



# IMF Working Paper

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## Fiscal Vulnerability and Sustainability in Oil-Producing Sub-Saharan African Countries

*Robert York and Zaijin Zhan*

**IMF Working Paper**

African Department

**Fiscal Vulnerability and Sustainability in Oil-Producing Sub-Saharan African Countries**

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**Abstract**

**This Working Paper should not be reported as representing the views of the IMF.** The views expressed in this Working Paper are those of the authors and do not necessarily represent those of the IMF or IMF policy. Working Papers describe research in progress by the authors and are published to elicit comments and to further debate.

Over many years rises and fall of world oil prices have been repeatedly reflected in the boom-bust cycles in oil-exporting countries the world over. The recent spectacular rise and equally spectacular fall in prices provides an opportunity to inquire whether anything is different this time. In this paper we limit the analysis to the experience, outlook, and long-term fiscal policy considerations for eight of the world's oil-producing countries in sub-Saharan Africa. Because we are interested in gauging their fiscal vulnerability and sustainability from the angle of managing exhaustible oil wealth, we focus on the non-oil primary balance as the relevant indicator of how initial conditions and resource endowments can influence long-term considerations in several different models of fiscal rules.

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## I. INTRODUCTION

Over many years rises and fall of world oil prices have been repeatedly reflected in the boom-bust cycles in oil-exporting countries the world over. The recent spectacular rise and equally spectacular fall in prices provides an opportunity to inquire whether anything is different this time.

In this paper we limit our analysis to the experience, outlook, and long-term fiscal policy considerations for eight of the world's oil-producing countries, those in sub-Saharan Africa: Angola, Côte d'Ivoire, Nigeria; and, in the Gulf of Guinea, Cameroon, Chad, the Republic of Congo, Equatorial Guinea, and Gabon. We are interested in gauging their fiscal vulnerability and sustainability from the angle of managing exhaustible oil wealth, and in analyzing the challenges oil price volatility confronts them with.

In particular, we elaborate on how the management of oil wealth and fiscal policies in oil-producing sub-Saharan African countries has evolved recently, how their experiences compare, and what uncertainties could affect our assessment. We focus on the non-oil primary balance as the relevant indicator of how initial conditions and resource endowments can influence long-term fiscal sustainability in several different models of fiscal rules. Our research strategy is to apply these models to each of the eight countries using similar simplifying assumptions, so that we are using the same lens to view how they do or do not differ.

Our research is motivated by recent global developments and by concern that management of oil wealth and improvement in fiscal policies in the region has not progressed much, so that there is a risk that opportunity has been lost (at least temporarily). It is pertinent to make a few preliminary observations:

- The global financial crisis has elevated the risk for all countries that there will be setbacks if growth slows further, compromising recent gains in stabilizing economies and reducing poverty. As political and public pressures to spend mount, particularly in oil-producing countries in sub-Saharan Africa, the room to maneuver has been narrowed by the lack of fiscal adjustment in the period leading up to the historical peak, and subsequent decline, in oil prices.
- The decline in oil prices and souring economic outlook send a conflicting message to policymakers in these countries; while a fiscal stimulus might be warranted to support aggregate demand, falling oil prices mean less oil revenue, so that some fiscal adjustment will be necessary to avoid a deterioration in the fiscal balance. In several of the oil-producing countries we are considering, room to maneuver is also limited

by minimal budgetary savings, the dramatic shift in the fiscal position over a short period, and the distance from a broad range of estimates of sustainability.

- Relatively low world oil prices and minimal global economic activity could dampen investment in the oil sector, with adverse consequences for exploration and development. Without new discoveries the production horizon for six of the eight oil-producing countries discussed is relatively short, heightening concerns over—and urgency about—fiscal vulnerability and sustainability.
- The inherent volatility of oil prices also highlights the problem that pro-cyclical fiscal policy has so far been the norm in most sub-Saharan oil-producing countries.

In what follows, in Section II, we first set the context by providing background for the ensuing analysis. In Section III, we assess recent fiscal policy developments and prospects to explain our concern about vulnerability and sustainability. Section IV outlines the models we use to determine sustainability and our simplifying assumptions. The results are presented in Section V, and we draw some conclusions and policy implications in Section VI.

## II. BACKGROUND

It is important to the analysis to recognize that oil-producing sub-Saharan African countries are fairly heterogeneous in terms of productive capacity, oil reserves, and the importance of oil to the economy.

### A. Oil Resources

The oil-producing sub-Saharan Africa countries collectively produced about 1.9 billion barrels of oil in 2008 and are projected to increase production to nearly 2 billion barrels this year (Table 1). This represents about 5 percent of total world production.

- Production in the group had been dominated by Nigeria, which accounted for more than 40 percent of the total over the last several years, followed closely by Angola, Congo, Equatorial Guinea, and Gabon at about 5–6 percent each; and Cameroon, Chad, and Côte d’Ivoire at about 1–2 percent each.
- Proven oil reserves, which are defined as oil that has a 90 percent probability of being extracted, are estimated at about 52 billion barrels in the group for 2009.<sup>2</sup> Nigeria has

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<sup>2</sup> In this paper we limit the analysis to proven oil reserves. We do not include natural gas reserves, even though they are increasing in importance and are significant in a few countries. Gas reserves are not yet well-delineated in the region, and production is at an early stage. It is important to note, however, that gas reserves are likely to be significant, with some estimates amounting to about three-quarters of proven oil reserves.

by far the largest pool, an estimated 36.4 billion barrels, 70 percent of the total (Figure 1). Angola accounts for about 18 percent, the five countries in the Central African Economic and Monetary Union (CEMAC) for about 11 percent, and Côte d'Ivoire for the remaining 1 percent.

- Based on proven reserves and current production capacity, Nigeria is projected to have the longest production horizon, 50 years or more. The projected horizon for Gabon is about 32 years, ending in 2041 (Figure 2). The other countries in the group have horizons extending until about 2030–35, with Angola, Cameroon, and Congo tapping out earliest.

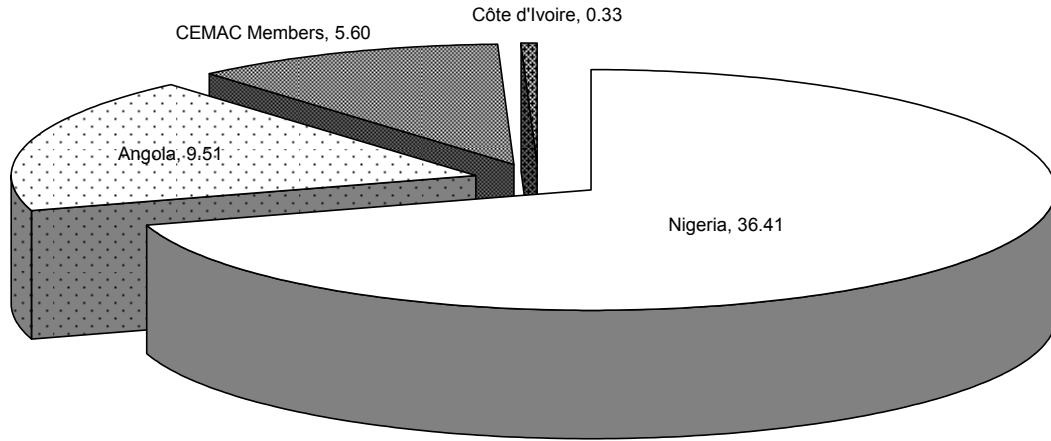
**Table 1. Oil-Producing Countries in Sub-Saharan Africa:  
Oil Production, 2007-09<sup>1</sup>**

	2007	2008	2009	2007	2008	2009
	(millions of barrels)			(share of sub-region)		
Angola	626.6	710.6	812.3	34.2	38.0	41.6
Cameroon	31.2	31.3	28.2	1.7	1.7	1.4
Chad	52.4	46.6	44.6	2.9	2.5	2.3
Congo, Rep. of	81.7	86.6	107.6	4.5	4.6	5.5
Côte d'Ivoire	17.4	16.5	17.9	1.0	0.9	0.9
Equatorial Guinea	128.3	127.9	114.5	7.0	6.8	5.9
Gabon	88.5	86.2	91.8	4.8	4.6	4.7
Nigeria	807.9	765.8	737.9	44.0	40.9	37.7
Total	1834.1	1871.5	1954.9	100.0	100.0	100.0

Sources: Country authorities.

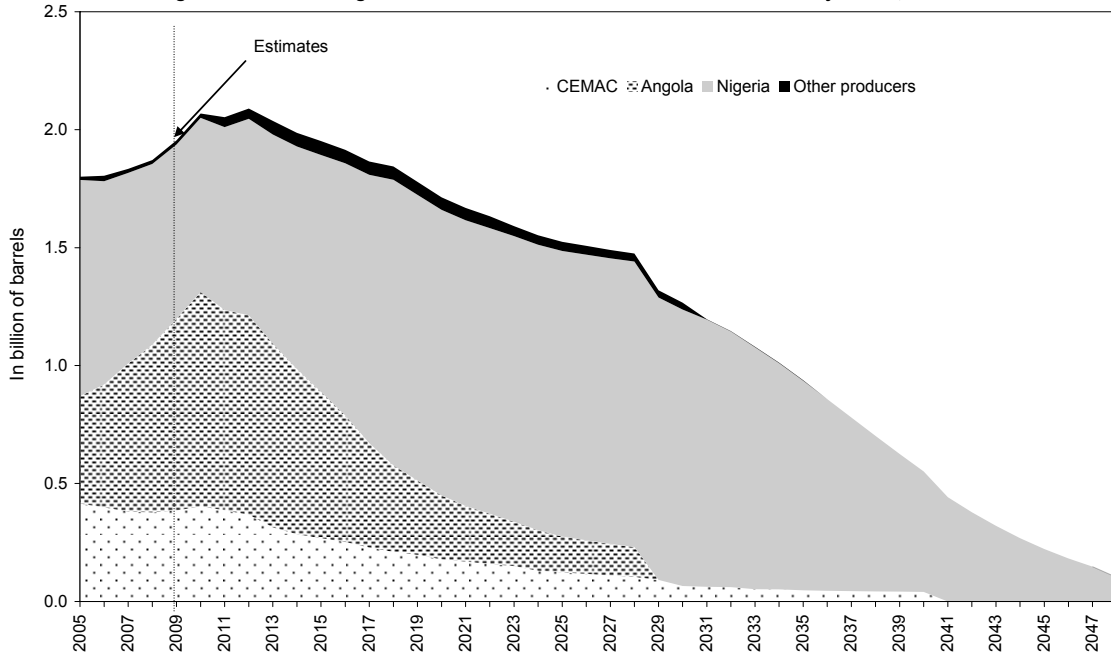
<sup>1</sup> The figures only account for the production of oil and do not include the production of natural gas.

**Figure 1. Oil-Producing Countries in Sub-Saharan Africa: Proven Oil Reserves, 2009**  
(Billion of barrels)



Source: Country authorities; and IMF staff estimates.

**Figure 2. Oil-Producing Sub-Saharan African Countries: Oil Production Projections, 2005–48<sup>1</sup>**



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

<sup>1</sup> Assuming the recovery of 100 percent of proven oil reserves.



## B. Oil Dependence

There is significant variation in how much each oil producer depends on the oil sector as a source of growth, revenue, and exports:

- In the past three years, real non-oil GDP growth has been relatively modest in many of them (Table 2). However, Angola and Equatorial Guinea have experienced double-digit expansions in the non-oil sector and this has contributed to strong overall real GDP growth (Table 3). In terms of the share of oil sector activity, 2006–08 witnessed only modest growth in two of the eight countries: Cameroon and Gabon.

**Table 2. Oil-Producing Countries in Sub-Saharan Africa:  
Real GDP Growth, 2005-08**

	Non-oil GDP	Oil GDP	Overall GDP
	(average annual growth)		
Angola	21.9	15.0	17.9
Cameroon	3.7	-1.5	3.4
Chad	3.7	-9.9	0.0
Congo, Republic of	6.0	1.5	3.3
Côte d'Ivoire	1.5	1.7	1.5
Equatorial Guinea	31.0	4.3	11.0
Gabon	4.7	0.8	2.9
Nigeria	8.9	-4.5	6.0

Source: Country authorities; and IMF staff estimates.

- The oil sector accounts for the majority of economic activity in four of the eight countries, exceeding two-thirds in Equatorial Guinea and Congo. In Nigeria, it is about one-third of the total economy, in Cameroon about 10 percent, and in Côte d'Ivoire less than 4 percent.
- From the perspective of exports and revenue, the dependence on oil is striking for the entire group. For six countries, oil accounts for more than two-thirds of total exports, and for five countries, oil accounts for more than two-thirds of total revenue. In Angola and Equatorial Guinea, the ratio of oil exports to total exports is above 90 percent. The dependence of these countries on oil exports for revenue is relatively high compared with oil-producing countries elsewhere in the world.

**Table 3. Oil-Producing Countries in Sub-Saharan Africa: Size of the Oil Sector, 2006-08**

	Oil GDP/total GDP (percent)			Oil exports/total exports (percent)			Oil revenue/total revenue (percent)		
	2006	2007	2008	2006	2007	2008	2006	2007	2008
Angola	58.4	55.8	57.4	89.8	94.7	95.6	80.2	81.0	83.6
Cameroon	10.2	9.6	11.2	37.2	30.4	33.3	35.6	33.8	38.2
Chad	46.7	45.2	45.7	83.5	83.3	84.0	72.3	73.6	78.9
Congo, Republic of	68.6	62.0	67.6	87.5	83.6	87.7	85.5	82.1	86.0
Côte d'Ivoire	3.9	3.3	3.5	32.8	30.7	27.2	14.0	13.2	21.0
Equatorial Guinea	78.8	73.8	74.7	98.6	98.6	98.9	92.0	88.5	93.5
Gabon	51.5	49.9	51.6	83.8	80.4	77.3	64.0	58.6	65.7
Nigeria <sup>1</sup>	37.3	36.1	36.7	84.4	85.7	83.9	85.9	77.0	81.0

Source: Country authorities; and IMF staff estimates.

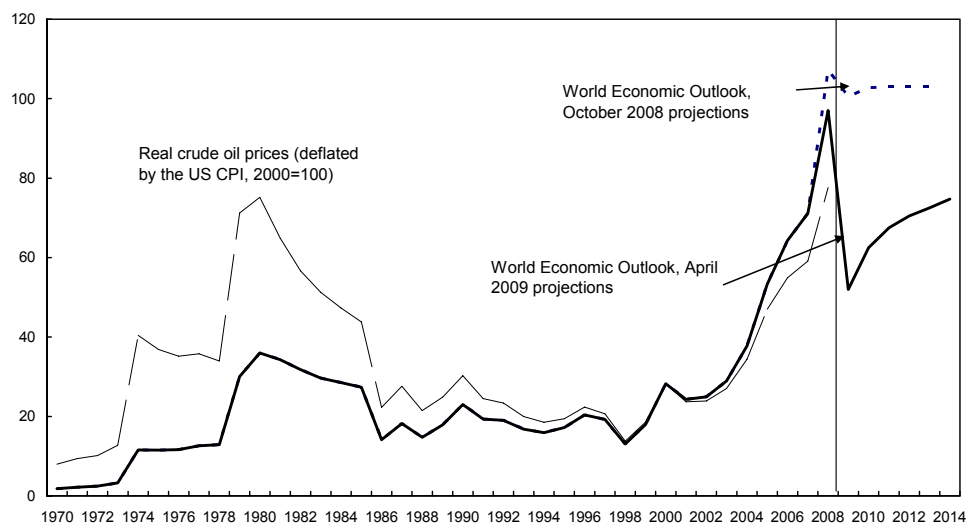
<sup>1</sup> Consolidated government (federal, state, and local).

### III. RECENT FISCAL DEVELOPMENTS AND PROSPECTS

#### A. History Repeats Itself

The run-up in world oil prices from 2005 through 2008 is unprecedented: prices doubled in nominal terms, from an average of US\$53.35 to US\$102.25 (Figure 3). For oil-dependent countries like those in sub-Saharan Africa, this could have provided a similarly unprecedented opportunity to consolidate their fiscal positions even while allowing for significant expansion of pro-growth and pro-poor social policies. A few countries, notably Nigeria and Gabon, reduced their external debt significantly over this period. However, it appears that no country seized the opportunity to consolidate its fiscal position. Once again, the fiscal positions in all eight moved procyclically and non-oil deficits widened, in some cases dramatically.

**Figure 3. Nominal and Real Crude Oil (Spot) Prices, 1970-2014 (in US Dollars)<sup>1</sup>**



Source: IMF, *World Economic Outlook*, October 2008 and April 2009.

<sup>1</sup> The crude oil price is defined as the average of West Texas Intermediate, Brent, and Dubai Fateh crude oil.

- For a long time, fiscal policy in these countries has generally not been able to smooth fluctuations in government spending (current and capital) when oil prices are volatile. The correlation coefficient of total government expenditure and the world oil price is positive and above 0.7 for all but Gabon (Table 4). The evidence for procyclicality is supported by Thornton (2008), who, using a sample covering 1960–2004, finds a statistically significant response of real government consumption to a cyclical upturn for all in the group except Angola, which was not included in his analysis; for Côte d’Ivoire, Congo, and Equatorial Guinea the response was more than proportionate.<sup>3</sup> For 2006–08, growth in current spending outpaced the growth in oil revenue from the record high prices in Angola, Cameroon, Chad, Equatorial Guinea, and Nigeria (Figure 4), with similarly high rates of growth in capital outlays in Angola, Cameroon, and Equatorial Guinea. Growth in current spending relative to the increase in oil revenue was better controlled in Côte d’Ivoire, Congo, and Gabon.
- In five of these countries, the fiscal position worsened as oil prices soared. The non-oil primary fiscal deficit was higher for 2008 than for 2006 in Angola, Cameroon, Chad, Côte d’Ivoire, and Equatorial Guinea (Table 5). In Angola it was higher by the equivalent of 11 percent of non-oil GDP and in Equatorial Guinea by about 20 percent. In the other three oil producers, the non-oil primary deficit declined, most appreciably in Congo, where the consolidation was equivalent to about 6 percent of non-oil GDP.

**Table 4. Oil-Producing Countries in Sub-Saharan Africa: Correlation Between World Oil Prices and Government Spending, 1970-2008**

	Correlation coefficient: total expenditure and the world oil price <sup>1</sup>
Angola <sup>2</sup>	0.99
Cameroon	0.73
Chad	0.86
Congo, Republic of	0.78
Côte d’Ivoire	0.73
Equatorial Guinea	0.90
Gabon	0.65
Nigeria	0.82

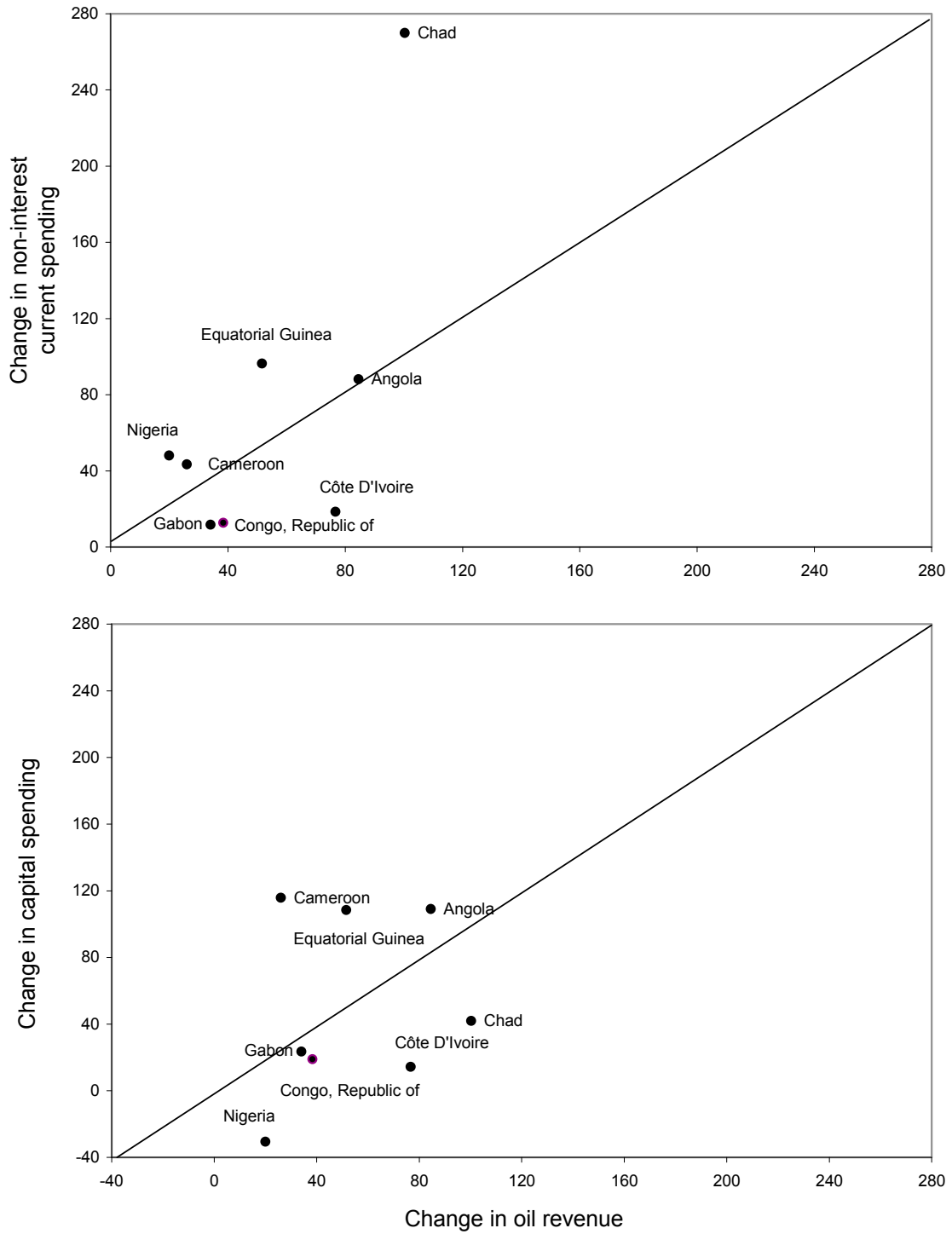
Source: IMF staff estimates.

<sup>1</sup> The world oil price is based on the average prices of West Texas Intermediate, Brent, and Dubai Fateh crude oil.

<sup>2</sup> For Angola, data is for 1996-2008.

<sup>3</sup> Thornton (2008) used ordinary least squares to examine the relationship between real government consumption (G) and output (Y) for 37 low-income African countries for 1960–2004. Procyclicality of government spending implies a positive coefficient on Y, with a more than proportionate response indicated by a coefficient greater than one.

**Figure 4. Oil-Producing Countries in Sub-Saharan African: Change in Revenue and Government Spending, 2006-08 (in percent)**



Sources: Country authorities; and IMF staff estimates.

**Table 5. Oil-Producing Countries in Sub-Saharan Africa:  
Non-oil Primary Balance, 2006-08**

	2006	2007	2008
	(percent of non-oil GDP)		
Angola	-50.3	-56.9	-61.3
Cameroon	-1.4	-2.8	-7.8
Chad	-21.2	-26.9	-30.1
Congo, Republic of	-53.9	-59.0	-47.8
Côte d'Ivoire	-3.1	-1.9	-4.5
Equatorial Guinea	-29.0	-34.9	-50.3
Gabon	-15.7	-10.4	-12.0
Nigeria <sup>1</sup>	-33.7	-34.7	-31.8

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

<sup>1</sup> Consolidated government (federal, state, and local).

What is also unfortunate is that the increase in government spending was not accompanied by significant improvements in public financial management or the further development of special fiscal institutions that could have helped to contain such spending and ensure its quality. The increased spending may be a symptom of continuing inadequacies in these areas.

- Several indicators of the effectiveness of public financial management, institutional quality, and governance point to a similar conclusion for all eight countries; some progress has been made in these areas (for example, fiscal responsibility legislation and preparations to introduce performance-based budgeting in Nigeria), but there may also have been some deterioration. Table 6 draws on World Bank data on the quality of public sector management and institutions; six of the eight oil-producing sub-Saharan African countries still appear to rank below the average of all IDA-eligible countries,<sup>4</sup> and they have not gained much ground since 2005. Table 7 supports this assessment; six countries rank low on political risk, a proxy for institutional quality, and government effectiveness.

**Table 6. Oil-Producing Countries in Sub-Saharan Africa: Quality of Public Sector Management and Institutions, 2005-07<sup>1</sup>**

	Quality of Budget and Financial Management		Efficiency of Revenue Mobilization		Quality of Public Administration		Transparency, Accountability, and Corruption in the Public Sector		Average	
	2005	2007	2005	2007	2005	2007	2005	2007	2005	2007
Angola	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Cameroon	3.5	3.5	4.0	3.5	3.0	3.0	2.5	2.5	3.3	3.1
Chad	3.0	2.0	2.5	2.5	2.5	2.5	2.0	2.0	2.5	2.3
Congo, Rep. of	3.0	2.5	3.0	3.0	2.5	2.5	2.5	2.6	2.8	2.7
Côte d'Ivoire	2.5	2.0	4.0	4.0	2.0	2.0	2.0	2.0	2.6	2.5
Equatorial Guinea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Gabon	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Nigeria	3.0	3.0	3.0	3.0	2.5	3.0	3.0	2.9	2.9	3.0
Memorandum item										
Avg. of all IDA-eligible countries	3.2	3.2	3.4	3.4	3.0	3.0	2.9	2.9	3.1	3.1

Sources: Adapted from IMF, Sub-Saharan Africa: Regional Economic Outlook, April 2007; and 2005-07 IDA Resource Allocation Index (IRAI).

<sup>1</sup>The quality index is derived from the World Bank's Country Policy and Institutional Assessment, which rates countries against a set of criteria (including public sector management and institutions) and establishes a Resource Allocation Index to rank them. The scale of the index is 1 for the lowest rating, and 6 for the highest.

<sup>4</sup> IDA-eligible countries are those that in 2009 have per capita GNI below US\$1,095.

**Table 7. Oil-Producing Countries in Sub-Saharan Africa: Selected Indicators of Institutional Quality, 2000 and 2007**

		Political risk <sup>1</sup> (100=low, 0=high)	Government effectiveness <sup>2</sup>		
			Percentile rank (0-100)	Score (-2.5 to +2.5)	Standard error
Angola	2000	47.0	5	-1.39	0.19
	2007	57.5	11	-1.16	0.19
Cameroon	2000	56.0	24	-0.75	0.19
	2007	66.0	17	-0.87	0.17
Chad	2000	n.a.	29	-0.62	0.25
	2007	n.a.	4	-1.45	0.18
Congo, Rep. of	2000	52.0	3	-1.52	0.23
	2007	55.0	7	-1.34	0.19
Côte d'Ivoire	2000	53.0	22	-0.79	0.19
	2007	44.0	5	-1.37	0.18
Equatorial Guinea	2000	n.a.	4	-1.46	0.22
	2007	n.a.	6	-1.37	0.18
Gabon	2000	63.0	32	-0.6	0.19
	2007	59.5	27	-0.66	0.19
Nigeria	2000	46.0	13	-1.02	0.18
	2007	43.5	15	-0.93	0.16
Memorandum item					
Norway	2000	89.0	95	1.94	0.18
	2007	89.5	99	2.12	0.18

Sources: International Country Risk Guide; and Kaufman, D. A. Kraay, and M. Mastruzzi, 2008, Governance Matters VII: Governance Indicators for 1996-2007.

<sup>1</sup> Political risk is used as a proxy for institutional quality as it includes such components as law and order, democratic accountability, and bureaucracy quality.

<sup>2</sup> The percentile rank is based on a sample of 212 countries; the average score across the sample is 0.

- As a second-best option to tighten public financial management, many oil-producing countries have turned to special fiscal institutions to help address the challenges posed by volatile oil prices and dependence on oil revenue. Ossowski et al. (2008) define special financial institutions to include fiscal rules and fiscal responsibility legislation, oil funds, and the use of budgetary oil prices (see Box 1). These authors find that special fiscal institutions can help manage oil wealth, but are most effective in countries that demonstrated fiscal prudence even before these institutions were created. So far, oil producers in sub-Saharan Africa have not made extensive use of such institutions, and the limited experience is mixed (Table 8). None use explicit fiscal rules or fiscal responsibility legislation, although in Congo and Equatorial Guinea the fiscal stance is reportedly guided by a model based on the permanent income hypothesis. Only Equatorial Guinea and Gabon have oil-wealth funds (Funds for Future Generations, see Box 2), and only Angola, Cameroon, and Nigeria budget an oil price and save oil revenue above the reference price in extra-budgetary accounts. In Nigeria, the proceeds of such saving are to be used for public investments agreed between federal and state governments.
- Only Nigeria uses a medium-term expenditure framework to link the budget with longer-term policies and fiscal sustainability, although Congo is working on one. To reduce dependence on oil revenue, all eight countries place importance on

accelerating efforts to mobilize more domestic revenue (see Table 8, projected increases in non-oil revenue as a proportion to total revenue) mainly through tax and customs administration reform and tax policy measures.

### **Box 1. Special Fiscal Institutions for the Management of Oil Revenue**

Strong public financial management is the first and best solution to the economic and fiscal policy challenges posed by volatile oil prices and dependence on oil revenue. However, many countries in sub-Saharan Africa, including the oil producers, do not manage their public finances well because their administrative and institutional capacity is limited. A few of oil-producing countries have tried to compensate for these deficiencies by setting fiscal rules and passing fiscal responsibility legislation, establishing oil funds, and using budgetary oil prices.

Ossowski et al. (2008) note that special fiscal institutions are second-best to careful public financial management and present challenges in their own right, the main one being to ensure that they operate in a transparent and accountable manner and are designed and supported by other effective institutions.

- *Fiscal rules and fiscal responsibility legislation:* These are mainly designed to shape the formulation and execution of fiscal policies by binding the hands of the government or fiscal agent. They are sometimes enshrined in law, but are often presented merely as guidelines. Some rules and legislation provide for quantitative indicators; others establish benchmarks for transparency and accountability. Experience with fiscal-related rules or legislation is relatively limited, but they do not seem to have been highly successful (Ossowski et al., 2008).
- *Oil funds:* The operational objective of an oil fund is typically to smooth the flow of oil revenue to the budget; the policy objective is to support economic stability by smoothing government expenditure. Some funds also have a long-term savings objective. Ossowski et al. (2008) report 21 oil funds in a sample of 31 oil-producing countries, of which two were in sub-Saharan Africa (Equatorial Guinea and Gabon). To be effective, these funds should be integrated into annual budgets, should not have autonomy over the use of their financial resources, and should have mechanisms in place to ensure good governance and transparency.
- *Budgetary oil price:* This involves use of a conservative oil price or revenue in budget projections. The prices are determined in a variety of ways; are negotiated among levels of government (as in Nigeria), based on prudent assumptions or futures prices, or are artificially low.

### Box 2. Oil Funds—Selected Examples

An oil fund can serve a number of policy objectives, such as stabilizing the economy (through the smoothing of government spending), acting as a repository for the government's oil-related savings, and supporting good management practices (transparency and accountability) for the country's oil wealth (financial assets).

In the oil-producing countries in sub-Saharan Africa, only Equatorial Guinea and Gabon have such a Fund for Future Generations. Chad had a similar fund, but it was discontinued in 2006. The African Funds for Future Generations have similar features: they are primarily designed to preserve oil-related savings; they are held in BEAC, the regional central bank; and each has an accumulation rule (in principle, ½ percent of oil revenue for Equatorial Guinea and a more complicated formula for Gabon, depending on the current size of its fund (see Table 8). How the two funds operate also differs; most importantly, there are no rules relating to withdrawals from Equatorial Guinea's fund, and deposits can be held offshore.

For cross-country comparison, consider the features of some other oil funds:

*Norway's State Petroleum Fund (SPF)*: Despite its name, Norway's SPF is effectively a fiscal tool—a separate government account—to manage accumulated fiscal surpluses rather than oil revenues in isolation. It was established in 1990, but did not become active until five years later when a fiscal surplus was achieved. There are no rigid rules for accumulation or withdrawal of wealth from the SPF. Generally, all oil revenues and investment returns are transferred to the SPF and the SPF makes reverse transfers to the budget to cover non-oil deficits. Consequently, the net accumulation of assets in the SPF depends not only on oil revenues, but more importantly, on the overall fiscal stance. The SPF is controlled by the Ministry of Finance and managed by the central bank with extensive use of external fund managers. By design, the SPF does not deal directly with two main objectives of many oil funds: to reduce revenue volatility, and ensure sustainable use of a nonrenewable resource. Instead, these objectives are addressed in the budgetary process, which also ensures transparency and accountability.

*Kuwait's Future Generation Fund (FGF)*: The FGF, established in 1976, is one of the oldest oil funds. Its main objective is to provide steady investment income for future generations. The government is required to deposit 10 percent of total revenue into the FGF each year, regardless of oil prices and the overall fiscal stance. While there is no precise rule for withdrawal, drawing from the FGF requires the approval of the national assembly. FGF assets, owned by the state of Kuwait, are managed by the Kuwait Investment Authorities, an autonomous government agency with an independent board of directors and a managing director appointed from the private sector.

*State Oil Fund of the Republic of Azerbaijan (SOFAZ)*: SOFAZ was established in 1999 mainly as a savings fund. It receives all government revenue associated with post-Soviet oil and gas production. With no immediate objective for stabilization, net inflows do not depend on oil prices or the overall budget. The SOFAZ, an extra-budgetary institution, is controlled by a supervisory board whose members are appointed by the president of Azerbaijan. Spending funded by the SOFAZ, although not included in the state budget, has to be approved by the President and stay within the consolidated budgetary ceilings approved by the parliament. In addition, outflows from the SOFAZ cannot exceed inflows in any given year.

*Algeria's Fund for the Regulation of Receipts (FRR)*: FRR was established in 2000, is fully integrated into the budget, and in practice is effectively a government sub-account in the central bank. In addition to saving for future generations, the FRR has a revenue stabilization feature. Oil revenues in excess of the budgeted oil price are transferred to the FRR, and withdrawals from it are permitted to finance budget deficits or reduce government debt.



Table 8. Oil Producing Countries in Sub-Saharan Africa: Medium-Term Fiscal Strategies

	Non-CEMAC			CEMAC <sup>1</sup>				
	Angola	Cote D'Ivoire	Nigeria	Cameroon	Chad	Congo, Rep. of	Equatorial Guinea	Gabon
<b>Fiscal rule</b>								
General	No explicit rule.	A basic fiscal balance to GDP ratio of zero or more; and a public debt to GDP ratio (internal and external) of 70	No explicit rule.	For all CEMAC countries, a basic fiscal balance to GDP ratio of zero or more; and a public debt to GDP ratio (internal and external) of 70 percent or less. <sup>2</sup>				
Oil-related	Oil revenues are budgeted according to a "conservative" oil price assumption, which is usually below-market.	n.a.	Oil revenues in excess of the "budgeted oil price and production level" are transferred into the "excess crude account" at the central bank (since 2004).	Oil revenues in excess of the budget oil price are used to pay down debt and fund one-off projects.	10 percent of oil revenues saved.	No explicit rule; however, the medium-term fiscal stance is guided by a model based on the permanent-income hypothesis.	No explicit rule; however, the medium-term fiscal stance is guided by a model based on the permanent-income hypothesis.	Fund for Future Generations; if the balance is less than CFAF 500 billion, the government is required to transfer to the Fund 10 percent of budgeted oil revenue from the current year, and 50 percent of windfall oil revenue; if the balance is greater than CFAF 500 billion, the required transfer is 100 percent of windfall revenue.
<b>Fiscal stance</b>								
Non-oil primary deficit, 2008 (percent of non-oil GDP)	61.3	4.4	32.7	7.8	30.1	47.8	75.6	12.0
Non-oil primary deficit, 2011 (percent of non-oil GDP) <sup>3</sup>	40.1	4.6	25.1	5.3	24.7	32.7	54.0	8.8
Medium-term expenditure framework	No	No	Yes	No	No	Under development	No	No
<b>Management of oil wealth</b>								
Oil-wealth fund	A reserve fund for the difference between the world price for Angola's oil and the budgeted price	n.a.	Excess crude account at the central bank in the name of various government entities (\$US17 billion at end-2007)	n.a.	None. Fund for Future Generations abolished in 2006.	None	Fund for Future Generations	Fund for Future Generations
Governance	Not a traditional oil fund with explicit rules for its operations.	n.a.	All oil revenues flow to federal accounts and shared among oil producing states (13 percent); federal (52.7 percent), states (26.7 percent) and local (20.6 percent).	n.a.	"Offshore" escrow account overseen by WB.	n.a.	Held in the regional central bank.	Managed by the regional central bank in a special account.

**Table 8. (cont.) Oil producing Countries in Sub-Saharan Africa: Medium-Term Fiscal Strategies**

<b>Domestic revenue mobilization</b>								
Non-oil revenue/total revenue, 2008 (percent)	16.4	79.0	19.0	61.8	21.1	14.0	6.5	34.3
Non-oil revenue/total revenue, 2011 (percent) <sup>3</sup>	24.3	84.2	29.6	76.4	38.0	23.0	12.0	51.6
Domestic revenue mobilization efforts	A key objective of the authorities is to improve the growth prospects for the non-oil sector.	Objective is to stabilize revenue at 19 percent of GDP with strong tax administration efforts, which should help offset declining oil and cocoa revenue.	The aim is to diversify revenue from oil to non-oil sources.	With high tax rates and tense social situation, the focus will be stepped-up efforts to improve tax and customs revenue administration.	To enhance non-oil revenue collection through reforms in tax and customs administration, which includes making the large taxpayers unit operational and form a medium-term action plan to address the large leakages in customs.	Focus on tax and customs administration reform; and tax reform.	Continued reinforcement of tax administration and a determined effort to reform customs administration are essential to improve non-oil revenue.	To improve the efficiency of the tax system by broadening the non-oil revenue base, including through reducing exemptions.
<b>Targets under an IMF-supported program</b>	n.a.	Overall fiscal balance with a capped oil revenue adjuster	n.a.	Non-oil primary budget balance	n.a.	Non-oil primary budget balance	n.a.	Primary fiscal balance, excluding oil revenue

Source: IMF Country Reports; Fund staff.

<sup>1</sup> Central African Economic and Monetary Union.

<sup>2</sup> Based on the CEMAC and WAEMU (West African Economic and Monetary Union) first-tier convergence criteria.

<sup>3</sup> Fund staff estimates and projections for 2011 (published in the April 2009 World Economic Outlook).

## B. Medium-Term Projections and Vulnerability

The global financial crisis and the ensuing decline in world oil prices has increased the fiscal vulnerability of oil-producing countries in sub-Saharan Africa as elsewhere and heightened concerns about long-term sustainability. Countries, therefore, need to weigh their options for fiscal policy responses: where there is room and financing to maneuver, countries may have scope for a fiscal expansion; where there is not, some consolidation may be necessary (see Box 3).

### Box 3. Fiscal Policy in Sub-Saharan Africa and the Global Economic Crisis

The global financial crisis poses major challenges to fiscal policy in sub-Saharan African countries because growth is weakening, largely in response to external factors (declining exports and commodity prices, remittances, tourism, and foreign direct investment). According to Berg et al. (2009), the fiscal effects of the crisis are likely to be large and to operate mainly via revenue losses, especially in commodity-related revenue, and a possible reduction in foreign aid flows. At the same time, spending pressures will increase.

Fiscal policy could be used counter-cyclically to help smooth the impact of the crisis for countries that have stabilized their economies, have some fiscal space, and either have or can gain access to financing. For those for which conditions are less favorable, the scope for fiscal expansion is limited and there may be no alternative to consolidation to guard against a significant deterioration in the fiscal position.

For those that do have room to maneuver, Berg et al. (2009) suggest that they keep in mind cyclical conditions, especially the size and sign of the output gap, and the importance of keeping external debt sustainable; allow automatic stabilizers to work, which would involve letting non-commodity-related revenue and spending adjust endogenously to the slowdown in economic activity; and in some case accommodate declines in commodity-related revenue (for example, from mineral and petroleum resources). Also, Berg et al. suggest that any fiscal stimulus package stress the importance of well-targeted and reversible discretionary spending to prevent a permanent increase in fiscal deficits; and favor spending (especially for infrastructure and social programs) over reductions in tax rates.

For countries that must consolidate Berg et al. (2009) suggest that they broaden the tax base and reinforce revenue administration; perhaps raise some tax rates temporarily; and rationalize expenditure programs to enhance the efficiency of the envelope for creating fiscal space.

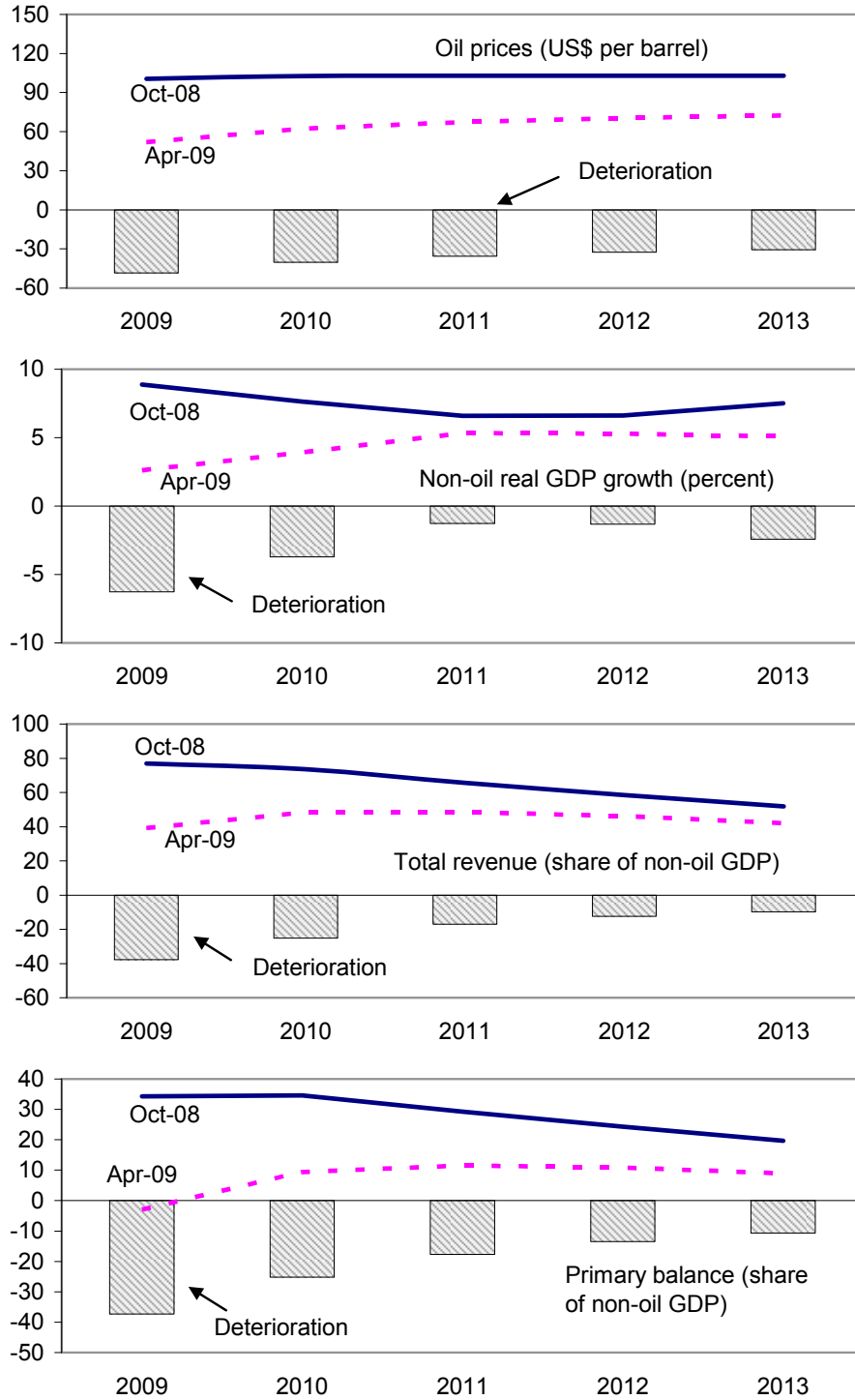
For oil-producing countries in the region, the global financial crisis is projected to cause a marked deterioration in the medium-term outlook, especially the fiscal position, compared with several months ago. This will increase their fiscal vulnerability and move them further away from sustainability, as we attempt to demonstrate in detail below.

- Compared with the assumptions underlying the IMF's *World Economic Outlook* published in October 2008, world oil prices were projected in April 2009 to be significantly lower for 2009–13. Last October oil prices were assumed to average about US\$102.45 over the four-year period; in contrast, in April 2009 they were

assumed to rise modestly from about US\$52.00 in 2009 to US\$72.50 in 2013, resulting in an average price of US\$65.00 over the period (Figures 3 and 5).

- Real economic activity in the non-oil sector is projected to decline in each of the eight countries by a region-wide (unweighted) average of 6.3 percent in 2009 and 3.7 percent in 2010, and this is heavily influenced by the plunge in growth in Equatorial Guinea in both years (Table 9). For six of the eight countries (except Congo and Gabon), the projected path of growth in the non-oil economy through 2013 is now much lower than was projected in October 2008.
- The adverse impact on total revenue is dramatic. It is projected to decline by a region-wide average of nearly 38 percent this year and will be nearly 10 percent lower in 2014 than was expected just several months ago. The projected loss is particularly marked for Congo: in October 2008, IMF staff projected total revenue at about 226 percent of non-oil GDP in 2009, but now project it at 67 percent of non-oil GDP.
- The primary balance worsens across the group by a similar order of magnitude as the decline in total revenue, reflecting the lack of consolidation in seven of the eight countries. The unweighted primary surplus was projected in October 2008 at about 34 percent of non-oil GDP in 2009, declining to a surplus of about 20 percent in 2013. The more recent projection is an average primary deficit of about 3 percent of non-oil GDP in 2009, moving to a surplus of 11 percent over the medium term. Once again, the difference in the outlook is most dramatic for Congo, where the plunge in oil prices is now projected to lower the primary surplus by an average of 100 percent of non-oil GDP for 2009–13.

**Figure 5. Oil-Producing Countries in Sub-Saharan Africa:  
Deteriorating Economic Outlook, 2009-13<sup>1</sup>**



Source: IMF, World Economic Outlook, various issues.

<sup>1</sup> The projections are based on the published World Economic Outlook from October 2008 and April 2009.

**Table 9. Oil-Producing Countries in Sub-Saharan Africa: Deterioration in the Economic Outlook, 2009-2013**

		Oct. 2008 World Economic Outlook (1)					April 2009 World Economic Outlook (2)					Difference, (2)-(1)				
		2009	2010	2011	2012	2013	2009	2010	2011	2012	2013	2009	2010	2011	2012	2013
Angola	Non-oil real GDP growth <sup>1</sup>	11.2	11.5	8.6	7.6	8.8	9.0	11.4	8.2	7.3	8.6	-2.2	-0.1	-0.4	-0.3	-0.2
	Total revenue <sup>2</sup>	94.5	95.7	83.0	78.6	72.5	52.3	53.5	58.8	57.9	56.1	-42.2	-42.2	-24.2	-20.7	-16.4
	Primary balance <sup>2</sup>	31.2	37.2	30.7	29.9	27.9	-14.1	-6.5	4.8	7.6	10.4	-45.3	-43.7	-25.9	-22.4	-17.5
Cameroon	Non-oil real GDP growth <sup>1</sup>	5.0	5.7	6.3	5.5	5.5	2.8	3.2	3.8	4.2	4.7	-2.2	-2.5	-2.5	-1.3	-0.8
	Total revenue <sup>2</sup>	21.8	20.7	19.4	18.9	18.8	19.5	18.7	18.6	18.6	18.8	-2.3	-2.0	-0.8	-0.2	0.0
	Primary balance <sup>2</sup>	1.4	0.1	-1.5	-1.9	-2.0	-0.2	-0.8	-0.8	-0.6	-0.4	-1.5	-0.9	0.6	1.3	1.6
Chad	Non-oil real GDP growth <sup>1</sup>	4.8	4.6	4.7	4.7	4.7	4.0	3.5	4.0	4.0	4.0	-0.8	-1.1	-0.7	-0.7	-0.7
	Total revenue <sup>2</sup>	55.9	51.4	40.8	40.1	36.3	21.2	28.8	31.0	30.2	28.8	-34.7	-22.5	-9.8	-9.9	-7.5
	Primary balance <sup>2</sup>	23.7	23.1	14.6	16.1	12.4	-8.7	2.9	5.6	5.6	4.5	-32.4	-20.2	-9.0	-10.5	-7.9
Congo	Non-oil real GDP growth <sup>1</sup>	7.3	7.5	7.2	7.2	6.5	3.5	6.0	7.5	7.5	6.8	-3.8	-1.4	0.3	0.3	0.3
	Total revenue <sup>2</sup>	225.6	226.2	193.8	164.3	144.2	67.0	116.1	110.1	101.7	92.0	-158.7	-110.1	-83.7	-62.6	-52.2
	Primary balance <sup>2</sup>	164.2	168.0	138.5	112.7	95.3	0.6	54.6	51.8	47.0	40.5	-163.6	-113.3	-86.7	-65.7	-54.8
Côte d'Ivoire	Non-oil real GDP growth <sup>1</sup>	4.4	5.6	6.3	6.3	6.5	3.6	4.2	4.6	5.2	5.9	-0.8	-1.4	-1.7	-1.1	-0.6
	Total revenue <sup>2</sup>	22.0	22.5	22.4	22.5	22.5	18.6	20.9	21.3	21.9	22.3	-3.4	-1.6	-1.1	-0.7	-0.2
	Primary balance <sup>2</sup>	0.9	0.6	-0.1	-1.0	-1.1	-1.4	0.2	-0.5	-1.3	-1.9	-2.2	-0.4	-0.4	-0.3	-0.8
Equatorial Guinea	Non-oil real GDP growth <sup>1</sup>	26.0	13.1	7.2	9.4	17.2	-5.4	-2.8	3.8	2.5	-0.4	-31.4	-16.0	-3.5	-6.9	-17.5
	Total revenue <sup>2</sup>	109.6	89.5	89.4	74.6	56.1	76.6	84.3	85.5	76.7	58.8	-33.0	-5.2	-3.9	2.1	2.7
	Primary balance <sup>2</sup>	21.9	17.9	26.4	20.2	10.1	5.4	16.7	21.2	17.1	8.0	-16.5	-1.2	-5.3	-3.1	-2.2
Gabon	Non-oil real GDP growth <sup>1</sup>	4.9	5.3	4.5	4.1	3.5	-0.5	2.8	6.0	6.0	4.7	-5.5	-2.5	1.5	1.9	1.2
	Total revenue <sup>2</sup>	62.9	60.4	55.4	51.2	47.3	43.8	46.0	44.6	42.1	39.9	-19.1	-14.4	-10.8	-9.1	-7.4
	Primary balance <sup>2</sup>	29.6	28.6	24.8	20.7	16.9	4.5	9.7	10.9	9.9	8.4	-25.0	-18.9	-13.9	-10.8	-8.5
Nigeria	Non-oil real GDP growth <sup>1</sup>	7.6	7.6	8.1	8.1	7.3	4.0	3.0	4.8	5.5	6.3	-3.6	-4.6	-3.3	-2.5	-1.1
	Total revenue <sup>2</sup>	23.4	22.0	20.9	18.2	17.2	15.1	18.9	18.8	20.2	20.0	-8.3	-3.0	-2.1	1.9	2.8
	Primary balance <sup>2</sup>	2.0	1.0	0.4	-1.9	-2.6	-9.6	-1.9	-0.9	1.3	1.9	-11.6	-2.9	-1.3	3.2	4.6
Memorandum item																
World oil price (US dollars) <sup>3</sup>		100.50	102.75	103.00	103.00	103.00	52.00	62.50	67.50	70.50	72.50	-48.50	-40.25	-35.50	-32.50	-30.50

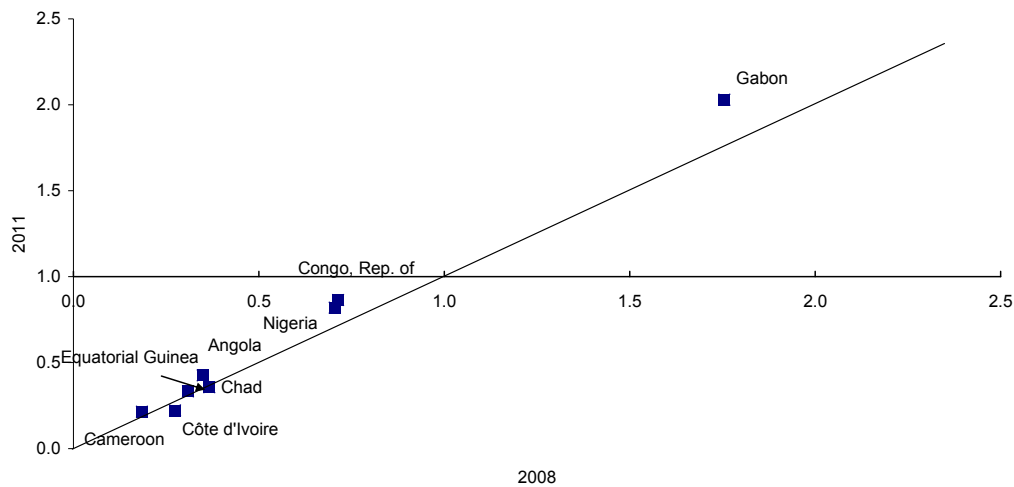
Source: IMF staff estimates and projections.

<sup>1</sup> Annual percentage change.

<sup>2</sup> Percent of non-oil GDP.

- To assess trends in the long-term sustainability of fiscal policies in these eight countries, we compared the actual fiscal position in 2008 with a fiscally sustainable benchmark, which we derive below (Section V) from a model based on the permanent income hypothesis.<sup>5</sup> Figure 6 presents fiscal sustainability ratios, which are computed as the ratio of the implied sustainable non-oil primary balance compared with the actual (2008) and projected (2011<sup>6</sup>) non-oil primary balance. Only Gabon is expected to have a sustainable fiscal stance over the medium term, Congo and Nigeria show some improvement, and the rest generally follow an unchanged fiscal policy.<sup>7</sup>

Figure 6. Oil Producing Countries in Sub-Saharan Africa:  
Fiscal Sustainability Ratios, 2008 vs. 2011<sup>1</sup>



Source: IMF staff estimates and projections.

<sup>1</sup> Computed as the ratio of the sustainable non-oil primary balance, derived from a model based on the permanent income hypothesis with constant real expenditures, relative to the projected non-oil primary balance (presented in the World Economic Outlook, April 2009). Countries below 1 would need to adjust to move toward sustainability; countries above the 45-degree line show a projected improvement between 2008 and 2011.

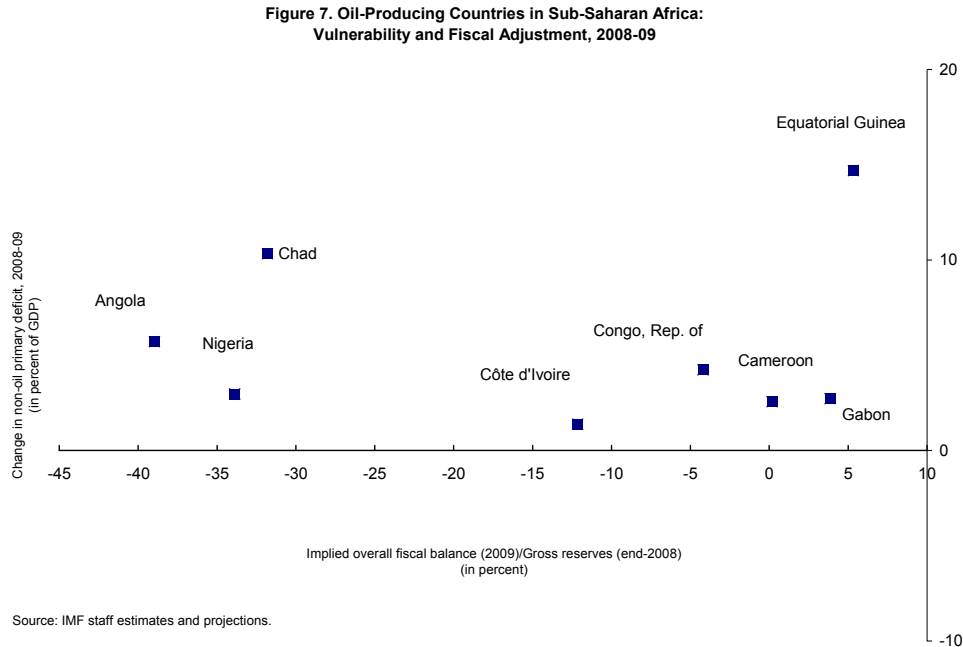
- To assess near-term adjustment efforts in these eight countries in the face of a negative oil price shock, we examined the overall balance for the central government in 2009 and the change in the non-oil primary deficit during 2008–09 (Figure 7). Equatorial Guinea and Gabon are expected to have an overall surplus in 2009, while five countries are expected to have sizable fiscal deficits relative to their gross international reserves (close to 40 percent in the case of Angola). Somewhat surprisingly, all eight countries are expected to see higher non-oil primary deficits in

<sup>5</sup> We use the estimates from the permanent income model here because they lie in the middle between two extremes which we explore in Section IV, a balanced-budget rule and bird-in-hand.

<sup>6</sup> All projections for years beyond 2008 are based on the April 2009 *World Economic Outlook*.

<sup>7</sup> Countries with ratios below one would have to adjust to reach the sustainable benchmark. In Figure 6, countries above the 45 degree line are projected to improve their fiscal sustainability between 2008 and 2011.

2009 compared with 2008 as oil prices collapsed. There is little evidence that there has been any substantial fiscal adjustments in response to lower oil prices and, in turn, lower oil wealth.



#### IV. SOME FISCAL RULES FOR SUSTAINABILITY

In this paper we assess fiscal sustainability using three different models of fiscal rules, which range from spending all oil revenue to saving it all and spending only the real returns from previously accumulated oil wealth. The indicator of interest is the non-oil primary balance, because it is the most useful measure of the direction of fiscal policy and sustainability. Barnett and Ossowski (2003) point out that fiscal policy in this framework is essentially constant because both non-oil revenue and primary expenditure are held constant as a share of GDP. In contrast, the primary and overall balances are affected by oil revenue and will move when oil prices change and oil revenue is exhausted.

These are the three models:

- Bird-in-hand:** As elaborated by Bjerkholt and Niculescu (2004), the government would turn its oil resources into financial assets and commit to spend each year only the projected return on those financial assets. This is a highly conservative approach that (in principle) preserves a country's oil wealth indefinitely; it presumes that the overall budget would not fall into deficit.<sup>8</sup>

<sup>8</sup> Indeed, taking a bird-in-hand approach, the government would behave as if there is no future oil revenue.



- **Balanced budget:** Here, the government would adopt a balanced budget over the relevant time horizon, using up each year's (projected) oil revenue in the process. Since the budget is balanced, this regime would necessarily lead to an annual non-oil deficit equivalent to the amount of oil revenue. While this might be considered an extreme position and is often referred to as "going on a binge," some countries might move in this direction if the oil sector is a relatively small share of total economic activity and the horizon for oil production is coming to an end.
- **Constant real expenditure:** Here, the government would adopt a fiscal stance that preserves its net worth, which is based on the net present value of future flows of oil revenue (abstracting from debt). To maintain its net worth the government would spend only the permanent (annual) income from its oil-generated wealth, thus ensuring sustainability by maintaining a constant real expenditure path beyond the lifetime of oil reserves. A variation of this rule, which is also considered in this paper, is to allow constant real per capita expenditure to demonstrate the impact of treating current and future generations equally. Unlike the other two rules, there are micro-foundations for a constant real expenditure path based on Friedman's permanent income hypothesis.

The constant real expenditure model is based on Milton Friedman's (1957) notion of permanent income. Friedman postulated that the consumption behavior of consumers is determined by lifetime or long-term income expectations, not by current income. In his view, short-term or transitory changes in income have little or no effect on consumption; only permanent or lifetime income matters. The analogy to oil wealth is readily apparent; a government with such an asset could choose a spending profile that smoothes public consumption over time, subject to its intertemporal budget constraint based on its long-term income.

Barnett and Ossowski (2003) developed a model based on Friedman's notion of permanent income to show how a government could solve a dynamic optimization problem to determine a constant real expenditure path that could help achieve long-term fiscal sustainability. This model has been used by a number of other researchers (for example, Leigh and Olters, 2006; Carcillo, Leigh, and Villafuerte, 2007; and Olters, 2007) to assess fiscal sustainability in several oil-producing sub-Saharan countries. In its simplest form, the government chooses a tax and spending policy to maximize a social welfare function, subject to an intertemporal budget constraint and a no-Ponzi-game condition (which simply restricts the terminal stock of government bonds):

$$\begin{aligned}
 (1) \quad & \text{Max}_{\{G_t\}} \sum_{s=t}^{\infty} \beta^{s-t} U(G_s), \\
 (2) \quad & \text{s.t.} \quad B_t = RB_{t-1} + G_t - T_t - Z_t, \\
 (3) \quad & \text{and} \quad \lim_{s \rightarrow \infty} B_{t+s} = 0
 \end{aligned}$$

where  $\beta$  is a discount factor,  $G_t$  is primary government expenditure,  $B_t$  is government debt at the end of the period,  $R=1+r$  is the long-run interest rate (assumed to be constant),  $T_t$  is non-oil revenue, and  $Z_t$  is oil revenue. Since only government expenditure and revenue affect the evolution of debt in this model, the social welfare function could be specified using the primary balance or the revenue for a given level of expenditure (tax-smoothing approach), and expenditure for a given level of revenue.

Barnett and Ossowski (2003) show that the solution to the problem (assuming  $\beta R=1$ ) is a Euler equation given by<sup>9</sup>

$$(4) \quad U'(G_t) = \beta R U'(G_{t+1}),$$

where  $U'(G_t)$  is the first derivative and the result emerges that  $G_t = G_{t+1} \equiv \bar{G}$ ; that is, government spending should be constant. More formally, spending is equal to the permanent income or the return on the present discounted value of wealth (or oil revenue)

$$(5) \quad \bar{G} = T + r/R \sum_{i=0}^N R^{-i} Z - r B_{t-1}$$

We estimate equation (5) and compare the results against the bird-in-hand and the balanced budget rule in Section V.<sup>10</sup>

### A. Underlying Assumptions

To estimate the underlying long-term sustainable non-oil primary balances for the eight members of our oil-producing group, we make simplifying assumptions about oil reserves, world oil prices, and key macroeconomic variables.

- **Oil reserves:** We restrict our analysis to proven reserves, which IMF staff and the authorities estimate at about 52 billion barrels; this is within the range of independently reported estimates (Table 10). We do not include gas reserves, which

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<sup>9</sup> Assuming that either  $\beta \cdot R > 1$  or  $\beta \cdot R < 1$  would imply that government spending either decline to zero or explodes.

<sup>10</sup> Leigh and Olters (2006), Carcillo, Leigh, and Villafuerte (2007), and Olters (2007) extend the basic model to include habit formation or inertia in government spending, which allows them to estimate an adjustment path toward long-term sustainability. This paper does not employ such an analysis because it requires more detailed knowledge of country-specific factors than we possess. Indeed, judging the appropriate pace of fiscal adjustment is better left to country experts, since it requires an understanding of individual country circumstances, such as cyclical conditions, institutional and capacity constraints, available financing, external sustainability, and an informed view of the political environment.

are important for Equatorial Guinea and Nigeria, for lack of comparable data for the other countries. However, given the increasing importance of gas in these countries, including all hydrocarbon production could affect our analysis and conclusions (see Box 4 below).

- **World oil prices:** The projections assume an increase in the average price per barrel from US\$52.00 in 2009 to US\$74.75 in 2014 (Figure 8 and Table 11).<sup>11</sup> Over the long term we assume that the real world oil price remains constant at the 2014 level (the *World Economic Outlook* projects that annual consumer price inflation in advanced economies will average 1.7 percent). To demonstrate the sensitivity of our estimates of the sustainable non-oil fiscal balance to the world oil price, we also consider two high-price scenarios, with oil prices 20 percent and 50 percent above the baseline, and two low-price scenarios, with oil prices 20 percent and 50 percent below the baseline.
- **Macroeconomic variables:** We employ a small set of homogenous macroeconomic assumptions for all the countries (Table 11): annual real GDP growth in the non-oil sector of 4 percent; a real interest rate of 4 percent; population growth of 2½ percent; and a discount of 10 percent to world oil prices on the prices received by oil producers in our group.<sup>12</sup> By using a common set of macroeconomic assumptions we believe we can better isolate the impact on fiscal sustainability of differences in initial conditions—relative importance of the non-oil sector, fiscal stance, oil reserves—for all eight countries. Moreover, we do not possess the detailed knowledge or expertise to fine-tune the projections to reflect country-specific factors that may be important drivers for such analyses; this type of analysis is better left to country teams. However, we do not believe applying a common set of assumptions reduces the importance of our results, since our intention is to draw out broad policy implications and conclusions.

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<sup>11</sup> The *World Economic Outlook* oil price is based on the average price of West Texas Intermediate, Brent, and Dubai Fateh crude oil.

<sup>12</sup> One of the most important caveats about our use of a homogenous set of assumption concerns growth of the non-oil economy, which varies widely among the eight countries and is an important driver of the simulations. Also, by assuming a constant path for real non-oil growth, we abstract from any potential positive feedback from high public investment, which could significantly alter the path of growth.

Table 10. Oil-Producing Countries in Sub-Saharan Africa: Estimates of Proven Oil Reserves, 2008-09

	Angola	Cameroon	Chad	Congo, Rep. of	Côte d'Ivoire	Equatorial Guinea	Gabon	Ghana	Nigeria	São Tomé and Príncipe	Total CEMAC	Total SSA OPCs
	(In billions of barrels)											
IMF staff estimates <sup>1</sup>	9.51	0.35	0.58	1.36	0.33	1.21	2.08	0.62	36.41	0.04	5.58	52.49
BP Statistical Review 2008 <sup>2</sup>	9.00	...	0.90	1.90	...	1.80	2.00	...	36.20	...	...	...
Oil and Gas Journal, January 2008 <sup>3</sup>	9.04	0.20	1.50	1.60	0.10	1.10	2.00	...	36.22	...	...	...
World Oil, end-2006 <sup>3</sup>	9.04	...	...	1.94	...	1.76	2.00	...	37.20	...	...	...
OPEC Annual Statistical Bulletin 2007 <sup>4</sup>	9.04	...	...	...	...	...	2.15	...	36.22	...	...	...
CIA World Factbook 2009 <sup>5</sup>	9.04	0.20	1.50	1.60	0.10	1.10	2.00	0.15	36.22	...	6.40	51.91
USGS WPA 2000, F95 <sup>6</sup>	4.52	0.70	...	1.87	0.14	0.93	2.30	0.05	16.10	...	...	...

Sources: Detailed in the footnotes.

<sup>1</sup> These estimates, to the extent possible, reflect existing assumptions in the countries' databases for production during 2008–48 and underlie the simulations in Section V.

<sup>2</sup> BP Statistical Review of World Energy 2008; see <http://www.bp.com/sectiongenericarticle.do?categoryId=9023752&contentId=7044473>.

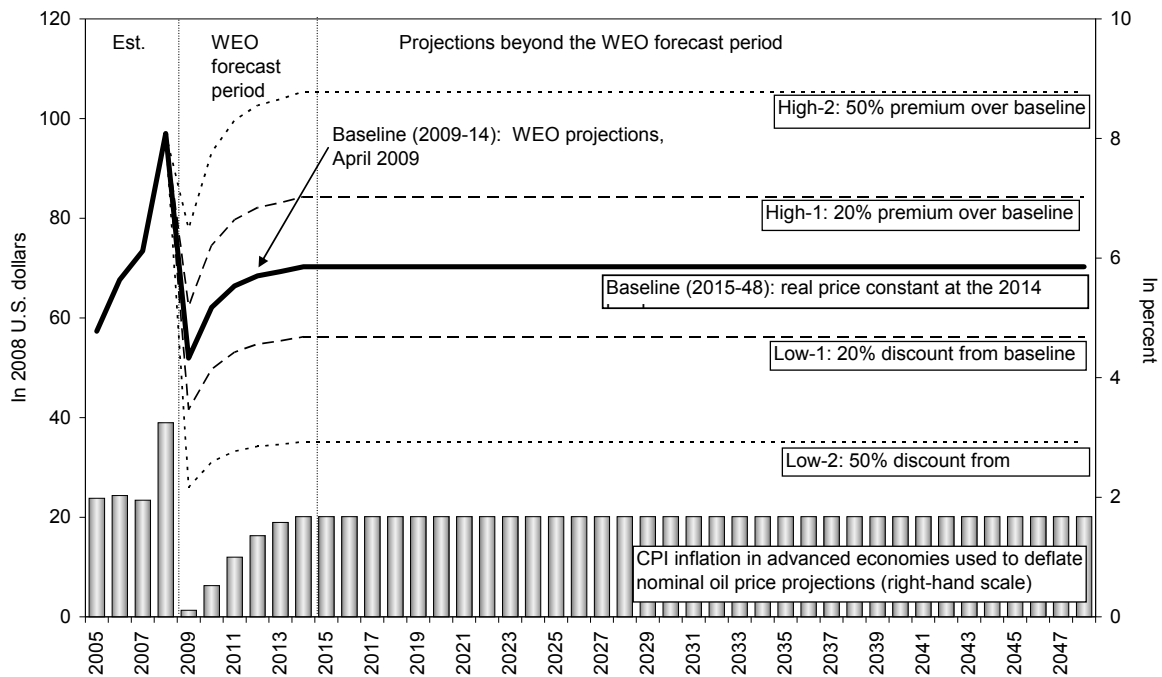
<sup>3</sup> U.S. Energy Information Administration; see <http://www.eia.doe.gov/emeu/international/oilreserves.html>.

<sup>4</sup> OPEC Annual Statistical Bulletin 2007; see <http://www.opec.org/library/Annual%20Statistical%20Bulletin/pdf/ASB2007.pdf>.

<sup>5</sup> CIA World Factbook 2009 (estimates as of January 2008); see <https://www.cia.gov/cia/publications/factbook/rankorder/2178rank.html>.

<sup>6</sup> U.S. Geological Survey, World Petroleum Assessment 2000 (<http://pubs.usgs.gov/dds/dds-060/>). Note that the USGS collects data on resources, which has a broader definition and normally include reserves.

Figure 8. Oil Price Assumptions, 2005–48



Source: World Economic Outlook (WEO) estimates and projections until 2014; and IMF staff projections.

**Table 11. Oil-Producing Countries in Sub-Saharan Africa: Long-Term Macroeconomic Assumptions (in percent unless otherwise noted)**

Non-oil sector real growth rate	4.0
Real interest rate	4.0
Population growth	2.5
Starting balance of oil funds as of end-2008 (\$)	0.0
World oil prices (US\$ per barrel)	
2009-14 <sup>1</sup>	52.00-74.75
2015-48	Real prices are constant at the 2014 level
Discount to world oil prices	10.0
Consumer Price Inflation (CPI) in advanced economies	
2009-14 <sup>1</sup>	0.1-1.68
2015-48	1.68

<sup>1</sup> Based on the April 2009 World Economic Outlook assumptions.

## V. ESTIMATES OF LONG-TERM FISCAL SUSTAINABILITY

### A. Baseline Results

The baseline estimates of long-term fiscal sustainability using the four fiscal rules detailed above produce some interesting results, which confirm the findings of Olters (2007) and the IMF (2007) based on a single fiscal rule (constant real expenditure). At the outset we realize that our estimates are subject to considerable uncertainty and are imprecise because they are based on a rather heroic set of homogenous assumptions. However, we also believe they are robust to the extent that several models produce similar outcomes based on the available information and initial conditions.

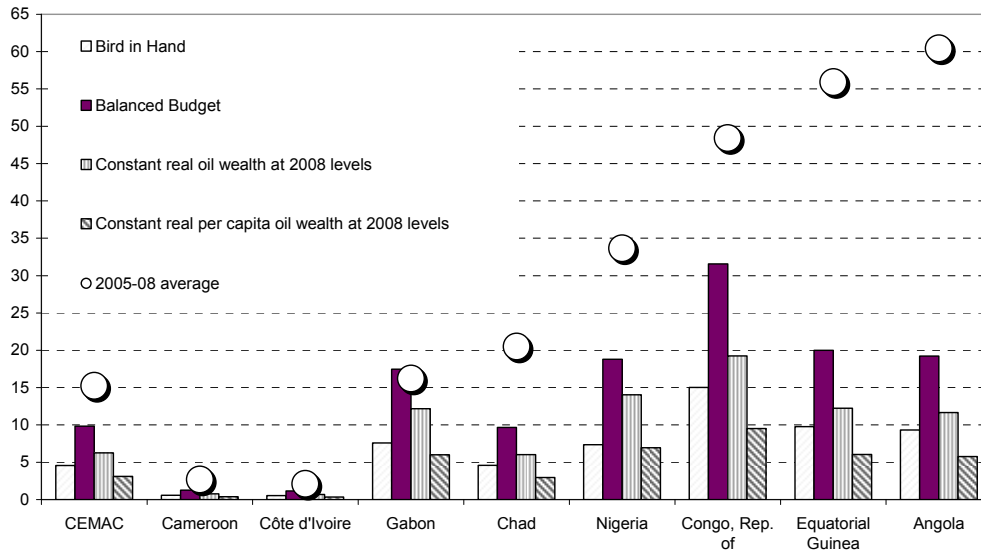
- Our estimates show convincingly that, as a group, the fiscal stance of the eight oil-producing countries in sub-Saharan Africa for 2005–08 as world oil prices rose is far from sustainable—although the results vary widely among them. These estimates are robust to the choice of fiscal policy, whether it is conservative, in that the government commits to spend only the projected annual return on its oil-generated financial assets (the bird-in-hand) and with a relatively high real rate of return (assumed to be 4 percent)<sup>13</sup>, or it goes on a binge, using up each year’s projected oil revenue, and runs a balanced budget (Figure 9).
- For every country except Gabon, the non-oil fiscal deficit for 2005–08 was above the estimate of sustainability produced by the four fiscal rules. Gabon’s fiscal stance could be considered sustainable if the budget were balanced, although this is an extreme position. Our estimates suggest that the fiscal position in Cameroon and

<sup>13</sup> During 1997–2007, the Norwegian Government Pension Fund had earned an annualized net real return of 4.6 percent (after management costs and inflation).

Côte d'Ivoire is close to sustainable—that is, a non-oil primary deficit that could be maintained after oil reserves are depleted. This is a good position for these two countries to be in, since their proven reserves are considerably lower and they thus have a relatively shorter production profile than the other members of the group.

- Angola, Chad, Congo, Equatorial Guinea, and Nigeria are currently very far from even a broad interpretation of fiscal sustainability. The situation in Angola, Congo, and Equatorial Guinea is particularly worrisome: For Angola, a sustainable and spendthrift fiscal rule would position the non-oil primary deficit at about 19 percent of non-oil GDP, with a thrifty rule lowering that deficit to about 9 percent, and a more balanced position based on the permanent-income hypothesis landing somewhere in between. The current non-oil primary deficit in Angola is about 60 percent of non-oil GDP. For Congo, the current fiscal stance is about 30 percent of non-oil GDP above the sustainable level based on the average estimate derived from the four fiscal rules we employ. For Equatorial Guinea it is about 44 percent of non-oil GDP higher.
- The most conservative estimate of the sustainable non-oil primary deficit is based on the permanent-income model with constant real per capita expenditure, which establishes a level that ensures that future generations enjoy similar per capita consumption financed by oil-related saving. For our sample of countries under this fiscal rule, we find a range of 0.4 percent of non-oil GDP for Cameroon at the low end to 9½ percent for Congo. We calculate the simple average for the eight countries to be about 5 percent of non-oil GDP. The average deficit for 2005–08 was in fact 30 percent of non-oil GDP.

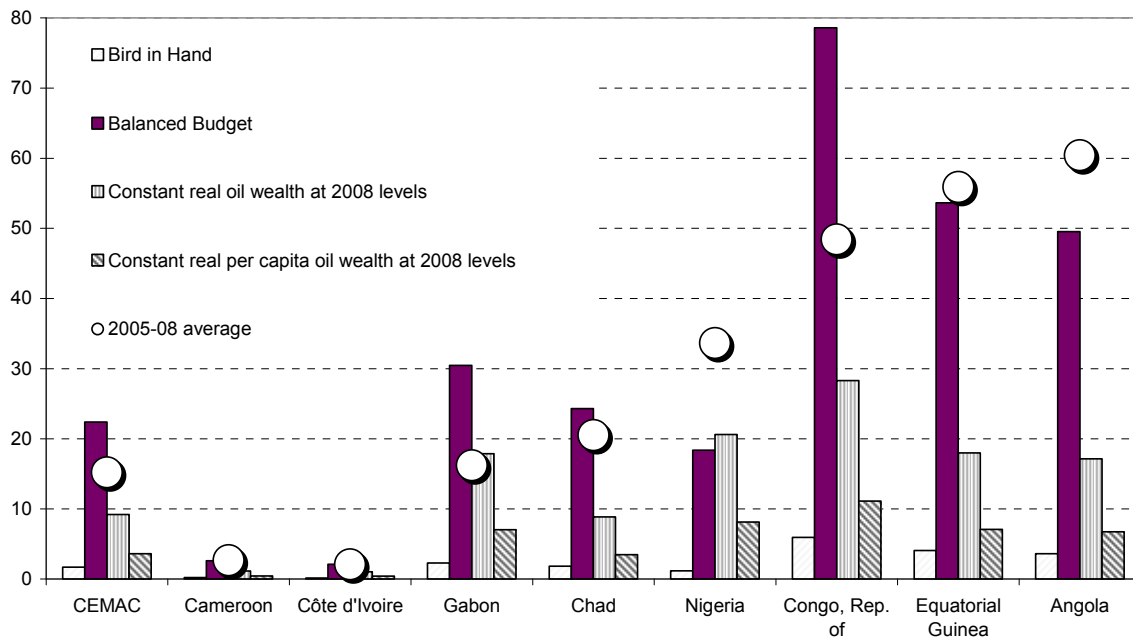
Figure 9. Oil-Producing Countries in Sub-Saharan Africa: Average Sustainable Non-Oil Primary Deficit Under Different Fiscal Rules, 2009-48 (in percent of non-oil GDP)



Source: Authors' calculations.

- Achieving a sustainable non-oil primary deficit for most countries in our sample requires sizable adjustments, even over the short term (Figure 10). Comparing each country's actual non-oil primary deficit for 2005–08 against the estimated sustainable levels for 2009–14, we find that under the constant real oil wealth rule only Gabon is in this position. The non-oil primary deficits in Nigeria and Angola are about 10 percentage points above the sustainable level. All other countries' non-oil primary deficits are close to or smaller than the sustainable level under the balanced-budget rule, but far from sustainable under the three more conservative fiscal rules. These results suggest that while a number of countries do save a portion of the current oil revenue, the amount saved is not sufficient to provide a stable income stream to support a smooth consumption path even after the oil era ends.

**Figure 10. Oil-Producing Countries in Sub-Saharan Africa: Average Sustainable Non-Oil Primary Deficit Under Different Fiscal Rules, 2009-13 (in percent of non-oil GDP)**

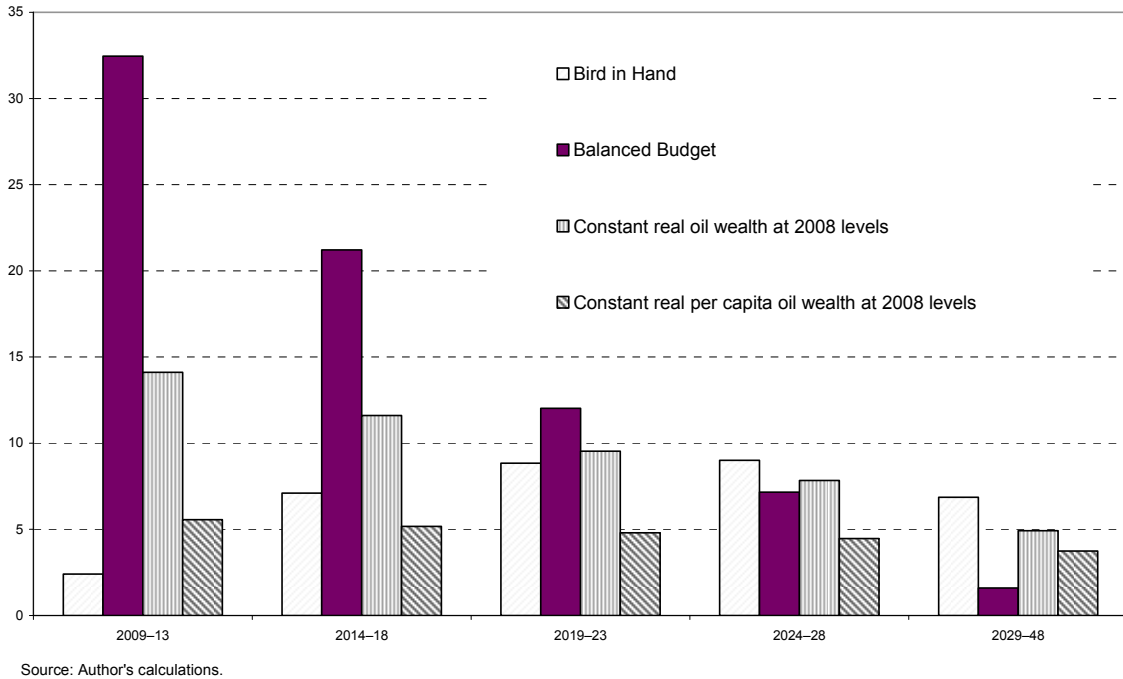


Source: Authors' calculations.

- Our estimates also illustrate the tradeoff between current and future consumption (Figure 11). Under the balanced budget rule, the government would have the largest spending room in the near term (with an unweighted average of the sustainable non-oil primary deficit of more than 32 percent of non-oil GDP). However, this fiscal rule would also lead to rapid depletion of oil wealth. Toward the end of our projection period, the sustainable non-oil primary deficit dwindles to less than 2 percent of non-oil GDP. The required adjustments in the non-oil primary deficit and in turn the implied volatility of fiscal expenditure are striking. Under more conservative fiscal rules, consumption in the near term is lower. However, due to faster accumulation of

the savings from oil revenue, the sustainable non-oil primary deficit will be higher in outer years and will also evolve much more smoothly.

**Figure 11. Oil-Producing Countries in Sub-Saharan Africa: Unweighted-average Sustainable Non-Oil Primary Deficit Under Different Fiscal Rules, selected periods (in percent of non-oil GDP)**

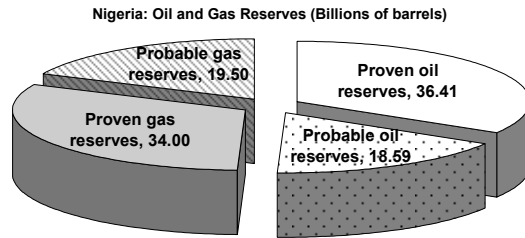


We recognize that an important limitation of our analysis is the use of proven oil reserves to derive the estimates of long-term fiscal sustainability. This does not account for the possibility that the resource base could be extended and broadened through exploitation of “probable oil reserves” and natural gas. Allowing for a wider resource base through this addition would, other things being equal, extend the production horizon and permit a government to run a higher non-oil primary deficit in the current period—which would be consistent with long-term fiscal sustainability—than the estimates we present above. For some countries like Nigeria, using this wider resource base would partially qualify our results (see Box 4).



**Box 4. Nigeria: Fiscal Sustainability Under a Wider Resource Base**

Nigeria stands out among sub-Saharan African oil producers in terms of oil reserves. Its proven reserves are more than the reserves of the rest combined. It also has estimated probable oil reserves of about 50 percent of proven oil reserves and its natural gas deposits (both proven and probable) are roughly the same size as its oil reserves.

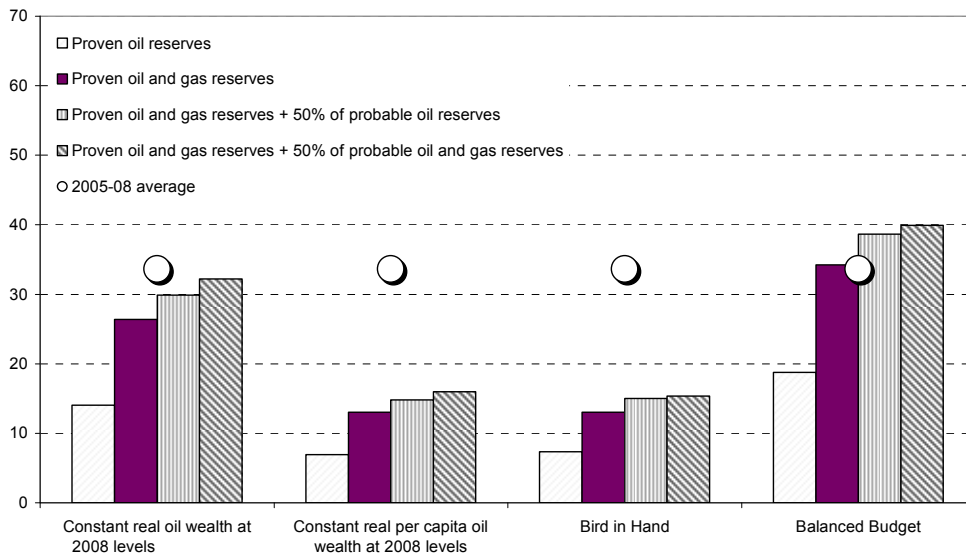


Sources: IMF staff estimates and Olter (2007).  
 Note: 1 trillion cubic feet of gas reserves = 5.61 billions of barrels of oil equivalents.

Considering a wider resource base would substantially raise Nigeria’s sustainable non-oil primary deficit. The vast amount of proven gas reserves alone would increase its average sustainable non-oil primary deficit under the constant real-wealth rule from 14 percent of non-oil GDP to about 26 percent. If 50 percent of Nigeria’s probable oil and gas reserves were also exploited within the projection period, the sustainable non-oil primary deficit would surpass 32 percent of non-oil GDP, which is only slightly below the average non-oil primary deficit in 2005–08. Under the balanced budget rule, Nigeria’s current non-oil primary deficit would be considered sustainable if account is taken of its proven gas reserves.

Nonetheless, the more benign results based on a wider resource base should also be interpreted cautiously because even under an optimistic assumption that all proven oil and gas reserves and 50 percent of all probable reserves were extracted, Nigeria’s current non-oil primary deficit is still well above the sustainable level based on conservative fiscal rules (constant per capita real wealth and bird-in-hand). Also, there are inherent risks and uncertainty in developing probable oil and gas reserves that until very recently have not been widely explored.

**Nigeria: Sustainable Non-Oil Primary Deficit Under Different Reserves Assumptions, 2009-48 (in percent of non-oil GDP)**



Source: Author's calculations.

We also recognize that our analysis is affected by the assumption of constant real growth in the non-oil sector, which does not allow for the possibility of higher growth rates in response to higher public investment. To the extent that higher and front-loaded public investment (in health, education, and economic infrastructure) could raise the rate of non-oil sector growth, running a non-oil primary deficit above the long-term estimate may be appropriate, at least over a short period. However, the evidence on the link between growth and investment is controversial, and we are not convinced that our broad estimates would be fundamentally altered by allowing such feedback affects.

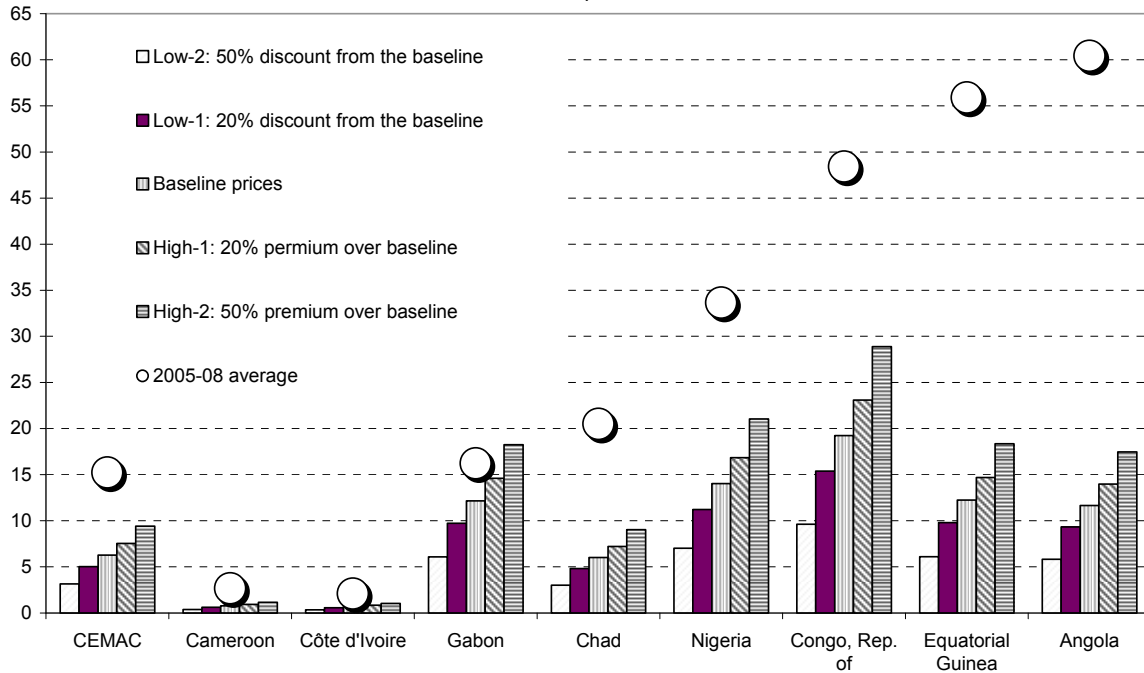
## **B. Sensitivity Analysis**

### **World Oil Prices**

The level and path of the sustainable non-oil primary deficit depends on key assumptions, especially about world oil prices, which are volatile and beyond the control of policy makers. In a static sense, a parallel shift of the oil-price path while holding other variables constant would lead to a shift of the sustainable non-oil primary deficit in the same direction and with about the same magnitude in percentage terms (Figure 12). For example, Congo's sustainable non-oil primary deficits average about 19 percent of non-oil GDP for 2009–48 under the baseline oil price assumptions; but if prices were 50 percent higher, the average sustainable non-oil primary deficits would rise close to 29 percent.

However, we find somewhat surprisingly that the unsustainable nature of the fiscal stance in sub-Saharan Africa oil-producing countries is not highly sensitive to world oil prices, at least compared with the permanent-income model under a constant real expenditure rule. Even with more optimistic assumptions on oil prices, the average non-oil primary deficit in 2005–08 in most of these countries was still far above the levels considered to be sustainable. Gabon is the only exception—with oil prices 50 percent above the baseline, its fiscal position could be considered sustainable for the whole projection period.

**Figure 12. Oil-Producing Countries in Sub-Saharan Africa: Sensitivity of the Sustainable Non-Oil Primary Deficit to Oil Prices Under a Permanent Income Hypothesis, 2009-48 (in percent of non-oil GDP)**



Source: Authors' calculations.

## Real Interest Rates

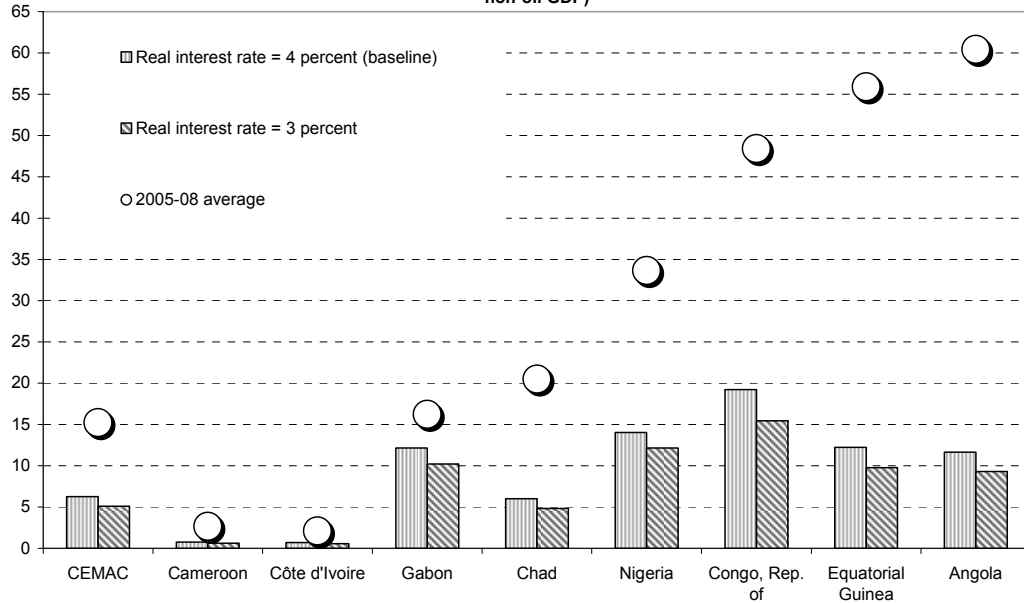
The assumption for the real interest rate (return on financial assets) also plays an important role in determining the sustainable non-oil primary deficit. The higher the return on investment, the lower the saving required to sustain a permanent income stream, which implies a higher sustainable non-oil primary deficit. In reality, the real return depends on the investment strategy of the proposed oil fund or portfolio manager. Oil-producing countries in sub-Saharan Africa may have more limited investment options than more developed countries, so that earning a comparable return on their investment may be challenging. Consequently, we explore the impact of lowering the real interest rate to 3 percent, which is closer to the the historical real return on US bonds.<sup>14</sup>

As expected, a lower real interest rate leads to lower sustainable non-oil primary deficits for all countries (Figure 13). However, it is interesting to note that the impact of a lower real interest rate varies by fiscal rule, depending on the split of oil revenue between saving and consumption in each period (Figure 14). At one extreme is the balanced-budget rule where no oil revenue is saved each period. In this case the different real interest assumptions have

<sup>14</sup> We should note that even this assumption may be optimistic for several countries. For example, oil proceeds accruing to CEMAC members have to be repatriated and deposited at the regional central bank (BEAC), which offers a very low return on them.

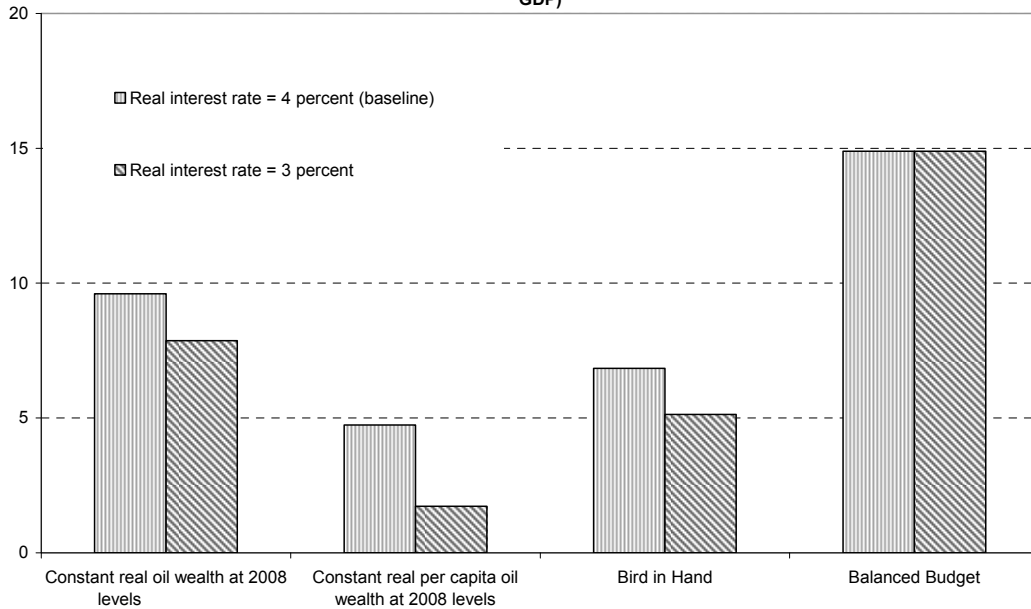
no impact on the sustainable non-oil primary deficit. At the other extreme is the more conservative fiscal rule based on constant real per capita oil wealth because most oil revenue is saved each period. Here, a 1 percentage point reduction in the real interest rate lowers the sustainable non-oil primary deficit by some 3 percentage points.

**Figure 13. Oil-Producing Countries in Sub-Saharan Africa: Sensitivity of the Sustainable Non-Oil Primary Deficit to Real Interest Rates Under a Permanent Income Hypothesis, 2009-48 (in percent of non-oil GDP)**



Source: Authors' calculations.

**Figure 14. Oil-Producing Countries in Sub-Saharan Africa: Unweighted-average Sustainable Non-Oil Primary Deficit Under Different Fiscal Rules and Real Interest Rates, 2009-48 (in percent of non-oil GDP)**



Source: Authors' calculations.

### C. The Impact of Oil Price Uncertainty

To further test the robustness of our conclusions and taking Congo as an example, we examined the impact of oil price uncertainty on sustainable non-oil primary deficits. Oil prices are inherently hard to predict (Figure 3). Although a multiple-scenario analysis based on different price assumptions provides some robustness checks (see Section V.B), this approach has a number of weaknesses. With the oil price being a continuous variable, the probability that the future oil price would be equal to any deterministic oil price assumption is practically zero. More importantly, the scenario analysis leaves a critical question unanswered: how likely is it that each scenario will eventually materialize? This piece of information is especially essential for policy planning purposes because macro policies need to strike a subtle balance between preparing for the unexpected and avoiding being driven by future events that have extremely low probability.

To assess how introducing randomness to future oil price assumptions would affect the sustainability of non-oil primary deficits, we perform a Monte Carlo simulation. Future oil prices are assumed to follow a mean-reversion process.<sup>15</sup> Specifically, we have equation (6)

$$(6) \quad P_t = P_{t-1} + \beta(\bar{P} - P_{t-1}) + \sigma\varepsilon$$

where  $P_t$  is the oil price in the current period,  $P_{t-1}$  the oil price in the previous period,  $\bar{P}$  the assumed equilibrium oil price,  $\beta$  the coefficient for reversion speed,  $\sigma$  the volatility of yearly oil prices, and  $\varepsilon$  a random variable with the standard normal distribution. The model calibration is summarized in Table 12.

**Table 12. Republic of Congo: Simulation Parameters with Oil-Price Uncertainty**

Variable	Value	Comments
$P_{2009}$	\$52.00	April 2009 WEO projection for the average oil price for 2009.
$\bar{P}$	\$66.63	April 2009 WEO projection for the average oil price over the period 2009-14.
$\beta$	0.333	One-third of the deviation from the equilibrium price will be reversed each year.
$\sigma$	7.19	Standard deviation of world oil prices over the period 1980-2004.

We make the following observations about the simulation results (Figure 15):

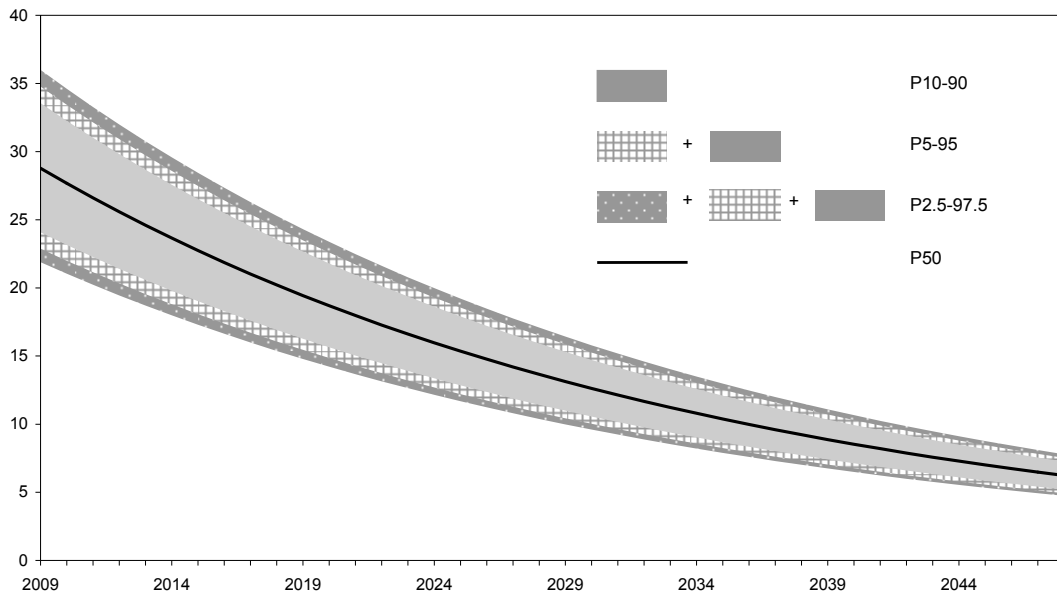
- The uncertainty about future oil prices leads to a wide range of estimates of Congo's sustainable non-oil primary deficit. For example, the 90 percent confidence interval for the non-oil primary deficit in 2009 covers the range of 23–35 percent of non-oil GDP (denoted as P5-95 areas) while the 95 percent confidence interval spans

<sup>15</sup> Tests on whether nominal and/or real oil prices follow a mean-reversion process (or a random-walk process) yielded mixed results. For example, Barnett and Vivanco (2003) found that in the longer samples (1957–2001) oil prices seem to have a unit root while in the shorter samples (1974–2001) they appear to be stationary.

22–36 percent of non-oil GDP (P2.5-97.5 areas). The median estimate of 2–9 percent of non-oil GDP (the P50 line) is similar to the baseline result in Section V.A.

- The uncertainty about Congo’s sustainable non-oil primary deficits gradually declines as the confidence intervals narrow around the median estimates. In 2009, the 95 percent confidence interval spans 14 percent of non-oil GDP, but in 2048 the same interval covers only 3 percent. Sustainable non-oil primary deficits depend on expected total oil wealth (realized oil revenue and proven underground reserves), of which only the value of the reserves is affected by oil price swings. At the start of the projection period, a substantial portion of Congo’s oil wealth is still yet to be exacted and thus subject to price uncertainty; toward the end when most of its oil reserves have translated into financial wealth, fluctuations in oil prices would have less impact on Congo’s total oil wealth and thus the sustainable non-oil primary deficit.
- Introducing randomness to future oil prices, however, does not change our earlier assessment that Congo’s current fiscal stance is unsustainable. The average non-oil primary deficit of 48 percent of non-oil GDP for 2004–08 is well above the sustainable levels covered by the 95 percent confidence interval. Simple calculations suggest that the probability that future oil prices will be high enough to make Congo’s current non-oil primary deficit sustainable is practically zero.

Figure 15. Republic of Congo: Sustainable Non-oil Primary Deficit Under Oil-Price Uncertainty, 2009–48 (in percent of non-oil GDP)



Source: Author's calculations.

## VI. SUMMARY AND POLICY IMPLICATIONS

By their very nature estimates of long-term fiscal sustainability are subject to wide variability and uncertainty. In our estimates, the main sources of variability and uncertainty come from the simplifying assumptions we deploy, which do not take account of country-specific factors that we are not in a position to exploit, oil prices, and the profile of oil production (including the level of reserves). Nonetheless, we believe that our analysis provides useful insight into this challenging issue and a robust snapshot of the current situation of Angola, Cameroon, Chad, Côte d'Ivoire, Gabon, Equatorial Guinea, Nigeria, and the Republic of Congo:

- The eight countries did not take full advantage of the record run-up in world oil prices in 2005–08 to consolidate their fiscal positions. Instead, non-oil primary deficits increased in five of them, and the adjustment in the other three was relatively small. This suggests that there was a repetition of the boom-bust cycle typical of oil-exporting countries in response to rising oil prices. Also of concern is that the latest episode of higher spending was accompanied by only limited improvement in public financial management; more would have provided some assurance that these resources were spent effectively.
- The medium-term fiscal outlook, however, points to some fiscal adjustment in the right direction in all these countries, which is important considering the volatility of world oil prices, their rapid decline from the historical peak, and the distance most of the countries have to go to reach long-term sustainability under various fiscal rules.
- Even with an extreme assumption—that the authorities pursue a spendthrift policy of consuming each year's oil revenue leading to a balanced budget on an annual basis—this group of countries does not compare favorably. The fiscal positions of Cameroon and Côte d'Ivoire are relatively close to broad notions of sustainability, but the others are estimated to be some distance away. This general conclusion does not seem to be affected by a wide range of oil price projections and changes in the real interest rate. We also showed that introducing uncertainty in oil prices does not change our assessment, particularly in the case of Congo.

This leads us to the following broad policy implications:

- With world oil prices volatile and production profiles relatively short, most of the oil-producing countries in sub-Saharan Africa should step up their efforts to consolidate their fiscal positions in order to reduce the probability of an abrupt adjustment as oil production winds down. A sustained consolidation would also help reduce the probability of a return to debt distress should oil prices trend downward.
- At the same time, these countries need to make more effort to manage their oil wealth. That means they must not only firm up public financial management, they

must give more attention to developing the kind of special fiscal institutions that have proved useful elsewhere.

- Finally, efforts to consolidate the fiscal position toward long-term sustainability should probably be directed to both the spending and the revenue sides, since domestic revenue mobilization is generally inadequate throughout the group of sub-Saharan oil producers. More domestic revenue could help to offset some of the uncertainty and difficulties caused by relying so heavily on oil-revenue alone, and it would certainly be needed in the post-production era when their oil resources run dry.



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