FOR INFORMATION

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To: Members of the Executive Board

From: The Acting Secretary

Subject: **Republic of Yemen—Debt Sustainability Analysis**

Board Action:	Executive Directors' **information**
Prepared By:	The staffs of the Fund and the International Development Association
Questions:	Mr. Jaeger, MCD (ext. 36207) Mr. Zaher, MCD (ext. 36162)

INTERNATIONAL MONETARY FUND

REPUBLIC OF YEMEN

DEBT SUSTAINABILITY ANALYSIS

June 1, 2016

Approved By
Daniela Gressani and Masato Miyazaki(IMF) and John Panzer (IDA)

Prepared by the staffs of the International Monetary Fund and the International Development Association

Risk of external debt distress:	**High**
Augmented by significant risks stemming from domestic public debt and/or private external debt?	**Yes (domestic debt)**

Although the level of public and publicly guaranteed external debt has remained low since the update in July 2014, this debt sustainability analysis (DSA) concludes that Yemen now faces a high risk of debt distress. The armed conflict that started in September 2014, and especially its disrupting impact on the country's ability to earn foreign exchange through hydrocarbon exports, is severely constraining the government's capacity to service its external obligations. Moreover, in a scenario of continued conflict or high insecurity, the country is likely to continue to face high risk of distress, or even outright distress, over the next few years. Public domestic debt is very high by low-income country standards, adding to external debt vulnerabilities, and protracted low growth or fiscal imbalances could render public debt unsustainable.[1]

[1] This analysis is based on the joint Fund-Bank debt sustainability framework for conducting debt sustainability analysis in low-income countries. Under IDA's Country Policy and Institutional Assessment (CPIA), Yemen's three-year average score in 2012–14 is 3.0, and its policy performance is categorized as weak. This DSA therefore uses the indicative thresholds for countries for this category, which are: 30 percent for the present value (PV) of the external debt-to-GDP ratio; 100 percent for the PV of the external debt-to-exports ratio; 20 percent for the PV of the external debt-to-revenue ratio; 15 percent for the external debt service-to-exports ratio; and 18 percent for the external debt service-to-revenue ratio. These thresholds are applicable to public and publically guaranteed external debt.

BACKGROUND

1. Reflecting the fallout from armed conflict, Yemen's economy has been pushed to the brink of collapse. The armed conflict that started in September 2014 constricted economic activity, destroyed part of the country's infrastructure and other real capital, and has caused staggering human losses and suffering. Activity in the hydrocarbon sector was especially hard hit by the conflict, with hydrocarbon production and exports coming to a virtual halt, triggering large fiscal and external imbalances.

2. External debt has remained low, and the authorities continued to service their external debt obligations. Public and publicly guaranteed external debt rose only slightly from 15.2 percent of GDP in 2013 to an estimated 15.9 percent of GDP in 2015 (Table 1). External financing needs during 2014-15 were mostly covered through drawing down foreign exchange reserves. As a result, the level of official foreign exchange reserves has fallen far below prudent levels.[2] Nevertheless, the authorities have remained current on their external debt service obligations through March 2016.

3. By contrast, public debt has surged during the conflict, reflecting central bank financing of large fiscal deficits. Public debt increased from 48.2 percent of GDP in 2013 to an estimated 68.6 percent of GDP in 2015 (Table 3). This surge almost exclusively reflects the high fiscal deficit in 2015 when the armed conflict triggered a collapse in revenue collections while the authorities continued to execute some of their expenditure obligations, mainly public wages and interest payments on debt. With most financing sources having dried up during 2015, the government's overdraft facility at the Central Bank of Yemen (CBY) covered most of the budget shortfall.

4. External debt is mostly concessional and owed to official creditors. External debt (excluding a $1 billion dollar deposit by Saudi Arabia at the CBY) stood at US$5.9 billion at end-2015, of which about 60 percent was owed to multilateral creditors, including the World Bank (a share of 30 percent), the Arab Fund for Economic and Social Development (15 percent), and the Arab Monetary Fund (5 percent). The remaining external debt is owed to bilateral creditors, including Russia (19 percent), Saudi Arabia (6 percent), Kuwait (6 percent), and China (5 percent). Most of these loans were contracted on highly concessional terms.

5. Domestic public debt consists mainly of treasury bills and bonds and direct borrowing from the central bank. All domestic public debt is denominated in local currency. At end-2015, the stock of treasury bills, generally issued at 6 months maturity, accounted for 37 percent of total domestic debt. About 75 percent of treasury bills were held by domestic banks, followed by pension funds (15 percent), and public institutions outside the general government perimeter (10 percent). Treasury bonds, generally issued at 5 years maturity, accounted for 22 percent of total domestic debt. Direct borrowing from the central bank through the government's overdraft facility reached 35 percent of domestic debt by the end of 2015, up from 22 percent of domestic debt at the end of 2014.

[2] By the end of 2015, the Central Bank of Yemen's (CBY) gross foreign exchange reserves had declined to only 2 months of the previous year's imports. Since the beginning of 2016, exchange reserves have been depleted further.

UNDERLYING ASSUMPTIONS

6. The macroeconomic baseline outlook assumes that the armed conflict will end by mid-2016. The baseline builds on the most recent available data for Yemen as well as the April 2016 WEO projections of key external variables, especially the international prices of oil and natural gas (Box 1). Perhaps most importantly, the revised baseline projections assume that the armed conflict will come to a halt by mid-2016 and that security will be restored to levels sufficient to restart hydrocarbon production and exports as well as other economic activities.

7. The baseline scenario is supplemented by an alternative scenario, where conflict and security risks abate only gradually over the medium term. This alternative scenario is motivated by the stylized fact that armed conflicts tend to be protracted, and, even after conflicts officially come to an end, security risks often remain elevated for some time (Box 2). The DSA's standardized stress tests cannot capture this significant Yemen-specific risk to debt sustainability. The DSA therefore also presents an alternative (or customized) scenario, where lingering conflict and security risks continue to obstruct economic activity over the next few years. Under this alternative scenario, hydrocarbon production and exports pick up much more gradually than in the baseline, and private investment in particular remains hampered by high insecurity. As a result, growth is projected to average only 1½ percent over the medium term (2016-20), well below baseline medium-term growth of 5 percent. In this alternative scenario, export and fiscal revenues are accordingly projected to remain depressed over the medium term. In the long run, baseline and alternative scenarios are projected to converge to similar economic outcomes.

EXTERNAL DSA

8. Under the baseline scenario, external debt ratios remain generally below indicative thresholds, with the exception of the debt-export ratio (Table 1 and Figure 1). The PV of the external public debt-to-exports ratio is projected to peak at 147 percent in 2016, a massive increase compared with 45 percent in the last pre-conflict year (2014). This surge in the debt-to-export ratio reflects mainly the impact of the armed conflict on exports. With conflict and security risks assumed to fade starting in mid-2016, the debt-to-export ratio in the baseline falls back below the threshold in 2017. However, the ratio is projected to remain close to the threshold through most of the projection horizon.

9. Among the alternative scenarios, the customized scenario assuming continued high risk of conflict and insecurity further highlights Yemen's increased external debt vulnerabilities (Table 2 and Figure 1). Under the customized scenario, the PV of the external public debt-to-exports ratio breaches the 100 percent threshold over the medium term, peaking at 156 percent in 2016 and stays above 100 percent until 2025. At the same time, other external debt indicators apart from the debt service-to-exports ratio in the customized scenario remain below relevant thresholds. As regards the other standardized alternative scenarios, the relevant threshold is also breached in 2016 in the case of the debt-to-exports ratio when key variables are maintained at their historical values.

Box 1. Macroeconomic Framework: Baseline Scenario

Assuming that the armed conflict will end by mid-2016, the baseline scenario includes the following key assumptions and projections:

Growth: After contracting by an estimated 28 percent in 2015, real GDP growth is projected to average 5 percent over the medium term, i.e. 2016-2020 (Table 1). The pace of medium-term growth reflects mainly three assumption: (i) a V-shaped recovery from the 2015 output collapse; (ii) the resumption of hydrocarbon production and export; and (iii) the availability of external inflows in the form of grants and concessional lending sufficient to finance reconstruction activities. Over the long term, i.e. 2021-35, real GDP growth is projected to average 4½ percent, similar to the baseline of the 2014 DSA update.

Hydrocarbon sector: Oil and liquefied natural gas (LNG) production is assumed to recover over the medium term, reaching again pre-conflict levels in 2020. Over the longer term, increases in oil production are projected to remain modest (2 percent per year), reflecting aging oil fields and limited new exploration in light of low projected international oil prices.

Inflation: Inflation is projected to remain elevated for the next few years, owing initially to continued shortages of goods and services, demand pressures from the accumulated monetary overhang, and pass-through from currency depreciation as the nominal exchange rate is adjusted for the differentials between home and international inflation. Inflation is projected to return to single digits only over the medium term, in line with the assumed recovery of the economy's supply side and the full restoration of stability-oriented and credible macroeconomic policies.

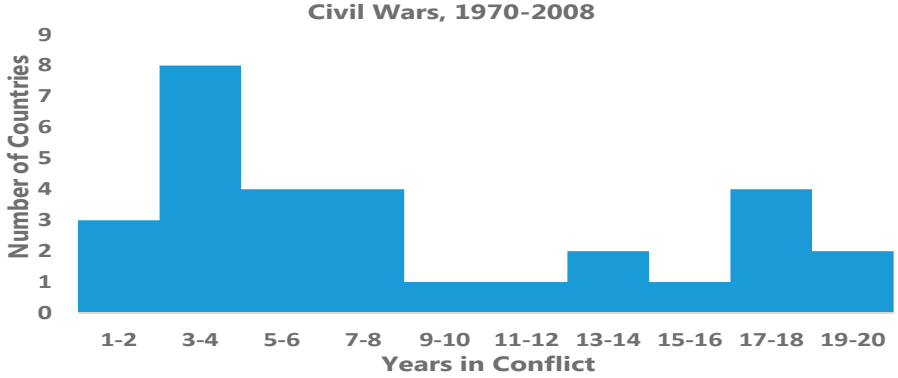
Public finances: Following the massive deterioration in the fiscal position as a consequence of the armed conflict, the fiscal deficit is projected to quickly revert back to more sustainable levels. Fiscal consolidation is underpinned by a strong expenditure adjustment effort, but also markedly higher non-hydrocarbon revenue due to improved tax collection supported by the economic recovery. Specifically, the ratio of non-hydrocarbon revenue to GDP is projected to increase from 9½ percent in 2016 to about 14 percent in 2035. On the expenditure side, tight control of the public wage bill and other current expenditures, especially energy subsidies, are projected to reduce overall expenditures from 24 percent of GDP in 2016 to 19 percent in 2035, despite higher investment expenditure. As a result, the fiscal deficit is projected to decline gradually to about 1½ percent of GDP by 2035.

External sector: Exports of goods and services (in dollar terms) are initially expected to expand at a rapid clip, reflecting mainly the recovery in hydrocarbon production. But non-hydrocarbon exports would also grow rapidly, in part reflecting a low base effect. Overall export growth is projected to expand at 24 percent over the medium term and stabilize at about 5 percent in the long run (Table 1). Imports of goods and services (again in dollar terms) are projected to grow at about 10 percent over the medium term, in part to accommodate reconstruction activities and the rebuilding of stocks of consumer goods depleted during the conflict. Over the long run, import growth is projected to average only about 4 percent. The current account deficit would gradually decrease to about 5 percent of GDP in the medium term and narrow further over the long run to about 1 percent of GDP. Official donors are conservatively expected to provide about US$1 billion in grants annually over the medium term, and external creditors are assumed to continue providing financing on highly favorable terms. Improvements in the security and business environment should also help attract some foreign direct investment and other private inflows.

Box 2. Motivation of Continued Conflict and Insecurity Scenario

Civil wars tend to be persistent. Data from the Uppsala Conflict Data Program (UCDP) database covering 29 armed intrastate conflicts or civil wars lasting less than 20 years during 1970-2008 suggest a peak in the frequency distribution for the duration of conflicts around 3-4 years (Box 2 Figure 1). But many conflicts last considerably longer, i.e. the frequency distribution to the right of its 3-4 years peak has an extended, thick tail. The empirical literature[1/] discusses various factors why incentives to stop civil wars can be weak. For example, conflicts tend to last longer in countries with low income and high inequality. At the same time, declines in the prices of commodities that a country exports or external military interventions tend to shorten conflicts. The main obstacle for ending civil wars through peace settlements is usually the lack of credible lock-in mechanisms, but the build-up of skills and organizations specialized in violence during a conflict can also act as a factor prolonging the duration of conflicts.

Box 2 Figure 1: Frequency Distribution for Duration of Civil Wars, 1970-2008



Sources: UCDP Armed Conflict Database; staff estimate.

A halt to armed conflict may not restore the levels of security and confidence needed to foster a sustained economic recovery. While ending a civil war is usually a necessary first step to restoring economic growth and stability, lingering high risks of conflict resumption or low levels of security can remain binding bottlenecks. In fact, civil wars tend to have a high risk of resuming within the first five years after a peace agreement. Moreover, even if a peace agreement sticks, government institutions may have been severely weakened by the conflict, and restoring acceptable levels of security may prove difficult. Yemen's own extensive conflict history illustrates the difficulty of reaching a lasting and full resolution of conflicts, even if full-scale armed conflict is avoided. For example, in 2011, social unrest triggered a political crisis, resulting in a challenging security environment, especially for hydrocarbon production and exports. This destabilized the economy, resulting in an output decline in 2011 of about 13 percent.

[1/] For example, Collier, Hoeffler, and Söderbom (2004), *On the Duration of Civil War*; and Fearon (2004), *Why Do Some Civil Wars Last so Much Longer than Others?* Both articles appeared in the May 2004 issue of the *Journal of Peace Research*, pp. 253-301.

10. Under the stress test scenarios, the debt-to-exports ratios in particular signal that Yemen is vulnerable to large adverse shocks (Table 2 and Figure 1). The bound tests for adverse export and capital inflow shocks result in debt-to-exports ratio well above the 100 percent threshold through most of the projection period. An extreme adverse export shock would also push the debt service-to-exports ratio above the 15 percent threshold over the long term.

PUBLIC DSA

11. Under the baseline scenario, the public debt-to-GDP ratio breached the debt benchmark already in 2014, and the ratio, although declining, remains excessive through most of the projection period (Table 3 and Figure 2). The PV of total public debt-to-GDP ratio amounted to 44 percent in 2014, exceeding the benchmark of 38 percent for Yemen. In the baseline, the PV of the public debt ratio is projected to peak at above 60 percent during 2015-16, reflecting the halting of hydrocarbon production since the armed conflict intensified in March 2015. With the projected resumption of hydrocarbon production and exports in the baseline, the PV of the public debt ratio is projected to decline steadily to 28 percent by 2035, compared to 30 percent in the previous DSA.

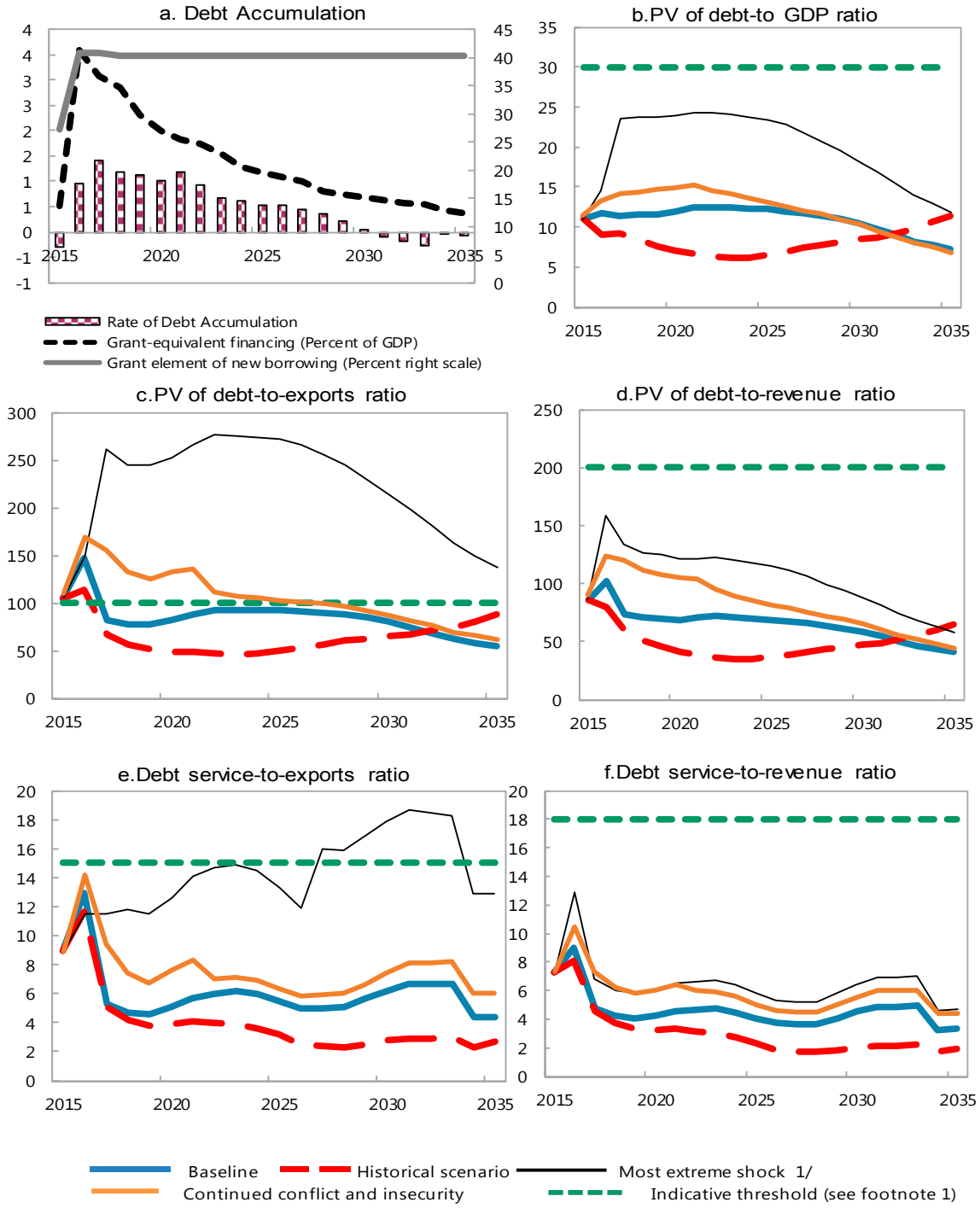
12. The alternative scenarios and the stress tests illustrate vividly the vulnerability of the domestic debt outlook to large adverse shocks, especially to growth (Table 4 and Figure 2). Real GDP growth significantly lower than in the baseline could keep the present value of the public debt ratio well above the debt benchmark in the longer term, in most cases producing public debt profiles that exceed the benchmark. At the same time, the alternative customized scenario for the public debt ratio largely follows the declining debt path in the baseline.

CONCLUSIONS

13. Since the 2014 DSA, as a consequence of armed conflict, Yemen's debt vulnerabilities have increased substantially. The armed conflict that began in September 2014 abruptly destabilized Yemen's external and public finances, crimped its growth potential, and, as a consequence, increased substantially the risk that external and public debts cannot be serviced in the future. As regards the risk of external debt distress, the level of public and publicly guaranteed debt and projected debt service remains low. But the armed conflict and its disruptive impact on the country's ability to earn foreign exchange through exports has severely constrained the government's capacity to service its external obligations. Nevertheless, the authorities have serviced their external obligations through March 2016. The DSA also suggests that if conflict and security risks recede only slowly over the next few years, Yemen could face serious difficulties in servicing its external obligations. As regards the risk of public debt distress, the financing by the central bank of large fiscal deficits has ratcheted domestic public debt up to very high levels. While the DSA suggests that public debt could gradually decline to much lower levels in scenarios where growth recovers and fiscal discipline is maintained, the public debt outlook is highly vulnerable to future disruptions to growth or the recurrence of fiscal imbalances.

14. The authorities broadly agreed with the staff's assessment. They noted that the updated DSA accurately reflects Yemen's much deteriorated economic and financial fundamentals. Looking ahead, the authorities agreed that continued conflict or insecurity represent tangible risks that are not well captured by standard DSA stress tests. The authorities also underscored that without a prompt end to the conflict, or at least the assured prospect of measures that could bolster the very low level of official foreign exchange reserves, external payment difficulties could soon become insuperable.

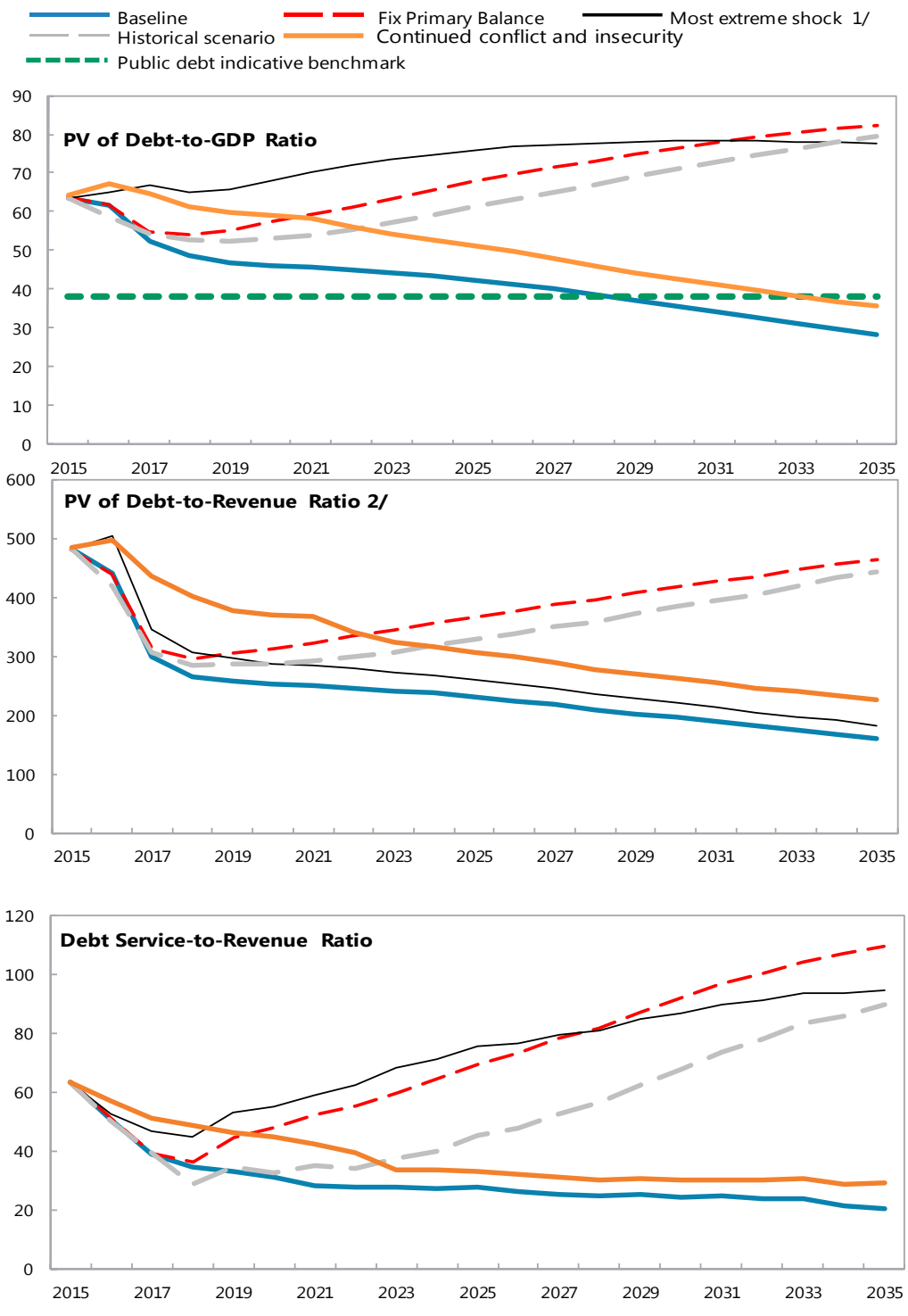
Figure 1. Republic of Yemen: Indicators of Public and Publicly Guaranteed External Debt under Alternatives Scenarios, 2015–2035 1/



Sources: Country authorities; and staff estimates and projections.

1/ The most extreme stress test is the test that yields the highest ratio on or before 2025. In figure b. it corresponds to combined shocks; in c. to combined shocks; in d. to a non-debt flows shock; in e. to a exports shock and in figure f. to a one-time depreciation shock

Figure 2. Republic of Yemen: Indicators of Public Debt Under Alternative Scenarios, 2015–2035 1/



Sources: Country authorities; and staff estimates and projections.
1/ The most extreme stress test is the test that yields the highest ratio on or before 2025.
2/ Revenues are defined inclusive of grants.

Table 1 . Republic of Yemen: External Debt Sustainability Framework, Baseline Scenario, 2012–2035 1/
(In percent of GDP, unless otherwise indicated)

	Actual			Historical 6/ Average	Standard 6/ Deviation	Estimate	Projections								
	2012	2013	2014			2015	2016	2017	2018	2019	2020	2016–20 Average	2025	2035	2021–35 Average
External debt (nominal) 1/	**19.4**	**17.4**	**16.5**			**18.4**	**20.0**	**19.1**	**19.4**	**19.7**	**20.1**		**20.7**	**12.1**	
of which: public and publicly guaranteed (PPG)	17.4	15.2	14.3			15.9	17.3	16.7	16.9	17.0	17.3		17.6	9.8	
Change in external debt	-1.0	-2.1	-0.8			1.9	1.6	-0.9	0.3	0.2	0.4		-0.4	-0.9	
Identified net debt-creating flows	-0.8	0.7	3.5			12.7	5.1	1.6	2.6	3.1	2.8		0.7	-1.0	
Non-interest current account deficit	**1.5**	**2.9**	**1.4**	**2.7**	**3.9**	**5.5**	**6.7**	**4.7**	**4.3**	**4.6**	**4.6**		**3.2**	**0.1**	2.4
Deficit in balance of goods and services	11.6	7.8	6.9			12.6	16.3	10.3	9.6	9.2	8.9		7.0	3.1	
Exports	24.9	22.4	21.5			10.4	8.0	13.8	14.9	14.9	14.4		13.2	13.0	
Imports	36.5	30.2	28.4			23.0	24.3	24.1	24.4	24.1	23.3		20.2	16.2	
Net current transfers (negative = inflow)	-14.4	-9.2	-11.3	-8.5	2.6	-10.6	-11.7	-9.5	-9.1	-8.2	-7.8		-6.3	-4.4	-5.7
of which: official	-6.2	-0.9	-3.5			0.0	-2.7	-2.1	-2.0	-1.5	-1.4		-0.8	-0.3	
Other current account flows (negative = net inflow)	4.2	4.3	5.8			3.6	2.1	3.9	3.9	3.6	3.5		2.5	1.3	
Net FDI (negative = inflow)	**-1.0**	**0.0**	**3.0**	**-0.3**	**3.2**	**1.7**	**-1.8**	**-1.4**	**-1.0**	**-1.1**	**-1.4**		**-2.0**	**-0.8**	-1.4
Endogenous debt dynamics 2/	**-1.3**	**-2.2**	**-0.9**			**5.6**	**0.1**	**-1.8**	**-0.7**	**-0.4**	**-0.4**		**-0.5**	**-0.3**	
Contribution from nominal interest rate	0.2	0.2	0.3			0.1	0.3	0.1	0.2	0.3	0.3		0.4	0.3	
Contribution from real GDP growth	-0.5	-0.8	0.0			5.4	-0.1	-1.9	-1.0	-0.7	-0.7		-0.9	-0.6	
Contribution from price and exchange rate changes	-1.1	-1.6	-1.2			...	...	...	...	...	...		...	...	
Residual (3-4) 3/	**-0.2**	**-2.8**	**-4.4**			**-10.9**	**-3.4**	**-2.5**	**-2.3**	**-2.9**	**-2.4**		**-1.1**	**0.1**	
of which: exceptional financing	0.0	0.0	0.0			0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	
PV of external debt 4/	...	...	11.9			13.5	14.5	13.8	14.1	14.3	14.6		15.2	9.5	
In percent of exports	...	...	55.5			129.4	181.6	99.9	94.7	95.8	101.1		115.4	73.0	
PV of PPG external debt	**...**	**...**	**9.7**			**11.0**	**11.8**	**11.4**	**11.5**	**11.6**	**11.8**		**12.2**	**7.2**	
In percent of exports	**...**	**...**	**44.9**			**105.3**	**146.9**	**82.2**	**77.5**	**78.0**	**82.0**		**92.2**	**55.0**	
In percent of government revenues	**...**	**...**	**46.0**			**86.4**	**102.6**	**73.7**	**70.4**	**69.9**	**68.9**		**68.6**	**40.9**	
Debt service-to-exports ratio (in percent)	**2.9**	**3.0**	**4.2**			**9.1**	**13.6**	**5.9**	**5.3**	**5.3**	**5.8**		**6.5**	**5.5**	
PPG debt service-to-exports ratio (in percent)	**2.9**	**2.9**	**4.2**			**8.9**	**12.9**	**5.3**	**4.7**	**4.5**	**5.0**		**5.4**	**4.4**	
PPG debt service-to-revenue ratio (in percent)	**3.0**	**2.9**	**4.3**			**7.3**	**9.0**	**4.8**	**4.2**	**4.1**	**4.2**		**4.1**	**3.3**	
Total gross financing need (Billions of U.S. dollars)	0.4	1.4	2.3			3.0	2.2	2.0	2.1	2.3	2.3		1.6	0.1	
Non-interest current account deficit that stabilizes debt ratio	2.5	5.0	2.2			3.7	5.1	5.6	4.0	4.4	4.2		3.6	1.0	
Key macroeconomic assumptions															
Real GDP growth (in percent)	2.4	4.8	-0.2	2.2	5.6	-28.1	0.7	11.9	5.3	3.7	3.7	5.1	4.7	4.8	4.6
GDP deflator in US dollar terms (change in percent)	5.6	8.9	7.2	10.2	8.8	18.6	0.6	13.0	1.5	3.3	2.7	4.2	1.3	1.4	1.3
Effective interest rate (percent) 5/	1.1	1.1	1.6	1.2	0.3	0.5	1.4	0.8	1.3	1.6	1.5	1.3	1.9	2.5	2.0
Growth of exports of G&S (US dollar terms, in percent)	-11.4	2.7	2.8	8.2	20.5	-58.7	-22.2	118.4	14.8	7.3	3.2	24.3	5.2	5.0	5.3
Growth of imports of G&S (US dollar terms, in percent)	20.7	-5.7	0.6	10.5	14.9	-30.9	6.9	25.8	8.1	5.5	3.1	9.9	3.6	2.7	3.5
Grant element of new public sector borrowing (in percent)	...	...	...	...	...	27.3	40.8	40.8	40.4	40.4	40.2	40.5	40.2	40.2	40.2
Government revenues (excluding grants, in percent of GDP)	23.8	23.0	21.0			12.7	11.5	15.4	16.4	16.6	17.2		17.8	17.5	17.7
Aid flows (in Billions of US dollars) 7/	2.4	0.6	1.4			0.2	1.5	1.6	1.8	1.6	1.5		1.2	0.7	
of which: Grants	2.2	0.4	1.1			0.2	1.0	1.0	1.0	0.8	0.7		0.6	0.4	
of which: Concessional loans	0.3	0.2	0.2			0.0	0.5	0.6	0.8	0.8	0.8		0.6	0.3	
Grant-equivalent financing (in percent of GDP) 8/	...	...	...			0.5	3.6	3.1	2.9	2.3	2.0		1.2	0.4	1.0
Grant-equivalent financing (in percent of external financing) 8/	...	...	...			99.6	71.5	69.0	68.8	65.5	63.5		63.8	71.5	65.4
Memorandum items:															
Nominal GDP (Billions of US dollars)	35.4	40.4	43.2			36.9	37.3	47.2	50.4	54.0	57.5		76.4	138.3	
Nominal dollar GDP growth	8.2	14.2	7.0			-14.8	1.2	26.5	6.9	7.1	6.5	9.6	6.0	6.2	6.0
PV of PPG external debt (in Billions of US dollars)			4.2			4.0	4.4	4.9	5.5	6.0	6.6		9.0	9.6	
(PVt-PVt-1)/GDPt-1 (in percent)						-0.3	0.9	1.4	1.2	1.1	1.0	1.1	0.5	-0.1	0.3
Gross workers' remittances (Billions of US dollars)	3.0	3.4	3.4			3.3	3.4	3.6	3.7	3.8	3.8		4.4	6.0	
PV of PPG external debt (in percent of GDP + remittances)	...	...	8.9			10.1	10.8	10.6	10.7	10.9	11.1		11.5	6.9	
PV of PPG external debt (in percent of exports + remittances)	...	...	32.8			56.8	68.2	53.0	51.8	53.2	56.2		64.2	41.2	
Debt service of PPG external debt (in percent of exports + remittances)	...	...	3.0			4.8	6.0	3.4	3.1	3.1	3.5		3.8	3.3	

Sources: Country authorities; and staff estimates and projections.

1/ Includes both public and private sector external debt.

2/ Derived as [r - g - ρ(1+g)]/(1+g+ρ+gρ) times previous period debt ratio, with r = nominal interest rate; g = real GDP growth rate, and ρ = 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 PV of private sector debt is equivalent to its face value.

5/ Current-year interest payments 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 PV of new debt).

Table 2. Republic of Yemen: Sensitivity Analysis for Key Indicators of Public and Publicly Guaranteed External Debt, 2015–2035
(In percent)

	Estimate	Projections						
	2015	2016	2017	2018	2019	2020	**2025**	2035
PV of debt-to GDP ratio								
Baseline	11	12	11	12	12	12	**12**	7
A. Alternative Scenarios								
A1. Key variables at their historical averages in 2015-2035 1/	11	9	9	8	8	7	**7**	11
A2. New public sector loans on less favorable terms in 2015-2035 2	11	12	11	12	13	14	**16**	11
A3. Continued conflict and insecurity	11	12	13	13	14	14	**12**	7
B. Bound Tests								
B1. Real GDP growth at historical average minus one standard deviation in 2016-2017	11	12	13	13	13	14	**14**	8
B2. Export value growth at historical average minus one standard deviation in 2016-2017 3/	11	11	15	15	15	15	**15**	8
B3. US dollar GDP deflator at historical average minus one standard deviation in 2016-2017	11	12	12	12	12	13	**13**	8
B4. Net non-debt creating flows at historical average minus one standard deviation in 2016-2017 4/	11	18	21	21	21	21	**20**	10
B5. Combination of B1-B4 using one-half standard deviation shocks	11	14	24	24	24	24	**23**	12
B6. One-time 30 percent nominal depreciation relative to the baseline in 2016 5/	11	17	15	15	16	16	**17**	10
PV of debt-to-exports ratio								
Baseline	105	147	82	77	78	82	**92**	55
A. Alternative Scenarios								
A1. Key variables at their historical averages in 2015-2035 1/	105	114	67	57	51	48	**49**	87
A2. New public sector loans on less favorable terms in 2015-2035 2	105	154	83	84	89	96	**121**	88
A3. Continued conflict and insecurity	101	156	144	123	117	124	98	68
B. Bound Tests								
B1. Real GDP growth at historical average minus one standard deviation in 2016-2017	105	147	75	73	75	79	**89**	53
B2. Export value growth at historical average minus one standard deviation in 2016-2017 3/	105	124	233	222	224	234	**256**	141
B3. US dollar GDP deflator at historical average minus one standard deviation in 2016-2017	105	147	75	73	75	79	**89**	53
B4. Net non-debt creating flows at historical average minus one standard deviation in 2016-2017 4/	105	227	148	139	139	144	**154**	77
B5. Combination of B1-B4 using one-half standard deviation shocks	105	149	261	245	245	253	**271**	138
B6. One-time 30 percent nominal depreciation relative to the baseline in 2016 5/	105	147	75	73	75	79	**89**	53
PV of debt-to-revenue ratio								
Baseline	86	103	74	70	70	69	**69**	41
A. Alternative Scenarios								
A1. Key variables at their historical averages in 2015-2035 1/	86	79	60	52	46	41	**37**	65
A2. New public sector loans on less favorable terms in 2015-2035 2	86	108	74	76	80	81	**90**	65
A3. Continued conflict and insecurity	83	114	112	104	101	98	77	44
B. Bound Tests								
B1. Real GDP growth at historical average minus one standard deviation in 2016-2017	86	107	82	80	81	80	**80**	47
B2. Export value growth at historical average minus one standard deviation in 2016-2017 3/	86	97	94	91	91	89	**86**	47
B3. US dollar GDP deflator at historical average minus one standard deviation in 2016-2017	86	102	75	73	74	74	**73**	43
B4. Net non-debt creating flows at historical average minus one standard deviation in 2016-2017 4/	86	159	133	126	125	121	**115**	58
B5. Combination of B1-B4 using one-half standard deviation shocks	86	126	153	145	143	139	**132**	67
B6. One-time 30 percent nominal depreciation relative to the baseline in 2016 5/	86	146	96	94	96	95	**95**	56

Table 2. Republic of Yemen: Sensitivity Analysis for Key Indicators of Public and Publicly Guaranteed External Debt, 2015–2035 (concluded)

(In percent)

	Estimate	Projections						
	2015	2016	2017	2018	2019	2020	**2025**	2035
Debt service-to-exports ratio								
Baseline	9	13	5	5	5	5	**5**	4
A. Alternative Scenarios								
A1. Key variables at their historical averages in 2015-2035 1/	9	12	5	4	4	4	**3**	3
A2. New public sector loans on less favorable terms in 2015-2035 2	9	13	5	5	5	6	**8**	8
A3. Continued conflict and insecurity	9	14	9	7	7	8	**6**	7
B. Bound Tests								
B1. Real GDP growth at historical average minus one standard deviation in 2016-2017	9	13	5	5	5	5	**5**	4
B2. Export value growth at historical average minus one standard deviation in 2016-2017 3/	9	11	12	12	11	13	**13**	13
B3. US dollar GDP deflator at historical average minus one standard deviation in 2016-2017	9	13	5	5	5	5	**5**	4
B4. Net non-debt creating flows at historical average minus one standard deviation in 2016-2017 4/	9	13	6	6	6	7	**7**	8
B5. Combination of B1-B4 using one-half standard deviation shocks	9	10	10	11	11	12	**12**	14
B6. One-time 30 percent nominal depreciation relative to the baseline in 2016 5/	9	13	5	5	5	5	**5**	4
Debt service-to-revenue ratio								
Baseline	7	9	5	4	4	4	**4**	3
A. Alternative Scenarios								
A1. Key variables at their historical averages in 2015-2035 1/	7	8	5	4	3	3	**2**	2
A2. New public sector loans on less favorable terms in 2015-2035 2	7	9	5	5	5	5	**6**	6
A3. Continued conflict and insecurity	7	10	7	6	6	6	**5**	4
B. Bound Tests								
B1. Real GDP growth at historical average minus one standard deviation in 2016-2017	7	9	6	5	5	5	**5**	4
B2. Export value growth at historical average minus one standard deviation in 2016-2017 3/	7	9	5	5	5	5	**4**	4
B3. US dollar GDP deflator at historical average minus one standard deviation in 2016-2017	7	9	5	5	4	5	**4**	4
B4. Net non-debt creating flows at historical average minus one standard deviation in 2016-2017 4/	7	9	6	6	5	6	**5**	6
B5. Combination of B1-B4 using one-half standard deviation shocks	7	9	6	7	6	6	**6**	7
B6. One-time 30 percent nominal depreciation relative to the baseline in 2016 5/	7	13	7	6	6	6	**6**	5
Memorandum item:								
Grant element assumed on residual financing (i.e., financing required above baseline) 6/	39	39	39	39	39	39	**39**	39

Sources: Country authorities; and staff estimates and projections.

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.

Table 3. Republic of Yemen: Public Sector Debt Sustainability Framework, Baseline Scenario, 2012–2035
(In percent of GDP, unless otherwise indicated)

	Actual					Estimate	Projections							
	2012	2013	2014	Average 5/	Standard Deviation 5/	2015	2016	2017	2018	2019	2020	2016–20 Average	2025	2035	2021–35 Average
Public sector debt 1/	47.3	48.2	48.7			68.6	67.3	57.9	54.0	52.1	51.7		48.0	31.0	
of which: foreign-currency denominated	17.4	15.2	14.3			15.9	17.3	16.7	16.9	17.0	17.3		17.6	9.8	
Change in public sector debt	1.6	0.9	0.5			19.8	-1.2	-9.5	-3.9	-1.9	-0.4		-1.2	-1.8	
Identified debt-creating flows	2.8	0.9	1.0			19.3	-1.7	-9.6	-4.0	-2.0	-0.4		-1.2	-1.8	
Primary deficit	0.9	1.5	-1.6	0.7	3.5	3.3	3.3	0.7	-0.2	-0.3	-0.1	0.7	-1.4	-1.9	-1.4
Revenue and grants	29.9	23.9	23.6			13.2	14.1	17.5	18.3	18.1	18.4		18.5	17.8	
of which: grants	6.1	0.9	2.7			0.5	2.6	2.1	2.0	1.5	1.2		0.7	0.3	
Primary (noninterest) expenditure	30.8	25.4	22.1			16.5	17.4	18.2	18.1	17.8	18.3		17.1	15.9	
Automatic debt dynamics	2.0	-0.5	2.6			16.0	-5.0	-10.3	-3.8	-1.7	-0.4		0.2	0.1	
Contribution from interest rate/growth differential	2.6	0.6	3.4			18.7	-5.2	-10.1	-3.4	-1.2	-0.2		0.0	0.1	
of which: contribution from average real interest rate	3.7	2.8	3.3			-0.3	-4.7	-2.9	-0.5	0.7	1.6		2.2	1.6	
of which: contribution from real GDP growth	-1.1	-2.2	0.1			19.0	-0.5	-7.2	-2.9	-1.9	-1.8		-2.2	-1.5	
Contribution from real exchange rate depreciation	-0.6	-1.2	-0.8			-2.8	0.2	-0.2	-0.3	-0.5	-0.2		...	...	
Other identified debt-creating flows	0.0	0.0	0.0			0.0	0.0	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	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	
Debt relief (HIPC and other)	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	-1.3	0.0	-0.5			0.6	0.4	0.2	0.1	0.1	0.0		0.0	0.0	
Other Sustainability Indicators															
PV of public sector debt	...	...	44.1			63.6	61.8	52.6	48.6	46.7	46.2		42.5	28.4	
of which: foreign-currency denominated	...	...	9.7			11.0	11.8	11.4	11.5	11.6	11.8		12.2	7.2	
of which: external	...	...	9.7			11.0	11.8	11.4	11.5	11.6	11.8		12.2	7.2	
PV of contingent liabilities (not included in public sector debt)	...	...	...			...	...	...	...	...	...		...	...	
Gross financing need 2/	6.8	7.4	4.8			11.7	10.4	7.5	6.1	5.6	5.6		3.7	1.7	
PV of public sector debt-to-revenue and grants ratio (in percent)	...	...	186.6			481.6	439.4	299.6	265.2	258.0	251.4		230.0	159.5	
PV of public sector debt-to-revenue ratio (in percent)	...	...	210.2			501.5	539.0	340.8	297.3	281.1	269.2		239.4	162.0	
of which: external 3/	...	...	46.0			86.4	102.6	73.7	70.4	69.9	68.9		68.6	40.9	
Debt service-to-revenue and grants ratio (in percent) 4/	19.9	24.8	26.9			63.4	50.7	39.0	34.5	32.8	31.1		27.5	20.5	
Debt service-to-revenue ratio (in percent) 4/	25.0	25.8	30.3			66.0	62.1	44.4	38.7	35.8	33.3		28.7	20.9	
Primary deficit that stabilizes the debt-to-GDP ratio	-0.7	0.6	-2.1			-16.5	4.5	10.1	3.6	1.6	0.3		-0.2	-0.1	
Key macroeconomic and fiscal assumptions															
Real GDP growth (in percent)	2.4	4.8	-0.2	2.2	5.6	-28.1	0.7	11.9	5.3	3.7	3.7	5.1	4.7	4.8	4.6
Average nominal interest rate on forex debt (in percent)	1.2	1.2	1.8	1.3	0.3	0.5	1.3	0.3	0.8	1.1	1.1	0.9	1.4	1.7	1.4
Average real interest rate on domestic debt (in percent)	14.2	10.0	9.9	6.1	9.8	-0.1	-8.8	-5.9	-0.8	2.4	5.3	-1.5	7.8	7.6	7.4
Real exchange rate depreciation (in percent, + indicates depreciation)	-3.4	-7.1	-5.3	-6.9	8.6	-14.1	...	...	...	...	...	...	...	...	...
Inflation rate (GDP deflator, in percent)	5.9	9.2	7.2	11.9	9.3	18.6	25.7	24.3	17.9	14.0	10.4	18.5	7.4	7.4	7.5
Growth of real primary spending (deflated by GDP deflator, in percent)	23.6	-13.6	-13.1	-0.3	10.1	-46.2	6.0	17.3	4.7	1.8	6.7	7.3	3.0	4.3	3.7
Grant element of new external borrowing (in percent)	...	...	...	...	...	27.3	40.8	40.8	40.4	40.4	40.2	40.5	40.2	40.2	...

Sources: Country authorities; and staff estimates and projections.
1/ Public sector refers to the combined central and local governments.
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.
5/ Historical averages and standard deviations are generally derived over the past 10 years, subject to data availability.

Table 4. Republic of Yemen: Sensitivity Analysis for Key Indicators of Public Debt 2015–2035
(In percent)

	Estimate	Projections						
	2015	2016	2017	2018	2019	2020	2025	2035
PV of Debt-to-GDP Ratio								
Baseline	64	62	53	49	47	46	43	28
A. Alternative scenarios								
A1. Real GDP growth and primary balance are at historical averages	64	59	54	53	52	53	61	79
A2. Primary balance is unchanged from 2015	64	62	55	54	55	57	68	82
A3. Permanently lower GDP growth 1/	64	63	54	51	51	52	57	71
A4. Continue conflict and insecurity	63	66	64	60	59	58	53	40
B. Bound tests								
B1. Real GDP growth is at historical average minus one standard deviations in 2016-2017	64	65	67	65	66	68	76	78
B2. Primary balance is at historical average minus one standard deviations in 2016-2017	64	63	56	52	50	49	45	30
B3. Combination of B1-B2 using one half standard deviation shocks	64	62	61	58	58	60	64	61
B4. One-time 30 percent real depreciation in 2016	64	68	58	53	51	50	47	34
B5. 10 percent of GDP increase in other debt-creating flows in 2016	64	71	61	56	54	53	48	32
PV of Debt-to-Revenue Ratio 2/								
Baseline	482	439	300	265	258	251	230	159
A. Alternative scenarios								
A1. Real GDP growth and primary balance are at historical averages	482	417	307	284	286	287	327	442
A2. Primary balance is unchanged from 2015	482	439	313	295	305	312	366	462
A3. Permanently lower GDP growth 1/	482	445	308	279	278	279	309	396
A4. Continue conflict and insecurity	479	490	428	395	371	363	315	250
B. Bound tests								
B1. Real GDP growth is at historical average minus one standard deviations in 2016-2017	482	458	372	347	357	365	408	435
B2. Primary balance is at historical average minus one standard deviations in 2016-2017	482	445	321	285	277	269	244	170
B3. Combination of B1-B2 using one half standard deviation shocks	482	438	340	313	317	321	345	342
B4. One-time 30 percent real depreciation in 2016	482	484	329	291	282	274	253	192
B5. 10 percent of GDP increase in other debt-creating flows in 2016	482	504	346	306	297	288	260	181
Debt Service-to-Revenue Ratio 2/								
Baseline	63	51	39	35	33	31	28	21
A. Alternative scenarios								
A1. Real GDP growth and primary balance are at historical averages	63	50	39	29	34	33	45	89
A2. Primary balance is unchanged from 2015	63	51	39	36	44	48	69	109
A3. Permanently lower GDP growth 1/	63	51	40	36	36	36	46	84
A4. Continue conflict and insecurity	63	57	51	49	46	46	38	35
B. Bound tests								
B1. Real GDP growth is at historical average minus one standard deviations in 2016-2017	63	52	47	45	53	55	76	94
B2. Primary balance is at historical average minus one standard deviations in 2016-2017	63	51	40	40	46	36	33	23
B3. Combination of B1-B2 using one half standard deviation shocks	63	51	43	37	43	44	59	69
B4. One-time 30 percent real depreciation in 2016	63	52	42	38	37	36	36	31
B5. 10 percent of GDP increase in other debt-creating flows in 2016	63	51	48	66	42	53	34	25

Sources: Country authorities; and staff estimates and projections.
1/ Assumes that real GDP growth is at baseline minus one standard deviation divided by the square root of the length of the projection period.
2/ Revenues are defined inclusive of grants.