%	4.0%	4.0%	3.6%	4.0%	4.0%	
40		0.650	4.7%	4.3%	4.3%	4.3%	4.3%	3.8%	4.3%	4.3%	
41		0.700	4.8%	4.5%	4.5%	4.5%	4.5%	4.0%	4.5%	4.5%	
42		0.750	5.0%	4.8%	4.8%	4.8%	4.8%	4.3%	4.8%	4.8%	

4.2. Steady state fiscal policy consistency

To assess the consistency of fiscal policy in steady state for alternative scenarios, the “Seigniorage” sheet calculates the required deficit reduction (RDR) in percent of GDP needed to maintain a stable debt to GDP ratio in steady state for alternative inflation rates (Fig. 5). In steady state, positive values of the RDR indicates that fiscal policy is not consistent with a stable debt ratio and either inflation need to rise to increase seigniorage revenue or primary deficit need to be reduced.

The RDR is defined as the difference between the primary deficit, net of seigniorage, required to stabilize the debt to GDP ratio in steady state pd_{ss} and the primary deficit pd at the end of the projection period. pd_{ss} is assumed to vary as a function of steady state seigniorage σ_{ss} calculated for inflation rates increasing from 0 to 1000 percent.

$$rdr_{ss} = pd_{ss}(\sigma_{ss}) - pd_{t+5}$$

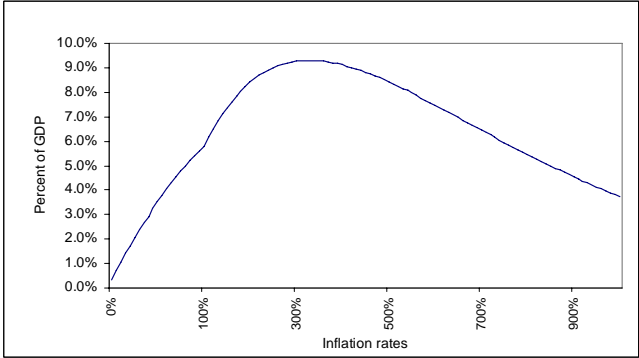
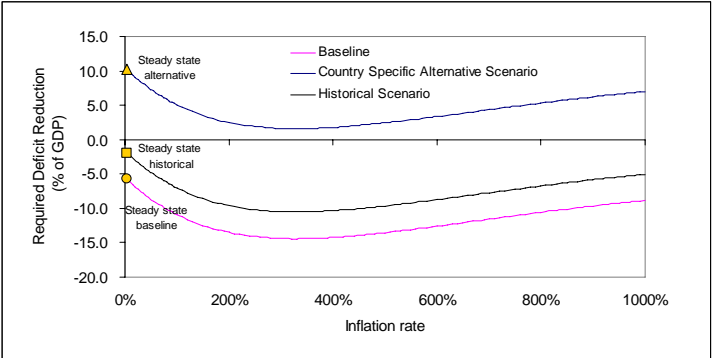
Steady state fiscal consistency is tested for the baseline scenario, the country specific alternative scenario the historical scenario. In the baseline, lower RDR than in the historical, imply that macroeconomic fundamentals are expected to improve with respect to historical averages and/or fiscal policy to be more restrictive. In this case, the failure to reduce primary deficits with respect to the past fiscal policy outcomes would result in higher inflation. The alternative country specific scenario would signal risks to fiscal sustainability that might imply larger RDR than assumed in the

baseline. If fiscal adjustment needed to maintain stable debt ratios is considered unachievable, the tool would signal that higher inflation is likely in the event of shocks.

The fiscal policy consistency estimates also the maximum seigniorage revenue that could be obtained by monetizing the fiscal deficit and therefore defines the minimum RDR, given inflation maximizing seigniorage (Fig.6), for the three alternative scenarios.

Figure 5. Required Deficit Reduction
(In percent of GDP)

Figure 6. Inflation Maximizing Seigniorage



5. The Base Case Scenario Sheet

The sheet "Table" lists the main macroeconomic assumptions used in the fiscal sustainability analysis. The sheet also shows the dynamic forward-looking debt simulation (derived from debt updating equation shown in Annex A1)⁴. The sheet also summarizes the results of alternative scenarios and bound tests.

Sheet "Table_SR" reports the same results of the baseline analysis in a printable format.

5.1. Dynamic Forward-Looking Debt Simulation

The change in **Net public debt** (the sum of net external and net domestic public debt) is decomposed in the different factors as reported in Table 1, with the sign of the contribution to the change in net public debt in percent of GDP. The FSA tool presents the factors of the debt decomposition as in Table 2: the primary balance (line 4, a negative term indicate a primary surplus), seigniorage revenue (line 7, a negative item) and automatic debt dynamics factors (line 8). The automatic debt dynamics is further decomposed into a contribution of the real interest rate net of real growth rate (line 9) and the capital gain or loss on external public debt due to changes in the real exchange rate (line 15, a positive item indicates a real depreciation)⁵. The contribution of the real interest rate distinguishes between the contribution of real interest rate on domestic and foreign public debt, net of interest rate earned on NFA (see Table 3 for the mathematical derivation of the different terms of the debt decomposition). The template also includes other debt-creating or debt-reducing flows (line 15, a positive item): privatization receipts (line 16, a negative item); recognition of contingent liabilities (line 17, a positive item); and other factors (in line 18, such as the cost of recapitalizing the banking sector, a positive item).

The public debt ratio is then projected as the sum of the debt ratio in the previous period and the total sum of the contributions of various factors as described above. Since many market access countries are credit constrained, the template allows for a pre-determined path of external public debt, deriving domestic public debt path as a residual. This base case public debt decomposition also indicates the relative importance of various contributing factors to the evolution of the debt ratio. Finally, it also serves as a basis for stress tests, by simulating a number of shocks by assuming some deviation of variables used in this public debt decomposition from their historical averages. The results of these tests are summarized as well, together with the baseline assumptions and projections in sheet "Table" and "Table_SR" (see Table 4)⁶.

⁴ Footnotes also report the formulas in the spreadsheet.

⁵ Note that full separation between the different channels in the debt equation is not possible. As a result, the term defined as real exchange rate depreciation also includes the exchange rate revaluation effect on interest payments on foreign currency denominated debt.

⁶ Stochastic simulation exercises conducted for a sample of emerging market countries indicate that debt crises are typically preceded by shocks to economic variables equal to two standard deviations during two years.

Table 1. Component of the change in public net debt to GDP ratio

Component	Formula	Sign	Line in "Table"
1) Primary balance:	$(g_t - t_t)$	+	4
2) Seigniorage:	σ_t	-	7
4) Domestic real interest rate cost:	$\frac{(i_t^d - \pi_t) \cdot b_{t-1}}{(1 + \pi_t) \cdot (1 + g_t)}$	+	11
5) Foreign real interest rate cost	$\frac{(i_t^f - \pi_t^*) \cdot b_{t-1}^*}{(1 + \pi_t^*) \cdot (1 + g_t)}$ + $\frac{(i_t^l - \pi_t^*) \cdot nfa_{t-1}^*}{(1 + \pi_t^*) \cdot (1 + g_t)}$	+	12-13
3) Real GDP growth:	$\frac{g_t}{(1 + g_t)} \cdot d_{t-1}$	-	14
6) Capital loss due to real exchange rate depreciation	$\frac{\hat{e}_t \cdot [(1 + i_t^f) \cdot b_{t-1}^* - (1 + i_t^l) \cdot nfa_{t-1}^*]}{(1 + \pi_t^*) \cdot (1 + g_t)}$	+	15

5.2. Dynamic Consistency Measure

The FS tool also calculates two additional sustainability indicators: the primary balance at which debt-output ratio is stabilized in each projection year and at the end of the projection period (cells: Y39; Table sheet): In addition, the FS tool also calculates the corresponding required deficit reduction, defined as the difference between projected and debt - stabilizing primary balance during each projection year and in the long run (at the end of the projection period) (cell: Y40; Table sheet). Note that a positive number indicates inconsistency between inflation targets and stable debt ratios - if public debt is to be kept constant, larger fiscal adjustment is necessary to avoid higher inflation that would otherwise close the gap by bringing in more seigniorage revenue.

5.3. Additional Outputs

The template also reports the gross financing needs of the public sector (defined as the public sector deficit, plus all maturing debt). This variable is derived, for all the scenarios as well as for the sensitivity tests, in percent of GDP and in billions of dollars (sheet "Table_GF").⁷

⁷ In the stress and bound tests the calculations of the gross financing needs assume the same maturity structure as in the baseline scenario.

The third section of the output table provides information regarding the macroeconomic assumptions underlying the baseline scenario and how they compare to historical outcomes. In this section the historical averages and standard deviations are calculated over the past 10 (5) years, to calibrate stress tests and bound tests. Eventually, the fourth section of the output table reports the result of the stress tests and bound tests.

Table 2. Output of the sheet “Table_SR”

Table --: Public Sector Debt Sustainability Framework, 2001-2011
(In percent of GDP, unless otherwise indicated)

	Actual					Projections						Debt-stabilizing primary balance 11/
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
						I. Baseline Projections						
Public sector debt 1/	89.5	77.8	69.8	63.2	61.2	54.2	49.0	44.5	39.6	34.4	29.0	-0.8
o/w foreign-currency denominated (net) 2/	37.3	32.0	21.9	17.5	17.1	16.1	15.1	14.0	13.5	12.8	12.1	
o/w domestic debt (net) 3/	52.2	45.8	47.9	45.8	44.1	38.0	34.0	30.4	26.1	21.7	16.9	
Change in public sector debt	32.0	-11.7	-8.0	-6.6	-2.0	-7.1	-5.1	-4.6	-4.9	-5.1	-5.4	
Identified debt-creating flows (4+7+8+16)	30.0	-16.9	-14.6	-8.1	-2.1	-7.1	-5.1	-4.6	-4.9	-5.1	-5.4	
Primary deficit	-7.8	-6.3	-6.8	-7.0	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	
Revenue and grants	75.9	70.8	70.0	67.1	67.2	66.0	65.3	65.3	65.3	65.3	65.3	
Primary (noninterest) expenditure	68.1	64.5	63.2	60.1	60.7	59.4	58.8	58.8	58.8	58.8	58.8	
Seignorage	-3.6	-0.9	-0.9	-1.5	-0.6	-0.7	-0.6	-0.6	-0.6	-0.6	-0.6	
Automatic debt dynamics:	23.6	-9.7	-7.0	0.4	5.5	0.6	2.4	2.6	2.3	2.0	1.7	
Contribution from interest rate/growth differential	13.6	-2.2	2.6	2.6	4.5	0.7	2.5	2.6	2.4	2.1	1.8	
Of which contribution from real interest rate	9.0	4.4	6.8	8.3	7.4	3.7	5.1	5.0	4.5	4.0	3.5	
Contribution from domestic real interest rate 4/	7.3	2.2	5.8	7.3	6.2	2.1	3.5	3.5	3.1	2.7	2.2	
Contribution from real interest rate on foreign debt 5/	2.3	2.1	1.2	1.3	1.6	1.7	1.7	1.6	1.5	1.4	1.3	
Contribution from real interest rate on net foreign assets 6/	-0.5	0.1	-0.2	-0.2	-0.4	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	
Of which contribution from real GDP growth	4.7	-6.6	-4.3	-5.7	-2.9	-2.9	-2.6	-2.3	-2.1	-1.9	-1.6	
Contribution from real exchange rate depreciation 7/	10.0	-7.5	-9.6	-2.2	0.9	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	
Other identified debt-creating flows	17.8	0.0	0.0	0.0	-0.4	-0.4	-0.4	0.0	0.0	0.0	0.0	
Privatization receipts (negative)	17.8	0.0	0.0	0.0	-0.4	-0.4	-0.4	0.0	0.0	0.0	0.0	
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	
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	
Residual, including asset changes (2-3)	2.0	5.2	6.6	1.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	
Public sector debt-to-revenue ratio 1/	117.9	109.9	99.7	94.2	91.1	82.1	75.1	68.1	60.6	52.7	44.4	
Primary deficit that stabilizes the debt-to-GDP ratio	-39.8	5.4	1.2	-0.4	-4.5	0.6	-1.4	-1.9	-1.6	-1.4	-1.1	
Required deficit reduction	32.0	-11.7	-8.0	-6.6	-2.0	-7.1	-5.1	-4.6	-4.9	-5.1	-5.4	
Gross financing need 9/	96.1	66.4	46.1	36.3	36.9	34.3	31.2	28.3	24.9	21.5	17.9	
in billions of U.S. dollars	140.0	122.5	111.0	109.8	128.9	125.1	122.3	119.4	114.0	106.2	96.0	
						10-Year Historical Average	10-Year Standard Deviation					Projected Average
Key Macroeconomic and Fiscal Assumptions												
Real GDP growth (in percent)	-7.5	7.9	5.8	8.9	4.8	4.0	5.6	5.0	5.0	5.0	5.0	5.0
Average nominal interest rate on public debt (in percent) 10/	58.5	33.0	27.5	22.3	19.6	40.0	13.9	11.0	13.2	13.1	13.1	12.9
Average nominal interest rate on public domestic debt (in percent) 11/	80.3	51.1	42.0	28.0	22.0	11.3	14.6	14.6	14.6	14.6	14.6	14.6
Average nominal interest rate on forex debt (in percent) 11/	11.3	7.9	5.7	8.0	10.3	8.4	2.0	10.4	10.9	10.9	10.9	10.9
Average nominal interest rate on NFA (in percent) 12/	11.3	7.9	5.7	8.0	10.3	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average real interest rate (including exchange rate revaluation on foreign currency denominated debt)	31.8	-2.2	-3.2	9.4	13.8	8.2	11.2	5.5	8.9	9.5	9.3	9.2
Average real interest rate on public domestic debt (nominal rate minus change in CPI, in percent)	26.9	6.6	16.8	18.2	15.2	19.3	20.9	5.3	10.2	11.2	11.1	11.1
Average real interest rate on forex debt (nominal rate minus change in CPI, in percent)	8.5	6.3	3.5	5.4	7.6	6.0	1.8	8.0	8.4	8.4	8.4	8.4
Change in the real exchange rate (Local currency per US dollar) 13/	44.3	-20.3	-30.6	-10.3	5.1	-1.0	-0.5	-0.4	-0.8	-0.8	-1.0	-1.0
Nominal appreciation (increase in US dollar value of local currency, in percent)	-53.6	-11.8	17.7	4.3	-8.5	-24.0	24.1	-2.4	-1.4	-0.5	-0.2	0.0
Inflation rate (in percent)	53.4	44.5	25.2	9.9	6.8	51.2	29.7	6.0	4.5	3.5	3.5	3.5
US Inflation rate (in percent)	2.8	1.6	2.3	2.7	2.7	2.4	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by GDP deflator, in percent)	1.5	2.0	1.4	3.6	5.9	16.9	35.9	2.8	3.8	5.0	5.0	5.0
Base Money (percent of GDP)	10.1	7.7	7.0	7.8	7.8	8.1	1.2	7.7	7.7	7.7	7.7	7.7
												Debt-stabilizing primary balance 17/
A. Alternative Scenarios												
A1. Key variables are at their historical averages in 2005-09 14/						60.2	59.3	58.6	57.8	56.6	55.1	-0.8
A2. No policy change (constant primary balance) in 2005-09						54.2	47.8	42.5	36.8	30.9	24.6	-0.1
A3. Country-specific shock in 2005, with reduction in GDP growth (relative to baseline) of one standard deviation 15/						96.1	105.5	107.8	113.5	121.3	130.5	-13.2
A4. Selected variables are consistent with market forecast in 2005-09						54.2	49.0	44.3	39.3	34.1	28.5	-0.7
B. Bound Tests												
B1. Real interest rate is at historical average plus two standard deviations in 2005 and 2006						76.3	96.9	94.4	91.6	88.6	85.4	-3.0
B2. Real GDP growth is at historical average minus two standard deviations in 2005 and 2006						71.0	93.7	107.7	122.2	137.3	152.8	-5.8
B3. Primary balance is at historical average minus two standard deviations in 2005 and 2006						60.1	61.1	57.1	52.8	48.2	43.4	-1.4
B4. Combination of 2-4 using one standard deviation shocks						76.9	97.2	96.3	95.1	93.8	92.2	-4.6
B5. One time 30 percent real depreciation in 2005 16/						63.5	58.7	54.6	50.2	45.5	40.6	-1.3
B6. 10 percent of GDP increase in other debt-creating flows in 2005						64.2	59.4	55.4	51.0	46.4	41.5	-1.3

5.4. Oil Rich Country Base Case Scenario Sheet

If the ORC function is enabled in the “Instructions” sheet, all output and calculation sheets show the suffix “_oil”, with the exception of the sheets “Table”, “Seigniorage” and of the sheets used to perform the stochastic simulations and produce the fan charts: “StochSim”, “Graph DSP SIM”, “outputsim” and “rdrsim”.

The structure of the results of the debt sustainability analysis reported in the sheets “Table” and “Table_SR_Oil” remains equal to the standard analysis as presented in this section. However, the debt decomposition assumes a fiscal rule for the non-oil primary deficit, financed through the oil revenues evaluated at a reference budget price and the change in net debt depends also on the accumulation of net oil assets in an oil-stabilization fund, according to the debt decomposition formula presented in Appendix A2⁸ and summarized in Table 3.

The change in **Net public debt**, is decomposed in (Table 4) the non-oil primary deficit (line 4, a negative term indicate a primary surplus), oil revenues at reference price (line 7, a negative item), seigniorage revenue (line 8, a negative item) and automatic debt dynamics factors (line 9). The automatic debt dynamics is further decomposed into a contribution of the real interest rate net of real growth rate (line 10) and the capital gain or loss on external public debt due to changes in the real exchange rate (line 15, a positive item indicates a real depreciation)⁹. The contribution of the real interest rate distinguishes between the contribution of real interest rate on domestic and foreign public debt. The change in net public debt also depends on the accumulation of net oil assets (line 16), which includes the net inflow in the oil stabilization fund of oil revenues net of oil revenues evaluated at the reference price and interest earned on the stock of oil assets¹⁰. The template also includes other debt-creating or debt-reducing flows (line 19).

The second section of the output sheet reports the non-oil primary deficit that stabilizes the public debt to GDP ratio and the required deficit reduction (RDR) with respect to the baseline non-oil primary deficit to stabilize the debt ratio. In addition the table reports also:

- 1) the main assumptions underlying the fiscal rule: market and reference oil price and the non-oil primary deficit as a percentage of non-oil GDP;
- 2) the stock of assets in the oil stabilization fund and the net annual changes;
- 3) the gross public debt (net of central bank holding of government securities); and
- 4) the gross financing needs.

The third section reports the underlying general macroeconomic variables and the fourth section the result of the alternative scenarios and bound tests.

⁸ Footnotes also report the formulas in the spreadsheet.

⁹ Note that full separation between the different channels in the debt equation is not possible. As a result, the term defined as real exchange rate depreciation also includes the exchange rate revaluation effect on interest payments on foreign currency denominated debt and on the interest earned on NFA and the oil stabilization fund.

¹⁰ The interest element includes also the interest earned on other NFA.

Table 3. Component of the change in public net debt to GDP ratio for ORC

Component	Formula	Sign	Line in "Table"
1) Non-oil primary balance:	$(g_t - t_t)$	+	4
2) Oil revenues at reference price	$oilr_t$	-	7
3) Seigniorage:	σ_t	-	8
4) Domestic real interest rate cost:	$\frac{(i_t^d - \pi_t) \cdot b_{t-1}}{(1 + \pi_t) \cdot (1 + g_t)}$	+	12
5) Foreign real interest rate cost	$\frac{(i_t^f - \pi_t^*) \cdot b_{t-1}^*}{(1 + \pi_t^*) \cdot (1 + g_t)}$	+	13
6) Real GDP growth:	$\frac{g_t}{(1 + g_t)} \cdot d_{t-1}$	-	14
7) Capital loss due to real exchange rate depreciation	$\frac{\hat{e}_t \cdot [(1 + i_t^f) \cdot b_{t-1}^* - (1 + i_t^l) \cdot (nfa_{t-1}^* + oa_{t-1}^*)]}{(1 + \pi_t^*) \cdot (1 + g_t)}$	+	15
8) Net changes in the assets of the oil stabilization fund	$\frac{(i_t^l - \pi_t^*) \cdot (nfa_{t-1}^* + oa_{t-1}^*)}{(1 + \pi_t^*) \cdot (1 + g_t)} + oa_t^*$	-	16

Table 4. Output of the Sheet "Table_SR_Oil"

hide

Table -- Nigeria: Public Sector Debt Sustainability Framework, 2001-2011
(In percent of GDP, unless otherwise indicated)

	Actual					Projections						Debt-stabilizing primary balance 11/	
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011		
	I. Baseline Projections												
1 Public sector debt 1/	46.0	60.6	52.7	34.7	-2.2	-23.5	-41.3	-58.8	-75.2	-92.0	-107.5	-34.5	
o/w foreign-currency denominated (net) 2/	40.8	49.3	43.1	26.9	-7.9	-39.0	-53.2	-63.4	-75.4	-82.9	-90.9		
o/w domestic debt (net) 3/	5.2	11.2	9.6	7.8	5.6	15.5	11.9	6.6	0.2	-9.1	-16.6		
2 Change in public sector debt	-1.2	14.6	-7.9	-18.0	-36.9	-21.2	-17.8	-17.5	-16.4	-16.8	-15.4	0.0	
3 Identified debt-creating flows (4+7+8+16)	-7.5	-3.3	-11.1	-17.9	-19.0	-21.2	-17.8	-17.5	-16.4	-16.8	-15.4	0.0	
4 Non-oil primary deficit	23.9	17.9	18.3	18.5	19.1	17.9	18.4	17.1	17.5	17.7	18.5	34.8	
Revenue and grants	9.6	10.2	9.1	8.0	6.6	7.9	8.4	9.0	9.6	9.8	10.0		
Primary (noninterest) expenditure	33.6	28.1	27.4	26.5	25.7	25.8	26.9	26.1	27.1	27.5	28.5		
Oil revenue at reference price 4/	-25.1	-20.1	-20.8	-19.0	-18.4	-19.9	-19.3	-18.8	-19.2	-19.3	-18.8	-18.8	
7 Seigniorage	-2.4	-0.8	-1.2	-0.4	-0.2	-0.7	-0.6	-0.5	-0.5	-0.4	-0.4	-0.4	
8 Automatic debt dynamics	-1.7	0.9	-5.8	-5.4	-5.9	0.5	2.4	2.8	2.1	1.1	0.7	0.3	
9 Contribution from interest rate/growth differential	0.3	1.9	-3.9	-1.9	-1.8	0.1	2.4	2.1	3.3	3.5	3.2	3.1	
10 Of which contribution from real interest rate	1.7	2.7	1.9	1.1	0.4	0.0	1.2	1.0	0.7	0.0	-1.0	-1.8	
11 Contribution from domestic real interest rate 4/	0.0	0.1	0.0	-0.1	-0.3	0.3	1.1	1.0	0.6	0.0	-1.0	-1.8	
12 Contribution from real interest rate on foreign debt 5/	1.7	2.5	1.9	1.1	0.8	-0.3	0.1	0.0	0.0	0.0	0.0	0.0	
14 Of which contribution from real GDP growth	-1.4	-0.7	-3.9	-3.0	-2.2	0.1	1.2	2.1	2.7	3.4	4.2	4.9	
15 Contribution from real exchange rate depreciation 7/	-2.0	-1.0	-1.8	-2.5	-4.1	0.4	0.1	-0.4	-1.3	-2.3	-2.6	-2.8	
16 Contribution from net change in the assets of the oil stabilization fund	-0.6	-0.9	-1.7	-11.6	-19.7	-19.1	-19.8	-19.1	-16.3	-16.0	-15.5	-15.7	
17 Net inflow in the oil stabilization fund	0.0	0.0	-1.2	-11.3	-13.3	-18.4	-17.8	-16.8	-14.7	-14.1	-13.4	-13.4	
18 Contribution from real interest rate on oil assets 8/	-0.6	-0.9	-0.5	-0.3	-0.4	-0.7	-1.0	-1.3	-1.6	-1.9	-2.0	-2.2	
19 Other identified debt-creating flows	-1.6	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
20 Privatization receipts (negative)	-1.6	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
21 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	0.0	
22 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	0.0	
23 Residual, including asset changes (2-3)	6.3	17.8	3.3	-0.1	-17.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Public sector debt-to-revenue ratio 1/	477.3	591.7	576.5	431.9	-32.9	-295.8	-489.2	-652.1	-722.6	-924.6	-1076.7		
Primary deficit that stabilizes the debt-to-GDP ratio	25.1	3.3	26.1	36.5	56.1	39.1	36.3	34.6	33.9	34.5	34.0		
Required deficit reduction	-8.4	-24.8	-1.3	10.0	30.3	13.3	9.4	8.5	6.8	7.0	5.4		
IMF WEO oil price US\$/bbl	24.3	25.0	28.9	38.3	54.2 #	60.5	58.5	57.5	56.9	56.4	56.1		
Oil Reference Price for Fiscal Rule US\$/bbl	24.3	25.0	22.0	25.0	30.0 #	33.0	30.0	30.0	30.6	31.2	31.8		
Oil stabilization fund net inflow, % of GDP	0.0	0.0	1.2	11.3	13.3 #	18.4	17.8	16.8	14.7	14.1	13.4		
Oil stabilization fund net assets	21.4	17.9	14.1	23.5	28.5 #	43.4	57.3	69.4	79.4	87.1	95.5		
Non-Oil Primary Deficit, % of Non-Oil GDP	43.2	29.9	33.8	36.4	41.4 #	38.1	38.5	35.0	35.0	35.5	36.5		
Gross Public Debt (in billions of US dollars)	38.8	40.5	43.1	46.2	30.7 #	18.4	17.9	17.5	17.3	17.3	17.5		
(in percent of GDP)	81.3	87.9	74.8	64.7	31.0 #	16.8	15.4	14.3	13.7	13.1	13.0		
Gross financing need 9/	30.4	24.7	25.7	25.2	24.6	31.5	45.1	54.7	66.2	77.2	90.5		
in billions of U.S. dollars	14.5	11.4	14.8	18.0	24.3	34.5	52.2	66.6	83.3	101.9	122.4		
Key Macroeconomic and Fiscal Assumptions						10-Year Historical Average	10-Year Standard Deviation					For debt stabilization	Projected Average
Real Oil GDP growth (in percent)	1.9	-5.1	18.1	4.5	5.5	5.1	5.1	5.4	4.0	4.0	4.0		
Real Non-Oil GDP growth (in percent)	4.3	8.0	4.4	7.4	8.2	7.0	5.3	5.4	5.5	5.5	5.5		
Real GDP growth (in percent)	3.1	1.5	10.7	6.0	6.9	4.5	3.2	6.1	5.2	4.8	4.8	4.8	5.2
Average nominal interest rate on public debt (in percent) 10/	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1335262.4	146.6	146.6	146.6	146.6	146.6
Average nominal interest rate on public domestic debt (in percent) 11/	17.2	16.8	14.6	14.2	13.8	17.1	14.6	14.6	14.6	14.6	14.6	14.6	222555.9
Average nominal interest rate on foreign debt (in percent) 11/	5.6	5.7	5.4	4.8	4.4	4.6	2.1	1.0	4.1	3.7	3.2	2.6	2.2
Average nominal interest rate on NFA (in percent) 12/	5.6	5.7	5.4	4.8	4.4	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average real interest rate (including exchange rate revaluation on foreign currency denomi)	-1.7	1.8	-0.6	-5.1	-12.3	-4.6	7.2	-2.5	5.8	7.9	9.5	10.9	11.0
Average real interest rate on public domestic debt (nominal rate minus change in CPI, in pe	-0.8	3.1	0.5	-0.8	-5.3	0.1	9.6	5.6	8.2	9.2	10.4	11.6	11.6
Average real interest rate on foreign debt (nominal rate minus change in CPI, in percent)	2.7	4.2	3.1	2.1	1.6	2.5	2.0	-1.4	1.6	1.2	0.7	0.2	-0.3
Change in the real exchange rate (Local currency per US dollar) 13/	-4.6	-2.5	-3.9	-8.4	-15.9	-4.9	-0.2	0.7	2.0	3.2	3.2	3.2	3.2
Nominal appreciation (increase in US dollar value of local currency, in percent)	-8.7	-8.4	-6.6	-2.5	2.5	-5.9	4.3	-3.4	-3.5	-3.5	-3.5	-3.5	-3.5
Inflation rate (in percent)	18.0	13.7	14.0	15.0	19.2	14.1	6.9	11.5	6.5	5.5	4.2	3.0	3.0
US Inflation rate (in percent)	2.8	1.6	2.3	2.7	2.7	2.4	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by GDP deflator, in percent)	31.0	-22.2	14.3	6.9	10.6	15.7	22.8	2.9	7.3	8.2	6.7	7.3	6.9
Base Money (percent of GDP)	10.1	10.5	9.1	7.6	5.9	8.7	1.9	5.7	5.6	5.6	5.6	5.6	5.6
A. Alternative Scenarios													
A1. Key variables are at their historical averages in 2005-09 14/						12.6	26.1	38.5	49.7	59.8	69.6	-6.0	
A2. No policy change (constant primary balance) in 2005-09						-23.5	-21212.6	-19687.9	-19164.0	-19243.6	-19576.1	-313.3	
A3. Country-specific shock in 2005, with reduction in GDP growth (relative to baseline) of one standard deviation 15/						16.6	34.8	40.2	61.0	81.3	99.0	-1.6	
A4. Selected variables are consistent with market forecast in 2005-09						14.8	35.0	55.5	79.1	106.2	136.6	14.5	
B. Bound Tests													
B1. Real interest rate is at historical average plus two standard deviations in 2005 and 2006						14.9	37.5	57.0	79.2	104.8	133.2	15.1	
B2. Real GDP growth is at historical average minus two standard deviations in 2005 and 2006						16.0	40.6	63.5	89.0	118.1	149.8	14.3	
B3. Primary balance is at historical average minus two standard deviations in 2005 and 2006						23.7	53.9	76.7	102.7	132.0	164.4	16.2	
B4. Combination of 2-4 using one standard deviation shocks						20.0	45.5	68.6	94.7	123.9	156.5	16.3	
B5. One time 30 percent real depreciation in 2005 16/						9.7	31.0	53.1	78.3	107.0	138.9	16.0	
B6. 10 percent of GDP increase in other debt-creating flows in 2005						24.0	44.4	64.1	86.0	110.8	137.7	15.1	

6. The Alternative Scenario Sheets

The sheet “Table” also summarizes the four alternative scenarios and the six bound tests. The template contains the following alternative scenarios:

Historical Average Scenario: This scenario presents an alternative evolution of the debt ratio under the assumption that all key variables (real growth rate, real interest rates, inflation, real exchange rate, primary balance to GDP ratio, seigniorage revenue to GDP ratio) are constant and equal to their historical averages over the projection period. The template calculates averages over a ten-year period, and uses that information to project debt dynamics five years ahead.¹¹ This scenario is a rough test of the “realism” of baseline projections; the baseline projections may be argued to be overly optimistic when it differs remarkably from predicted debt evolution if historical patterns were followed. Of course, this scenario may be somewhat misleading if significant changes in economic policies have taken place in recent history—using the early years of transition, for instance, would bias the “historical” value of certain parameters and thus might result in too high a debt ratio. More generally, circumstances reflecting credible changes in policies (and thus lower baseline debt ratio projections) may look anomalous in comparison. In any case, using this scenario—and justifying any large anomalies—could usefully discipline baseline projections.

The “A1_historical” sheet (Table 5) reports the result of this scenario. Key real macroeconomic variables are assumed to be at their historical average, as calculated in the bottom section of the sheet (cells B71:L76, Fig. 4). The table reports in red the variables modified with respect to the baseline scenario: primary balance, primary expenditure, seigniorage revenue, the real and nominal interest rates on domestic, foreign debt and NFA of the Central Bank and growth of real primary spending.

¹¹ If country teams wish to change the parameters used in this scenario, changes should be made in the “Table” sheet, and justification provided.

Table 5. “A1_historical” sheet

Alternative Scenario 1: Key Variables at Historical Average
(In percent of GDP, unless otherwise indicated)

	Actual		Projections					
	2005	2006	2007	2008	2009	2010	2011	
I. Baseline Medium-Term Projections								Debt-stabilizing primary deficit
Public sector debt 1/	61.2	60	59	59	58	57	55	
o/w foreign-currency denominated (net)	17.1	17.9	18.2	18.5	19.6	21.0	23.0	
o/w foreign-currency denominated (gross)	22.7	23.3	23.3	23.4	24.3	25.4	27.1	
o/w domestic debt (net) 3/	44.1	42.3	41.0	40.1	38.1	35.6	32.2	
Change in public sector debt	-2.0	-1.0	-1.0	-0.6	-0.8	-1.1	-1.5	0.0
Identified debt-creating flows (4+7+12)	9.4	-1.0	-1.0	-0.6	-0.8	-1.1	-1.5	0.0
Primary deficit	4.6	-6.0	-6.0	-6.0	-6.0	-6.0	-6.0	-4.1
Revenue and grants	67.2	66.0	65.3	65.3	65.3	65.3	65.3	
Primary (noninterest) expenditure	71.8	59.9	59.3	59.3	59.3	59.3	59.3	
Seigniorage	-0.6	-0.7	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
Automatic debt dynamics 2/	5.5	6.2	6.1	6.0	5.8	5.6	5.2	4.7
Contribution from interest rate/growth differential	4.5	6.3	6.2	6.1	6.0	5.7	5.4	4.9
Of which contribution from real interest rate	7.4	8.7	8.5	8.4	8.2	8.0	7.6	7.1
Contribution from domestic real interest rate 4/	6.2	7.7	7.5	7.4	7.2	6.8	6.4	5.8
Contribution from real interest rate on foreign debt 5/	1.6	1.3	1.3	1.3	1.3	1.4	1.4	1.5
Contribution from real interest rate on net foreign assets 6/	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.2
Of which contribution from real GDP growth	-2.9	-2.4	-2.3	-2.3	-2.3	-2.2	-2.2	-2.1
Contribution from real exchange rate depreciation 7/	0.9	-0.2	-0.1	-0.1	-0.1	-0.2	-0.2	-0.2
Other identified debt-creating flows	0.0	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0
Privatization receipts (negative)	0.0	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0
Recognition of implicit or contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (specify, e.g. bank recapitalization)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual, including asset changes (2-3)	-11.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public debt in percent of revenues 1/	91.1	91.3	90.7	89.8	88.5	86.8	84.5	
Primary deficit that stabilizes the debt-to-GDP ratio	6.6	-5.0	-5.1	-5.4	-5.2	-4.9	-4.5	-4.1
Required deficit reduction	-2.0	-1.0	-1.0	-0.6	-0.8	-1.1	-1.5	-2.0
Gross financing 5/	36.9	27.6	26.0	24.8	23.6	22.2	20.3	
in billions of U.S. dollars	128.9	99.6	100.0	101.8	104.0	104.7	103.0	
Key macroeconomic and fiscal assumptions								For debt stabilization
Average nominal interest rate on public debt (percent) 6/	15.9	14.2	12.7	11.7	11.7	11.7	11.7	11.7
Average nominal interest rate on public domestic debt (in percent) 11/	22.0	25.3	23.8	22.8	22.8	22.8	22.8	22.8
Average interest rate on foreign-currency denominated debt	10.3	8.4	8.5	8.5	8.5	8.5	8.5	8.5
Average nominal interest rate on NFA (in percent) 12/		8.4	8.5	8.5	8.5	8.5	8.5	8.5
Average real interest rate (nominal rate minus change in domestic CPI, percent)	9.1	8.2	8.2	8.2	8.2	8.2	8.2	8.2
Average real interest rate on domestic debt (nominal rate minus change in domestic CPI, p	15.2	19.3	19.3	19.3	19.3	19.3	19.3	19.3
Average real interest rate on foreign debt (nominal rate minus change in U.S. CPI, pe	7.6	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Change in the real exchange rate (Local currency per US dollar) 13/	5.1	-1.0	-0.5	-0.4	-0.8	-0.8	-1.0	-1.0
Nominal depreciation of local currency (LC per dollar)	9.3	2.5	1.4	0.5	0.2	0.2	0.0	0.0
Exchange rate (US dollar per LC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nominal appreciation of local currency (increase in US dollar value of local currency)	-8.5	-2.4	-1.4	-0.5	-0.2	-0.2	0.0	0.0
Inflation rate (GDP deflator, in percent)	6.8	6.0	4.5	3.5	3.5	3.5	3.5	3.5
US Inflation rate (in percent)	2.7	2.4	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by GDP deflator, in percent)	5.9	-13.2	2.9	4.0	4.0	4.0	4.0	4.0
Base Money (percent of GDP)	7.8	7.8	7.8	7.9	8.0	8.0	8.1	

Country-Specific Alternative Scenario: This scenario is user-defined and models the impact of country-specific shocks that the country is considered most vulnerable to in the medium term. Shocks could consist of fiscal slippages; a slowdown in the growth rate, higher borrowing costs, terms of trade shocks, sudden stops in the availability of external financing, or realization of contingent liabilities. Country teams are at liberty to design this scenario based on the particulars of the country.

The template allows for two possibilities: the user could either link this scenario to a complete alternative macroeconomic projection framework, or alternatively, the user could specify a path for the key variables (real interest, growth, exchange rates, inflation, primary balance and seigniorage revenue to GDP ratios) and make an assumption about the debt management strategy. Key parameters have to be derived from financial programming and inserted in the input sheet, in the input block that lists the assumptions for the country-specific alternative scenario (cell range F126:X144, Input Sheet). The input block for this alternative scenario has 3 main sections:

- 1) Macroeconomic and debt data: in this section the user has to import data from an alternative macroeconomic scenario (Fig. 7). For data not inserted, the template uses data inserted in the baseline section of the input sheet, unless other assumptions are inserted as explained in point 2) below.

Figure 7. Macroeconomic and Debt Data Input for the Alternative Scenario

Descriptor	2005	2006	2007	2008	2009	2010	2011
Country-Specific Alternative Scenario		Fill in yellow cells, based on alternative scenario					
		Default is baseline					
		If no alternative scenario is assumed, hide line 72 (and fn 9) in "Table_SR." and lines 21 and 40 (and fn 4) in "Table_GF" and follow instructions in sheet "Data_chart".					
Macroeconomic and debt data							
Public sector balance	-22,129,288						
Public sector expenditure	346,050,170						
Public sector interest expenditure	43,284,000						
Public sector revenue (and grants)	323,920,882						
Gross domestic product, current prices	481,813,761						
Gross domestic product, constant prices	143,254						
Consumer Price Index							
Exchange rate, national currency per U.S. Dollar, end of period	1,460,000						
Exchange rate, national currency per U.S. Dollar, average	1,378,148						
Domestic consumer price index	428,684						
Base Money	37,513,500	55,266,208	70,389,353	82,179,921	90,220,797	96,613,666	102,994,998
Net foreign assets	26,843,485	0	0	0	0	0	0
Foreign-currency denominated debt (expressed in local currency)	109,470,697	155,436,540	163,581,444	168,966,200	182,648,028	194,083,213	205,137,490
Privatization receipts (negative)	-1,957,671						
Recognition of implicit or contingent liabilities	0						
Other (specify, e.g. bank recapitalization)	0						
Amortization on MLT public sector debt	17,089,000						
Short-term public sector debt	0						
Interest payments on forex debt	10,116,000						

- 2) Assumptions: alternatively to the previous section, the user can insert only the main assumptions referring to:
 - a. Domestic real interest rate (in percent)
 - b. Foreign real interest rate (in percent)
 - c. Real GDP growth (in percent)
 - d. Real exchange rate depreciation (in percent)
 - e. Primary deficit (in percent of GDP)
 - f. Contingent liabilities (In percent of GDP)
 - g. Inflation (in percent)

Those assumptions have to be inserted in the input sheet cells S147:X153 (Fig. 8). For cells left blank, the template uses assumptions as in the baseline, if no data are inserted in the Macroeconomic and Debt Data section.

Figure 8. Assumptions for the Alternative Scenario.

	F	S	T	U	V	W	X	Y
1	Notes	2006	2007	2008	2009	2010	2011	
120	Assumptions							
121	Domestic real interest rate (in percent)	20.0	15.0	15.0	15.0	15.0	15.0	
122	Foreign real interest rate (in percent)	10.0	10.0	10.0				
123	Real GDP growth (in percent)	-3.0	3.0	3.0	3.0	5.0	5.0	
124	Real exchange rate depreciation (in percent)	30.0						
125	Primary deficit (in percent of GDP)	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	
126	Contingent liabilities (In percent of GDP)	15.0						
127	Domestic inflation rate	36.0	20.0	10.0	5.0	5.0	5.0	

- 3) Oil revenues and prices (visible for ORC only): in this section, the user can insert fiscal rules based on alternative market and reference oil prices (input sheet S156:X161, Fig. 9) . In ORC, public debt dynamics are particularly sensitive to assumptions about projected and budget reference oil prices, which determine the net oil revenues and acceptable level of non-oil deficits. The cost of oil price forecasting errors are asymmetric, with the cost of over predicting being far greater than the cost of under predicting.

The country specific alternative scenario for ORC maintains the consistency of the non-oil primary balance with the oil revenue at reference price. In this scenario, non-oil expenditures are assumed to increase one to one with reference price oil revenues and be equal to total oil and non-oil revenues. The choice of a reference price which results to be above the market price for the projection period would imply a decumulation of oil assets and eventually the resort to domestic financing of the non-oil primary deficit, if oil assets are depleted..

For ORC, the fiscal sustainability analysis considers the effect of the accumulation of net oil assets on net public debt, according to the debt decomposition presented in Table 3.

Figure 9: Oil Revenues and Prices

Descriptor	2006	2007	2008	2009	2010	2011
Oil revenues and prices						
Net oil revenues	2,021.5	2,295.8	6,031.3	8,833.0	11,394.2	13,972.7
Reference price-oil revenue	5,216.1	5,570.5	13,195.8	18,605.1	23,489.4	28,161.8
Oil stabilization fund	-3,194.6	-3,274.7	-7,164.5	-9,772.1	-12,095.2	-14,189.1
Oil prices						
Country specific alternative scenario	25.0	25.5	26.0	26.5	27.1	27.6
Baseline	60.0	60.0	60.0	60.0	60.0	60.0

- 4) External debt management assumptions: in this section, the user decides the evolution of external debt, assuming that the maturity structure will remain unchanged with respect to the baseline. The user can choose among the following options:
- Same as the baseline
 - Constant in dollar terms: borrowing is supposed to cover only principal repayments from first year of projection
 - Constant in percent of GDP: debt maintained constant is percent of GDP as in first year of projection
 - Sudden stop in the first year of projections: New disbursements are assumed to be nil in the first year of projections and to resume in the following years according to baseline, in dollar terms.
 - Declining path: gross external debt adjusts according to the user inputed target chosen in cell X169, in percent of GDP. The user can choose between: an automatically calculated constant adjustment path (default) or; insert a user defined path.

The user specifies the debt management option by inserting the corresponding number in cell R163 in the Input Sheet (Fig. 10). The default option is “Same as baseline”. The chosen option constrains gross external debt to a given path (see cells S164:X169), with domestic debt determined as a residual.

Figure 10. External Debt Management for the Alternative Scenario

Descriptor		2006	2007	2008	2009	2010	2011
External debt management assumptions	4	Chose the strategy number					
Same as the baseline	1	199,782,937.3	206,046,587.2	209,696,708.8	217,820,570.9	224,649,375.1	231,023,919.4
Constant in dollar terms	2	199,782,937.3	202,624,757.8	203,613,171.3	204,037,802.1	204,463,318.5	204,463,318.5
Constant in percent of GDP	3	199,782,937.3	219,116,980.5	238,125,378.6	258,782,755.2	281,232,159.2	305,629,049.0
Sudden stop in 2006 (no disbursements)	4	155,436,540.4	163,581,444.5	168,966,200.1	182,648,028.1	194,083,213.3	205,137,490.0
Declining path	5	199,782,937.3	279,298,680.0	304,829,187.5	304,968,969.9	291,240,233.9	274,156,243.1
In percent of GDP		37.3	32.9	29.0	25.7	22.6	20.0
Constant decline			-12%	-12%	-12%	-12%	-12%
User defined							-12%

Text case for alternative scenario.

In the text case used in the template, the alternative scenario evaluates the effects of the faltering of the country’s fiscal program in the first year of projections, with implications on interest rates, exchange rates, growth and the availability of foreign financing.

The following assumptions are inserted in the Assumptions section (Fig. 8):

- Primary fiscal balance is reduced by 1% of GDP in 2005 and stays at 3% thereafter;
- GDP growth slows at -3% in 2005 and picks up at 3% thereafter;
- Domestic interest rate picks at 20% and declines at 15% in real terms;
- Contingent liabilities of 15% of GDP increase the domestic debt burden;
- Interest rate on foreign debt increases at 10 percent in real terms in 2005-2008;
- The real exchange rate depreciates by 30% in 2006.
- Inflation rates increases by one standard deviation in 2006, with respect to baseline, and gradually decreases at 5%

- In addition, the country is assumed not able to borrow internationally in 2006. This scenario corresponds to option 4 of the external debt management section (Fig. 10).

The output of the alternative scenario is reported in sheet “A3_alternative” in the template (Table 6). The decomposition table reports the debt dynamics consistent with the alternative macroeconomic assumptions specified in the input sheet.

Table 6. Output Table of the Alternative Scenario

Alternative Scenario 3: Country-Specific Scenario
(In percent of GDP, unless otherwise indicated)

	Actual		Projections						Debt-stabilizing primary deficit
	2005	2006	2007	2008	2009	2010	2011		
I. Baseline Medium-Term Projections									
Public sector debt 1/	36.1	61.2	96	105	108	113	121	130	
o/w foreign-currency denominated (net)	23.8	17.1	24.5	18.1	14.8	13.6	13.0	12.5	
o/w foreign-currency denominated (gross)	30.8	22.7	24.5	18.1	14.8	13.6	13.0	12.5	
o/w domestic debt (net) 3/	12.3	44.1	71.6	87.3	93.0	99.9	108.3	117.9	
Change in public sector debt		-2.0	34.9	9.4	2.4	5.6	7.8	9.1	0.0
Identified debt-creating flows (4+7+12)		-3.8	34.9	9.4	2.4	5.6	7.8	9.1	0.0
Primary deficit		-6.5	-3.0	-3.0	-3.0	-3.0	-3.0	-3.0	-13.2
Revenue and grants	23.9	67.2	55.8	45.2	39.8	38.1	38.3	39.1	
Primary (noninterest) expenditure	21.0	60.7	52.8	42.2	36.8	35.1	35.3	36.1	
Seignorage		-0.6	-2.8	-1.8	-1.1	-0.7	-0.5	-0.5	-0.5
Automatic debt dynamics 2/		3.4	25.7	14.1	6.5	9.3	11.3	12.6	13.7
Contribution from interest rate/growth differential		2.4	19.5	10.2	9.2	10.4	11.6	12.7	13.8
Of which contribution from real interest rate		5.3	15.6	13.0	12.3	13.5	14.9	16.3	17.6
Contribution from domestic real interest rate 4/		4.1	13.4	10.7	10.6	12.3	13.9	15.2	16.6
Contribution from real interest rate on foreign debt 5/		1.6	2.4	2.3	1.7	1.2	1.1	1.0	1.0
Contribution from real interest rate on net foreign assets 6/		-0.4	-0.2	0.0	0.0	0.0	0.0	0.0	0.0
Of which contribution from real GDP growth		-2.9	3.9	-2.8	-3.1	-3.1	-3.3	-3.5	-3.8
Contribution from real exchange rate depreciation 7/		0.9	6.1	3.9	-2.7	-1.0	-0.3	-0.1	-0.1
Denominator = $1+g+\pi^*+g\pi^*$		1.1	1.0	1.1	1.1	1.1	1.1	1.1	1.1
Other identified debt-creating flows		0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0
Privatization receipts (negative)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Recognition of implicit or contingent liabilities		0.0	15.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (specify, e.g. bank recapitalization)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual, including asset changes (2-3)		1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public debt in percent of revenues 1/	151.2	91.1	172.3	233.1	271.1	297.5	316.5	333.8	
Primary deficit that stabilizes the debt-to-GDP ratio		-4.5	-37.9	-12.4	-5.4	-8.6	-10.8	-12.1	-13.2
Required deficit reduction		-2.0	34.9	9.4	2.4	5.6	7.8	9.1	10.2
Gross financing 5/		36.9	43.1	50.9	53.1	55.2	57.6	59.3	
in billions of U.S. dollars		128.9	186.1	288.5	368.3	431.9	485.1	531.9	
Key macroeconomic and fiscal assumptions									
Real GDP growth (in percent)		4.8	-6.0	3.0	3.0	3.0	3.0	3.0	3.0
Average nominal interest rate on public debt (percent) 6/		15.9	11.0	13.2	13.1	13.1	12.9	12.8	
Average nominal interest rate on public domestic debt (in percent) 11/		16.8	80.0	50.0	35.0	25.0	20.0	18.5	18.5
Average interest rate on foreign-currency denominated debt		10.3	12.4	12.5	12.5	10.9	10.9	10.9	10.9
Average nominal interest rate on NFA (in percent) 12/			5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average real interest rate (nominal rate minus change in CPI, percent)		9.1	33.8	18.1	9.2	11.8	13.1	13.6	
Average real domestic interest rate (nominal rate minus change in CPI, percent)		9.4	40.0	20.0	15.0	15.0	15.0	15.0	
Change in the real exchange rate (Local currency per US dollar) 13/			30.0	15.0	-14.2	-6.6	-2.2	-1.0	-1.0
Nominal depreciation of local currency (LC per dollar)		9.3	77.8	1.4	0.5	0.2	0.2	0.0	
Exchange rate (US dollar per LC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Nominal appreciation of local currency (increase in US dollar value of local currency)		-8.5	-43.7	-1.4	-0.5	-0.2	-0.2	0.0	
Inflation rate (in percent)		6.8	40.0	30.0	20.0	10.0	5.0	3.5	3.5
US Inflation rate (in percent)		2.7	2.4	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by GDP deflator, in percent)		5.9	-18.3	-17.6	-10.3	-1.5	3.5	5.2	
Base Money (percent of GDP)		7.79	8.7	8.3	7.8	7.6	7.5	7.5	

No Policy Change Scenarios: This scenario assumes that current policies (as of the base year, defined as the last year for which actual data exist) regarding revenue and expenditure are maintained for the projection period. As negotiations with authorities entail indications to raise revenue and cut expenditure, it would be instructive to compare the baseline projections thus obtained against a no-change scenario. This alternative scenario assumes that the primary balance to GDP ratio remains unchanged with respect to the last year of actual data. Fiscal revenue and primary expenditure remain constant in percent of GDP and interest expenditure in national currency assumes the same nominal interest rate on domestic and foreign debt as in the baseline. All other macroeconomic data are assumed unchanged with respect to baseline. The assumptions regarding this scenario are incorporated in the input block for this scenario in the input sheet (cell range E95:X105, Input Sheet, Fig. 11). The output of this scenario is reported in sheet “A2_npc” (Table 7).

Figure 11. Input Sheet for No Policy-Change Scenario

	E	F	R	S	T	U	V	W	X	Y	Z
1	Descriptor	Notes	2005	2006	2007	2008	2009	2010	2011		
2				First year of projections							
91	No-Policy-Change Scenario		Fill in yellow cells, based on no-policy-change scenario								
92			Default is unchanged primary balance, in percent of GDP								
93			Insert alternative values into yellow cells, if more elaborate scenario is assumed								
94				47,197,000.0							
95	Public sector balance		-22,129,288.4	2,297,970.1	290,610.9	4,601,867.9	9,616,463.0	15,866,326.4	23,395,659.8		
96	Public sector expenditure		346,050,170.3	358,225,976	395,123,152	424,929,611	457,176,872	491,421,330	527,899,201		
97	<i>chv</i> primary		292,650,170.3	325,719,643.8	357,241,263.0	388,065,319.6	421,729,986.0	458,315,062.3	498,073,894.0		
98	Public sector interest expenditure (gross)		53,400,000.0	32,506,332.4	37,881,888.7	36,864,291.8	35,446,886.0	33,106,268.2	29,825,307.4		
99	Public sector revenue (and grants)		323,920,881.9	360,523,946.2	395,413,762.5	429,531,479.2	466,793,335.0	507,287,656.9	551,294,861.1		
100	Gross domestic product, current prices		481,813,760.6	536,258,722.5	588,155,326.0	638,903,475.6	694,328,352.2	754,561,336.7	820,019,532.7		
101	Gross domestic product, constant prices		143,253.8	150,416.5	157,937.3	165,834.2	174,125.9	182,832.2	191,973.8		
102	Exchange rate, national currency per U.S. Dollar, end of period		1,460,000.0	1,496,579.2	1,517,867.3	1,525,271.5	1,528,452.5	1,531,640.0	1,531,640.0		
103	Exchange rate, national currency per U.S. Dollar, average		1,378,149.1	1,469,730.6	1,498,531.7	1,512,525.2	1,519,903.4	1,527,317.5	1,527,317.5		
104	Consumer Price Index		428,683.5	454,404.5	474,647.3	491,049.1	508,235.8	526,024.1	544,434.9		
105	Public debt (net)		295,086,759	287,762,835	281,244,523	271,469,120	255,811,149	233,216,976	202,063,574		
106											
107	<i>Formulas</i>										
108	GDP Deflator (percent change)			6.00	4.45	3.46	3.50	3.50	3.50		
109	Real revenue and grants		755618	79339.9	83306.9	87472.2	91845.8	96438.1	101260.0		
110	Real non-interest expenditure		68267.2	71680.5	75264.6	79027.8	82979.2	87128.1	91484.6		
111	Growth in real revenues and grants			5.0	5.0	5.0	5.0	5.0	5.0		
112	Growth of real non-interest expenditures			5.0	5.0	5.0	5.0	5.0	5.0		
113	Share of foreign-currency denominated debt in total debt (previous period)			0.3	0.3	0.3	0.3	0.4	0.4		
114	Interest rate on public domestic debt			9.9	12.5	12.3	12.0	11.5	10.7		
115	Real interest rate on public debt, including capital gains on the exchange rate			4.63	7.72	8.27	7.92	7.59	7.03		
116											
117	Gross financing need			17,183,029.9	19,736,389.1	15,425,132.1	10,410,537.0	4,160,673.6	-3,368,659.8		

Table 7. Output Table of the No Policy Change Scenario

Alternative Scenario 2: No Policy Change (Constant Primary Balance)
(In percent of GDP, unless otherwise indicated)

	Actual		Projections					
	2005	2006	2007	2008	2009	2010	2011	
I. Baseline Medium-Term Projections								
Public sector debt 1/	61.2	53.7	47.8	42.5	36.8	30.9	24.6	Debt-stabilizing primary deficit
o/w foreign-currency denominated (net)	17.1	16.0	14.7	13.4	12.5	11.5	10.3	
o/w foreign-currency denominated (gross)	22.7	21.3	19.8	18.3	17.2	15.9	14.4	
o/w domestic debt (net) 3/	44.1	37.7	33.1	29.1	24.3	19.4	14.4	
Change in public sector debt	-2.0	-7.6	-5.8	-5.3	-5.6	-5.9	-6.3	0.0
Identified debt-creating flows (4+7+12)	-4.2	-7.6	-5.8	-5.3	-5.6	-5.9	-6.3	0.0
Primary deficit	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-0.1
Revenue and grants	67.2	67.2	67.2	67.2	67.2	67.2	67.2	
Primary (noninterest) expenditure	60.7	60.7	60.7	60.7	60.7	60.7	60.7	
Seignorage	-0.6	-0.7	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
Automatic debt dynamics 2/	3.4	0.0	1.7	1.8	1.5	1.2	0.8	0.7
Contribution from interest rate/growth differential	2.4	0.2	1.8	1.8	1.6	1.3	1.0	0.8
Of which contribution from real interest rate	5.3	3.1	4.3	4.1	3.6	3.0	2.4	2.0
Contribution from domestic real interest rate 4/	4.1	1.6	2.8	2.7	2.3	1.8	1.3	0.9
Contribution from real interest rate on foreign debt 5/	1.6	1.7	1.7	1.6	1.4	1.3	1.2	1.1
Contribution from real interest rate on net foreign assets 6/	-0.4	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Of which contribution from real GDP growth	-2.9	-2.9	-2.6	-2.3	-2.0	-1.8	-1.5	-1.2
Contribution from real exchange rate depreciation 7/	0.9	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Other identified debt-creating flows	-0.4	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0
Privatization receipts (negative)	-0.4	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0
Recognition of implicit or contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (specify, e.g. bank recapitalization)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual, including asset changes (2-3)	2.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public debt in percent of revenues 1/	91.1	79.8	71.1	63.2	54.8	46.0	36.7	
Primary deficit that stabilizes the debt-to-GDP ratio	-4.5	1.1	-0.6	-1.2	-0.8	-0.6	-0.2	-0.1
Required deficit reduction	-2.0	-7.6	-5.8	-5.3	-5.6	-5.9	-6.3	-6.4
Gross financing 5/	36.9	22.5	20.1	17.0	13.5	9.9	6.2	
in billions of U.S. dollars	128.9	82.0	79.0	71.7	61.6	48.8	33.1	For debt stabilization
Key macroeconomic and fiscal assumptions								
Real GDP growth (in percent)	4.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average nominal interest rate on public debt (percent) 6/	15.9	11.0	13.2	13.1	13.1	12.9	12.8	
Average nominal interest rate on public domestic debt (in percent) 11/	16.8	9.9	12.5	12.3	12.0	11.5	10.7	10.7
Average interest rate on foreign-currency denominated debt	10.3	10.4	10.9	10.9	10.9	10.9	10.9	10.9
Average nominal interest rate on NFA (in percent) 12/	10.3	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average real interest rate (including real exchange rate appreciation)	10.3	4.6	7.7	8.3	7.9	7.6	7.0	
Change in the real exchange rate (Local currency per US dollar) 13/	5.1	-1.0	-0.5	-0.4	-0.8	-0.8	-1.0	-1.0
Nominal depreciation of local currency (LC per dollar)	9.3	2.5	1.4	0.5	0.2	0.2	0.0	
Exchange rate (US dollar per LC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Nominal appreciation of local currency (increase in US dollar value of local currency)	-8.5	-2.4	-1.4	-0.5	-0.2	-0.2	0.0	
Inflation rate (in percent)	6.8	6.0	4.5	3.5	3.5	3.5	3.5	3.5
US Inflation rate (in percent)	2.7	2.4	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by GDP deflator, in percent)	5.9	5.0	5.0	5.0	5.0	5.0	5.0	
Base Money (percent of GDP)	7.79	7.71	7.66	7.66	7.66	7.66	7.66	

Market Forecast Scenario: For countries where market forecasts of key macroeconomic variables are available, the economists should include them in the template as well. This could serve as a useful check on optimism regarding policies that might be inherent in baseline projections. The implementation of this alternative scenario requires the user input for selected variables consistent with market forecast in the input block for the assumptions/projections to be utilized in this scenario (cell range E205:X216, Input Sheet). Note that if nothing is imputed in this block, the market forecast scenario picks up the base case scenario assumptions/projections by default (Fig. 12).

Figure 12. Input Sheet for Market Forecast Scenario

	E	F	R	S	T	U	V	W	X	Y	Z
1	Descriptor	Notes	2005	2006	2007	2008	2009	2010	2011		
2				First year of projections							
201	Market Forecast Scenario			Insert variables for which market forecast is available Default is baseline If no market forecast available, hide line 59 in "Table_SR," and lines 22 and 41 in "Table_GF".							
202											
203											
204											
205	Real GDP growth (in percent)		4.8								
206	Average real interest rate on public debt (in percent)		13.8								
207	Primary deficit in percent of GDP		-6.5								
208	Exchange rate depreciation (local currency value of US dollar, change in percent)		9.3								
209	Inflation (GDP deflator, in percent)		6.8								
210	Average nominal interest rate on public debt (in percent)		19.6								
211	Average nominal interest rate on public domestic debt (in percent)		22.0								
212	Average nominal interest rate on forex debt (in percent)		10.3								
213	Other identified debt-creating flows		-0.4								
214	Share of foreign-currency denominated debt in total debt (previous period)		0.4								
215	Base Money		37,513,499.5								
216	Net foreign assets		26,843,485.2								
217											
218											

Lower oil prices (ORC only): This scenario deals explicitly with the impact of oil price uncertainty on net public debt dynamics, evaluating the robustness of the oil price fiscal rule with respects to market oil prices lower than in the baseline. This scenario is not a fully alternative one, but it assumes that macroeconomic fundamentals gross external debt and the oil reference price remain unchanged with respect to baseline projections. The relevant input in the “Input_fiscal” sheet is in S48:X48 (Fig. 3). The output of the scenario is reported in sheet “Table_Lowest_oil” (Table 8).

Table 8. Output Table of the Low Oil Price Scenario

Table --: Public Sector Debt Sustainability Framework, 2001-2011
(In percent of GDP, unless otherwise indicated)

	Projections						Debt-stabilizing primary balance 17/ -16.2
	2006	2007	2008	2009	2010	2011	
I. Baseline Projections							
Public sector debt 1/	-1.0	1.2	2.1	3.5	4.8	7.2	
o/w foreign-currency denominated (net)	-20.0	-17.2	-14.7	-11.2	-7.7	-4.4	
o/w domestic debt (net) 3/	19.0	18.4	16.7	14.6	12.5	11.6	
Change in public sector debt	1.2	2.2	0.9	1.4	1.3	2.4	
Identified debt-creating flows (4+7+8+16)	1.2	2.2	0.9	1.4	1.3	2.4	
Non-oil primary deficit	17.9	18.4	17.1	17.5	17.7	18.5	
Revenue and grants	7.9	8.4	9.0	9.6	9.8	10.0	
Primary (noninterest) expenditure	25.8	26.9	26.1	27.1	27.5	28.5	
Oil revenue at reference price 4/	-19.9	-19.3	-18.8	-19.2	-19.3	-18.8	
Seignorage	-0.7	-0.6	-0.5	-0.5	-0.4	-0.4	
Automatic debt dynamics:	0.5	1.1	0.8	0.7	0.5	0.4	
Contribution from interest rate/growth differential	0.1	1.0	1.0	0.9	0.8	0.6	
Of which contribution from real interest rate	0.0	1.0	1.0	1.0	1.0	0.8	
Contribution from domestic real interest rate 5/	0.3	0.9	1.0	1.0	1.0	0.8	
Contribution from real interest rate on foreign debt 6/	-0.3	0.1	0.0	0.0	0.0	0.0	
Of which contribution from real GDP growth	0.1	0.0	-0.1	-0.1	-0.2	-0.2	
Contribution from real exchange rate depreciation 7/	0.4	0.0	-0.1	-0.3	-0.3	-0.2	
Contribution from net changes in the assets of the oil stabilization fund	3.4	2.6	2.2	3.0	2.9	2.6	
Net inflow in the oil stabilization fund	4.1	3.1	2.7	3.4	3.3	2.9	
Contribution from real interest rate on oil assets 8/	-0.7	-0.6	-0.5	-0.4	-0.4	-0.3	
Other identified debt-creating flows	0.0	0.0	0.0	0.0	0.0	0.0	
Privatization receipts (negative)	0.0	0.0	0.0	0.0	0.0	0.0	
Recognition of implicit or contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	
Other (specify, e.g. bank recapitalization)	0.0	0.0	0.0	0.0	0.0	0.0	
Residual, including asset changes (2-3)	0.0	0.0	0.0	0.0	0.0	0.0	
Public sector debt-to-revenue ratio 1/	-12.6	14.1	22.7	36.2	49.0	72.2	
Primary deficit that stabilizes the debt-to-GDP ratio	16.7	16.3	16.2	16.1	16.3	16.2	
Required deficit reduction	-9.2	-10.6	-9.9	-11.0	-11.2	-12.4	
Low-Scenario oil prices US\$/bbl	25.0	25.5	26.0	26.5	27.1	27.6	
Oil Reference Prices for Fiscal Rule US\$/bbl	33.0	30.0	30.0	30.6	31.2	31.8	
Oil stabilization fund net inflow, % of GDP	-4.1	-3.1	-2.7	-3.4	-3.3	-2.9	
Oil stabilization fund net assets	24.4	21.3	18.6	15.2	11.9	9.0	
Non-Oil Primary Deficit, % of Non-Oil GDP	38.1	38.5	35.0	35.0	35.5	36.5	
Gross Public Debt (In billions of US dollars)	18.4	17.9	17.5	17.3	17.3	17.5	
(In percent of GDP)	16.8	15.4	14.3	13.7	13.1	13.0	
Gross financing need 9/	31.5	43.4	51.2	59.9	67.1	76.5	
in billions of U.S. dollars	34.5	50.3	62.3	75.3	88.5	103.5	
Key Macroeconomic and Fiscal Assumptions							
Real Oil GDP growth (in percent)	5.1	5.1	5.4	4.0	4.0	4.0	
Real Non-Oil GDP growth (in percent)	7.0	5.3	5.4	5.5	5.5	5.5	
Real GDP growth (in percent)	6.1	5.2	5.4	4.8	4.8	4.8	5.2
Average nominal interest rate on public debt (in percent) 9/	6.3	9.6	10.5	10.2	9.7	9.7	9.3
Average nominal interest rate on public domestic debt (in percent) 10/	16.8	11.9	11.4	10.8	10.1	10.1	11.9
Average nominal interest rate on forex debt (in percent) 10/	1.0	4.1	3.7	3.2	2.6	2.2	2.8
Average nominal interest rate on NFA (in percent) 11/	5.0	5.0	5.0	5.0	5.0	5.0	
Average real interest rate (including exchange rate revaluation on foreign currency denominated)	-2.5	4.0	5.2	6.0	6.7	6.7	4.3
Average real interest rate on public domestic debt (nominal rate minus change in CPI, in percent)	5.3	5.4	6.0	6.6	7.1	7.1	6.3
Average real interest rate on forex debt (nominal rate minus change in CPI, in percent)	-1.4	1.6	1.2	0.7	0.2	-0.3	0.3
Average real interest rate on NFA (nominal rate minus change in CPI, in percent)	2.6	2.5	2.5	2.5	2.5	2.5	2.5
Change in the real exchange rate (Local currency per US dollar) 13/	-4.9	-0.2	0.7	2.0	3.2	3.2	0.6
Nominal appreciation (increase in US dollar value of local currency, in percent)	-3.4	-3.5	-3.5	-3.5	-3.5	-3.5	-3.5
Inflation rate (in percent)	11.5	6.5	5.5	4.2	3.0	3.0	5.6
US Inflation rate (in percent)	2.4	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by CPI, in percent)	2.9	7.3	0.2	6.7	7.3	6.9	5.2
Primary deficit	17.9	18.4	17.1	17.5	17.7	18.5	17.9
Base Money (percent of GDP)	5.66	5.63	5.55	5.55	5.55	5.55	

7. The Bounds Test Sheets

Bounds tests are used to assess the behavior of the public debt ratio under different assumptions on key parameters. Shocks equal to 2 standard deviations with respect to the 10-year historical averages during the first two years of the projection period are applied separately to the real interest and growth rates, and the primary balance, respectively. The template also examines debt trajectories in the case of a 30 percent real 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.¹² In addition, a combined shock of 1 standard deviation with respect to historical averages of these variables for the first two years of the projection period is also reported. The magnitude of shocks to individual variables is consistent with shocks that have typically been observed in the run-up to a crisis. In the same way, the combined shock is consistent with the historical evidence that such shocks do not happen in isolation, but occur simultaneously.¹³ In all bounds tests, variables revert to the baseline projection after two years.¹⁴

It is important to emphasize that these tests do not represent full-fledged scenarios, as there is no interaction among variables. More specifically, the stress tests are built by replacing in the baseline projections the value of one variable (for instance, the interest rate), leaving all other variables unchanged, with only a few exceptions: (i) interest payments on debt are endogenous, i.e., they increase in scenarios where interest rates are higher; (ii) public sector revenues are endogenous with respect to GDP: shocks in the latter also affect revenue; and, of course, (iii) the debt stocks are endogenous. But the remaining parameters are left mostly unchanged: for example, in the stress tests featuring a shock to GDP, the real exchange rate remains unchanged.

Each bounds test is calculated in a different sheet, which presents the debt decomposition table and the gross financing needs modified according to the simulated shock. Variables modified in the bounds tests are highlighted in red as in the case of the alternative scenarios.

1) Shock to the Real Interest Rate

This shock is represented in sheet “B1_Irate”. The real interest rates on domestic and foreign debt are supposed to be equal to their historical average plus 2 standard deviations for the first and second year of projections, respectively. The real interest rates return as in the baseline in the following years (cells O49:P55, Table 9).

¹² This issue was discussed in detail in SM/03/206. Section V presents various approaches to evaluating risks arising from contingent liabilities, distinguishing between those explicit and implicit in nature. Appendix III contains cross-country econometric evidence on the cost of banking crises.

¹³ See “Sustainability Assessments-Review of Application and Methodological Refinement”, IMF, 2003.

¹⁴ These shocks are based on the IMF (2003) and serve as a 95 confidence interval around the baseline. In particular, stochastic simulations show that the most extreme bound test provides an upper bound of the debt ratios that is likely to be exceeded only with a probability of less than 1 percent. The second most extreme bound test provides an upper bound likely to be exceeded with a probability between 1 to 5 percent.

2) Shock to real GDP Growth

This shock is represented in sheet “B2_GDP”. The growth rate is assumed to be equal to the historical average minus 2 standard deviations for the first and second year of projections. The growth rate returns as in the baseline in the following years (cells O48:P48, Table 10).

3) Shock to the Primary Balance

This shock is represented in sheet “B3_PB”. The primary deficit (in percent of GDP) is assumed to be equal to the historical average plus 2 standard deviations for the first and second year of projections. The primary deficit returns as in the baseline in the following years (cells O18:P18, Table 11). In addition, primary expenditure adjusts to be consistent with the new primary balance, while revenue remains unchanged with respect to the baseline (cells O20:P20, Table 11).

4) Combined Shocks to the real interest rate, growth and the primary balance.

This shock is represented in sheet “B4_Combined”. All three variables are assumed to be equal to their historical averages plus 1 standard deviation for the real interest rate and the primary deficit and minus 1 standard deviation for the growth rate. Shocks are assumed to last the first two years of the projection period. All variables return to their baseline value after the second year (Table. 12).

5) Nominal depreciation

This shock is represented in sheet “B5_depreciation”. The nominal exchange rate¹⁵ is assumed to depreciate by 30 percent in the first year of projection. The rate of change of the exchange rate afterwards is equal to what was assumed in the base case. Thus the level of the nominal exchange rate is permanently modified with respect to the baseline (cell O58, Table 13).

6) Contingent Liability Shock

This shock is represented in sheet “B6_CL”. The Contingent liabilities shock assumes that other factors increase by 10 percent in the first year of the projection period and return to zero afterwards. The main reason behind this one-off increase is the realization of contingent liabilities. (cell O35, Table 14).

¹⁵ This scenario assumes inflation as in the baseline. Therefore, the nominal depreciation corresponds to a real depreciation.

Table 9. Real Interest Rate Bounds Test.

Bound Test 1: Real Interest Rate Shock
(In percent of GDP, unless otherwise indicated)

	Projections						Debt-stabilizing primary deficit
	2006	2007	2008	2009	2010	2011	
I. Baseline Medium-Term Projections							
Public sector debt 1/	76.3	96.9	94.4	91.6	88.6	85.4	
o/w foreign-currency denominated (net)	22.7	29.8	29.8	31.1	32.9	35.6	
o/w foreign-currency denominated (gross)	28.1	34.9	34.7	35.8	37.3	39.7	
o/w domestic debt (net) 3/	53.5	67.1	64.6	60.5	55.8	49.8	
Change in public sector debt	15.0	20.6	-2.5	-2.8	-3.0	-3.2	0.0
Identified debt-creating flows (4+7+12)	15.0	20.6	-2.5	-2.8	-3.0	-3.2	0.0
Primary deficit	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-3.0
Revenue and grants	66.0	65.3	65.3	65.3	65.3	65.3	
Primary (noninterest) expenditure	59.4	58.8	58.8	58.8	58.8	58.8	
Seigniorage	-0.6	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Automatic debt dynamics 2/	22.5	28.0	4.5	4.2	4.0	3.7	3.5
Contribution from interest rate/growth differential	22.8	28.2	4.6	4.5	4.3	4.1	3.8
Of which contribution from real interest rate	25.7	31.8	9.2	8.9	8.6	8.3	7.9
Contribution from domestic real interest rate 4/	24.2	29.8	6.9	6.6	6.2	5.7	5.1
Contribution from real interest rate on foreign debt 5/	2.0	2.5	2.7	2.7	2.8	2.9	3.1
Contribution from real interest rate on net foreign assets 6/	-0.5	-0.5	-0.4	-0.4	-0.4	-0.3	-0.3
Of which contribution from real GDP growth	-2.9	-3.6	-4.6	-4.5	-4.4	-4.2	-4.1
Contribution from real exchange rate depreciation 7/	-0.3	-0.2	-0.1	-0.2	-0.3	-0.3	-0.4
Other identified debt-creating flows	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0
Privatization receipts (negative)	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0
Recognition of implicit or contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (specify, e.g. bank recapitalization)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual, including asset changes (2-3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public debt in percent of revenues 1/	115.6	148.3	144.5	140.3	135.7	130.8	
Primary deficit that stabilizes the debt-to-GDP ratio	-21.5	-27.1	-4.0	-3.7	-3.5	-3.2	-3.0
Required deficit reduction	15.0	20.6	-2.5	-2.8	-3.0	-3.2	-3.5
Gross financing 5/	46.1	58.6	44.4	41.6	38.6	34.9	
in billions of U.S. dollars	168.3	230.1	187.5	190.0	190.7	187.4	
Key macroeconomic and fiscal assumptions							
Real GDP growth (in percent)	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average nominal interest rate on public debt (percent) 6/	36.5	35.0	13.0	12.8	12.7	12.5	12.5
Average nominal interest rate on public domestic debt (in percent) 11/	67.0	65.5	14.6	14.6	14.6	14.6	14.6
Average interest rate on foreign-currency denominated debt	12.0	12.1	10.9	10.9	10.9	10.9	10.9
Average nominal interest rate on NFA (in percent) 12/	12.0	12.1	10.9	10.9	10.9	10.9	10.9
Average real interest rate (nominal rate minus change in GDP deflator, percent)	30.5	30.5	9.5	9.3	9.2	9.0	9.0
Average real interest rate on domestic debt (nominal rate minus change in domestic CPI, perc	61.0	61.0	11.2	11.1	11.1	11.1	
Average real interest rate on foreign debt debt (nominal rate minus change in U.S. CPI, perc	9.6	9.6	8.4	8.4	8.4	8.4	
Change in the real exchange rate (Local currency per US dollar) 13/	-1.0	-0.5	-0.4	-0.8	-0.8	-1.0	-1.0
Nominal depreciation of local currency (LC per dollar)	2.5	1.4	0.5	0.2	0.2	0.0	0.0
Exchange rate (US dollar per LC)	0.0	0.0	0.0	0.0	0.0	0.0	
Nominal appreciation of local currency (increase in US dollar value of local currency)	-2.4	-1.4	-0.5	-0.2	-0.2	0.0	
Inflation rate (in percent)	6.0	4.5	3.5	3.5	3.5	3.5	3.5
US Inflation rate (in percent)	2.4	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by GDP deflator, in percent)	2.8	3.8	5.0	5.0	5.0	5.0	
Base Money (percent of GDP)	7.7	7.7	7.7	7.7	7.7	7.7	
							For debt stabilization

Table 10. Real GDP Bounds Test

Bound Test 2: Real Output Shock
(In percent of GDP, unless otherwise indicated)

	Actual	Projections						
	2005	2006	2007	2008	2009	2010	2011	
I. Baseline Medium-Term Projections								Debt-stabilizing primary deficit
Public sector debt 1/	61.2	71.0	93.7	107.7	122.2	137.3	152.8	
o/w foreign-currency denominated (net)	17.1	21.2	28.8	34.0	41.5	50.9	63.6	
o/w foreign-currency denominated (gross)	22.7	26.5	33.9	38.9	46.2	55.3	67.8	
o/w domestic debt (net) 3/	44.1	49.9	64.9	73.7	80.7	86.4	89.1	
Change in public sector debt	-2.0	9.8	22.7	14.1	14.5	15.1	15.5	0.0
Identified debt-creating flows (4+7+12)	-1.7	9.8	22.7	14.1	14.5	15.1	15.5	0.0
Primary deficit	-6.5	1.3	10.0	10.0	10.0	10.0	10.0	-5.8
Revenue and grants	67.2	66.0	65.3	65.3	65.3	65.3	65.3	
Primary (noninterest) expenditure	60.7	67.3	75.3	75.3	75.3	75.3	75.3	
Seigniorage	-0.6	0.2	0.3	-0.6	-0.6	-0.6	-0.6	-0.6
Automatic debt dynamics 2/	5.5	8.7	12.9	4.6	5.1	5.6	6.0	6.4
Contribution from interest rate/growth differential	4.5	8.9	13.0	4.8	5.4	6.0	6.5	7.1
Of which contribution from real interest rate	7.4	4.1	7.4	9.2	10.5	11.8	13.1	14.3
Contribution from domestic real interest rate 4/	6.2	2.4	5.2	6.7	7.5	8.3	8.8	9.1
Contribution from real interest rate on foreign debt 5/	1.6	1.9	2.4	2.7	3.0	3.6	4.3	5.3
Contribution from real interest rate on net foreign assets 6/	-0.4	-0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Of which contribution from real GDP growth	-2.9	4.8	5.5	-4.5	-5.1	-5.8	-6.5	-7.3
Contribution from real exchange rate depreciation 7/	0.9	-0.2	-0.1	-0.1	-0.3	-0.3	-0.5	-0.6
Other identified debt-creating flows	0.0	-0.5	-0.5	0.0	0.0	0.0	0.0	0.0
Privatization receipts (negative)	0.0	-0.5	-0.5	0.0	0.0	0.0	0.0	0.0
Recognition of implicit or contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (specify, e.g. bank recapitalization)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual, including asset changes (2-3)	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public debt in percent of revenues 1/	91.1	107.7	143.5	165.0	187.2	210.3	233.9	
Primary deficit that stabilizes the debt-to-GDP ratio	-4.5	-8.5	-12.6	-4.0	-4.5	-5.0	-5.4	-5.8
Required deficit reduction	-2.0	9.8	22.7	14.1	14.5	15.1	15.5	15.9
Gross financing 5/	36.9	38.5	59.2	66.2	72.3	77.8	82.1	
in billions of U.S. dollars	128.9	124.1	181.2	218.3	257.8	300.1	343.9	
Key macroeconomic and fiscal assumptions								For debt stabilization
Real GDP growth (in percent)	4.8	-7.2	-7.2	5.0	5.0	5.0	5.0	5.0
Average nominal interest rate on public debt (percent) 6/	15.9	11.0	13.2	13.1	13.1	12.9	12.8	
Average nominal interest rate on public domestic debt (in percent) 11/	22.0	11.3	14.6	14.6	14.6	14.6	14.6	14.6
Average interest rate on foreign-currency denominated debt	10.3	10.4	10.9	10.9	10.9	10.9	10.9	10.9
Average nominal interest rate on NFA (in percent) 12/		5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average real interest rate (nominal rate minus change in GDP deflator, percent)	9.1	5.0	8.7	9.7	9.6	9.4	9.3	
Change in the real exchange rate (Local currency per US dollar) 13/	5.1	-1.0	-0.5	-0.4	-0.8	-0.8	-1.0	-1.0
Nominal depreciation of local currency (LC per dollar)	9.3	2.5	1.4	0.5	0.2	0.2	0.0	
Exchange rate (US dollar per LC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Nominal appreciation of local currency (increase in US dollar value of local currency)	-8.5	-2.4	-1.4	-0.5	-0.2	-0.2	0.0	
Inflation rate (in percent)	6.8	6.0	4.5	3.5	3.5	3.5	3.5	3.5
US Inflation rate (in percent)	2.7	2.4	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by GDP deflator, in percent)	5.9	2.8	3.8	5.0	5.0	5.0	5.0	
Base Money (percent of GDP)	7.8	7.7	7.7	7.7	7.7	7.7	7.7	

Table 11. Primary Balance Bounds Test

Bound Test 3: Primary Balance Shock
(In percent of GDP, unless otherwise indicated)

	Actual		Projections					
	2005	2006	2007	2008	2009	2010	2011	
I. Baseline Medium-Term Projections								Debt-stabilizing primary deficit
Public sector debt 1/	61.2	60.1	61.1	57.1	52.8	48.2	43.4	
o/w foreign-currency denominated (net)	17.1	17.9	18.8	18.0	17.9	17.9	18.1	
o/w foreign-currency denominated (gross)	22.7	23.2	23.9	22.9	22.6	22.3	22.2	
o/w domestic debt (net) 3/	44.1	42.2	42.3	39.1	34.8	30.3	25.3	
Change in public sector debt	-2.0	-1.2	1.0	-4.0	-4.3	-4.6	-4.9	0.0
Identified debt-creating flows (4+7+12)	-1.7	-1.2	1.0	-4.0	-4.3	-4.6	-4.9	0.0
Primary deficit	-6.5	-0.6	-0.6	-6.5	-6.5	-6.5	-6.5	-1.4
Revenue and grants	67.2	66.0	65.3	65.3	65.3	65.3	65.3	
Primary (noninterest) expenditure	60.7	65.4	64.7	58.8	58.8	58.8	58.8	
Seigniorage	-0.6	-0.7	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
Automatic debt dynamics 2/	5.5	0.6	2.7	3.1	2.8	2.6	2.3	2.0
Contribution from interest rate/growth differential	4.5	0.7	2.7	3.2	3.0	2.7	2.5	2.2
Of which contribution from real interest rate	7.4	3.7	5.6	6.1	5.7	5.2	4.8	4.2
Contribution from domestic real interest rate 4/	6.2	2.1	3.9	4.4	4.0	3.6	3.1	2.6
Contribution from real interest rate on foreign debt 5/	1.6	1.7	1.8	1.9	1.8	1.8	1.7	1.7
Contribution from real interest rate on net foreign assets 6/	-0.4	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Of which contribution from real GDP growth	-2.9	-2.9	-2.9	-2.9	-2.7	-2.5	-2.3	-2.1
Contribution from real exchange rate depreciation 7/	0.9	-0.2	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2
Other identified debt-creating flows	0.0	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0
Privatization receipts (negative)	0.0	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0
Recognition of implicit or contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (specify, e.g. bank recapitalization)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual, including asset changes (2-3)	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public debt in percent of revenues 1/	91.1	91.1	93.6	87.4	80.8	73.8	66.4	
Primary deficit that stabilizes the debt-to-GDP ratio	-4.5	0.6	-1.6	-2.5	-2.2	-2.0	-1.7	-1.4
Required deficit reduction	-2.0	-1.2	1.0	-4.0	-4.3	-4.6	-4.9	-5.1
Gross financing 5/	36.9	31.1	32.4	24.6	21.6	18.5	15.0	
in billions of U.S. dollars	128.9	113.5	127.1	104.0	98.9	91.2	80.6	
Key macroeconomic and fiscal assumptions								For debt stabilization
Real GDP growth (in percent)	4.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average nominal interest rate on public debt (percent) 6/	15.9	11.0	13.2	13.1	13.1	12.9	12.8	
Average nominal interest rate on public domestic debt (in percent) 11/	22.0	11.3	14.6	14.6	14.6	14.6	14.6	14.6
Average interest rate on foreign-currency denominated debt	10.3	10.4	10.9	10.9	10.9	10.9	10.9	10.9
Average nominal interest rate on NFA (in percent) 12/		5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average real interest rate (nominal rate minus change in GDP deflator, percent)	9.1	5.0	8.7	9.7	9.6	9.4	9.3	
Change in the real exchange rate (Local currency per US dollar) 13/	5.1	-1.0	-0.5	-0.4	-0.8	-0.8	-1.0	-1.0
Nominal depreciation of local currency (LC per dollar)	9.3	2.5	1.4	0.5	0.2	0.2	0.0	
Exchange rate (US dollar per LC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Nominal appreciation of local currency (increase in US dollar value of local currency)	-8.5	-2.4	-1.4	-0.5	-0.2	-0.2	0.0	
Inflation rate (in percent)	6.8	6.0	4.5	3.5	3.5	3.5	3.5	3.5
US Inflation rate (in percent)	2.7	2.4	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by GDP deflator, in percent)	5.9	13.0	3.9	-4.6	5.0	5.0	5.0	
Base Money (percent of GDP)	7.8	7.7	7.7	7.7	7.7	7.7	7.7	

Table 12. Combined Bounds Test

Bound Test 4: Combined One Standard Deviation Shock
(In percent of GDP, unless otherwise indicated)

	Actual		Projections					
	2005	2006	2007	2008	2009	2010	2011	
I. Baseline Medium-Term Projections								Debt-stabilizing primary deficit
Public sector debt 1/	61.2	76.9	97.2	96.3	95.1	93.8	92.2	
o/w foreign-currency denominated (net)	17.1	22.9	29.9	30.4	32.3	34.8	38.4	
o/w foreign-currency denominated (gross)	22.7	28.2	35.0	35.3	36.9	39.2	42.6	
o/w domestic debt (net) 3/	44.1	54.0	67.4	65.9	62.8	59.0	53.8	
Change in public sector debt	-2.0	15.6	20.4	-1.0	-1.2	-1.3	-1.6	0.0
Identified debt-creating flows (4+7+12)	-1.7	15.6	20.4	-1.0	-1.2	-1.3	-1.6	0.0
Primary deficit	-6.5	-3.3	-3.3	-6.5	-6.5	-6.5	-6.5	-4.6
Revenue and grants	67.2	66.0	65.3	65.3	65.3	65.3	65.3	
Primary (noninterest) expenditure	60.7	62.6	62.0	58.8	58.8	58.8	58.8	
Seigniorage	-0.6	0.2	0.2	0.6	0.6	0.6	0.6	0.6
Automatic debt dynamics 2/	5.5	19.1	24.0	4.9	4.7	4.6	4.3	4.0
Contribution from interest rate/growth differential	4.5	19.3	24.1	5.1	5.0	4.8	4.7	4.4
Of which contribution from real interest rate	7.4	18.3	22.9	9.6	9.4	9.2	9.0	8.7
Contribution from domestic real interest rate 4/	6.2	17.0	21.1	6.9	6.7	6.4	6.0	5.5
Contribution from real interest rate on foreign debt 5/	1.6	1.8	2.2	2.7	2.8	2.9	3.1	3.3
Contribution from real interest rate on net foreign assets 6/	-0.4	-0.4	-0.4	-0.1	-0.1	-0.1	-0.1	-0.1
Of which contribution from real GDP growth	-2.9	1.0	1.3	-4.5	-4.4	-4.4	-4.3	-4.4
Contribution from real exchange rate depreciation 7/	0.9	-0.2	-0.1	-0.1	-0.2	-0.3	-0.3	-0.4
Other identified debt-creating flows	0.0	-0.4	-0.5	0.0	0.0	0.0	0.0	0.0
Privatization receipts (negative)	0.0	-0.4	-0.5	0.0	0.0	0.0	0.0	0.0
Recognition of implicit or contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (specify, e.g. bank recapitalization)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual, including asset changes (2-3)	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public debt in percent of revenues 1/	91.1	116.5	148.9	147.4	145.6	143.6	141.2	
Primary deficit that stabilizes the debt-to-GDP ratio	-4.5	-18.9	-23.7	-5.5	-5.3	-5.2	-5.0	-4.6
Required deficit reduction	-2.0	15.6	20.4	-1.0	-1.2	-1.3	-1.6	-1.9
Gross financing 5/	36.9	44.4	55.5	45.2	43.2	41.0	38.0	
in billions of U.S. dollars	128.9	151.7	191.3	167.7	173.3	177.7	178.9	
Key macroeconomic and fiscal assumptions								For debt stabilization
Real GDP growth (in percent)	4.8	-1.6	-1.6	5.0	5.0	5.0	5.0	5.0
Average nominal interest rate on public debt (percent) 6/	15.9	25.3	23.8	13.0	12.8	12.7	12.5	12.5
Average nominal interest rate on public domestic debt (in percent) 11/	22.0	46.2	44.6	14.6	14.6	14.6	14.6	14.6
Average interest rate on foreign-currency denominated debt	10.3	10.2	10.3	10.9	10.9	10.9	10.9	10.9
Average nominal interest rate on NFA (in percent) 12/		10.2	10.3	5.0	5.0	5.0	5.0	5.0
Average real interest rate (nominal rate minus change in GDP deflator, percent)	9.1	19.3	19.3	9.5	9.3	9.2	9.0	9.0
Average real interest rate on domestic debt (nominal rate minus change in domestic CPI, p)	15.2	40.2	40.2	11.2	11.1	11.1	11.1	
Average real interest rate on foreign debt debt (nominal rate minus change in U.S. CPI, percent)		7.8	7.8	8.4	8.4	8.4	8.4	
Change in the real exchange rate (Local currency per US dollar) 13/	5.1	-1.0	-0.5	-0.4	-0.8	-0.8	-1.0	-1.0
Nominal depreciation of local currency (LC per dollar)	9.3	2.5	1.4	0.5	0.2	0.2	0.0	0.0
Exchange rate (US dollar per LC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Nominal appreciation of local currency (increase in US dollar value of local currency)	-8.5	-2.4	-1.4	-0.5	-0.2	-0.2	0.0	
Inflation rate (in percent)	6.8	6.0	4.5	3.5	3.5	3.5	3.5	3.5
US Inflation rate (in percent)	2.7	2.4	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by GDP deflator, in percent)	5.9	1.5	-2.7	-0.4	5.0	5.0	5.0	
Base Money (percent of GDP)	7.8	7.7	7.7	7.7	7.7	7.7	7.7	

Table 13. Nominal Exchange Rate Depreciation

Bound Test 5: Real Exchange Rate Shock
(In percent of GDP, unless otherwise indicated)

	Actual			Projections				
	2005	2006	2007	2008	2009	2010	2011	
I. Baseline Medium-Term Projections								
Public sector debt 1/	61.2	63.5	58.7	54.6	50.2	45.5	40.6	Debt-stabilizing primary deficit
o/w foreign-currency denominated (net)	17.1	24.6	23.0	21.4	20.5	19.5	18.4	
o/w foreign-currency denominated (gross)	22.7	32.7	30.8	28.8	27.6	26.2	24.8	
o/w domestic debt (net) 3/	44.1	38.9	35.8	33.2	29.7	26.1	22.2	
Change in public sector debt	-2.0	2.2	-4.7	-4.1	-4.4	-4.7	-4.9	0.0
Identified debt-creating flows (4+7+12)	-1.7	2.2	-4.7	-4.1	-4.4	-4.7	-4.9	0.0
Primary deficit	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-1.3
Revenue and grants	67.2	66.0	65.3	65.3	65.3	65.3	65.3	
Primary (noninterest) expenditure	60.7	59.4	58.8	58.8	58.8	58.8	58.8	
Seigniorage	-0.6	-0.7	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
Automatic debt dynamics 2/	5.5	9.8	2.8	3.0	2.7	2.5	2.2	1.9
Contribution from interest rate/growth differential	4.5	0.7	3.0	3.1	2.9	2.6	2.4	2.1
Of which contribution from real interest rate	7.4	3.7	6.0	5.9	5.5	5.0	4.6	4.1
Contribution from domestic real interest rate 4/	6.2	2.1	3.6	3.7	3.4	3.0	2.7	2.3
Contribution from real interest rate on foreign debt 5/	1.6	1.7	2.6	2.4	2.3	2.2	2.0	1.9
Contribution from real interest rate on net foreign assets 6/	-0.4	-0.1	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1
Of which contribution from real GDP growth	-2.9	-2.9	-3.0	-2.8	-2.6	-2.4	-2.2	-1.9
Contribution from real exchange rate depreciation 7/	0.9	9.1	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2
Other identified debt-creating flows	0.0	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0
Privatization receipts (negative)	0.0	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0
Recognition of implicit or contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (specify, e.g. bank recapitalization)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual, including asset changes (2-3)	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public debt in percent of revenues 1/	91.1	96.2	90.0	83.6	76.9	69.7	62.2	
Primary deficit that stabilizes the debt-to-GDP ratio	-4.5	-8.7	-1.8	-2.4	-2.1	-1.9	-1.6	-1.3
Required deficit reduction	-2.0	2.2	-4.7	-4.1	-4.4	-4.7	-4.9	-5.2
Gross financing 5/	36.9	26.6	25.9	23.3	20.3	17.1	13.7	
in billions of U.S. dollars	128.9	97.1	102.1	99.4	93.9	85.9	74.7	For debt stabilization
Key macroeconomic and fiscal assumptions								
Real GDP growth (in percent)	4.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average nominal interest rate on public debt (percent) 6/	15.9	11.0	13.2	13.1	13.1	12.9	12.8	
Average nominal interest rate on public domestic debt (in percent) 11/	22.0	11.3	14.6	14.6	14.6	14.6	14.6	14.6
Average interest rate on foreign-currency denominated debt	10.3	10.4	10.9	10.9	10.9	10.9	10.9	10.9
Average nominal interest rate on NFA (in percent) 12/		5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average real interest rate (nominal rate minus change in GDP deflator, percent)	9.1	5.0	8.7	9.7	9.6	9.4	9.3	
Change in the real exchange rate (Local currency per US dollar) 13/	5.1	50.9	-0.5	-0.4	-0.8	-0.8	-1.0	-1.0
Nominal depreciation of local currency (LC per dollar)	9.3	56.2	1.4	0.5	0.2	0.2	0.0	
Exchange rate (US dollar per LC)	0.0	0.000	0.000	0.000	0.000	0.000	0.000	
Nominal appreciation of local currency (increase in US dollar value of local currency)	-8.5	-36.0	-1.4	-0.5	-0.2	-0.2	0.0	
Inflation rate (in percent)	6.8	6.0	4.5	3.5	3.5	3.5	3.5	3.5
US Inflation rate (in percent)	2.7	2.4	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by GDP deflator, in percent)	5.9	2.8	3.8	5.0	5.0	5.0	5.0	
Base Money (percent of GDP)	7.8	7.7	7.7	7.7	7.7	7.7	7.7	

Table 14. Contingent Liabilities Shock

Bound Test 6: Contingent Liability Shock
(In percent of GDP, unless otherwise indicated)

	Actual		Projections					Debt-stabilizing primary deficit
	2005	2006	2007	2008	2009	2010	2011	
I. Baseline Medium-Term Projections								
Public sector debt 1/	61.2	64.2	59.4	55.4	51.0	46.4	41.5	
o/w foreign-currency denominated (net)	17.1	19.1	18.3	17.5	17.3	17.2	17.3	
o/w foreign-currency denominated (gross)	22.7	24.5	23.4	22.4	22.0	21.6	21.4	
o/w domestic debt (net) 3/	44.1	45.0	41.2	37.9	33.7	29.2	24.2	
Change in public sector debt	-2.0	2.9	-4.7	-4.1	-4.4	-4.6	-4.9	0.0
Identified debt-creating flows (4+7+12)	-1.7	2.9	-4.7	-4.1	-4.4	-4.6	-4.9	0.0
Primary deficit	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-6.5	-1.3
Revenue and grants	67.2	66.0	65.3	65.3	65.3	65.3	65.3	
Primary (noninterest) expenditure	60.7	59.4	58.8	58.8	58.8	58.8	58.8	
Seigniorage	-0.6	-0.7	-0.6	-0.6	-0.6	-0.6	-0.6	-0.6
Automatic debt dynamics 2/	5.5	0.6	2.8	3.0	2.7	2.5	2.2	1.9
Contribution from interest rate/growth differential	4.5	0.7	2.9	3.1	2.9	2.6	2.4	2.1
Of which contribution from real interest rate	7.4	3.7	6.0	6.0	5.5	5.1	4.6	4.1
Contribution from domestic real interest rate 4/	6.2	2.1	4.2	4.2	3.9	3.4	3.0	2.5
Contribution from real interest rate on foreign debt 5/	1.6	1.7	1.9	1.8	1.8	1.7	1.7	1.7
Contribution from real interest rate on net foreign assets 6/	-0.4	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Of which contribution from real GDP growth	-2.9	-2.9	-3.1	-2.8	-2.6	-2.4	-2.2	-2.0
Contribution from real exchange rate depreciation 7/	0.9	-0.2	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2
Other identified debt-creating flows	0.0	9.6	-0.4	0.0	0.0	0.0	0.0	0.0
Privatization receipts (negative)	0.0	-0.4	-0.4	0.0	0.0	0.0	0.0	0.0
Recognition of implicit or contingent liabilities	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other (specify, e.g. bank recapitalization)	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual, including asset changes (2-3)	-0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Public debt in percent of revenues 1/	91.1	97.3	91.0	84.8	78.1	71.0	63.5	
Primary deficit that stabilizes the debt-to-GDP ratio	-4.5	-9.4	-1.8	-2.4	-2.1	-1.9	-1.6	-1.3
Required deficit reduction	-2.0	2.9	-4.7	-4.1	-4.4	-4.6	-4.9	-5.2
Gross financing 5/	36.9	26.9	26.2	23.7	20.7	17.6	14.1	
in billions of U.S. dollars	128.9	98.3	103.0	100.2	94.7	86.8	75.8	
								For debt stabilization
Real GDP growth (in percent)	4.8	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average nominal interest rate on public debt (percent) 6/	15.9	11.0	13.2	13.1	13.1	12.9	12.8	
Average nominal interest rate on public domestic debt (in percent) 11/	22.0	11.3	14.6	14.6	14.6	14.6	14.6	14.6
Average interest rate on foreign-currency denominated debt	10.3	10.4	10.9	10.9	10.9	10.9	10.9	10.9
Average nominal interest rate on NFA (in percent) 12/		5.0	5.0	5.0	5.0	5.0	5.0	5.0
Average real interest rate (nominal rate minus change in GDP deflator, percent)	9.1	5.0	8.7	9.7	9.6	9.4	9.3	
Change in the real exchange rate (Local currency per US dollar) 13/	5.1	-1.0	-0.5	-0.4	-0.8	-0.8	-1.0	-1.0
Nominal depreciation of local currency (LC per dollar)	9.3	2.5	1.4	0.5	0.2	0.2	0.0	
Exchange rate (US dollar per LC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Nominal appreciation of local currency (increase in US dollar value of local currency)	-8.5	-2.4	-1.4	-0.5	-0.2	-0.2	0.0	
Inflation rate (in percent)	6.8	6.0	4.5	3.5	3.5	3.5	3.5	3.5
US Inflation rate (in percent)	2.7	2.4	2.5	2.5	2.5	2.5	2.5	2.5
Growth of real primary spending (deflated by GDP deflator, in percent)	5.9	2.8	3.8	5.0	5.0	5.0	5.0	
Base Money (percent of GDP)	7.8	7.7	7.7	7.7	7.7	7.7	7.7	

8. Summary of Output

The FS template also provides a summary of output for public debt dynamics, and gross financing needs under the baseline, the alternative scenarios and bounds tests. These results are summarized in the sheet “Table_SR” (see Table 2). The results of each alternative scenario and bounds tests are reported in the bottom section of sheet “Table_SR” in cells B70:AA82 (Figure 13). Together with debt dynamics, the output table reports the debt stabilizing primary balance for each alternative scenario and bounds test.

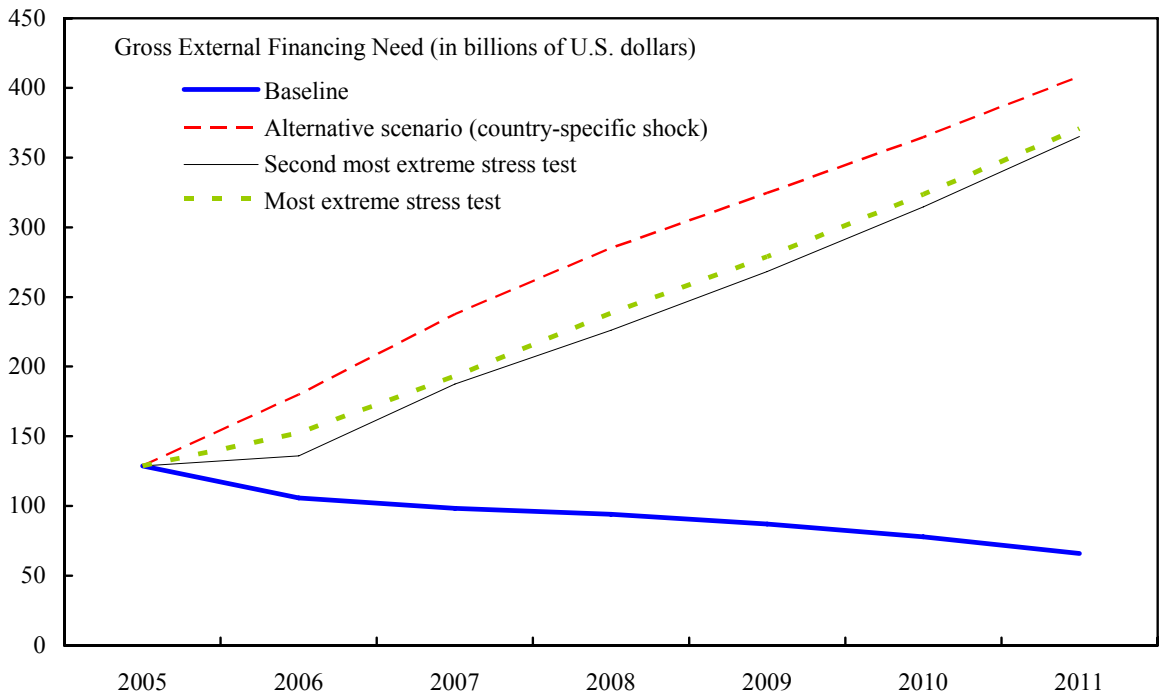
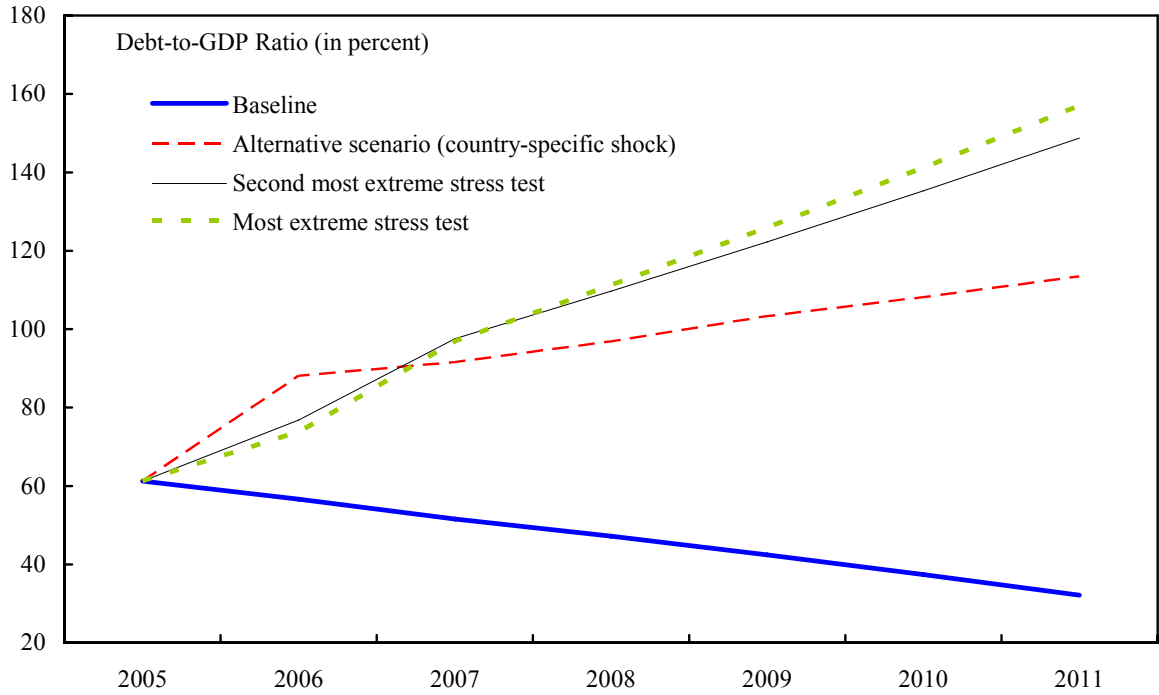
The gross financing needs for different scenarios and bounds tests are presented in the sheet “Table_GF”. Analogous output tables are also reported for ORCs.

Figure 13. Representation of Alternative Scenarios and Bounds Tests

	A	B	C	R	S	T	U	V	W	X	Z	AA
5												
6												
7					Projections							
66					2006	2007	2008	2009	2010	2011		
67												Debt-stabilizing primary balance 17/
68					II. Stress Tests for Public Debt Ratio							
69		A. Alternative Scenarios										
70		A1. Key variables are at their historical averages in 2005-09 14/			60.2	59.3	58.6	57.8	56.6	55.1		-0.8
71		A2. No policy change (constant primary balance) in 2005-09			54.2	47.8	42.5	36.8	30.9	24.6		-0.1
72		A3. Country-specific shock in 2005, with reduction in GDP growth (relative to baseline) of			96.1	105.5	107.8	113.5	121.3	130.5		-13.2
73		A4. Selected variables are consistent with market forecast in 2005-09			54.2	49.0	44.3	39.3	34.1	28.5		-0.7
74												
75		B. Bound Tests										
76												
77		B1. Real interest rate is at historical average plus two standard deviations in 2005 and 2006			76.3	96.9	94.4	91.6	88.6	85.4		-3.0
78		B2. Real GDP growth is at historical average minus two standard deviations in 2005 and 2006			71.0	93.7	107.7	122.2	137.3	152.8		-5.8
79		B3. Primary balance is at historical average minus two standard deviations in 2005 and 2006			60.1	61.1	57.1	52.8	48.2	43.4		-1.4
80		B4. Combination of 2-4 using one standard deviation shocks			76.9	97.2	96.3	95.1	93.8	92.2		-4.6
81		B5. One time 30 percent real depreciation in 2005 16/			63.5	58.7	54.6	50.2	45.5	40.6		-1.3
82		B6. 10 percent of GDP increase in other debt-creating flows in 2005			64.2	59.4	55.4	51.0	46.4	41.5		-1.3
83												
84												
85												
86												

The sheet “Figure” provides a graphical summary of the results (see Fig. 14). Both charts report debt trends and gross financing needs for the projection period according to the baseline, to the two most extreme stress tests (including bounds tests, the historical scenario and the no policy-change scenario) and to the alternative scenario.

Figure 14. Debt Ratios and Gross Financing Needs

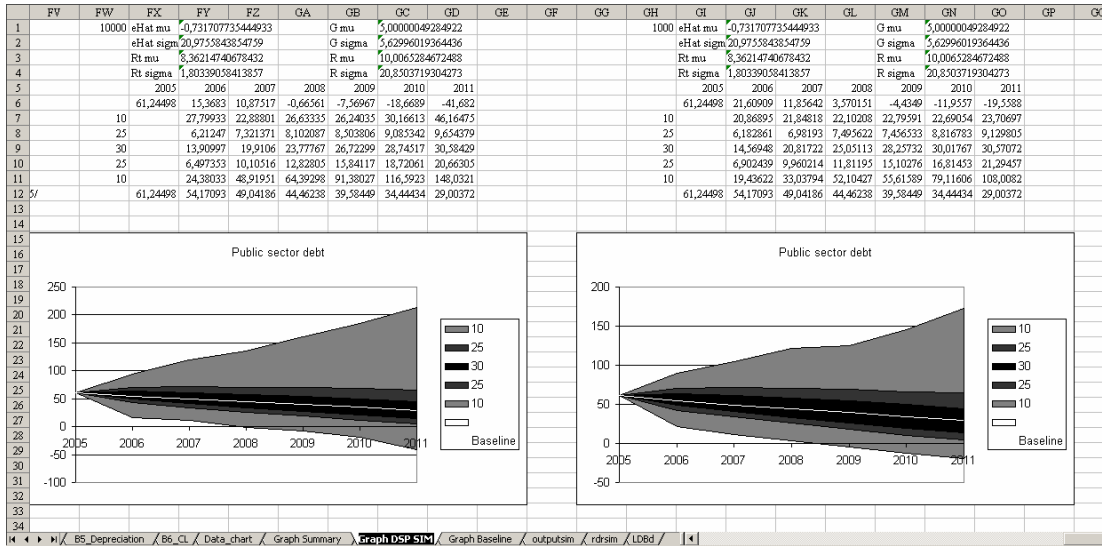


Source: Staff calculations.

The results of the stochastic simulations are presented in sheet “Graph DSP SIM” through fan charts (Figure 15) that report the realizations of the debt-to-GDP ratio and the Required Deficit Reduction in percent of GDP between the bottom and to top 2.5 percentiles.

The charts report the results of the stochastic simulations according to the chosen percentiles and the baseline debt to GDP ratio or required deficit reduction. If the fiscal reaction function is enabled, the charts report also for which scenarios the fiscal reaction function has been activated.

Figure 15. Stochastic Simulations of Net Public Debt and Required Deficit Reduction



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Glossary

Amortization

Amortization is the process of reducing a debt through regular installment payments, as opposed to paying off the debt all at once. Payments usually include repayment of principal and interest.

Arrears

Arrears are overdue payments of principal and/or interest.

Balance of Payment (BoP)

Balance of Payment (BoP) is a statistical statement that systematically summarizes, for a specific time period, the economic transactions of an economy with the rest of the world. Transactions, for the most part between residents and nonresidents, consist of those involving goods, services, and income; those involving financial claims on, and liability to, the rest of the world; and those (such as gift) classified as transfers, which involve offsetting entries to balance – in an accounting case – one-sided transactions.

Base Money

Base money is also called monetary base, or high-powered money. Composed of [currency](#) and coins outside the banking system plus Central Bank [liabilities](#) to the deposit [money](#) banks (reserves held by the latter at the Central Bank). The control over the amount of high-powered money in the economy is the main route through which the monetary authorities control the money supply.

Bounds Test

Bounds tests are a way to assess the behavior of the public debt ratio after shocks to key variables. Under bounds tests, variables are assumed far away from their values in the baseline scenario. A common approach is to assume an increase/decrease of twice the standard deviation of the relevant variable.

Cagan Money Demand Function

In a Cagan money demand function, nominal base money stock, M at the end of each period $t-1$ is a loglinear function of nominal income and expected average inflation during the period t :

$$\frac{M^{eop}_{t-1}}{P_t} = A \cdot Y_t \cdot e^{-\eta \cdot \pi^e_t}$$

Where M^{eop}_{t-1} is Base Money at the end of period $t-1$, P_t is the [average price level](#) in year t , Y_t is real GDP in year t , η is the semi-elasticity of money demand with respect to inflation and A is a constant term. This functional form was used by Cagan in his analysis of the German hyperinflation.

Capital Account of the Balance of Payments

The Capital account of a country is an account of the balance of payments which records capital transfers and the acquisition and disposal of non-produced, non-financial assets between individuals, businesses, and government agencies in that country and those in other countries. These transactions are separated from transactions recorded on current account because capital account transactions are not directly related to the process of production and consumption.

Choleski Factorization

The Cholesky decomposition is named after [André-Louis Cholesky](#), who found that a [symmetric positive-definite matrix](#) can be [decomposed](#) into a [lower triangular matrix](#) and the [transpose](#) of the lower triangular matrix. The lower triangular matrix is called the Cholesky factorization of the original, positive-definite matrix.

Contingent/hidden Liability

Contingent liabilities are characterized by the fact that one or more conditions must be fulfilled before a financial transaction takes place. They may arise from obligations from government guarantees of minimum pension or deposit insurance, the pension reform (or the absence of it), non-sovereign borrowing and liabilities of regional and local governments, government insurance schemes as well as bank failures and other financial sector bailouts. They are usually not explicitly shown on government accounts.

Concessional Rescheduling

Concessional Rescheduling is a rescheduling of debt that leads to a reduction in the net present value of future debt service payments.

Consolidated Accounts of the Public Sector

Consolidated Accounts of the Public Sector in this paper include the accounts of the general and local (state, province, municipalities...) government and the Central Bank.

Contemporaneous and Serial Correlation

Contemporaneous correlation is the correlation between two contemporaneous (the same time period) variables such as X_t and Y_t . Serial correlation is the correlation between the observations of one variable in different time periods, such as X_t and X_{t-1} . Also refer to **Correlation**.

Correlation

Correlation is a statistical measure of how much the movements of two random variables are related. The degree of correlation is measured by correlation coefficient ranging between -1 and +1. A result of -1 means a perfect negative correlation, +1 means a perfect positive correlation, and 0 means no correlation at all. A positive correlation between two variables means that they tend to move up and down together. A zero correlation means that the change in value of one variable has no impact or bearing on the change in value of the other variable.

Current Account

Current Account is an account in the balance of payments which records the transactions with the rest of the world in three broad categories: goods and services (which is subdivided into

goods and services), income (including interest, profits and wages) and current transfer (grants received and given).

Indexed Debt

Indexed Debt is debt whose principal value is linked to external variables such as the price level or a country's exchange rate with respect to a particular currency (usually the US dollar).

Debt Relief

Debt relief is an arrangement intended to reduce the burden of debt on a country, usually including forgiveness of part or all of what is owed to creditors who may include private banks and other entities, government, or international financial institutions.

Debt Service

Debt service is the sum of interest payments and repayments of principal made on a periodic base on a debt instrument.

Deficit Monetization

Financing government deficits by issuing base money.

Domestic Debt

Domestic debt generally refers to the debt owed to creditors resident in the same country as the debtor, and denominated in local currency, but it is possible for debtors to issue local currency debts that can be purchased by non-residents and held abroad. It is also possible for governments to issue domestic debt in a foreign currency (e.g. US dollar -denominated bonds).

Domestic Public Debt

Public debt refers to debt owed by the public sector, including central, region and local government and public enterprises, of which government holds more than 50% of ownership. Also refer to **Domestic Debt**.

Elasticity of money demand with respect to nominal interest rates

In Economics, elasticity means the incremental percentage change in one variable divided by the percentage change of another variable triggering the change in the first variable.

Emerging Markets

markets in newly industrialized or developing countries with capital markets at early stages of institutional development.

Endogeneity

In econometrics, endogeneity refers to the fact that a variable included in a model is determined within the model. If it is not, the variable is exogenous.

Expenditure

An amount of money that is spent on goods and services. Expenditure is part of payments by government that do not arise because of an obligation incurred earlier. A loan repayment is not expenditure, but interest is.

Export Credit Agency

Export credit agency provides generally non-concessional export credits (loans). In addition to concessional financing, most governments of developed countries either extend non-concessional export credit loans directly to the borrower or provide guarantees of export credit finance obtained by exporters from banks and financial institutions.

External Debt

External debt is the part of a country's debt owed to creditors outside the country, which will require payment of principal and/or interest at some point in the future. This includes debt owed to private commercial banks, governments, or international financial institutions.

External Public Debt

Refer to **External Debt** and **Public Debt**.

Extrabudgetary

At each level of government, there are three groups of operations: budgetary, extrabudgetary and social security. Budgetary operations are covered in the budget. Extrabudgetary operations, which are carried out outside of the budget, raise resources through compulsory levies and provide nonmarket goods and services. Social security schemes are a special category of extrabudgetary operations.

Fan Chart

Fan Charts are used to depict confidence bands corresponding to different degrees of uncertainty around the median projections, for example of debt-to-GDP ratios.

Fiscal Dominance

Fiscal dominance refers to the situation where higher real interest rates on public debt lead to increased fears of default and therefore higher risk premia and again higher real interest rates. In such circumstances using active interest rate rules to combat inflation destabilizes the economy (Blanchard (2005), Schabert and van Wijnbergen (2006)).

Fiscal Reaction Function

The fiscal reaction function models primary balance as function of its underlying variables. The idea is that fiscal outcome is not independent and government and policy makers deliberately adjust policies in response to different economic and fiscal conditions.

Fiscal Rule

In the widest sense, fiscal rule refers to budgetary institution, or a set of rules and regulations according to which budgets are drafted, approved and implemented. In a more narrow sense, the term refers to legislated restrictions on fiscal policy that set specific limits on aggregate fiscal indicators such as the fiscal balance, primary balance (non-interest surplus), debt and expenditure or taxation.

Fiscal Sustainability

Fiscal sustainability refers to government fiscal policies. A set of fiscal policies is unsustainable if the present and prospective fiscal stance results in a persistent and rapid increase in the public

debt-to-GDP ratio. Fiscal sustainability is closely linked to the concepts of **solvency** and **liquidity**.

Floating Exchange Rate

Floating exchange rate is also called flexible exchange rate or market-determined exchange rate. It is the exchange rate that is determined by the unregulated forces of supply and demand.

General Government

General government comprises central government, state/regional government and local government.

General Government Account

General Government Account is the record of fiscal revenue, expenditure and balance of general government.

Government Budget Constraint

Government Budget Constraint implies that any excess of government expenditure and net interest payment on debts over current revenue (taxes) has to be financed by public borrowing, sale of assets or money creation. It can be shown in an equation:

Government financial deficit	Financing sources
Primary expenditure	Debt sales to the public
+ Net interest payments on debt	= + Sales of PS assets
- Taxes	+ Money creation

Gross Financing Need

The gross financing need measures how much cash the government has to have in hand to cover all the claims coming due in the current year. It is calculated as the sum of the amortization of foreign and domestic public debt coming due during the current year, the interest expenditure, and the primary deficit also for the current year.

HP-filter

The Hodrick-Prescott filter (HP-filter) is a mathematical tool used in [macroeconomics](#), specifically in the analysis of [business cycles](#). It is used to obtain a smoothed non-linear representation of a [time series](#), one that is more sensitive to long-term than to short-term fluctuations. The adjustment of the sensitivity of the trend to short-term fluctuations is achieved by modifying a multiplier λ .

The reasoning for the formula is as follows: Let y_t for $t = 1, 2, \dots, T$ denote the logarithms of a time series variable. Given an adequately chosen, positive value of λ , there is a "trend component", denoted by τ , that minimizes

$$\sum_{t=1}^T (y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1} [(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2.$$

Inflation Targeting

Inflation targeting has been adopted by several countries with floating exchange rate systems, as a way to anchor inflation expectations. Its most distinguishing feature is the announcement of a quantitative target for inflation. It evolved most directly from the practices of Germany's Bundesbank and the Swiss National Bank in late 1970s and 1980s. For example, the Bundesbank, though it conducted short-term policy with reference to targets for money supply growth, derived those targets each year by calculating the rate of money growth estimated to be consistent with the bank's long-run desired rate of inflation, normally 2 percent per year. Hence, the Bundesbank indirectly targeted inflation, using money growth as a quantitative indicator to aid in the calibration of its policy. Notably, the evidence suggests that, when conflicts arose between its money growth targets and inflation targets, the Bundesbank generally chose to give greater weight to its inflation targets

Inflation Tax

Inflation tax is the amount of nominal money balances individuals have to accumulate just to keep the real value of money balances constant, and is calculated as the product of inflation rate (tax rate) and real base money (tax base). Inflation tax transfers purchasing power from household to government.

Intertemporal Constraint of Government

The intertemporal, or solvency constraint of a government requires the present value of future primary fiscal surpluses and seigniorage to be at least as large as present value of initial debt. It can be summarized in a formula:

$$\begin{aligned} & \text{Net Public Debt to output ratio} \\ & = \text{PV of terminal net liabilities} \\ & + \text{PV of primary surpluses to output ratio} \\ & + \text{PV of seigniorage to output ratio} \end{aligned}$$

Laffer Curve

Laffer Curve describes the concave relationship between the tax rate and tax revenue. The basic idea is that tax revenue increases with the tax rate when the tax rate is low but decreases when the tax rate is high. In case of seigniorage revenue, the relevant "tax" rate is the rate of inflation. Seigniorage revenue increases with inflation at low inflation rates and decreases at high inflation rates (beyond the rate at which seigniorage is maximized). With Cagan money demand functions, the maximum is reached at $1/\eta$ (cf the *Cagan money demand function* entry in this glossary).

Liquidity

Extent to which assets are liquid, i.e. are in cash or can readily be converted into cash.

Long-run sustainability condition

Long-run sustainability condition on deficits is the condition under which they can be maintained indefinitely without ever declining or increasing debt-to-GDP ratios as a result. It can be used as a simple tool of fiscal sustainability assessment (Anand and van Wijnbergen (1989)). The primary surplus (percentage of GDP) needs to equal the growth adjusted real interest rate times the debt-to-GDP ratio, minus seigniorage (also as a percentage of GDP).

Market Access Country

The developing countries which have access to international capital market are called market access countries.

Maturity

Maturity is the length of time to the date the loan principal is due; if measured from the date the loan was extended, it refers to the *original maturity*; if measured from the current date, we refer to it as the *residual* or *effective maturity*.

Monte Carlo Simulation

Monte Carlo Simulation is a method of simulation whereby random values from a known distribution are generated repeatedly for the purposes of experimentation.

Net Foreign Asset of the Monetary Authorities (Central Bank)

Net foreign assets refer to items on the balance sheet of the monetary authorities, which include the domestic currency value of (i) the net official international reserves (on the asset side, including gold, foreign exchange, the country's reserve position in the IMF, and holdings of SDRs; minus, on the liability side, including short-term liabilities to foreign monetary authorities – that is, deposits of foreign central banks, swap facilities, overdrafts, and some medium- and long-term foreign debt, such as a country's use of IMF credits); and (ii) any other foreign assets minus liabilities of the monetary authorities not included in the definition of official reserves.

Net Public Debt

Net Public Debt is the sum of net external and domestic debt. Net external debt is total external debt minus net foreign assets. Net domestic debt is total domestic debt excluding government debt holding by the central bank. In formula,

$$D_t = B_t + e_t B_t^* - e_t NFA_t^*$$

where D_t : net public debt

B_t : domestic, non-monetary debt in LCU (excludes government debt held by the Central bank)

B_t^* : foreign debt in dollar terms (includes domestic debt issued in FX and any domestic debt linked to FX).

NFA_t^* : stock of net foreign assets in dollar terms

e_t : end-of period exchange rate LCU/\$

Normally Distributed Random Variable

A continuous random variable X , taking all real values in the range $[-\infty, \infty]$ is said to follow a Normal distribution with parameters μ and σ if it has probability density function

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp \left[-\frac{1}{2} \left(\frac{x - \mu}{\sigma} \right)^2 \right]$$

We write

$$X \sim N(\mu, \sigma^2)$$

This [probability density function](#) (p.d.f.) is a symmetrical, bell-shaped curve, centered at its expected value μ . The variance is σ^2 .

Oil Price Fiscal Rule (OPFR)

The fiscal rule that Nigeria recently implemented. Under this fiscal rule oil revenues are calculated at a pre-agreed price per barrel, called the reference price; revenues above this price are then saved by the government for use when oil prices might be lower than the reference price. Oil revenues computed at the reference price then serve as a benchmark for the non-oil fiscal deficit. This rule approximates the permanent income hypothesis for mature oil producers with a relatively constant oil extraction profile going far into the future. Also see **Fiscal Rule**.

Paris Club

The Paris Club is an informal group of official creditors comprising 19 permanent members which are governments have large claims on various other countries around the world. Its role is to find coordinated and sustainable solutions to the payment difficulties experienced by debtor nations. Paris Club creditors agree to rescheduling debts due to them. Rescheduling is a means of providing a country with debt relief through a postponement and, in the case of concessional rescheduling, a reduction in debt service obligations. The first meeting with a debtor country was in 1956 when Argentina agreed to meet its public creditors in Paris.

Pegged Exchange Rate

A type of [exchange rate regime](#) wherein a [currency's](#) value is matched to the value of another single currency or to a basket of other currencies, or to another measure of value, such as [gold](#). As the reference value rises and falls, so does the currency pegged to it. The exchange ratio may change in a predetermined manner over time (“crawling peg”) or be fixed in time (“fixed exchange rate”)

Ponzi Game or Ponzi Finance

In a Ponzi Game interest and amortization on old loans is fully funded from new borrowing. A ponzi game or Ponzi Finance Scheme violates the *solvency condition*.

Primary Deficit (Surplus)

The primary deficit (surplus) equals government total revenue minus total expenditure other than net interest. By excluding net interest, the primary deficit (surplus) provides a direct measure of the claim of the government on resources. The solvency condition requires the discounted value of all current and future primary surpluses to be at least equal to initial net public debt.

Primary Fiscal Balance

Primary fiscal balance equals to overall fiscal balance minus interest payment, where overall fiscal balance equals to total revenue less total expenditure. Also see Primary Deficit (Surplus).

Primary Expenditure

Primary expenditure equals to total expenditure minus interest payment.

Privatization Receipts

Privatization receipts are the proceeds of the sales of equity in public sector. It may be recorded as negative net lending in fiscal accounts.

Probability Density

For a continuous [random variable](#), a probability density function is the function whose integral over any set is the probability of the variable being in that set. So, the density function of a normal distribution is the well-known bell-shaped curve which implies that there is a high probability of being close to the mean and low probability of being a long way from it.

Public Debt

Public debt refers to public and publicly guaranteed debt (PPG) and is the sum of PPG external and PPG domestic debt.

Public Debt Dynamics

Public debt dynamics refers to the evolution of the debt to GDP ratio over time. It is a critically important basic tool for fiscal sustainability assessment. It can be summarized in the following formula:

$$\begin{aligned} &\Delta \text{ Public Net Debt to GDP ratio} \\ &= \text{Net Interest Payments to GDP ratio to GDP ratio} \\ &+ \text{Primary deficit to GDP ratio} \\ &- \text{Seigniorage to GDP ratio} \end{aligned}$$

Public Debt Ratio

Public debt ratio refers to public debt to GDP ratio in the fiscal sustainability analysis.

Public Sector

Public sector refers to general government, including the nonfinancial public enterprises such as publicly owned railways and public enterprises. To properly link debt dynamics and money supply developments, the Central Bank should also be considered part of the public sector, whether it is independent or not.

Publicly and Publicly Guaranteed Debt

Publicly and Publicly Guaranteed Debt comprises the external debt of the public sector, defined as central, regional and local government and public enterprises. Public enterprises subsume all enterprises, of which the government owns 50 percent or more. PPG external debt also includes public sector-guaranteed private sector debt. More than 80 percent of total external debt in all low-income countries together is PPG external debt.

Quasi-fiscal activities

Quasi-fiscal activities are the activities that don't show up explicitly in the budget, but affect net debt, such as non-payment of social security contributions by loss-making state enterprises or subsidies extended through the central bank.

Required Deficit Reduction

In steady state consistency framework, the required deficit reduction represents the difference between funding requirements and available funding sources at target values needed to stabilize debt-output ratio at the end of the projection period, which is derived from consistent fiscal and monetary policies.

Revenue

Revenue consists of receipts of government that do not give rise to obligation of repayment. Receipts from loans to the government are not revenues.

Risk Premium

Risk Premium is the excess return over a risk-free rate which investors require as compensation for the risk associated with holding a risky asset (like equity).

Seigniorage (Revenue)

Seigniorage is the net revenue derived from the issue of currency, or more accurately, *base money*:

$$S = \Delta \text{Nominal base money} / \text{Price level (P)}$$

Seigniorage has two components: pure seigniorage and inflation tax, presented as

$$\begin{aligned} S &= \text{pure seigniorage} + \text{inflation tax} \\ &= \Delta \text{Real base money} + (\Delta P/P) * \text{real base money}_{t-1} \end{aligned}$$

Pure seigniorage is the change in real money base, resulting from real output growth or a favorable shift in demand for money. Inflation tax equals to the products of inflation rate and real base money.

Solvency

A Government is solvent if the discounted value of all current and future (anticipated) primary surpluses is at least equal to the current net debt.

Solvency Constraint of Government

See definition of Intertemporal Constraint of Government.

Sovereign Default

Sovereign Default means default on sovereign debt, which is the debt issued or guaranteed by governments.

Standard Deviation

Standard Deviation is a statistical measure of variability of a random variable. It is defined as the square root of the variance, which is in turn defined as the squared deviation from the mean divided by number of observations (for population) or one less than number of population (for sample).

Stationary

Stationarity is a term in econometric time series analysis. Usually it refers to weakly stationary, which means a stochastic process has a finite and constant mean, variance and covariance for all t and $t-s$.

Steady State Consistency Approach

Steady state consistency approach, developed in Anand and van Wijnbergen (1989), links inflation, fiscal deficits and public debt management and uses a consistency measure, the *required deficit reduction*, or *rdr*, to check the consistency of a range of inflation targets with stable debt-output ratios. The *rdr* is the deficit reduction necessary to restore consistency between a given inflation (money growth) target with stable debt-output ratios and other policy parameters and structural characteristics of the economy; alternatively, consistency can be imposed which then yields the inflation rate consistent with structural stability, other policy variables and the financial structure of the economy for given (primary) deficits.

Stress Test

Stress tests are used to simulate public debt ratio behavior under different, usually adverse scenarios (higher world interest rates, lower growth, etcetera).

Sudden Reversal of Capital Flow

Sudden Stop of Capital Flow

In response to questionable government policy or even arbitrary sentiment changes, the sudden drying up of new investments, refusal to roll over old debt, or even active withdrawal of money from a country, which may lead to acute *liquidity* problems in the country.

VAR system

A VAR system is a set of equations describing the dynamics of a number of variables as evolving from their joint past history and feedback to each other. A VAR model applies when each variable in the system does not only depend on its own lags but also depends on other variables and their lags.

Variance covariance matrix

In statistics and probability theory, the variance covariance matrix is a matrix of covariances between elements of a vector. It is the generalization to higher dimensions, of the concept of the variance of a scalar-valued random variable.

If X is a column vector with n scalar random variable components, and μ_k is the expected value of the k^{th} element of X , i.e., $\mu_k = E(X_k)$, then the variance covariance matrix is defined as:

$$\Sigma = E \left[(X - E[X]) (X - E[X])^T \right]$$

$$= \begin{bmatrix} \mathbf{E}[(X_1 - \mu_1)(X_1 - \mu_1)] & \mathbf{E}[(X_1 - \mu_1)(X_2 - \mu_2)] & \cdots & \mathbf{E}[(X_1 - \mu_1)(X_n - \mu_n)] \\ \mathbf{E}[(X_2 - \mu_2)(X_1 - \mu_1)] & \mathbf{E}[(X_2 - \mu_2)(X_2 - \mu_2)] & \cdots & \mathbf{E}[(X_2 - \mu_2)(X_n - \mu_n)] \\ \vdots & \vdots & \ddots & \vdots \\ \mathbf{E}[(X_n - \mu_n)(X_1 - \mu_1)] & \mathbf{E}[(X_n - \mu_n)(X_2 - \mu_2)] & \cdots & \mathbf{E}[(X_n - \mu_n)(X_n - \mu_n)] \end{bmatrix}$$

The (i,i) diagonal element is the variance of X_i , (i,j) element is the covariance between X_i and X_j .

Velocity

Velocity measures how often money changes hand in a given time period. It is equal to the ratio of nominal GDP to the stock of money. It is inversely related to money demand.

Acronyms

BoP	Balance of Payment
CBT	Central Bank of Turkey
CPI	consumer price index
DECPG	Development Data Group
DV	dummy variable
EBF	extra budgetary fund
EU	European Union
FDI	foreign direct investment
FS	fiscal sustainability
FSA	fiscal sustainability analysis
FX	foreign exchange
GDP	gross domestic product
GDF	Global Development Finance
GMM	generalized method of moments
GNP	gross national product
HP	Hodrick-Prescott
IMF	International Monetary Fund
LCU	local currency
LDB	Live Data Base
LIC	low income country
LIBOR	London Interbank Offered Rate
MIC	middle income country
NPV	net present value
OLS	ordinary least square
OPEC	Organization of Petroleum Exporting Countries
OPFR	Oil Price Fiscal Rule
PS	public sector
PV	present value
RER	real exchange rate
REER	real effective exchange rate
SOE	state owned enterprise
TL	Turkish lira
VAR	vector autoregression
WB	World Bank
WEO	World Economic Outlook

Appendix A.1: Derivation of Public Debt Decomposition Dynamics

The following section provides a detailed description of the methodology used for decomposing public debt dynamics. Section A.1.1 lists the variables and their definitions used in the debt decomposition. Section A.1.2 derives the debt decomposition equation. Section A.1.3 derives the inflation and seigniorage formulas used in the template.

A.1.1 Set of Variables

- 1) $D_t = B_t + e_t B_t^* - e_t NFA_t^*$, public sector net debt
- 2) B_t : domestic debt in LCU
- 3) B_t^* : foreign debt in dollar terms
- 4) NFA_t^* : net foreign assets in dollar terms
- 5) e_t : end-of period exchange rate LCU/\$
- 6) M_t^{bop} : monetary base at the beginning of period in time t (or monetary base eop at t-1)
- 7) i_t^d : domestic interest rate paid over the period (t-1,t]
- 8) i_t^f : foreign interest rate paid on foreign debt and reserves on the period (t-1,t]
- 9) i_t^l : LIBOR rate paid on net foreign assets of the central bank on the period (t-1,t]
- 10) $P_{t,AV}$: average CPI level for period t
- 11) $\pi_{t,AV} = (P_{t,AV} - P_{t-1,AV}) / P_{t,AV}$ is average consumer price inflation in the year t
- 12) $\pi_t^* = (P_t^* - P_{t-1}^*) / P_t^*$, where P_t^* is the average U.S consumer price index.
- 13) Y_t : real GDP in period t in LCU
- 14) $g_t = (Y_t - Y_{t-1}) / Y_t$, real GDP growth rate in the year t.
- 15) $s_t = (e_t - e_{t-1}) / e_{t-1}$,
- 16) $\hat{e}_t = (1 + s_t) * (1 + \pi_t^*) / (1 + \pi_t) - 1$ is the rate of change in the bilateral real exchange rate (LCU per 1 USD) $e_t P_t^* / P_t$, where + denotes real depreciation, while - denotes real appreciation.
- 17) Small letters, d_t, b_t, b_t^*, nfa_t^* denote ratios of D_t, B_t, B_t^*, NFA_t^* to GDP.
- 18) $\sigma_t = (M_{t+1}^{bop} - M_t^{bop}) / P_t Y_t$ is defined as seigniorage revenue.
- 19) OF_t : other exogenous factors of public debt accumulation that may increase or decrease the outstanding stock of net public debt such as privatization receipt or recognition of contingent liabilities.

A.1.2 Public Debt Decomposition Equation

$$D_t = B_t + e_t \cdot B_t^* - e_t \cdot NFA_t^* = (G_t - T_t) - (M^{bop}_{t+1} - M^{bop}_t) + (1+i^d_t) \cdot B_{t-1} + (1+i^f_t) \cdot e_t \cdot B_{t-1}^* - (1+i^l_t) \cdot e_t \cdot NFA_{t-1}^* + OF_t \quad (1)$$

Let divide eq. (1) by $P_t Y_t$:

$$d_t = b_t + b_t^* - nfa_t^* = (g_t - t_t) - \sigma_t + \frac{(1+i^d_t) \cdot b_{t-1}}{(1+g_t) \cdot (1+\pi_t)} + \frac{(1+i^f_t) \cdot (1+s_t) \cdot b_{t-1}^*}{(1+g_t) \cdot (1+\pi_t)} - \frac{(1+i^l_t) \cdot (1+s_t) \cdot nfa_{t-1}^*}{(1+g_t) \cdot (1+\pi_t)} + of_t \quad (2)$$

Let multiply and divide the last two terms of the right-hand side by $(1+\pi_t^*)$ and group the real exchange rate components in $(1+\hat{e}_t)$:

$$d_t = b_t + b_t^* - nfa_t^* = (g_t - t_t) - \sigma_t + \frac{(1+i^d_t) \cdot b_{t-1}}{(1+g_t) \cdot (1+\pi_t)} + \frac{(1+i^f_t) \cdot (1+\hat{e}_t) \cdot b_{t-1}^*}{(1+g_t) \cdot (1+\pi_t^*)} - \frac{(1+i^l_t) \cdot (1+\hat{e}_t) \cdot nfa_{t-1}^*}{(1+g_t) \cdot (1+\pi_t^*)} + of_t \quad (3)$$

Let subtract d_t from eq. (3):

$$\Delta d_t = d_t - d_{t-1} = \Delta b_t + \Delta b_t^* - \Delta nfa_t^* = (g_t - t_t) - \sigma_t + \frac{(1+i^d_t) \cdot b_{t-1}}{(1+g_t) \cdot (1+\pi_t)} - b_{t-1} + \frac{(1+i^f_t) \cdot (1+\hat{e}_t) \cdot b_{t-1}^*}{(1+g_t) \cdot (1+\pi_t^*)} - b_{t-1}^* - \left(\frac{(1+i^l_t) \cdot (1+\hat{e}_t) \cdot nfa_{t-1}^*}{(1+g_t) \cdot (1+\pi_t^*)} \right) - nfa_{t-1}^* + of_t \quad (4)$$

Let decompose the real growth components $g_t / (1+g_t)$ from eq. (4)

$$\Delta d_t = d_t - d_{t-1} = \Delta b_t + \Delta b_t^* - \Delta nfa_t^* = (g_t - t_t) - \sigma_t + \frac{(i^d_t - \pi_t) \cdot b_{t-1}}{(1+\pi_t) \cdot (1+g_t)} - \frac{g_t}{(1+g_t)} b_{t-1} + \frac{(i^f_t \cdot (1+\hat{e}_t) - \pi_t^*) \cdot b_{t-1}^*}{(1+\pi_t^*) \cdot (1+g_t)} + \frac{\hat{e}_t \cdot b_{t-1}^*}{(1+\pi_t^*) \cdot (1+g_t)} - \frac{g_t}{(1+g_t)} \cdot b_{t-1}^* - \left(\frac{(i^l_t \cdot (1+\hat{e}_t) - \pi_t^*) \cdot nfa_{t-1}^*}{(1+\pi_t^*) \cdot (1+g_t)} + \frac{\hat{e}_t \cdot nfa_{t-1}^*}{(1+\pi_t^*) \cdot (1+g_t)} - \frac{g_t}{(1+g_t)} \cdot nfa_{t-1}^* \right) + of_t$$

Or

$$\Delta d_t = \Delta b_t + \Delta b_t^* - \Delta nfa_t^* = (g_t - t_t) - \sigma_t - \frac{g_t}{(1+g_t)} \cdot d_{t-1} + \frac{(i^d_t - \pi_t) \cdot b_{t-1}}{(1+\pi_t) \cdot (1+g_t)} + \frac{(i^f_t \cdot (1+\hat{e}_t) - \pi_t^*) \cdot b_{t-1}^*}{(1+\pi_t^*) \cdot (1+g_t)} - \frac{(i^l_t \cdot (1+\hat{e}_t) - \pi_t^*) \cdot nfa_{t-1}^*}{(1+\pi_t^*) \cdot (1+g_t)} + \frac{\hat{e}_t \cdot (b_{t-1}^* - nfa_{t-1}^*)}{(1+\pi_t^*) \cdot (1+g_t)} + of_t \quad (5)$$

Table 1 highlights the different components of equation (5) with the sign of the contribution to the change in net public debt:

Table A1. Component of the change in public net debt

Component	Formula	Sign
1) Primary balance:	$(g_t - t_t)$	+
2) Seigniorage:	σ_t	-
3) Real GDP growth:	$\frac{g_t}{(1 + g_t)} \cdot d_{t-1}$	-
4) Domestic real interest rate cost:	$\frac{(i_t^d - \pi_t) \cdot b_{t-1}}{(1 + \pi_t) \cdot (1 + g_t)}$	+
5) Foreign real interest rate cost	$+ \frac{(i_t^f \cdot (1 + e_t) - \pi_t^*) \cdot b_{t-1}^*}{(1 + \pi_t^*) \cdot (1 + g_t)}$ $- \frac{(i_t^l \cdot (1 + e_t) - \pi_t^*) \cdot nfa_{t-1}^*}{(1 + \pi_t^*) \cdot (1 + g_t)}$	+
6) Capital loss due to real exchange rate appreciation	$\frac{e_t \cdot (b_{t-1}^* - nfa_{t-1}^*)}{(1 + \pi_t^*) \cdot (1 + g_t)}$	+

A.1.3 Public Debt Decomposition in Oil Rich Countries

In oil rich countries (ORC), a substantial share of fiscal revenues is derived from exhaustible natural resources (oil and gas, referred to simply as “oil”). With respect to the previous debt decomposition, the primary fiscal deficit is replaced with the non-oil primary deficit and net oil revenues are treated as a financing flow. Equation (3) above is modified to apply a fiscal rule governing the use of oil assets: net oil revenues, determined at a budget price, finances the non-oil primary deficit and additional net oil assets accumulate in an oil fund distinguished from net foreign assets.

Total stock of oil assets OIL is denominated in dollar terms and it is decomposed into

$$OIL^* = OilR_t + OA^*_t + (1 + i^l) \cdot OIL^*_{t-1} \quad (6)$$

With OilR defined as oil revenues evaluated at the reference price assumed in the government budget net of oil related expenditure and transfers; OA* defined as the difference between the increase of oil assets at market price net of OilR; and the interest earned on the stock of oil assets in the previous period, assumed to be equal to the interest earned on NFA.

Net debt in percent of GDP d is now defined as domestic and external public debt net of central bank holding of government securities, of NFA and of oil assets, defining lower case variables as upper case variables in percent of GDP:

$$d_t = b_t + b_t^* - nfa_t^* - oil_t^* = (g_t - t_t) - oilr_t - \sigma_t + \frac{(1+i^d_t) \cdot b_{t-1}}{(1+g_t) \cdot (1+\pi_t)} + \frac{(1+i^f_t) \cdot (1+\hat{e}_t) \cdot b_{t-1}^*}{(1+g_t) \cdot (1+\pi_t^*)} + \frac{(1+i^l_t) \cdot (1+\hat{e}_t) \cdot nfa_{t-1}^*}{(1+g_t) \cdot (1+\pi_t^*)} - oa_t^* - \frac{(1+i^l_t) \cdot (1+\hat{e}_t) \cdot oil_{t-1}^*}{(1+g_t) \cdot (1+\pi_t^*)} + of_t \quad (3')$$

Analogously as the previous debt decomposition, let subtract d_{t-1} and let decompose the real growth components $g_t/(1+g_t)$ and the real exchange rate component from eq. (3'):

$$\Delta d_t = \Delta b_t + \Delta b_t^* - \Delta nfa_t^* - \Delta oil_t^* = (g_t - t_t) - oilr_t - \sigma_t - \frac{g_t}{(1+g_t)} \cdot d_{t-1} + \frac{(i^d_t - \pi_t) \cdot b_{t-1}}{(1+\pi_t) \cdot (1+g_t)} + \frac{(i^f_t - \pi_t^*) \cdot b_{t-1}^*}{(1+\pi_t^*) \cdot (1+g_t)} - \frac{(i^l_t - \pi_t^*) \cdot nfa_{t-1}^*}{(1+\pi_t^*) \cdot (1+g_t)} + \frac{\hat{e}_t \cdot [(1+i^f_t) \cdot b_{t-1}^* - (1+i^l_t) \cdot (nfa_{t-1}^* + oa_{t-1}^*)]}{(1+\pi_t^*) \cdot (1+g_t)} + \frac{(i^l_t - \pi_t^*) \cdot oa_{t-1}^*}{(1+\pi_t^*) \cdot (1+g_t)} - oa_t^* + of_t \quad (5')$$

According to eq. (5'), change in net public debt in percent of GDP is determined by non-oil primary deficit, oil revenues at budget price, seigniorage revenue, the real interest rate growth differential, capital gains (losses) from real exchange rate appreciation (depreciation), net accumulation of oil assets, interest earned on the stock of oil assets and other factors net.

Table 2 highlight the different component of equation (5') with the sign of the contribution to the change in net public debt:

Table A2. Component of the change in net public debt to GDP ratio for ORC

Component	Formula	Sign	Line in "Table"
1) Non-oil primary balance:	$(g_t - t_t)$	+	4
2) Oil revenues at reference price	$oilr_t$	-	7
3) Seigniorage:	σ_t	-	8
4) Domestic real interest rate cost:	$\frac{(i^d_t - \pi_t) \cdot b_{t-1}}{(1+\pi_t) \cdot (1+g_t)}$	+	12
5) Foreign real interest rate cost	$\frac{(i^f_t - \pi_t^*) \cdot b_{t-1}^*}{(1+\pi_t^*) \cdot (1+g_t)}$	+	13
6) Real GDP growth:	$\frac{g_t}{(1+g_t)} \cdot d_{t-1}$	-	14
7) Capital loss due to real exchange rate depreciation	$\frac{\hat{e}_t \cdot [(1+i^f_t) \cdot b_{t-1}^* - (1+i^l_t) \cdot (nfa_{t-1}^* + oa_{t-1}^*)]}{(1+\pi_t^*) \cdot (1+g_t)}$	+	15
8) Net changes in the assets of the oil stabilization fund	$\frac{(i^l_t - \pi_t^*) \cdot (nfa_{t-1}^* + oa_{t-1}^*)}{(1+\pi_t^*) \cdot (1+g_t)} + oa_t^*$	-	16

A.1.4 Inflation and seigniorage formulas

To account for the Laffer curve property of seigniorage revenue with respect to nominal money growth and inflation, we benchmark seigniorage revenue using a Cagan money demand function, where nominal base money stock at the beginning of each period is a function of nominal income $P_t \cdot Y_t$ and expected average inflation π_t during the period t .

$$M_t^{bop} = A \cdot P_t \cdot Y_t \cdot e^{-\eta \cdot \pi_t}$$

Where M_t^{bop} is base money at the beginning of period t , or end of period $t-1$; P_t is the CPI index average for the year t , $\pi_t = (P_t - P_{t-1})/P_t$ is the average inflation rate in period t , Y_t is the real GDP in year t , η is the semi-elasticity of demand for money with respect to inflation, A is a constant term.

Seigniorage σ in period t is defined as the change in the real stock of base money over the period t , measured in percent of real GDP:

$$\begin{aligned} \sigma_t &= \frac{M_{t+1}^{bop} - M_t^{bop}}{P_t \cdot Y_t} = A \cdot \frac{P_{t+1} Y_{t+1} e^{-\eta \pi_{t+1}} - P_t Y_t e^{-\eta \pi_t}}{P_t \cdot Y_t} = \\ &= e^{-\eta \pi_{t+1}} [(1 + g_{t+1}) \cdot (1 + \pi_{t+1})] - e^{-\eta \pi_t} \end{aligned}$$

For example, to calculate seigniorage revenue as a percent of GDP for 2004, we would need to take the difference between the stock of base money beginning 2005 and beginning 2004 and divide that by the product of the average price level in 2004 and the real GDP for 2004. Since the stock of base money is usually reported at the end of the year, we substitute the beginning 2005 year stock of base money with end of the previous year stock of base money (2004). Thus seigniorage revenue could be re-written as the difference between stock of base money at the end 2004 and the stock of base money at the end-2003, divided by the product of 2004 average price level and the real GDP.

Essentially, seigniorage revenue as a share of GDP depends on the elasticity of demand for money with respect to inflation, GDP growth and average inflation.

In the steady state, under the assumption of constant inflation and growth, the seigniorage revenue could be rewritten as follows:

$$\sigma = e^{-\eta \pi} [(1 + g) \cdot (1 + \pi) - 1]$$

Appendix A.2 Multivariate Stochastic Simulations

The interaction of the underlying variables can be represented by a vector autoregressive model (VAR) defined as follows. Let V be a vector, composed of the real interest rate on foreign and domestic debt, real GDP growth rate, and the change in the real exchange rate, e -hat.

$$V_t = (r_t^f, r_t^d, g_t, \hat{e}_t)$$

The vector evolves in an autoregressive pattern.

$$V_t = \beta_0 + \sum_{k=1}^K \beta_k V_{t-k} + \varepsilon_t$$

where $\varepsilon \sim (0, \Sigma)$ represents a vector of serially uncorrelated normal errors with

$E\varepsilon_t \varepsilon_s = 0$, for $t \neq s$. The contemporaneous and serial correlations among the forcing variables are incorporated via the coefficients and Σ . Econometric regression on historical data will yield estimates of the coefficients, $\hat{\beta}$'s and an estimate of the variance-covariance matrix $\hat{\Sigma}$.

Once the VAR system is estimated, the VAR model can then be used to generate a vector of shocks \bar{y}_t normally distributed with covariance matrix $\hat{\Sigma}$. This is done in a 2-step process. First generate four time series of random numbers, x_t *i.i.d.* as a standard normal distribution with mean 0 and variance 1, and using Monte Carlo simulations. Next, series of shocks to the underlying variables $(r_t^f, r_t^d, g_t, \hat{e}_t)$ with the appropriate covariance matrix $\hat{\Sigma}$ are created by defining $y_t = Lx_t$, where L is the Choleski factorization of $\hat{\Sigma}$, specifically $L'L = \hat{\Sigma}$.

If a fiscal policy reaction is chosen as an option, the primary fiscal balance pd_t is computed by incorporating the fiscal response to last period's debt-to-GDP ratio. The resulting debt-to-GDP ratios are updated from year to year by feeding the simulated $(r_t^f, r_t^d, g_t, \hat{e}_t)$ and pd_t into the debt updating equation and repeating these steps until the terminal year of projection.

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