

INTERNATIONAL DEVELOPMENT ASSOCIATION  
INTERNATIONAL MONETARY FUND

**REPUBLIC OF MADAGASCAR**

**Joint Bank/Fund Debt Sustainability Analysis 2008**

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and the International Monetary Fund

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*Madagascar's risk of debt distress remains low. The stress tests reveal that external debt sustainability is most sensitive to export shocks, given Madagascar's concentration of exports in textiles and mining products. The inclusion in the analysis of the relatively small amount of domestic debt does not change the assessment of the country's risk of debt distress.*

**I. Introduction**

1. **This debt sustainability analysis (DSA) has been prepared jointly by IMF and World Bank staff.** It is based on the framework for low-income countries approved by the respective Executive Boards. The framework takes into account indicative thresholds for external debt burden indicators determined by the quality of the country's policies and institutions.<sup>1</sup> It comprises a baseline scenario (which assumes, among others, full delivery of HIPC Initiative debt relief by external creditors) and a set of alternative scenarios.

**II. Recent Developments and Current Debt Situation**

2. **Madagascar reached its completion point under the Enhanced HIPC Initiative in October 2004.** The resulting debt relief, including additional bilateral debt relief from most Paris Club creditors, reduced the end-2003 NPV of debt-to-exports ratio to an estimated 137 percent.<sup>2</sup> At that time, the ratio was projected to increase to 154 percent in 2004 and

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<sup>1</sup> According to the World Bank Country and Policy Institutional Assessment (CPIA) Index, Madagascar is rated as a medium performer. This rating is the same using either the latest index or the three-year average. The indicative thresholds for external debt applicable for that category of countries are: (i) 150 percent for NPV of debt-to-exports ratio; (ii) 40 percent for the NPV of debt-to-GDP ratio; (iii) 250 percent for the NPV of debt to fiscal revenues ratio; (iv) 20 percent for the debt service to exports ratio; and (v) 30 percent for the debt service to revenue ratio.

<sup>2</sup> Total debt relief to Madagascar under the Initiative amounts to US\$836 million in NPV terms.

decline thereafter. Most Paris Club creditors have written-off their outstanding claims after full delivery of HIPC debt relief. In 2007, an agreement was concluded with Japan concerning a number of loans. The agreements on a Japanese loan and with the Russian Federation are in the process of finalization. Regarding non-Paris Club creditors, agreements were concluded with the Abu Dhabi Fund and the People's Republic of China. As of end-2007, Madagascar has an estimated US\$595 million in arrears towards non-Paris Club and private creditors that are not delivering HIPC debt relief (with Algeria, Libya, and Iraq accounting for 97 percent of the total). Madagascar continues to make efforts to contact these creditors, regularize payments, and obtain full debt relief under the HIPC Initiative.

3. **Madagascar's external public debt declined significantly from US\$3.5 billion at end-2005 (including arrears) to US\$1.7 billion at end-2007 on the account of the debt relief under MDRI.**<sup>3</sup> The MDRI debt relief has triggered a change in the creditor composition. The share of multilateral creditors has decreased from more than 75 percent at end-2005 to 58 percent at end-2007. Conversely, bilateral and commercial creditors represented 41 percent of total outstanding obligations (with Paris Club creditors accounting for 6 percent), compared to about 23 percent by end-2005. The bilateral Paris Club debt that remains is mainly to Russia.

**Madagascar : External Debt Outstanding, end-2007**

Creditor	Amounts (millions of US\$)	In percent of GDP	Share (in percent)
Total external debt	1729.8	23.4	100
Bilateral Creditors	712.2	9.7	41
Paris Club	96.3	1.3	6
Other countries	619.6	8.4	36
Private creditors	14.8	0.2	1
Multilateral	999.1	13.5	58

Source: Madagascar authorities and Fund staff estimates

<sup>3</sup> See [www.imf.org](http://www.imf.org) for details on the implementation of the MDRI by the IMF. The amount of relief includes undisbursed HIPC assistance from the Fund, previously expected to be delivered over time, and MDRI assistance. Excluding the HIPC share, the MDRI debt relief amounts to US\$186 million. For details on the implementation of the MDRI by IDA, see IDA/SecM2005 and IDA/SecM2006-0131.

### III. Baseline Medium- and Long-Term Scenario

4. **The baseline scenario remains broadly similar to the one described in the previous DSA (Box 1).**<sup>4</sup> Construction costs of the two large mining projects have been revised upward. Construction of an ilmenite mine (US\$805 million, 11 percent of GDP) began in 2006 and construction of a nickel and cobalt mine and processing facility (US\$3.2 billion, 44 percent of GDP) commenced in 2007. They will be completed over the next three years. Such a large inflow of capital is leading to upward pressure on the currency and these mining projects will result in higher economic growth and, starting in 2009/10, in higher exports. Starting in 2008, the bulk of the largest mining project will be financed by a US\$2.1 billion private commercial loan triggering a substantial increase in the country's nominal external debt from 23 percent of GDP in 2007 to 41 percent in 2009 and 2010. Because of this loan, the NPV of total external debt-to-GDP and total external debt-to-exports would increase substantially. However, the ratios would remain relatively low and decline rapidly as soon as production starts. In contrast, the public and publicly guaranteed debt is expected to remain broadly stable at about 23 percent of GDP in the short run before increasing slightly to reach about 26 percent by 2028 (Table 1).

5. **The baseline scenario is premised on the implementation of sound macroeconomic and structural policies and concessional external financing.** Key macroeconomic assumptions are indicated in Box 1. Grants and loans, which had climbed very rapidly to close to 14 percent of GDP in 2004 due to large inflows of external aid and borrowing to finance recovery after the 2002 political crisis, will remain relatively high in the short term (increasing from 8 percent of GDP in 2007 to 9 percent of GDP in 2008 based on recent information from donors) and gradually decrease to about 6 percent of GDP by the end of the projection period. New borrowing is projected to remain largely at concessional terms. Borrowing, in the short run, is based on the projections provided by donors as of March 2008. Borrowing projections over the longer run are based on historical patterns. The share of bilateral loans is assumed to be slightly larger than in the recent past. As a result, the grant element of new public sector borrowing is expected to decline from about 48 percent in 2008 to less than 45 percent starting in 2009. Borrowing projections do not include additional borrowing requirements that would be needed to fully attain the objectives of the Madagascar Action Plan (MAP).<sup>5</sup> Once quantified, these figures will be reflected in future updates of the DSA.

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<sup>4</sup> See Madagascar, Joint IDA-IMF Staff Advisory Note on the Poverty Reduction Strategy Paper, Madagascar Action Plan 2007-2012, January 26, 2007 (Report No. 38469-MG) and IMF Country Report No. 07/236, Republic of Madagascar: 2007 Article IV Consultation - Staff Report (<http://www.imf.org/external/country/MDG/index.htm>).

<sup>5</sup> Fourth Poverty Reduction Support Credit to the Republic of Madagascar, May 25, 2007 (Report No. 39028) and Country Report No. 07/59, Republic of Madagascar: Poverty Reduction Strategy Paper—Madagascar Action Plan (<http://www.imf.org/external/country/MDG/index.htm>).

### Box 1. Baseline Macroeconomic Assumptions

**Real GDP growth** is projected at about 7 percent on an annual basis on average over 2008–28. This growth rate is higher than the historical average (5 percent over 1998–2007 if the impact of the political turmoil of 2002 is excluded) due to the impact of two large mining projects that started at the end of 2006.

**Inflation** as measured by the GDP deflator in dollar terms is projected to average about 4 percent, with higher rates of 14 percent in 2008 and decelerating to 3 percent subsequently. However, reflecting the impact of the large inflows of FDI on the exchange rate, which in turn will depend crucially of the monetary policy undertaken, the increase in the GDP deflator in local currency is expected to decelerate from 9.7 percent in 2008 to 5 percent beginning in 2012.

**Export volumes** are projected to grow at close to 9 percent on average during the period 2008–28 and support GDP growth. The export growth rates jump in 2010 when the exports of the big mining projects start.

**Import volumes** average 5 percent for the period 2008–28. Import volumes are expected to grow significantly due to the high import content (estimated at about 80 percent) of the mining projects during their construction phase and will then slow down to about 5 percent.

**The current account deficit** is projected to increase significantly during the initial years of the projections due to the large increase in imports related to the big mining projects. However, as exports of these projects start, the current account deficit would gradually shrink from about 23 percent of GDP in 2008 to 9 percent by 2010 and 6 percent by the end of the projection period.

**Tax revenues** are projected to increase from 11.4 percent of GDP in 2007 to about 16 percent of GDP in 2027, as a result of tax policy reforms aimed at simplifying the tax regime, the termination of ad hoc tax and import duty exemptions, and steadfast improvements in tax and custom administration.

**Total government expenditures** are aimed to absorb available financing from tax revenue and external assistance, resulting in an increase of about 5 percent of GDP over the projection period.

**External grants and loans** progressively unwinds from the exceptionally high level of about 11 percent of GDP on average during the period 2004 to 2006 (in part for financing of recovery after the 2002 political crisis) to about 7 percent of GDP over 2008–13 and to 6 percent of GDP in the outer years.

6. **Under the baseline scenario, Madagascar’s external debt indicators remain well below the relevant thresholds throughout the projection period** (Figure 1 and Table 1). The external debt indicators dropped sharply in 2006 as a result of the MDRI (Table 1). The NPV of public and publicly guaranteed debt-to-GDP ratio which was about 36 percent in 2005 <sup>6</sup> (a level already below the threshold for medium performers) dropped to about 17 percent in 2007 and is projected to remain at this level for the projection period. Reflecting improvement in tax collection (Box 1), the NPV of debt-to-revenue ratio would decline more rapidly from about 145 percent in 2007 to about 103 percent at the end of the period. In the short run, structural problems in the shrimp sector and the slowdown in global economy in 2008 will lead to a slight deterioration of the NPV of debt-to-exports ratio up to 2009. In the medium run, the NPV of debt-to-exports is mainly driven by the impact of the big mining projects. These projects are expected to start exporting by end-2009 or in 2010. The value of these exports is so large that the ratio is projected to drop from 61 percent in 2009 to 47 percent in 2010 and grow through the projected period (but remaining well below the threshold) due to new borrowing. The debt service-to-exports and debt service-to-revenue ratios exhibit a similar pattern. Moreover, given the highly concessional nature of the existing debt and new borrowing, the debt service ratios are well below the indicative thresholds throughout the projection period but show a rising trend due to the accumulation of new debt.

7. **Madagascar’s total public debt ratios, including domestic debt, also stay well below the external debt indicative thresholds under the base case scenario** (Figure 2 and Table 3). The domestic debt is projected to remain under 10 percent of GDP through the projection period, as total expenditure is assumed to be broadly kept in check with available financing from tax revenue and external assistance, and the fiscal deficit is projected to remain predominantly financed by grants and loans on concessional terms.

#### IV. Sensitivity Analysis

##### *External public debt indicators*

8. **The sensitivity analysis suggests that the external debt indicators are low but could deteriorate with inappropriate policies, and/or if confronted by adverse shocks. However, they would generally remain below the thresholds.**<sup>7</sup>

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<sup>6</sup> See IMF Country Report No. 06/306, Republic of Madagascar: Request for a Three-Year Arrangement Under the Poverty Reduction and Growth Facility and Activation of the Trade Integration Mechanism (<http://www.imf.org/external/country/MDG/index.htm>).

<sup>7</sup> The stress tests performed under the sensitivity scenario assumed permanent modifications of key baseline assumptions (“alternative scenarios”) as well as temporary deviations (“bound tests”). The alternative scenarios include a “historical scenario”, under which the main variables that determine the debt dynamics are assumed to remain at their historical average, and a “financing scenario” that depicts the impact of lower concessionality in new borrowing. The “bound tests” are designed to examine the impact on debt and debt service indicators of shocks, based on the country’s historical volatility, to key variables.

- The debt indicators in the **historical scenario** (Figure 1 and Scenario A1 in Table 2 based on the average of the years 1998–2007) follow a lower trajectory than under the baseline. It should be noted, however, that the years leading up to 2007 include years of political turmoil, large terms of trade shocks, cyclones, and natural disasters. During that period, although real growth averaged only about 3.5 percent, the current account deficit was also low, averaging 6.5 percent of GDP. This explains the relatively benign trajectory of the debt indicators under the historic scenario.
- The **financing scenario** (Scenario A2) reveals that Madagascar’s external debt indicators are sensitive to the terms of new borrowing. Under this scenario, the NPV of debt-to-GDP remains below the threshold but would increase gradually from 16 percent in 2008 to 23 percent in 2018 and 26 in 2028. The NPV of debt-to-exports ratio would increase steadily from 60 percent in 2008 to 80 percent in 2018 and 124 in 2028. This increase is substantial, although the ratio would remain below the threshold. The projected path of these two ratios, together with the rising trend of the debt service to export ratio from 2 to 7 percent during the projection period, points to risks from new borrowing at less favorable terms than assumed in the baseline scenario.<sup>8</sup> In contrast, the ratio of NPV of debt-to-revenue would remain stable until 2011 before increasing to about 160 percent in 2028. The debt service to revenue ratio would increase from 4 percent in 2008 to 9 percent in 2028.
- **The bound tests do not reveal major underlying risks but highlight vulnerabilities to changes in the inflows of FDI and to their impact on growth and exports.** The most extreme stress tests show the impact of the combined FDI and growth shock on the NPV of debt-to-GDP and NPV of debt-to-revenue ratios (Scenario B5) do not result in indicators significantly breaching thresholds. The NPV of debt-to-GDP increases significantly (to 31 percent in the medium run before declining to 24 percent in 2028) but is comfortably below the threshold level. The NPV of debt-to-revenue would be closer to the threshold but would fall relatively rapidly after 2011. In contrast the NPV of debt-to exports ratio would be persistently above the threshold starting in 2010 under the exports shock scenario (Scenario B2). It should be noted, however, that this extremely pessimistic assumes that the two export-oriented large mining projects fail to export, while construction is moving in both sites. By construction, this scenario assumes a decline in exports in 2009 and 2010, at the very same moment the two large mining projects are expected to start, triggering a major increase in Madagascar total exports.<sup>9</sup> Under more realistic scenarios, the vulnerabilities associated with the big mining projects appear limited. Even if the expansion plan of the ilmenite project (Box 1) does not materialize or if exports of the large mining projects are only 1/3 of their baseline level (due either to a lower volume and/or to lower export prices) the NPV of debt-to-exports would remain below the threshold. These stress tests point nonetheless to the export concentration as a key vulnerability, as the exports of the two large

<sup>8</sup> This scenario is similar to a sharp decline in grant financing, compared to the baseline, compensated by loans.

<sup>9</sup> Even under this unrealistic scenario the debt-service-to-exports ratio would remain significantly below the threshold.

mining projects and textiles exports are expected to account for about two thirds of exports of goods over 2011–17.

***Potential impact of additional borrowing to finance the Madagascar Action Plan and the objectives of the Millennium Development Goals (MDG).***

9. Reaching the MAP and the MDG objectives will require a scaling up of external grants and loans. At the same time, a prudent borrowing strategy will be essential to ensure that the gains resulting from HIPC and MDRI relief are preserved. For illustrative purposes, staff quantified the potential impact of a substantial increase in public borrowing.<sup>10</sup> If public borrowing were to be three times larger than the SDR 1.9 billion assumed in the baseline scenario for the period 2009–15, the country’s risk of debt distress would be significantly increased, as illustrated by one of the ratios (NPV of debt-to-revenue) exceeding its indicative threshold.<sup>11</sup> Moreover, any adverse shock or disappointing macroeconomic outcome would lead to a breach of other indicative sustainability thresholds. This highlights the higher risk of debt distress associated to such a level of additional borrowing.

***Total public debt indicators***

10. **Total public debt indicators are most sensitive to economic growth shocks.** A temporary or permanent deviation from the baseline real GDP growth path would result in a deterioration of the total public debt ratios compared to the baseline at the end of the projection period, if spending plans were kept unchanged, which is unlikely in view of past experience (Table 4, Scenarios A3 and B1).

**V. Debt Distress Classification and Conclusions**

11. **Madagascar’s risk of debt distress remains low following the debt relief under the HIPC Initiative and the MDRI.**<sup>12</sup> In the baseline scenario, Madagascar’s debt indicators, albeit somewhat higher than in the previous DSA, remain well below the relevant indicative thresholds. The debt situation does not appear to be significantly vulnerable to shocks. Nonetheless, Madagascar’s debt outlook appears most sensitive to export shocks, given the high export concentration in textiles and two mining products. The sensitivity analysis points to the need not only for implementing the policies underpinning the baseline scenario, but also for careful monitoring of borrowing policies and good export performance.

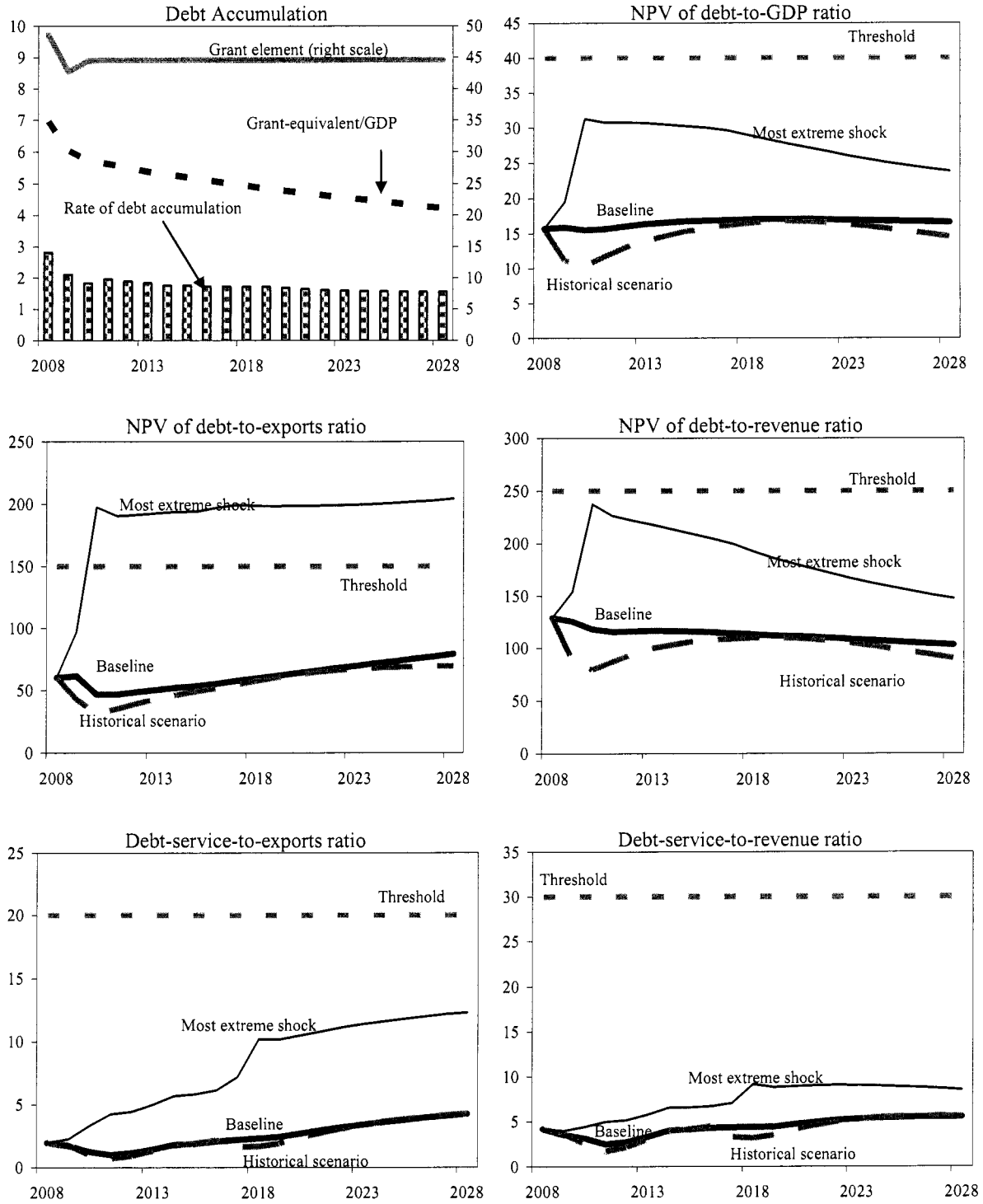
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<sup>10</sup> Projection for grants remains at the level in the baseline scenario.

<sup>11</sup> This scenario assumes no impact of increased borrowing on growth and exports, no absorptive capacity constraint, and no co-financing by the budget. After 2015, annual borrowing is assumed to be similar to borrowing in the baseline.

<sup>12</sup> The risk of debt distress is low, although the threshold of NPV of debt-to-export ratio is breached in a bound test. As explained in the sensitivity analysis, this bound test is extremely pessimistic because it assumes that the two export-oriented large mining projects fail to export. Under more realistic alternative stress tests, the threshold would not be breached.

Figure 1. Madagascar: Indicators of Public and Publicly Guaranteed External Debt Under Alternative Scenarios, 2008-2028



Source: Staff projections and simulations.

Table 1. Madagascar: External Debt Sustainability Framework, Baseline Scenario, 2005-2028 1/ (In percent of GDP, unless otherwise indicated)

	Actual			Historical Average 6/	Standard Deviation 6/	Projections							2014-28 Average
	2005	2006	2007			2008	2009	2010	2011	2012	2013	2008-13 Average	
<b>External debt (nominal) 1/</b>	72.7	29.2	23.4	32.1	40.7	40.8	38.5	37.1	35.8	30.7	26.2	26.2	
o/w public and publicly guaranteed (PPG)	72.7	29.2	23.4	23.0	23.6	23.3	23.7	24.4	24.9	26.3	26.2	26.2	
Change in external debt	-7.2	-43.5	-5.8	8.7	8.6	0.1	-2.3	-1.4	-1.3	-0.8	0.0	0.0	
Identified net debt-creating flows	-6.4	-5.3	-7.3	10.1	7.6	-0.1	-1.9	-1.5	-1.3	-0.6	0.1	0.1	
<b>Non-interest current account deficit</b>	10.1	8.5	14.0	6.5	4.0	8.3	4.9	4.8	5.3	5.9	6.0	5.9	
Deficit in balance of goods and services	26.9	29.8	30.3	26.2	26.0	33.2	33.5	33.1	32.6	28.7	21.1	21.1	
Exports	41.0	41.1	46.6	51.2	47.5	37.6	35.4	35.0	35.2	32.7	26.4	26.4	
Imports	-4.8	-4.0	-3.0	-3.1	-2.4	-2.2	-2.0	-1.9	-1.8	-1.5	-1.0	-1.4	
Net current transfers (negative = inflow)	-1.3	-1.3	-0.4	-1.0	-0.8	-0.7	-0.7	-0.7	-0.6	-0.6	-0.5	-0.5	
o/w official	0.8	1.2	0.7	0.6	0.4	6.1	5.1	4.8	4.5	3.4	1.6	1.6	
Other current account flows (negative = net inflow)	-10.0	-6.2	-7.2	-11.4	-10.4	-5.9	-5.4	-5.4	-5.7	-1.2	-1.3	-1.3	
<b>Net FDI (negative = inflow)</b>	-6.5	-7.6	-14.1	-6.1	3.2	-1.5	-2.5	-1.4	-0.9	-1.2	-1.3	-1.3	
<b>Endogenous debt dynamics 2/</b>	0.8	0.2	0.1	0.2	0.6	1.1	1.4	1.3	1.2	0.7	0.3	0.3	
Contribution from nominal interest rate	-3.2	-3.3	-1.3	-1.3	-2.1	-3.5	-2.8	-2.2	-2.1	-1.9	-1.6	-1.6	
Contribution from real GDP growth	-7.6	-3.1	-6.0	...	...	...	...	...	...	...	...	...	
Contribution from price and exchange rate changes	-0.8	-38.2	1.5	-1.4	1.0	0.2	-0.4	0.1	0.0	-0.2	-0.2	-0.2	
<b>Residual (3-4) 3/</b>	-1.0	-0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
o/w exceptional financing	...	...	...	...	...	...	...	...	...	...	...	...	
NPV of external debt 4/	...	...	16.8	24.8	33.0	33.0	30.5	28.8	27.2	21.4	16.6	16.6	
In percent of exports	...	...	55.6	94.7	126.8	99.3	91.1	87.1	83.7	74.8	79.0	79.0	
<b>NPV of PPG external debt</b>	...	...	16.8	15.7	15.9	15.5	15.7	16.1	16.4	17.0	16.6	16.6	
In percent of exports	...	...	55.6	60.0	61.2	46.8	48.6	48.6	50.4	59.4	79.0	79.0	
<b>In percent of government revenues</b>	...	...	144.7	129.1	125.6	118.0	115.6	116.0	116.4	112.9	102.8	102.8	
Debt service-to-exports ratio (in percent)	9.2	15.5	0.9	2.0	3.4	3.9	7.5	7.0	6.7	5.3	4.3	4.3	
PPG debt service-to-exports ratio (in percent)	9.2	15.5	0.9	1.9	1.7	1.3	1.0	1.1	1.4	2.3	4.3	4.3	
PPG debt service-to-revenue ratio (in percent)	22.7	41.5	2.4	4.2	3.5	3.2	2.5	2.7	3.3	4.4	5.5	5.5	
Total gross financing need (billions of U.S. dollars)	306.7	304.9	11.4	1082.5	1028.8	430.5	260.8	245.9	285.1	536.2	1455.5	1455.5	
Non-interest current account deficit that stabilizes debt ratio	17.3	52.0	19.8	13.9	10.9	8.2	7.2	6.2	6.6	6.7	6.0	6.0	
<b>Key macroeconomic assumptions</b>													
Real GDP growth (in percent)	4.6	5.0	6.2	5.9	7.0	7.3	7.6	6.1	6.2	6.5	6.5	6.5	
GDP deflator in US dollar terms (change in percent)	10.6	4.4	25.8	4.7	16.8	4.4	4.0	3.6	3.0	3.0	3.0	3.0	
Effective interest rate (percent) 5/	1.2	0.3	0.5	1.2	0.7	1.1	2.1	3.0	3.9	3.7	3.4	2.9	
Growth of exports of G&S (US dollar terms, in percent)	-4.8	21.8	35.4	15.2	30.1	8.1	11.2	46.0	12.4	7.9	7.6	15.5	
Growth of imports of G&S (US dollar terms, in percent)	-0.1	9.8	51.5	15.5	28.1	37.4	3.7	-9.6	5.0	8.1	10.1	9.1	
Grant element of new public sector borrowing (in percent)	...	...	...	...	...	...	...	...	...	...	...	...	
Aid flows (in billions of US dollars) 7/	682.3	3075.9	717.9	...	...	...	...	...	...	...	...	...	
o/w Grants	288.9	2639.8	316.4	434.0	475.7	524.3	567.2	605.9	642.5	910.0	1846.1	1846.1	
o/w Concessional loans	265.7	267.6	248.8	371.1	317.5	334.2	384.9	415.4	454.6	704.9	1821.8	1821.8	
Grant-equivalent financing (in percent of GDP) 8/	...	...	...	7.0	6.0	5.7	5.6	5.5	5.4	4.9	4.2	4.7	
Grant-equivalent financing (in percent of external financing) 8/	...	...	...	74.5	75.9	78.4	77.6	77.5	77.0	75.8	72.5	74.8	
<b>Memorandum items:</b>													
Nominal GDP (billions of US dollars)	5040.5	5525.9	7378.5	9216.2	10322.8	11788.3	13143.3	14364.4	15717.3	24841.1	62996.4	62996.4	
(NPV:NPV-1)/GDPt-1 (in percent)	2.8	2.1	1.8	2.0	1.8	2.0	1.9	1.8	1.8	1.7	1.6	1.7	

Source: Staff simulations.

1/ Includes both public and private sector external debt.

2/ Derived as  $[r - g - \rho(1+g)] / (1+g)^t + \rho$  times previous period debt ratio, with  $r$  = nominal interest rate,  $g$  = real GDP growth rate, and  $\rho$  = growth rate of GDP deflator in U.S. dollar terms.

3/ Includes exceptional financing (i.e., changes in arrears and debt relief); changes in gross foreign assets; and valuation adjustments. For projections also includes contribution from price and exchange rate changes.

4/ Assumes that NPV of private sector debt is equivalent to its face value.

5/ Current-year interests divided by previous period debt stock.

6/ Historical averages and standard deviations are generally derived over the past 10 years, subject to data availability.

7/ Defined as grants, concessional loans, and debt relief.

8/ Grant-equivalent financing includes grants provided directly to the government and through new borrowing (difference between the face value and the NPV of new debt).

Table 2. Madagascar: Sensitivity Analyses for Key Indicators of Public and Publicly Guaranteed External Debt, 2008-28  
(In percent)

	Projections							
	2008	2009	2010	2011	2012	2013	2018	2028
<b>NPV of debt-to-GDP ratio</b>								
<b>Baseline</b>	16	16	16	16	16	16	17	17
<b>A. Alternative Scenarios</b>								
A1. Key variables at their historical averages in 2009-28 1/	16	11	10	12	13	14	16	15
A2. New public sector loans on less favorable terms in 2009-28 2/	16	17	17	18	19	20	23	26
<b>B. Bound Tests</b>								
B1. Real GDP growth at historical average minus one standard deviation in 2009-10	16	17	19	19	20	20	21	20
B2. Export value growth at historical average minus one standard deviation in 2009-10 3/	16	19	29	29	28	28	25	19
B3. US dollar GDP deflator at historical average minus one standard deviation in 2009-10	16	18	20	20	21	21	22	22
B4. Net non-debt creating flows at historical average minus one standard deviation in 2009-10 4/	16	20	21	21	21	21	20	18
B5. Combination of B1-B4 using one-half standard deviation shocks	16	19	31	31	31	31	29	24
B6. One-time 30 percent nominal depreciation relative to the baseline in 2009 5/	16	22	22	22	23	23	24	23
<b>NPV of debt-to-exports ratio</b>								
<b>Baseline</b>	60	61	47	47	49	50	59	79
<b>A. Alternative Scenarios</b>								
A1. Key variables at their historical averages in 2009-28 1/	60	43	31	35	39	43	58	69
A2. New public sector loans on less favorable terms in 2009-28 2/	60	64	51	53	57	61	81	124
<b>B. Bound Tests</b>								
B1. Real GDP growth at historical average minus one standard deviation in 2009-10	60	61	47	47	49	50	59	79
B2. Export value growth at historical average minus one standard deviation in 2009-10 3/	60	98	198	191	192	193	199	204
B3. US dollar GDP deflator at historical average minus one standard deviation in 2009-10	60	61	47	47	49	50	59	79
B4. Net non-debt creating flows at historical average minus one standard deviation in 2009-10 4/	60	78	64	62	64	65	71	84
B5. Combination of B1-B4 using one-half standard deviation shocks	60	73	116	113	115	116	125	140
B6. One-time 30 percent nominal depreciation relative to the baseline in 2009 5/	60	61	47	47	49	50	59	79
<b>NPV of debt-to-revenue ratio</b>								
<b>Baseline</b>	129	126	118	116	116	116	113	103
<b>A. Alternative Scenarios</b>								
A1. Key variables at their historical averages in 2009-28 1/	129	88	79	87	94	100	109	90
A2. New public sector loans on less favorable terms in 2009-28 2/	129	132	129	131	136	141	153	161
<b>B. Bound Tests</b>								
B1. Real GDP growth at historical average minus one standard deviation in 2009-10	129	138	145	142	143	143	139	127
B2. Export value growth at historical average minus one standard deviation in 2009-10 3/	129	153	222	210	204	199	169	119
B3. US dollar GDP deflator at historical average minus one standard deviation in 2009-10	129	143	153	150	151	151	147	134
B4. Net non-debt creating flows at historical average minus one standard deviation in 2009-10 4/	129	160	161	154	152	150	135	109
B5. Combination of B1-B4 using one-half standard deviation shocks	129	154	237	226	222	218	192	147
B6. One-time 30 percent nominal depreciation relative to the baseline in 2009 5/	129	176	166	162	163	163	158	144

Table 2. Country: Sensitivity Analyses for Key Indicators of Public and Publicly Guaranteed External Debt, 2008-28 (continued)  
(In percent)

	Projections									
	2008	2009	2010	2011	2012	2013	2018	2018	2018	2028
<b>Debt service-to-exports ratio</b>										
<b>Baseline</b>	2	2	1	1	1	1	2	2	2	4
<b>A. Alternative Scenarios</b>										
A1. Key variables at their historical averages in 2009-28 1/	2	2	1	1	1	1	2	2	2	4
A2. New public sector loans on less favorable terms in 2009-28 2/	2	2	1	1	2	2	3	3	3	7
<b>B. Bound Tests</b>										
B1. Real GDP growth at historical average minus one standard deviation in 2009-10	2	2	1	1	1	1	1	1	1	4
B2. Export value growth at historical average minus one standard deviation in 2009-10 3/	2	2	3	4	4	5	10	10	12	12
B3. US dollar GDP deflator at historical average minus one standard deviation in 2009-10	2	2	1	1	1	1	2	2	4	4
B4. Net non-debt creating flows at historical average minus one standard deviation in 2009-10 4/	2	2	2	1	1	2	3	3	5	5
B5. Combination of B1-B4 using one-half standard deviation shocks	2	2	2	2	3	3	6	6	8	8
B6. One-time 30 percent nominal depreciation relative to the baseline in 2009 5/	2	2	1	1	1	1	2	2	4	4
<b>Debt service-to-revenue ratio</b>										
<b>Baseline</b>	4	4	3	2	3	3	4	4	6	6
<b>A. Alternative Scenarios</b>										
A1. Key variables at their historical averages in 2009-28 1/	4	4	3	2	2	3	3	3	6	6
A2. New public sector loans on less favorable terms in 2009-28 2/	4	4	3	3	4	4	6	6	9	9
<b>B. Bound Tests</b>										
B1. Real GDP growth at historical average minus one standard deviation in 2009-10	4	4	4	3	3	4	5	5	7	7
B2. Export value growth at historical average minus one standard deviation in 2009-10 3/	4	4	4	4	5	5	9	9	7	7
B3. US dollar GDP deflator at historical average minus one standard deviation in 2009-10	4	4	4	3	4	4	6	6	7	7
B4. Net non-debt creating flows at historical average minus one standard deviation in 2009-10 4/	4	4	4	3	4	4	6	6	6	6
B5. Combination of B1-B4 using one-half standard deviation shocks	4	4	4	4	5	5	9	9	9	9
B6. One-time 30 percent nominal depreciation relative to the baseline in 2009 5/	4	5	4	3	4	5	6	6	8	8
<i>Memorandum item:</i>										
Grant element assumed on residual financing (i.e., financing required above baseline) 6/	43	43	43	43	43	43	43	43	43	43

Source: Staff projections and simulations.

1/ Variables include real GDP growth, growth of GDP deflator (in U.S. dollar terms), non-interest current account in percent of GDP, and non-debt creating flows.

2/ Assumes that the interest rate on new borrowing is by 2 percentage points higher than in the baseline., while grace and maturity periods are the same as in the baseline.

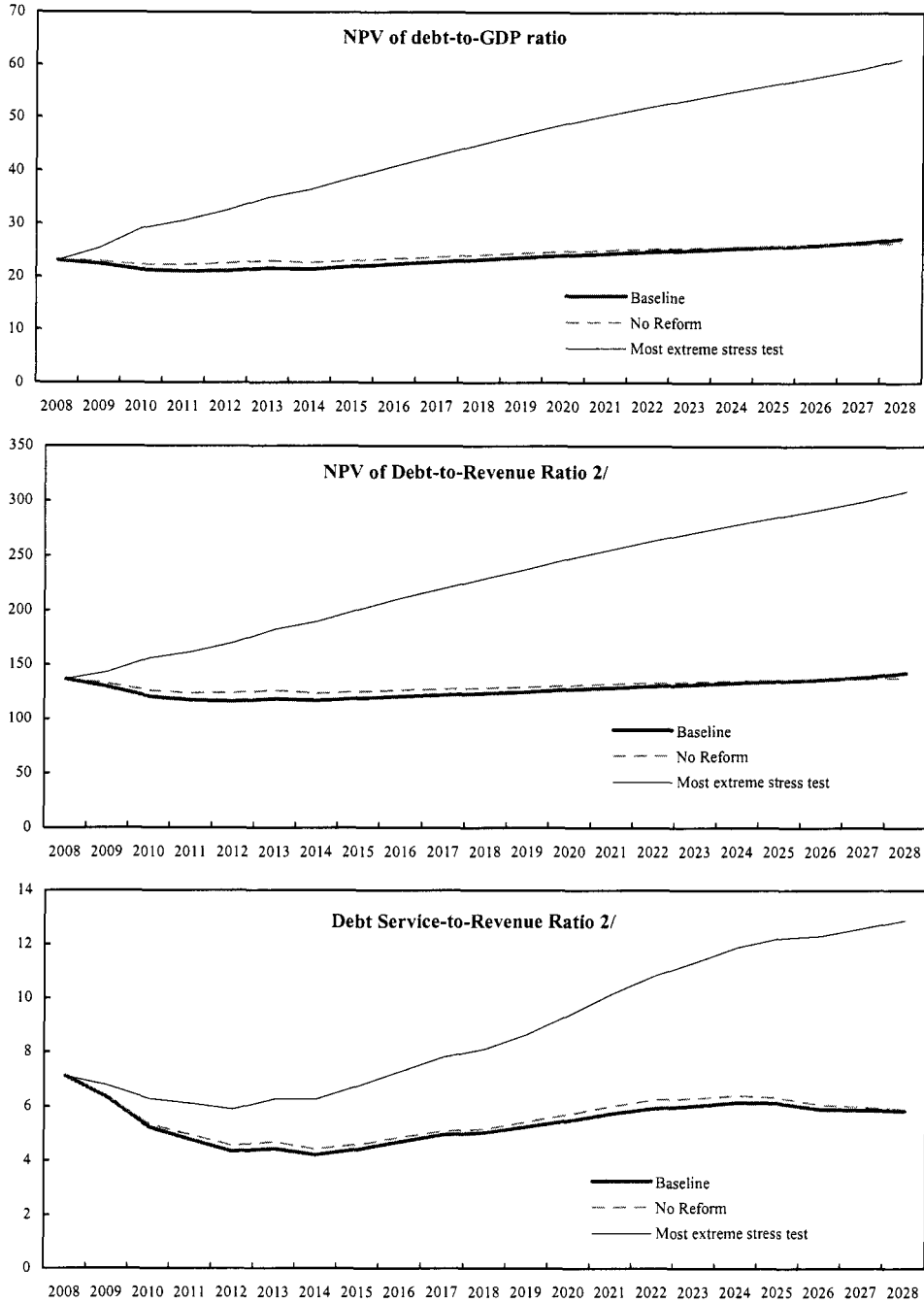
3/ Exports values are assumed to remain permanently at the lower level, but the current account as a share of GDP is assumed to return to its baseline level after the shock (implicitly assuming an offsetting adjustment in import levels).

4/ Includes official and private transfers and FDI.

5/ Depreciation is defined as percentage decline in dollar/local currency rate, such that it never exceeds 100 percent.

6/ Applies to all stress scenarios except for A2 (less favorable financing) in which the terms on all new financing are as specified in footnote 2.

**Figure 2. Madagascar: Indicators of Public Debt Under Alternative Scenarios, 2008-2028 1/**



Source: Staff projections and simulations.  
 1/ Most extreme stress test is test that yields highest ratio in 2018.  
 2/ Revenue including grants.

Table 3. Madagascar: Public Sector Debt Sustainability Framework, Baseline Scenario, 2005-2028  
(In percent of GDP, unless otherwise indicated)

	Actual					Estimate					Projections					2014-28 Average
	2005	2006	2007	Historical Average 5/ Standard Deviation 5/	2008	2009	2010	2011	2012	2013	2008-13 Average	2018	2028			
<b>Public sector debt 1/</b>	83.3	39.0	32.2		30.3	30.0	28.9	28.9	29.2	30.0	30.0	32.4	36.9			
o/w foreign-currency denominated	72.8	29.2	23.4		22.8	23.4	23.1	23.5	24.2	24.8	24.8	26.2	26.2			
Change in public sector debt	-9.1	-44.2	-6.9		-1.9	-0.3	-1.0	0.0	0.4	0.8	0.8	0.5	0.8			
Identified debt-creating flows	-4.6	-54.4	-6.2		0.1	-2.3	-1.1	-0.2	0.3	0.9	0.9	0.6	0.1			
Primary deficit	2.0	1.1	1.5	1.9	2.8	2.0	2.1	2.3	2.3	2.8	2.8	2.8	3.7			
Revenue and grants	16.7	17.9	15.9		16.9	17.3	17.6	17.9	18.1	18.2	18.2	18.7	19.1			
of which : grants	5.7	6.7	4.3		4.7	4.6	4.4	4.3	4.2	4.1	4.1	3.7	2.9			
Primary (noninterest) expenditure	18.7	19.0	17.5		19.7	19.3	19.8	20.2	20.4	21.0	21.0	21.6	22.8			
Automatic debt dynamics	-4.9	-13.6	-7.5		-2.7	-4.3	-3.2	-2.5	-2.0	-2.0	-2.0	-2.2	-2.6			
Contribution from interest rate/growth differential	-5.0	-3.9	-2.5		-2.3	-2.1	-2.8	-1.7	-1.4	-1.3	-1.3	-1.5	-2.0			
of which : contribution from average real interest rate	-0.9	0.0	-0.3		-0.2	0.0	-0.1	0.3	0.3	0.4	0.4	0.4	0.2			
of which : contribution from real GDP growth	-4.1	-4.0	-2.3		-2.1	-2.1	-2.7	-2.1	-1.7	-1.7	-1.7	-1.9	-2.2			
Contribution from real exchange rate depreciation	0.1	-9.7	-4.9		-0.4	-2.2	-0.4	-0.8	-0.6	-0.7	-0.7	...	...			
Other identified debt-creating flows	-1.7	-41.8	-0.2		-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0	0.0	-1.0			
Privatization receipts (negative)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-1.0			
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	0.0			
Debt relief (HIPC and other)	-1.7	-41.8	-0.2		-0.1	-0.1	-0.1	-0.1	-0.1	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	0.0			
Residual, including asset changes	-4.6	10.1	-0.7		-1.9	2.0	0.1	0.2	0.1	-0.1	-0.1	-0.1	0.7			
<b>NPV of public sector debt</b>	46.2	32.3	25.6		23.1	22.4	21.3	21.0	21.0	21.5	21.5	23.2	27.3			
o/w foreign-currency denominated	35.8	22.5	16.8		15.6	15.8	15.5	15.6	16.0	16.3	16.3	17.0	16.6			
o/w external	35.8	22.5	16.8		15.6	15.8	15.5	15.6	16.0	16.3	16.3	17.0	16.6			
NPV of contingent liabilities (not included in public sector debt)	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0			
Gross financing need 2/	16.5	13.4	11.2		11.5	9.6	8.7	8.3	7.9	8.1	8.1	9.0	13.6			
NPV of public sector debt-to-revenue and grants ratio (in percent)	277.1	180.4	160.8		136.7	129.5	120.6	117.2	116.2	118.6	118.6	123.7	142.7			
NPV of public sector debt-to-revenue ratio (in percent)	427.7	288.5	220.2		189.6	176.6	161.3	154.5	151.5	153.0	153.0	153.7	168.6			
o/w external 3/	327.3	201.0	144.7		128.2	124.5	117.3	115.0	115.4	115.9	115.9	112.6	102.7			
Debt service-to-revenue and grants ratio (in percent) 4/	26.4	18.9	8.3		7.1	6.3	5.2	4.8	4.3	4.4	4.4	5.0	5.8			
Debt service-to-revenue ratio (in percent) 4/	40.2	30.2	11.4		9.9	8.6	7.0	6.3	5.7	5.7	5.7	6.3	6.9			
Primary deficit that stabilizes the debt-to-GDP ratio	11.2	45.3	8.4		4.7	2.4	3.2	2.4	1.9	2.0	2.0	2.3	2.9			
<b>Key macroeconomic and fiscal assumptions</b>																
Real GDP growth (in percent)	4.6	5.0	6.2	3.7	5.9	7.0	7.3	9.8	7.6	6.1	6.2	7.4	6.5			
Average nominal interest rate on forex debt (in percent)	1.5	0.8	0.6	1.5	0.8	0.7	0.9	0.9	0.9	0.7	1.4	0.9	1.2			
Average real interest rate on domestic currency debt (in percent)	-1.5	9.3	1.2	0.8	5.2	1.4	2.6	2.6	2.6	2.6	2.4	2.4	2.3			
Real exchange rate depreciation (in percent, + indicates depreciation)	0.1	-14.2	-18.2	-2.0	11.7	-1.9	...	...	...	...	...	...	...			
Inflation rate (GDP deflator, in percent)	18.3	11.5	10.3	10.5	9.7	7.5	6.5	5.5	5.0	5.0	6.5	5.0	5.0			
Growth of real primary spending (deflated by GDP deflator, in percent)	-12.1	6.8	-2.6	7.6	20.9	5.2	12.3	10.2	7.0	9.3	10.8	7.1	8.7			
Grant element of new external borrowing (in percent)	43.2	44.2	44.2	13.2	44.2	44.2	44.2	44.2	44.2	44.2	44.2	44.2	46.2			

Sources: Country authorities, and Fund staff estimates and projections.

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

2/ Gross financing need is defined as the primary deficit plus debt service plus the stock of short-term debt at the end of the last period.

3/ Revenues excluding grants.

4/ Debt service is defined as the sum of interest and amortization of medium and long-term debt.

Table 4. Madagascar: Sensitivity Analysis for Key Indicators of Public Debt 2008-2028

	Projections							
	2008	2009	2010	2011	2012	2013	2018	2028
<b>NPV of Debt-to-GDP Ratio</b>								
<b>Baseline</b>	23	22	21	21	21	22	23	27
<b>A. Alternative scenarios</b>								
A1. Real GDP growth and primary balance are at historical averages	23	23	23	23	23	23	24	26
A2. Primary balance is unchanged from 2008	23	23	22	22	23	23	24	26
A3. Permanently lower GDP growth 1/	23	23	22	22	23	25	32	57
<b>B. Bound tests</b>								
B1. Real GDP growth is at historical average minus one standard deviations in 2009-2010	23	25	29	31	32	35	45	61
B2. Primary balance is at historical average minus one standard deviations in 2009-2010	23	23	22	22	22	22	24	28
B3. Combination of B1-B2 using one half standard deviation shocks	23	24	25	24	23	23	22	24
B4. One-time 30 percent real depreciation in 2009	23	27	25	24	23	24	24	27
B5. 10 percent of GDP increase in other debt-creating flows in 2009	23	29	27	26	26	27	27	29
<b>NPV of Debt-to-Revenue Ratio 2/</b>								
<b>Baseline</b>	137	129	121	117	116	119	124	143
<b>A. Alternative scenarios</b>								
A1. Real GDP growth and primary balance are at historical averages	137	132	127	124	123	123	118	120
A2. Primary balance is unchanged from 2008	137	133	126	124	124	126	129	138
A3. Permanently lower GDP growth 1/	137	131	125	124	126	133	168	288
<b>B. Bound tests</b>								
B1. Real GDP growth is at historical average minus one standard deviations in 2009-2010	137	143	156	162	170	182	229	309
B2. Primary balance is at historical average minus one standard deviations in 2009-2010	137	133	126	122	121	123	127	144
B3. Combination of B1-B2 using one half standard deviation shocks	137	136	135	128	123	123	115	122
B4. One-time 30 percent real depreciation in 2009	137	156	141	134	130	129	126	139
B5. 10 percent of GDP increase in other debt-creating flows in 2009	137	169	154	148	145	146	144	152
<b>Debt Service-to-Revenue Ratio 2/</b>								
<b>Baseline</b>	7	6	5	5	4	4	5	6
<b>A. Alternative scenarios</b>								
A1. Real GDP growth and primary balance are at historical averages	7	6	6	5	5	5	5	5
A2. Primary balance is unchanged from 2008	7	6	5	5	5	5	5	6
A3. Permanently lower GDP growth 1/	7	6	5	5	5	5	6	11
<b>B. Bound tests</b>								
B1. Real GDP growth is at historical average minus one standard deviations in 2009-2010	7	7	6	6	6	6	8	13
B2. Primary balance is at historical average minus one standard deviations in 2009-2010	7	6	5	5	4	5	5	6
B3. Combination of B1-B2 using one half standard deviation shocks	7	7	6	5	5	5	5	5
B4. One-time 30 percent real depreciation in 2009	7	7	6	5	5	5	6	6
B5. 10 percent of GDP increase in other debt-creating flows in 2009	7	6	7	6	5	5	6	7

Sources: Country authorities; and Fund staff estimates and projections.

1/ Assumes that real GDP growth is at baseline minus one standard deviation divided by the square root of 20 (i.e., the length of the projection period).

2/ Revenues are defined inclusive of grants.