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Old Curses, New Approaches? Fiscal Benchmarks for Oil-Producing Countries in Sub-Saharan Africa

Jan-Peter Olters

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Old Curses, New Approaches?
Fiscal Benchmarks for Oil-Producing Countries in Sub-Saharan Africa

Prepared by Jan-Peter Olters[1]

Authorized for distribution by Roger Nord

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Abstract

Buoyant oil prices have allowed oil-producing countries in sub-Saharan Africa (SSA OPCs) to increase oil exports and fiscal revenues, providing them with resources necessary to address the pressing social needs. To preclude another boom-bust cycle, this paper advocates the definition of a fiscal benchmark anchored in sustainability grounds, following Leigh-Olters (2006). The difference between current primary deficits and those that could be maintained after oil reserves are exhausted represent an indication of the degree to which fiscal positions will have to be adjusted—either gradually, while the overall balances remain in surplus, or abruptly, once oil revenues begin to dwindle.

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Author's E-Mail Adress: jolters@imf.org

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Someone … must always be taking the long view. They [sic] *must somehow notice in advance that the resource economy is moving along a path that is bound to end in disequilibrium of some extreme kind. If they do notice it, and take defensive actions, they will help steer the economy from the wrong path toward the right one.*

—Robert Solow (1974a)

I. Introduction

Despite significant resource endowments, poverty remains widespread in all the oil-producing countries of sub-Saharan Africa[2] (SSA OPCs). The current oil-price boom provides these countries with the resources necessary to address the most pressing social needs and accelerate socioeconomic development. However, historical experience, international comparison, and institutional fragility suggest that increasing government spending does not per se lead to higher growth or better social indicators. Furthermore, governments face the risk that further fiscal expansion will lead to a repetition of the boom-bust cycles that inhibited progress in poverty reduction during previous decades—especially when unaccompanied by a substantial strengthening of public institutions, expenditure prioritization, and budgetary oversight.[3] The fiscal crises, which had followed (unexpectedly) falling oil prices and/or declining production were synonymous with cuts to social programs, contractions in public investments, and a recourse to arrears financing. This abrupt—often haphazard—tightening in fiscal policy tended to affect disproportionately the most disadvantaged segments of society. As a result, income and wealth inequalities widened,[4] reversing any momentum toward accelerating socioeconomic development that fiscal stimuli had provided during the years of plenty. Being in the early phase of the current oil-price boom, the literature's renewed interest in questions of long-term designs of fiscal policy stems from the central question of whether—this time—SSA OPCs will be able seize the opportunity, avoid pitfalls, and uncurse remaining oil wealth.[5]

[2] The oil-producing countries included in this paper are Angola, Cameroon, Chad, the Republic of Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, and Nigeria, which have been oil producers and exporters for at least 5 years.

[3] For an analysis of economic management during previous SSA OPC boom-bust cycles, see, for instance, Gelb (1986) and—more recently—Mehlum and others (2006), who stressed that haphazard planning, hasty implementation, and generally poor quality of public investments represented major factors explaining the disappointing growth performance of oil producers. For an in-depth, country-specific analysis, see also Barro-Chambrier (1990).

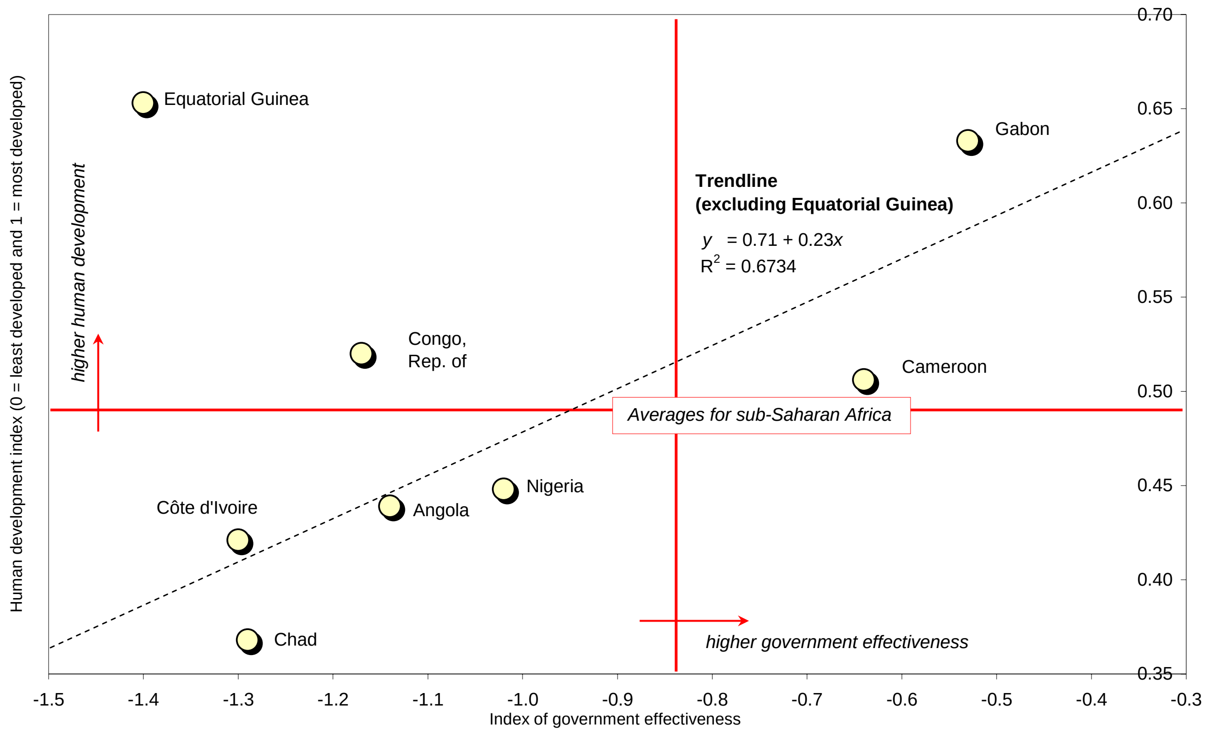
[4] See, for example, Jensen and Rutherford (2002) and Baldacci and others (2006).

[5] See, for instance, Nord and others (2007). To prevent the repetition of previous boom-bust cycles and to ensure that scaled-up public spending is used effectively, the authors recommend that SSA OPC governments consider issues of (i) fiscal sustainability; (ii) macroeconomic stability; and (iii) administrative capacity.

A. Old Curses

In previous decades, despite large increases in public spending during oil booms, the effectiveness of government spending in SSA OPCs has tended to be low and the quality of investments weak. While there is ample anecdotal evidence of wasteful spending (Melhado, 2006), it remains difficult to accurately quantify the social rate of return from government spending. However, output indicators can be measured. The United Nations Development Programme (UNDP) compiles a multidimensional *Human Development Index*. In UNDP (2006), the living conditions in most oil producers are close to or below the average for sub-Saharan African countries. It has long been argued—for instance, by Leite and Weidmann (2002) and Sala-i-Martin and Subramanian (2003)—that weak institutions and governance indicators are critical factors explaining the lack of success in using oil wealth effectively to diversify the economy and advance socioeconomic development. The *Government Effectiveness Index* compiled by Kaufmann and others (2005), summarizing indicators on governments' ability to formulate and implement sound policies, yield below-average results for all the oil countries except Gabon and Cameroon.[6] As Figure 1 shows, both measures are not unrelated.

Figure 1. SSA OPCs: Development and Governance Indices, 2004–05



Sources: UNDP (2006) and Kaufmann, Kraay, and Mastruzzi (2005); and IMF staff estimations.

[6] Similarly, Transparency International's (2006) *Corruption Perception Index* has only Gabon above the average for all sub-Saharan African countries. Gabon's particular position is largely explained by its small population size, high degree of urbanization, large per capita oil reserves, and the absence of military conflict or civil war, which all contributed to this country's substantially higher per capita GDP figures.

B. New Approaches

Three principal factors—the large reliance on oil revenues,[7] the particular volatility of oil prices, and the exhaustible nature of oil reserves—obligate SSA OPC governments, for precautionary reasons, to be particularly prudent in their designs of fiscal policies and to take a long-term view. Against the backdrop of historical experiences, researchers and policymakers seem to be converging gradually toward similar assessments, both emphasizing that fiscal sustainability considerations are pivotal policy constraints for managing resource-rich countries successfully.[8] Among the various steps taken to lengthen planning horizons and reinforce expenditure prioritization, many SSA OPCs are engaged in devising poverty-reduction strategies and, to varying degrees, are placing (or are seeking to place) related public investments in medium-term expenditure frameworks.

Preliminary analyses of SSA OPC fiscal conduct during the current oil-price boom seem to suggest that governments, thus far, have been more prudent than during previous cycles. SSA OPCs have spent, on average, about one-half their oil revenues to finance non-oil fiscal deficits (Nord and others, 2007), a fiscal response that is consistent with experiences made elsewhere (Di Tata and others, 2005). Still, non-oil balances have deteriorated in most SSA OPCs, in some cases quite sharply. Pressures for even higher public spending remain strong. Against this background, governments need to take into account possibly destabilizing effects of further fiscal expansions and their current ability to exert effective budgetary control and to apply oversight mechanisms to ensure an adequate quality of both existing and "scaled up" public expenditure. Similarly, the higher the percentage of current revenues from exhaustible reserves that is spent

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[7] Oil revenues currently represent a very significant source of SSA OPC government income, well over one-half of total 2006 revenues in Angola, Chad, the Republic of Congo, Equatorial Guinea, Gabon, and Nigeria.

[8] The importance of fiscal sustainability and the desirability of Funds for Future Generations were discussed and highlighted by African government representatives during the 2007 *Big Table Agenda* ("Managing Africa's Natural Resources for Growth and Poverty Reduction"), jointly hosted by the African Development Bank and the U.N.'s Economic Commission for Africa (ECA) in Addis Ababa, Ethiopia, on February 1–2, 2007. The related ECA Press Release No. 01/2007 summarized the importance by emphasizing that the challenge was to make natural resource extraction a cure rather than a curse for Africa. This change in attitude is also reflected in policy decisions taken by emerging oil producers, who have—almost without exception—demonstrated considerable commitment to devising institutional arrangements that limit fiscal discretion over oil revenue. The creation of fiscal reserves and, in turn, the definition of rules over the use of oil revenue are to preclude their governments from repeating the mistakes made by many of the more mature oil-exporters, including those in sub-Saharan Africa, and from having them form difficult-to-reverse spending habits. Contrary to previous generations of oil-fund arrangements (Davis and others, 2001), many of the most recent ones are explicitly based on the premise that *all* income from oil production is inherently different from other revenue streams (see, for instance, Azerbaijan, Mauretania, São Tomé and Príncipe, or Timor-Leste), requiring governments to justify their spending plans out of these temporary revenue streams vis-à-vis the legislature and the broader public; see Danninger and others (2004) for Azerbaijan, Kim (2005) for Timor-Leste, Lohmus (2005) for Kazakhstan, Segura (2006) for São Tomé and Príncipe, as well as Mauretania (2006).

on present demands, the more will governments have to respond to questions of intergenerational resource allocation and public wealth protection.

A forward-looking fiscal strategy needs to define mechanisms to transform exhaustible resources into other forms of revenue-generating wealth—principally financial assets, social capital, and physical infrastructure. Clearly, if oil reserves were limitless, governments could simply consume oil revenues directly. But as non-renewable resources are being depleted, public spending cannot forever exceed permanent income (in this case, the expected annuity value of oil wealth and non-oil revenue). The implementation of a long-term fiscal-policy framework would thus be aided by the definition of a clear fiscal anchor, which would provide policymakers, legislators, and civil society with a simple benchmark to distinguish sound and forward-looking policies from those designed only to address immediate demands. As the Maastricht fiscal-deficit criterion—with much less of an underlying economic foundation—has shown, such a benchmark can guide the public debate and, gradually, facilitate policy implementation. This, of course, becomes even more important when fiscal policies have to be executed in a context of weak public institutions and inadequate checks and balances.[9]

Following Barnett and Ossowski (2003) and Leigh and Olters (2006), this paper describes one method to define such a benchmark. It estimates the level of non-oil fiscal deficits that SSA OPCs could maintain beyond the period of oil production. By abstracting from possible effects of government spending on growth, the model builds on Friedman's (1957) permanent-income hypothesis (PIH) and results in a long-term fiscal-policy strategy that has governments accumulate net financial assets during the years of oil production. From their returns, governments can finance—indefinitely—non-oil primary deficits. While the abstraction from productive public investments poses a formal challenge to be addressed in future research, the framework has proven useful for operational purposes. The rate of return that governments can, or are assumed to, earn on their financial assets can be seen to represent a point of reference against which to judge the social desirability of capital expenditure. If financial saving and genuinely productive investments are viewed as substitutes, it follows that the non-oil primary deficit could temporarily exceed the permanently sustainable level—even after an initial adjustment period[10]—by those public investments for which the (social) rates of return exceed the real rate of interest earned on oil-fund assets.[11] Such a policy approach would thereby inject

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[9] See, Collier (2006), who argues that "checks and balances significantly and distinctively raise growth in the context of large natural resource rents." For more formal approaches on this nexus of institutions, patronage politics, resources, and socioeconomic development, see Keefer and Vlaicu (2004) and Collier and Hoeffler (2004, 2005).

[10] Leigh and Olters (2006) extended the basic PIH models by introducing habits, that is, the general notion that consumers become used to the level of consumption enjoyed in previous periods. In so doing, they permit a gradual adjustment toward the permanently sustainable non-oil primary deficit.

[11] For large-scale public investment projects, independent feasibility studies typically provide estimates of their social rates of return.

additional safeguards into political decision-making processes and further reduce the risk of boom-bust cycles.

The remainder of the paper is organized as follows. Section II summarizes the relevant literature. Section III develops the model, defines the optimal fiscal-policy paths, describes the assumptions, simulates the results for SSA OPCs, and discusses robustness and policy implications. Section IV concludes.

II. Literature Review

The question of how best to use revenues derived from exhaustible resources has a long history and can be traced back to, at least, Gray (1914) who analyzed the relation between resource prices and optimal exploitation paths. Hotelling (1931) showed that the competitive resource owner—by seeking the maximum rent from exploiting exhaustible reserves—depletes these at a socially optimal rate.[12] Solow (1974a) warned of the effects stemming from the traditionally high degree of volatility in these markets, arguing that, "in tranquil conditions, resource markets track their equilibrium paths moderately well," but that they are often exposed to shocks and "drastic movements of … price and production." He thereby added precautionary motives to the decision-making processes on the appropriate level of current spending from natural-resource revenues.

The first oil-price shock in the early 1970s sparked a number of studies that—by building on the discussion on intergenerational equity[13]—analyzed the question of whether governments should save (windfall) revenues from oil production or invest in productive capital. Early papers, such as Solow (1974b) and Hartwick (1977, 1978), formally derived constant per-capita consumption streams from the exploitation of natural resources by having governments invest related revenues in productive capital. Around the second oil-price shock, Corden and Neary (1982), together with van Wijnbergen (1984), Corden (1984), and Neary and van Wijnbergen (1986), warned about the (potentially) harmful side-effects of excessive spending of resource revenues on macroeconomic stability, initiating an extensive literature on "Dutch disease" effects.[14] Further studies yielded starker warnings still, with a curable disease turning into a terminal curse, starting

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[12] An excellent survey on the influence of Hotelling's article, widely thought to be the origin of *natural resource economics*, can be found in Davarajan and Fisher (1981).

[13] Seminal papers on intergenerational equity include Rawls (1971), Arrow (1973), and Solow (1974b, 1986).

[14] The Dutch disease mechanism sees natural resources—in the absence of responsive policies—causing a real appreciation of the domestic currency. The resultant loss of international competitiveness affects total factor productivity and leads to a gradual process of deindustrialization. See, among many others, Corden (1984) and Sachs and Warner (2001).

with Sachs and Warner (1995).[15] The *resource curse*—a phenomenon that is typically explained as the result of increased rent-seeking behavior, reduced incentives for necessary economic reforms, and excessive borrowing—represents a broader concept, combining macroeconomic factors with institutional ones.

As a result, policy advice in the literature increasingly emphasized “wealth protection” and “consumption smoothing” as ultimate policy objectives. According to these arguments, oil-exporting countries would benefit from rules that encourage authorities to save a fraction of current oil revenues—which implies that *overall* fiscal balances need to show considerable surpluses throughout the years of oil production. Given the interest-rate differential between public debt obligations and financial oil-fund assets, the accumulation of net financial assets entails a strategy, according to which governments use oil revenues first to eliminate arrears and reduce public debt (Collier and Gunning, 2005) and only then to accumulate net financial wealth in the form of stabilization and savings funds (Davis and others, 2001). This policy advice received empirical support by a number of studies that find discouraging rates of returns from public investments and only a limited effect on non-oil growth.[16]

With few exceptions (Takizawa and others, 2004), the literature treated government spending—while yielding utility—as being unrelated to growth. This assumption allows researchers to represent the social planner’s problem analogous to that of a household maximizing consumption over an infinite time horizon (Friedman, 1957). For OPCs, Friedman’s key result—the permanent-income hypothesis—means that public spending would be equal to non-oil revenues and the return on the net present value of all future oil revenues, as done by Engel and Valdès (2000) and Barnett and Ossowski (2003).[17] Models in this tradition have the advantage of being easily applicable to fiscal sustainability analyses of oil-exporting countries, resulting in monitorable fiscal anchors.

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[15] The literature on the “natural resource curse” has grown exponentially in recent years; see, for example, Manzano and Rigobon (2001), Hausmann and Rigobon (2002), Leite and Weidmann (2002), and Sala-i-Martin and Subramanian (2003). For recent surveys, see Stevens (2003) and Rosser (2006).

[16] See, for instance, Sala-i-Martin and Subramanian (2003), who identified waste and poor institutional quality as root causes for the poor long-run economic performance in Nigeria and, on that basis, advocated a direct distribution of oil revenues to the people instead.

[17] See also Davoodi (2002) for the Republic of Kazakhstan; Baunsgaard (2003) for Nigeria; Wakeman-Linn and others (2004) for Azerbaijan; Bailén and Kramarnko (2004) for the Islamic Republic of Iran; Velculescu and Rizavi (2005) for Trinidad and Tobago; and Segura (2006) for São Tomé and Príncipe. Recent studies in the direct lineage of Barnett and Ossowski (2003) include Leigh and Olters (2006) for Gabon; Balassone and others (2006) for Russia; and Carcillo and Leigh (forthcoming) for the Republic of Congo.

Future research will have to address formally a number of limitations, including (i) the implicit abstraction from productive investments;[18] (ii) the theoretical and empirical difficulties surrounding the concept of a social-welfare function;[19] and (iii) the fact that changes in the fiscal-policy stance would be abrupt rather than smooth. Arguing that such a sharp contraction might be both economically undesirable and politically impossible, Leigh and Olters (2006) extended the Barnett-Ossowski model by including *habits*[20] in the social-welfare function. With this innovation, the resultant simulations do not only derive the sustainable fiscal deficit but also the optimal adjustment path toward that level.[21]

There is no consensus in the literature on the appropriate definition of the overarching political objective. In the process of transforming oil reserves into financial wealth, governments can, in principle, aim at keeping spending constant in (i) real domestic currency, (ii) non-oil GDP, or (iii) real, per capita expenditure. *A priori*, none of these definitions have an absolute advantage over others; they simply imply different (normative) views of the nature of both intergenerational equity and government-provided goods and services. Defining a "budgetary" target in inflation-adjusted currency terms—as done in (i)— implies that, relative to a growing economy, the permanently sustainable non-oil primary deficit will be declining gradually. Real GDP output growth, *if* driven by increasing factor productivities, implies that future generations are better off (reflecting, for example, the result of effective expenditure on education). Subsequently, today's households would not required to leave the same level of resources for future generations. The

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[18] Takizawa and others (2004) preface their conclusion—a country could be better off spending its oil wealth upfront—with the caveat that this would only be the case *if* "government spending has positive externalities in production." This would help to explain Gupta and Verhoeven's (2001) conclusion of generally inefficient spending on health and education in Africa and Rajan and Subramanian's (2005) result of the absence of a robust positive relationship between aid and growth. For oil-rich countries, the institutional impediments to effectively implement public investments—principally for "natural resource curse"-related reasons (Sachs and Warner, 1995)—are more substantial still. Sala-i-Martin and Subramanian (2003), extending the arguments put forward by Leite and Weidmann (2002), argue that the abundance of oil wealth has "a seriously detrimental impact on the quality of domestic institutions and, through this channel, on long-run growth." Mehlum and others (2006) argue that the quality of public institutions determines whether or not resource-rich countries avoid the natural-resource curse. In principal, these institutional weaknesses could be overcome, in which case positive externalities could be expected and increased public investments justified. In this vein, several authors, such as Easterly and Rebelo (1993), Cashin (1995) or Miller and Tsoukis (2001), have reported positive correlations between public investment and growth. Gupta and others (2002) argue that a recomposition of expenditures from recurrent to capital expenditures would boost growth.

[19] On the theoretical and empirical difficulties surrounding the derivation of a consistent and robust social-welfare function (or an approximation thereof), see Olters (2004). In this vein, Nannestad and Paldam (1994) argued that the "theory of the social welfare function is … known as the most dismal part of the dismal science of economics."

[20] This approach originated in consumption theory; see, for example, Velculescu (2004).

[21] Barnett and Vivanco (2003) and Wakeman-Linn (2004) have hinted at the desirability of such an approach, albeit indirectly, when warning governments against large fluctuations in non-oil deficits.

same argument does not hold, however, if growth is principally the result of population growth. In that case, the government's objective function could target either constant spending as a share of (non-oil) GDP (if public expenditure is viewed as a non-congested *public good*) or in per capita terms (in which case spending is seen to consist largely of publicly provided *private goods*).

III. A Model of Permanent Income and Habit Formation

A. The Model

Following Leigh and Olters (2006), who introduced *habits*[22] to Barnett and Ossowski (2003), a social planner is assumed to make his or her intertemporal decision by determining the size of the (non-oil) primary deficit. The government's problem, with primary spending expressed in terms of non-oil GDP, can be written as

(1) $$\max_{\{g_s\}} \sum_{s=t}^{\infty} \beta^{s-t} \cdot U\left(g_s, h_s\right),$$

(2) s.t. $$b_t = \frac{1+r}{1+\gamma} \cdot b_{t-1} + g_t - \tau_t - z_t,$$

(3) and $$\lim_{s\to\infty} \frac{b_{t+s}}{\left(1+r\right)^s} = 0,$$

where $\beta = \frac{1}{1+\delta} \equiv \frac{1+\gamma}{1+r} < 1$ is the discount factor, δ the rate of time preference (that is, the degree of impatience), γ the growth rate of non-oil GDP, $Y_{t+1} = \left(1+\gamma\right) \cdot Y_t$, and r the real rate of interest, assuming that $r > \gamma$. The policy variables are all expressed as a share of (non-oil) GDP, as signified by the lower-case letters g, b, τ, and z: $g_t = \frac{G_t}{Y_t}$ is primary government expenditure; $b_t = \frac{B_t}{Y_t}$ net government debt at the end of period t; $\tau_t = \frac{\mathrm{T}_t}{Y_t}$ non-oil revenue; $z_t = \frac{Z_t}{Y_t}$ oil revenue. The variable h_t represents the current stock of habits.

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[22] Habit formation was developed in the consumption literature to capture the idea that consumption is addictive—that is, the amount of utility derived from consumption today depends negatively on how much was consumed yesterday. In the context of fiscal policy, habit formation can also be interpreted as reflecting institutional and political adjustment costs faced by policymakers (for instance, cutting the public-sector wage bill abruptly may not be politically feasible). Applying habit formation to fiscal policy, Velculescu (2004) shows that the optimal fiscal response to a permanent negative shock is to spread the necessary policy adjustment over a number of periods.

Formally, introducing habits implies altering the utility function so that current-period utility depends not only on current spending, but also on past spending. Specifically, the utility function becomes $U(g_t, h_t)$ rather than $U(g_t)$, where h_t represent the current stock of habits. Solving the government's problem yields Euler equation

(4) $$U^g(g_t, h_t) + \beta \cdot U^h(g_{t+1}, h_{t+1}) = R \cdot \beta \cdot \left[U^g(g_{t+1}, h_{t+1}) + \beta \cdot U^h(g_{t+2}, h_{t+2}) \right],$$

where $U^g(g_t, h_t)$ denotes the marginal utility of an additional unit of spending in this period and $U^h(g_{t+1}, h_{t+1})$ the marginal utility of stronger habits in the next period (due to higher spending today). A popular formulation of habit formation in the literature is the "subtractive formulation"; see Constantinides (1990), Campbell and Cochrane (1999), and Uribe (1999):

(5) $$U(g_t, h_t) = V(g_t - \alpha \cdot h_t),$$

where $\alpha \in [0,1]$ denotes habit strength, which implies that the utility from current-period spending, g_t, is negatively correlated with the strength of habits, h_t. One simple specification of the habit stock would be to have current utility be dependent on the previous period's consumption as well, that is, $h_t = g_{t-1}$. Combining the Euler equation (4) with the intertemporal budget equation(2) yields

(6) $$g_t^* = \left(1 - \frac{\alpha}{1+r}\right) \cdot \left[\tau + \frac{r-\gamma}{1+r} \cdot \sum_{s=t}^{N} \left(\frac{1+\gamma}{1+r}\right)^{-(s-t)} \cdot z_s - \frac{r-\gamma}{1+\gamma} \cdot b_{t-1} \right] + \frac{\alpha}{1+r} \cdot g_{t-1}.$$

Equation (6) shows that spending is a linear combination of the level realized in the previous period and of the one that is permanently sustainable.[23]

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[23] For a more detailed derivation of equation (6), see Leigh and Olters (2006). If governments do not finance (non-congested) public goods (such as functioning public infrastructure or health and education systems) but offer "private" commodities (such scholarships and public pensions), the corresponding objective function is more appropriately defined in terms of per-capita variables. The above problem can be rewritten by taking into consideration the fact that real non-oil GDP growth rates are the function of two factors, namely, population and factor productivity growth. Real growth is thus denoted $\gamma = \nu + \xi$, with $Y_{t+1} = (1 + \nu + \xi)\, Y_t$, where ν reflects population growth and ξ factor productivity improvements. Variables in per-capita terms are denoted by lower-case letters with a circumflex. Solving an analogous problem yields an expression that, similarly, is a linear combination of the last period's and the permanently sustainable level of per-capita consumption:

$$\hat{g}_t^* = \left(1 - \frac{\alpha}{1+r}\right) \cdot \left[\hat{\tau} + \frac{r-\nu-\xi}{1+r} \cdot \sum_{s=t}^{N} \left(\frac{1+\nu+\xi}{1+r}\right)^{-(s-t)} \cdot \hat{z}_s - \frac{r-\nu-\xi}{1+\nu+\xi} \cdot \hat{b}_{t-1} \right] + \frac{\alpha}{1+r} \cdot \hat{g}_{t-1}.$$

B. Background and Underlying Assumptions

In recent years, sub-Saharan Africa has become an increasingly important source of world energy. Apart from a number of geopolitical factors, which go beyond the scope of this paper, international oil companies increasingly regard oil exploration in Africa as being profitable. This is due to the generally high quality of African oil and the cost-effective maritime transportation straight across the Atlantic to North America. Moreover, SSA OPCs, more so than other regions of the world, have an interest in developing partnerships with international investors. In fact, since most of the latest discoveries have been offshore, especially in the deepwater zones of the Gulf of Guinea, both partners have a lot to gain: SSA OPCs benefit from the investments and technological expertise provided by foreign companies in order to exploit deep-sea fields, while oil companies value the prospect of offshore production, which reduces their exposure to political and social turmoil onshore.

Oil Reserves

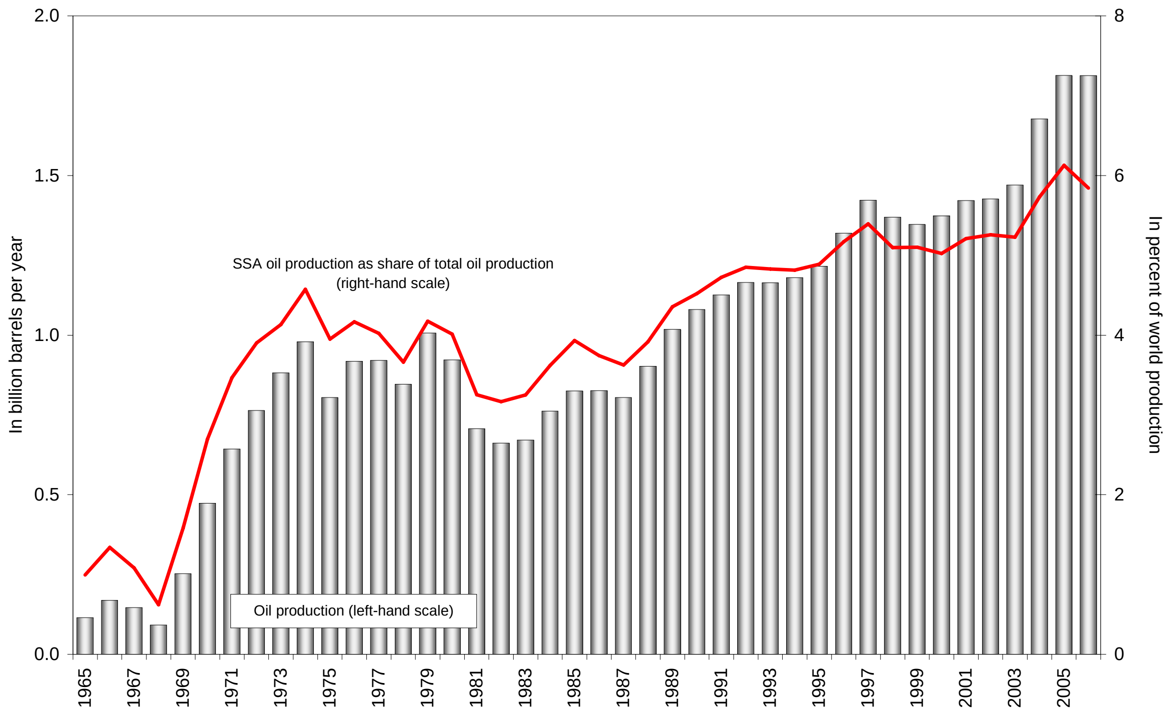
Oil reserves are generally defined to comprise quantities of oil that—on the basis of existing economic, geological, and engineering conditions—can be expected to be recovered in the future with a reasonable degree of certainty. The following analysis distinguishes the two principal types of reserves, namely,

- *proven* (1P) reserves, representing the estimated quantities of oil that have a probability of at least 90 percent to be recoverable from already discovered fields; and

- *probable* (2P–1P) or unproven reserves, representing quantities of oil that have a probability of at least 50 percent to be recoverable from discovered or suspected fields.

Altogether, SSA OPCs have at their disposal *proven* oil reserves of more than 50 billion barrels, or about 4 percent of world reserves. At current production levels, about 1.8 billion barrels per year in 2006 (Figure 2), SSA OPCs are able to produce oil for another 29 years. In all likelihood, however, SSA OPCs will be able to increase their production further. There are considerable foreign direct investments in the SSA OPC oil sector, and further discoveries are expected—with the effect that today’s *probable* reserves, estimated at an additional 64 billion barrels, could become tomorrow’s *proven* ones. Especially the large oil producers (Angola, Equatorial Guinea, and Nigeria) are expected to increase their production capacity significantly, while several emerging OPCs, notably Chad and Côte d’Ivoire are beginning their production cycles (as well as, over the medium-term horizon, São Tomé and Príncipe).

Figure 2. SSA OPCs: Oil Production, 1965–2006



Source: *BP Statistical Review of World Energy,* June 2006; and IMF staff estimates.

Gas Reserves

Long considered a by-product of oil exploration, gas is set to become an increasingly important source of energy. It is expected that global demand will increase considerably during the next few decades. While some oil producers—notably Côte d'Ivoire, Equatorial Guinea, and Nigeria—have made progress in reducing flaring and commercializing gas, African countries have found it generally difficult to secure an export market for their gas reserves and to receive commitments by international oil companies to making the investments that are required for the economic exploitation of this resource. As a result, this potentially very valuable commodity—estimated at about 38 billion barrels of oil equivalents (boe) for proven and another 32 billion boe of probable reserves—continues to be flared at relatively high rates.

Table 1 shows four alternative definitions of recoverable hydrocarbon reserves, which are based on the publicly available reserve estimates for oil and gas. Figure 3 represents estimates of corresponding production profiles.

Table 1. Sub-Saharan Africa: Estimates of Oil and Gas Reserves, 2005

	Angola	Cameroon	Chad	Congo, Rep. of	Côte d'Ivoire	Equatorial Guinea	Gabon	Nigeria	Total SSA OPCs
Oil reserves				(In billions of barrels)					
Proven reserves (1P),									
Fund staff estimates[1]	9.7	0.5	0.7	2.0	0.3	1.2	2.1	34.0	50.5
BP Statistical Review 2006[2]	9.0	…	0.9	1.8	…	1.8	2.2	35.9	…
Oil and Gas Journal, January 2006[3]	5.4	0.4	1.5	1.5	0.1	…	2.5	35.9	…
World Oil, end-2004[3]	9.0	…	…	1.9	…	1.8	2.1	37.2	…
OPEC Annual Statistical Bulletin 2005[4]	9.0	…	…	…	…	…	2.5	36.2	…
CIA World Factbook 2005[5]	25.0	0.1	…	1.5	0.2	0.6	1.9	36.0	…
USGS WPA 2000, F95[6]	4.5	0.7	…	1.9	0.1	0.9	2.3	16.1	…
Proven plus possible reserves (2P)									
Fund staff estimates[1]	40.0	1.5	2.2	5.5	0.5	2.3	7.3	55.0	114.3
Individual country studies[7]	38.8 – 48.8	…	…	…	…	…	…	55.0	…
USGS WPA 2000, F50[6]	13.7	1.5	…	5.5	0.5	2.3	7.6	37.1	…
Gas reserves				(In billions of barrels of oil equivalents[8])					
Proven reserves (1P),									
Fund staff estimates[1]	1.7	0.5	0.0	0.8	0.2	0.6	0.2	34.0	38.0
Oil and Gas Journal, January 2006[3]	0.3	0.7	…	0.6	0.2	0.2	0.2	32.9	…
World Oil, end-2004[3]	0.7	…	…	0.7	…	0.6	0.3	32.4	…
CEDIGAZ, January 2006[3]	1.7	1.4	…	0.8	0.2	0.4	0.2	32.9	…
OPEC Annual Statistical Bulletin 2005[4]	…	…	…	…	…	…	…	32.4	…
Individual country studies[7]	…	…	…	…	…	…	…	34.6	…
CIA World Factbook 2005[5]	0.3	0.7	…	0.6	0.2	0.2	0.2	28.3	…
USGS WPA 2000, F95[6]	2.1	0.4	…	0.9	0.2	0.5	1.0	9.4	…
Proven plus possible reserves (2P)									
Fund staff estimates[1]	6.0	1.4	0.0	2.8	0.9	2.5	3.5	53.5	70.6
Individual country studies[7]	1.7 – 4.5	…	…	…	…	…	…	53.5	…
USGS WPA 2000, F50[6]	6.9	0.9	…	2.8	1.0	1.3	3.9	21.2	…

[1] These estimates, to the extent possible, reflect existing assumptions in the countries' databases for production during 2006–45 and underlie the subsequent simulations.

[2] Source: BP, *Quantifying Energy: BP Statistical Review of World Energy 2006*; see www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/publications/energy_reviews_2006/STAGING/local_assets/downloads/pdf/oil_section_2006.pdf.

[3] Source: U.S. Energy Information Administration; see http://www.eia.doe.gov/emeu/international/oilreserves.html.

[4] Source: *OPEC Annual Statistical Bulletin 2005*; see http://www.opec.org/library/Annual%20Statistical%20Bulletin/pdf/ASB2005.pdf

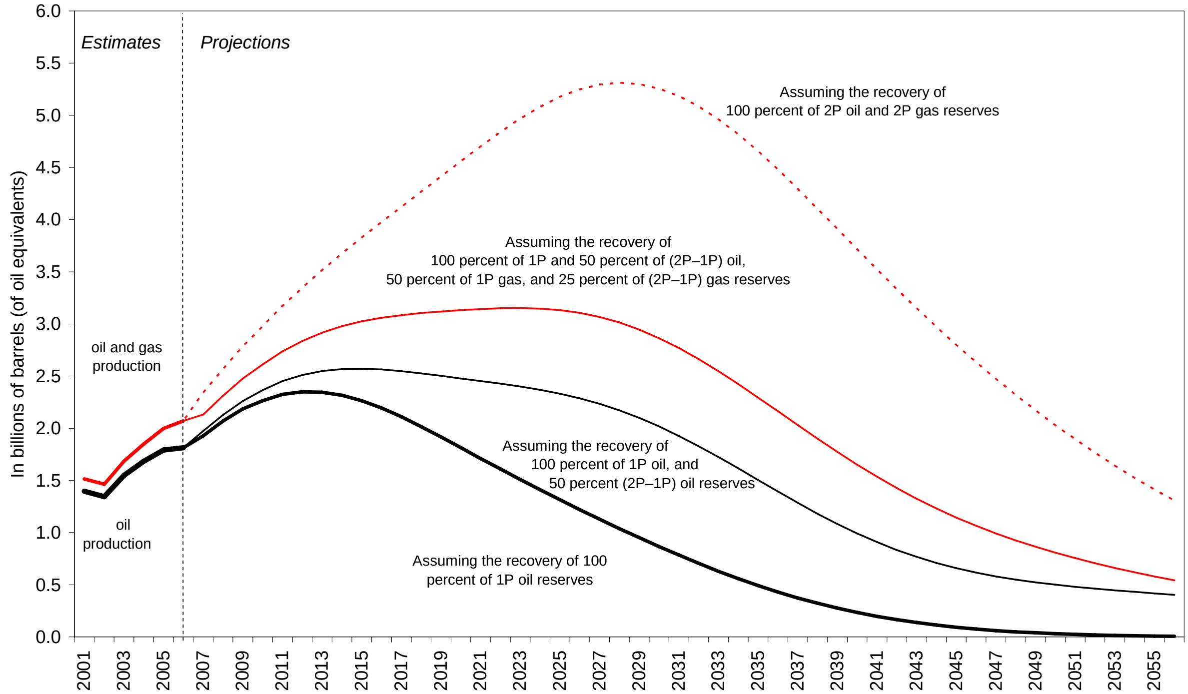
[5] Source: *CIA World Factbook 2005*; see https://www.cia.gov/cia/publications/factbook/rankorder/2178rank.html.

[6] Source: U.S. Geological Survey, *World Petroleum Assessment 2000* (http://pubs.usgs.gov/dds/dds-060/). Note that the USGS collected data on resources, which have broader definition and normally include reserves.

[7] Sources: For Angola, OECD/IEA, 2006, *Angola: Towards and Energy Strategy* (Paris: OECD/IEA); for Nigeria, UNDP/World Bank Energy Sector Management Assistance Programme (ESMAP), Report No. 279/04.

[8] Conversion rates. Cubic meters into cubic feet: 35.31. One trillion cubic feet in gas reserves into millions of barrels of oil equivalents: 5,610.

Figure 3. SSA OPCs: Oil and Gas Production, 2001–56



Source: IMF staff estimates and projections.

The Macroeconomic Context

During 2004–06, the first three years of the current oil boom, SSA OPCs have managed to take advantage of the increasing interest in African oil and the generally benign macroeconomic environment. Oil production expanded while prices were rising. As a result, these countries managed, during 2002–06, to more than triple their aggregate oil GDP, from US$30 billion in 2002 to more than US$105 billion in 2006. With a slightly improving oil-tax take,[24] oil revenues increased from US$18 billion to US$71 billion during the same period of time (Table 2). As a result, the overall primary fiscal balance improved considerably, from 0.1 percent of total GDP in 2002 to almost 13 percent in 2006. However, increasing spending demands resulted in a steady deterioration of the non-oil primary deficit, from an aggregate 22 percent of non-oil GDP in 2002 to 30½ percent in 2006. A number of special circumstances, such as political business cycles or post-war reconstruction efforts, can explain a large part of this development. Given the concomitant decline in non-oil tax collections rates, which fell by an aggregate 1½ percentage points of SSA OPC non-oil GDP during 2002–06, these developments could be interpreted as early symptoms of a re-occurring boom-bust cycle, notwithstanding considerable differences among individual countries (Table 3).

[24] These increases likely represent improvements in the quality of reporting oil revenues among SSA OPCs.

Table 2. Aggregate SSA OPC Economy: Selected Indicators, 2002–06
(In billions of U.S. dollars; unless otherwise indicated)

	2002	2003	2004	2005	2006
Real sector					
Total GDP	90.5	112.8	141.7	188.3	224.3
Non-oil GDP	60.7	72.0	85.6	101.0	119.1
Oil GDP	29.9	40.8	56.1	87.3	105.2
Fiscal sector					
Revenues	28.2	35.1	48.8	69.7	89.5
Oil revenue	17.9	23.0	35.0	53.7	71.0
Oil tax take; percent of oil GDP	59.9	56.3	62.4	61.5	67.5
Non-oil revenue	10.3	12.1	13.8	16.0	18.5
Non-oil tax take; percent of non-oil GD	17.0	16.9	16.1	15.8	15.5
Expenditure	28.1	34.4	39.7	51.2	60.7
Primary expenditure	23.7	30.4	35.5	46.7	57.3
Interest expenditure	4.4	4.1	4.2	4.5	3.3
Fiscal balances					
Overall balance	0.1	0.7	9.1	18.5	28.8
In percent of total GDP	0.1	0.6	6.4	9.8	12.9
Primary balance	4.5	4.8	13.3	23.0	32.2
In percent of non-oil GDP	7.4	6.6	15.5	22.8	27.0
Primary non-oil balance	-13.4	-18.2	-21.7	-30.7	-38.8
In percent of non-oil GDP	-22.0	-25.3	-25.3	-30.4	-32.6

Source: National authorities; and IMF staff estimations and projections.

Table 3. SSA OPCs: Selected Macroeconomic Indicators, 2005–06

(Billions of national currency; unless otherwise indicated)

	2005									2006								
	Angola	Cameroon	Chad	Congo, Rep. of	Côte d'Ivoire	Equatorial Guinea	Gabon	Nigeria	SSA OPCs[1]	Angola	Cameroon	Chad	Congo, Rep. of	Côte d'Ivoire	Equatorial Guinea	Gabon	Nigeria	SSA OPCs[1]
Exchange rate, units of national currency per US$1	87.16	527.47	527.47	527.47	527.47	527.47	527.47	131.01	1.00	80.36	528.47	528.47	528.47	528.47	528.47	528.47	128.00	1.00
National accounts																		
Gross domestic product (GDP)	2,670	8,901	3,104	3,150	8,621	3,940	4,571	12,643	188.3	3,519	9,671	3,420	3,866	9,082	4,773	4,767	14,488	224.3
Oil GDP	1,656	714	1,452	1,902	236	3,523	2,367	6,420	87.3	2,088	932	1,616	2,513	402	4,261	2,329	7,223	105.2
Non-oil GDP	1,014	8,187	1,653	1,247	8,385	417	2,204	6,223	101.0	1,431	8,739	1,804	1,353	8,680	511	2,438	7,265	119.1
Oil sector																		
Oil production, billions of bbl per year	0.455	0.030	0.063	0.082	0.014	0.133	0.098	0.916	1.791	0.521	0.032	0.057	0.099	0.024	0.128	0.097	0.855	1.813
Gas production, billions of boe per year	0.000	0.000	0.000	0.000	0.000	0.014	0.000	0.194	0.208	0.000	0.000	0.000	0.000	0.000	0.018	0.000	0.239	0.257
Brent price (WEO), US$/bbl	53.35	53.35	53.35	53.35	53.35	53.35	53.35	53.35	53.35	69.20	69.20	69.20	69.20	69.20	69.20	69.20	69.20	69.20
Domestic oil price, US$/bbl	50.14	50.42	42.76	48.60	53.35	48.69	50.49	53.35	51.39	59.91	59.97	54.17	60.61	64.27	59.77	60.27	69.20	64.22
Discount (–) or premium, percent	-6.0	-5.5	-19.9	-8.9	0.0	-8.7	-5.4	0.0	-3.7	-13.4	-13.3	-21.7	-12.4	-7.1	-13.6	-12.9	0.0	-7.2
Value of oil production	1,989	804	1,427	2,104	407	3,419	2,597	6,401	92	2,508	1,013	1,635	3,165	810	4,046	3,095	7,575	116
Estimated intermediate consumption	332.7	90.0	-24.9	201.5	170.8	-103.2	230.3	-19.6	4.7	419.2	80.5	18.5	652.7	408.8	-215.8	765.6	351.9	11.2
In percent of value of oil production	16.7	11.2	-1.7	9.6	41.9	-3.0	8.9	-0.3	5.1	16.7	7.9	1.1	20.6	50.4	-5.3	24.7	4.6	9.6
Fiscal sector																		
Total revenues	1,086	1,543	290	1,240	1,566	1,500	1,434	5,621	69.7	1,644	1,737	553	1,923	1,868	1,634	1,607	6,580	86.8
Oil revenues	862	439	144	1,020	83	1,375	907	4,759	53.7	1,357	601	400	1,663	183	1,486	1,026	5,628	71.0
Non-oil revenues	224	1,104	146	220	1,483	125	527	863	16.0	287	1,136	153	260	1,685	148	581	952	18.5
Total spending	890	1,278	405	745	1,714	703	1,003	3,915	51.2	1,312	1,456	618	1,025	1,816	882	1,077	4,012.2	60.7
Primary spending	841	1,149	395	587	1,537	700	874	3,554	46.7	1,274	1,353	603	907	1,665	881	961	3,767	57.3
Interest payments	49	129	10	158	178	3	129	362	4.5	37	104	15	118	151	1	117	245	3.3
Overall balance	196	265	-115	494	-148	797	431	1,706	18.5	332	281	-64	898	52	752	530	2,568	28.8
Non-oil primary balance	-617	-45	-249	-367	-53	-575	-347	-2,691	-30.7	-988	-217	-449	-647	20	-733	-380	-2,815	-38.8
Public debt	1,051	4,693	967	3,205	6,603	134	1,847	2,683	65.6	974	2,673	906	2,359	6,665	129	1,479	449	42.5
External debt	1,077	3,269	881	3,267	6,224	134	1,789	2,683	62.3	1,076	1,247	799	3,032	6,300	129	1,557	449	41.6
Net credit to government	-25	1,424	86	-61	379	0	58	0	3.3	-102	1,426	107	-672	365	0	-78	0	0.9
Key ratios																		
Oil revenues as percent of oil GDP	52.1	61.5	9.9	53.6	35.0	39.0	38.3	74.1	61.5	65.0	64.5	24.8	66.2	45.5	34.9	44.1	77.9	67.5
Non-oil revenues as percent of non-oil GDP	22.1	13.5	8.8	17.6	17.7	30.0	23.9	13.9	15.8	20.0	13.0	8.5	19.2	19.4	28.9	23.8	13.1	15.5
Overall balance as percent of GDP	7.3	3.0	-3.7	15.7	-1.7	20.2	9.4	13.5	9.8	9.4	2.9	-1.9	23.2	0.6	15.8	11.1	17.7	12.9
Overall balance as percent of non-oil GDP	19.3	3.2	-7.0	39.6	-1.8	191.1	19.6	27.4	18.4	23.2	3.2	-3.5	66.4	0.6	147.1	21.7	35.3	24.2
Non-oil primary balance as percent of non-oil GDP	-60.9	-0.6	-15.1	-29.5	-0.6	-137.7	-15.7	-43.2	-30.4	-69.0	-2.5	-24.9	-47.8	0.2	-143.4	-15.6	-38.7	-32.6

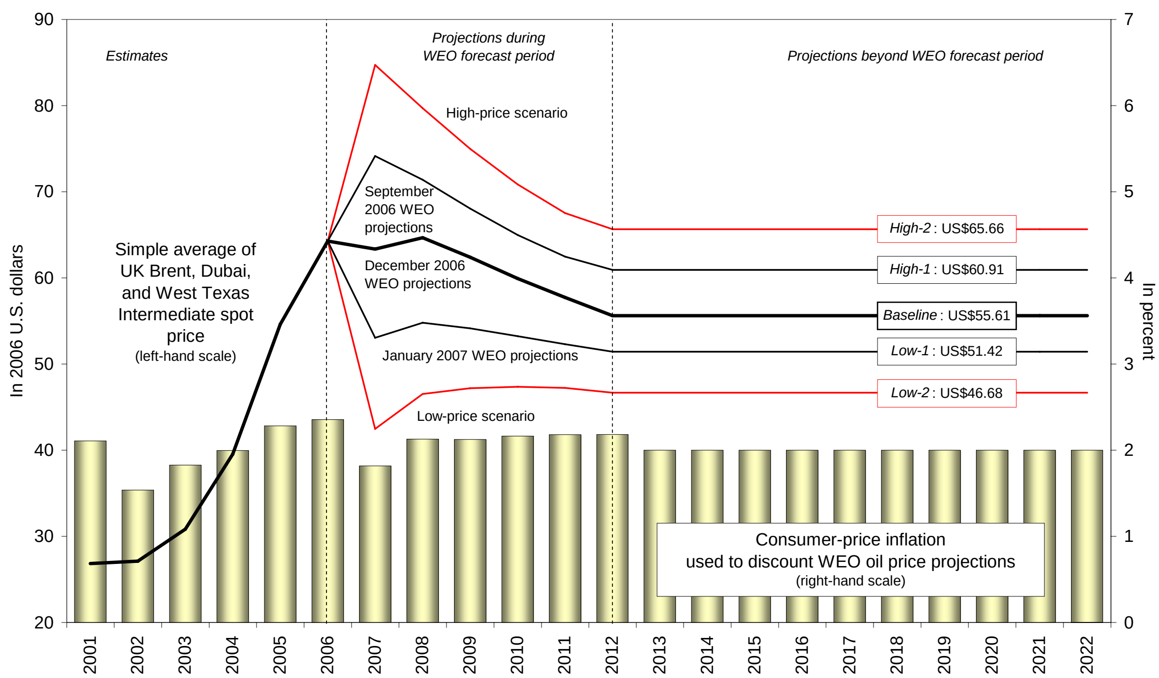
Source: Various IMF country databases.

[1] The aggregate SSA OPC economy is expressed in billions of U.S. dollars, unless otherwise indicated.

Price and Behavioral Assumptions

Key assumptions are contained in Table 1 (oil and gas reserves), Figure 3 (oil and gas production profiles, with the underlying, country-specific assumptions being summarized in the Appendix), and Table 3 (selected macroeconomic indicators). The baseline projection for real oil prices is based on the IMF's December 2006 *World Economic Outlook* (WEO) projections for 2006–12, according to which most of the recent oil price increases are viewed as being largely permanent.[25] In addition, the price profiles based on the September 2006 and January 2007 WEO projections have been considered. For very large price fluctuations, two further price profiles have been derived by, respectively, adding or subtracting half the difference between the September and January estimates to these two oil price profiles. For the long-run, it is assumed that oil prices remain constant in real terms, thereby defining a range of oil prices between US$65.66 and US$46.68 in the outer years. Intermediate consumption in the oil sector was assumed to be 5 percent of the gross value of oil production in all SSA OPCs. Growth, interest, and habit-strength assumptions are those used in Leigh and Olters (2006).

Figure 4. SSA OPCs: Oil Price Assumptions, 2003–22



Source: *World Economic Outlook* (WEO) estimates and projections until 2012; and IMF staff estimates and projections.

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[25] Expected WEO inflation rates for industrialized countries for 2007–12 and 2 percent per annum thereafter are used to convert the nominal WEO oil prices into real terms.

C. Model Calibration

On the basis of baseline assumptions, SSA OPCs will not be able to maintain the current fiscal positions. Relative to an average SSA OPC non-oil primary deficit of 27 percent of non-oil GDP in 2004–06, the corresponding estimates of a permanently sustainable deficit range between 11 percent (assuming the exploration of proven oil reserves) and 22 percent (assuming the exploration also of one-half of probable oil reserves as well as one-half of all proven and one-quarter of probable gas reserves). These benchmarks represent an indication of the degree to which fiscal positions will have to be adjusted—either gradually (while the overall balances remain in surplus) or abruptly (once oil revenues begin to dwindle).

Figures 5 and 6 show that, *ceteris paribus*, the fiscal position of most SSA OPCs cannot be maintained after the depletion of oil reserves—even when assuming that the recent increase in oil prices is essentially of a permanent nature and financial assets earn a respectable real rate of return. Contrasting the average non-oil primary deficit in 2004–06 with the permanently sustainable level derived on the basis of different exploration assumptions summarizes the varying risks faced by the different oil producers. For the SSA OPC economy as a whole, Figure 6 demonstrates a possible adjustment path over the medium-term horizon.

Clearly, an estimation of a fiscal deficit that could be financed *ad infinitum* is fraught with considerable uncertainty. There are risks both to the upside (for instance, new discoveries) and downside (for example, an unexpected fall in oil prices). The results derived in this paper thus represent primarily policy benchmarks, derived on the basis of available information and best long-term estimates (Table 4). As new information on reserves, prices, or other relevant factors become available, the benchmark results need to be updated.

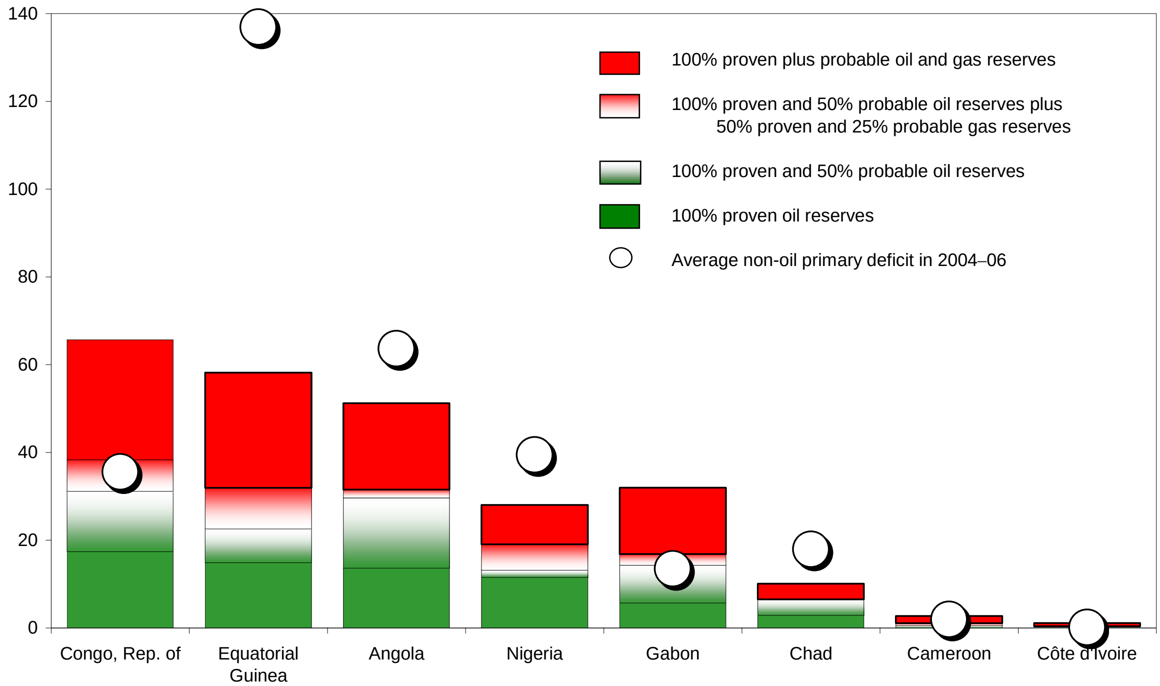
Governments are exposed to risks outside their control, stemming from geological uncertainties or changes in international oil prices. These provide risk-averse policymakers with precautionary motives for frontloading adjustment. But there are other factors as well that determine the governments' fiscal space of maneuver, and many of those are the direct result of policy choices. Regardless of the uncertainty from volatile oil prices and declining production profiles, governments need to focus on ways to

(i) devise effective financial investment strategies and overcome institutional obstacles, where necessary, to ensure the highest possible rates of return for a given level of risk for OPC oil saving;

(ii) implement structural reforms aimed at increasing the productivity of public investments so as to crowd in private investment, stimulate growth, and increase the sustainable level of government expenditure; and

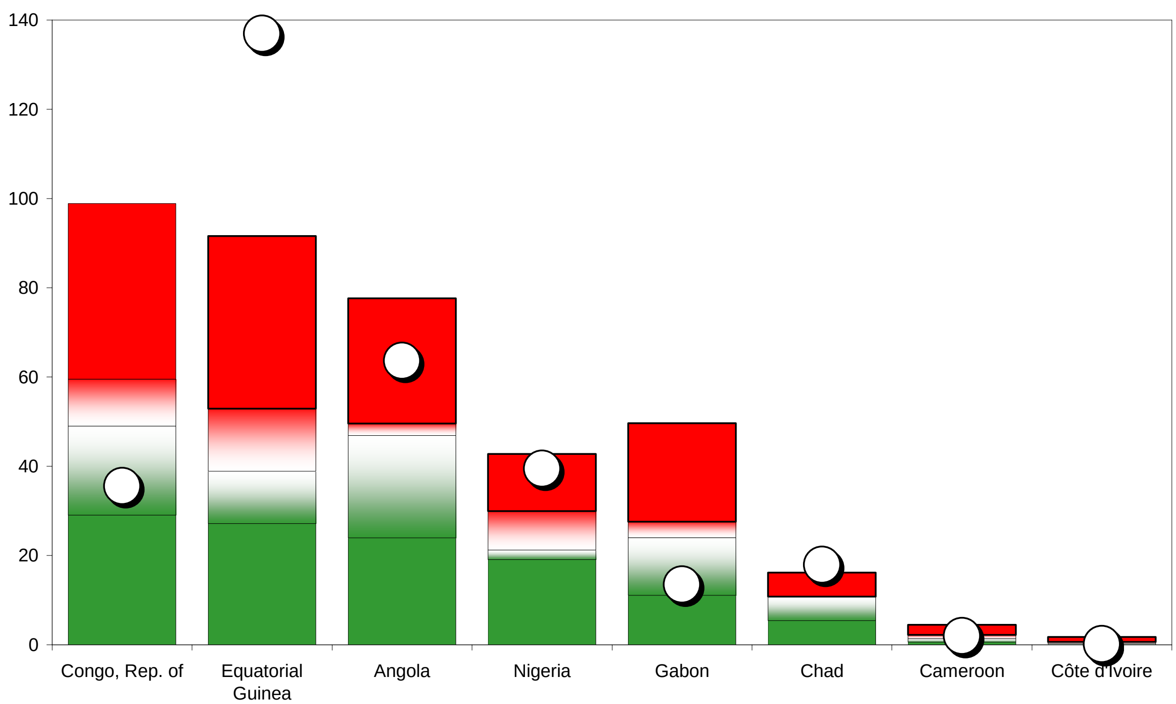
(iii) ensure that non-oil taxes do not fall as a share of non-oil GDP for reasons other than changes in tax policy.

Figure 5. SSA OPCs: Permanently Sustainable Non-Oil Primary Deficits
(Percent of non-oil GDP; assuming baseline oil prices and a 3.2 percent real rate of return on financial assets)



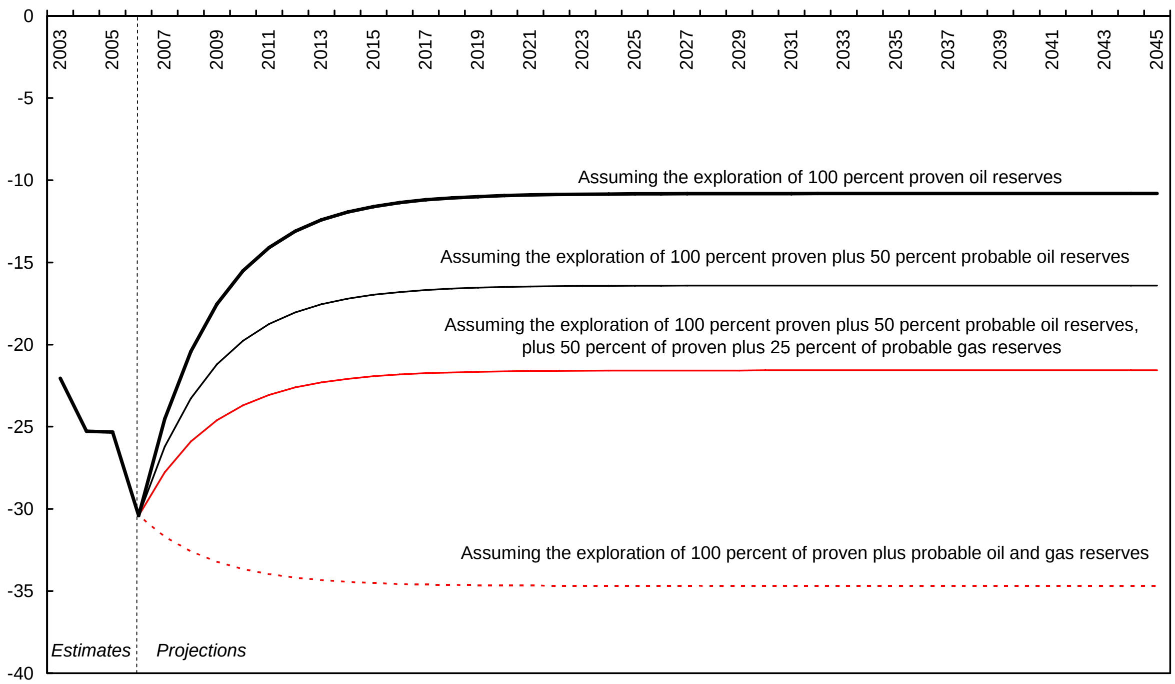
Source: National authorities; and author's estimates and calculations.

Figure 6. SSA OPCs: Permanently Sustainable Non-Oil Primary Deficits
(Percent of non-oil GDP; assuming baseline oil prices and a 4 percent real rate of return on financial assets)



Source: National authorities; and author's estimates and calculations.

Figure 7. Aggregate SSA OPC Economy: Non-Oil Primary Balances, 2003–45
(In percent of non-oil GDP; assuming baseline oil prices and a financial rate of return of 3.2 percent)



Source: National authorities; and author's estimates and calculations.

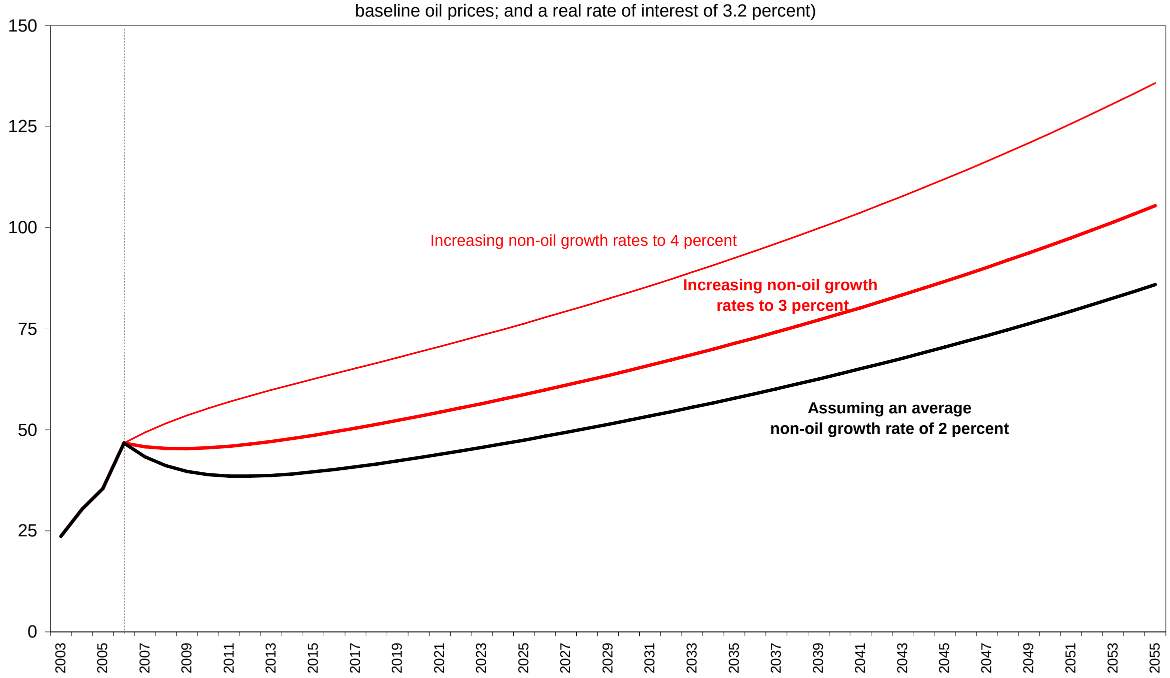
Governments can increase their fiscal space with carefully designed and effectively implemented public investments that are aimed at accelerating non-oil growth rates and a continued attention to maintaining tax discipline in, and the integrity of, the tax system for the non-oil sectors. While the model treats the relation between public spending and non-oil growth rates as exogenous, changing the underlying growth assumptions—implying that government spending becomes more targeted and effective and thus capable of crowding in private investments—sets off a virtuous cycle of accelerating non-oil growth rates, increasing non-oil tax revenues, and higher levels of sustainable government expenditure (Figure 8). Similar effects exist with respect to the non-oil tax system (Figure 9). Clearly, with higher non-oil growth, and a more rapid diversification of the economies, the relative importance of oil funds would decrease correspondingly.

Table 4. SSA OPCs: Permanently Sustainable Non-Oil Primary Deficits Under Various Assumptions
(Percent of non-oil GDP)

	Avg. NOPD 2004–06	With a financial rate of return of 3.2%					With a financial rate of return of 4.0%				
		High-2	High-1	Baseline	Low-1	Low-2	High-2	High-1	Baseline	Low-1	Low-2
Angola, assuming the exploration of	63.7										
proven oil	…	17.1	15.4	13.7	11.9	10.2	29.5	26.7	23.9	21.2	18.4
proven and 50% probable oil	…	36.0	32.9	29.7	26.7	23.6	56.6	51.8	46.9	42.3	37.6
proven and 50% probable oil and 50% proven and 25% probable gas	…	38.2	35.0	31.5	28.5	25.2	59.7	54.7	49.6	44.8	39.8
proven and probable oil and gas reserves	…	61.5	56.5	51.2	46.6	41.7	92.9	85.5	77.6	70.7	63.3
Cameroon, assuming the exploration of	2.0										
proven oil	…	-0.2	-0.3	-0.4	-0.5	-0.6	0.9	0.8	0.6	0.5	0.3
proven and 50% probable oil	…	0.4	0.2	0.1	0.0	-0.2	1.8	1.5	1.3	1.1	0.9
proven and 50% probable oil and 50% proven and 25% probable gas	…	1.1	0.9	0.7	0.5	0.3	2.8	2.5	2.2	1.9	1.6
proven and probable oil and gas reserves	…	3.0	2.7	2.3	2.0	1.7	5.5	5.0	4.5	4.0	3.6
Chad, assuming the exploration of	17.9										
proven oil	…	3.8	3.3	2.8	2.3	1.9	7.0	6.2	5.4	4.6	3.8
proven and 50% probable oil	…	8.1	7.3	6.5	5.7	4.9	13.3	12.4	10.8	9.5	8.3
proven and 50% probable oil and 50% proven and 25% probable gas	…	8.1	7.3	6.5	5.7	4.9	13.3	12.4	10.8	9.5	8.3
proven and probable oil and gas reserves	…	12.4	11.3	10.1	9.1	7.9	19.7	17.9	16.1	14.5	12.8
Congo, Rep. of, assuming the exploration of	35.6										
proven oil	…	21.8	19.6	17.4	15.2	13.1	36.0	32.6	29.0	25.6	22.1
proven and 50% probable oil	…	38.0	34.6	31.1	27.9	24.5	59.7	54.4	49.0	44.0	38.7
proven and 50% probable oil and 50% proven and 25% probable gas	…	46.5	42.5	38.3	33.6	30.5	72.1	65.9	59.5	53.6	47.5
proven and probable oil and gas reserves	…	78.9	72.5	65.7	59.7	53.3	118.7	109.1	98.9	89.9	80.3
Côte d'Ivoire, assuming the exploration of	0.1										
proven oil	…	-1.8	-1.9	-1.9	-1.9	-2.0	-1.1	-1.1	-1.2	-1.3	-1.3
proven and 50% probable oil	…	-1.7	-1.7	-1.8	-1.8	-1.9	-0.8	-0.9	-1.0	-1.1	-1.1
proven and 50% probable oil and 50% proven and 25% probable gas	…	-1.3	-1.4	-1.5	-1.6	-1.6	-0.3	-0.4	-0.6	-0.7	-0.8
proven and probable oil and gas reserves	…	-0.5	-0.6	-0.7	-0.9	-1.0	1.0	0.8	0.5	0.3	-0.1
Equatorial Guinea, assuming the exploration of	136.9										
proven oil	…	19.4	17.1	14.9	12.5	10.2	34.6	30.8	27.1	23.2	19.4
proven and 50% probable oil	…	28.5	25.5	22.6	19.6	16.6	48.4	43.6	38.9	34.0	29.2
proven and 50% probable oil and 50% proven and 25% probable gas	…	39.6	35.8	31.9	28.1	24.3	65.1	59.0	52.9	46.8	40.7
proven and probable oil and gas reserves	…	70.7	64.6	58.2	52.3	46.1	110.9	101.4	91.6	82.4	72.9
Gabon, assuming the exploration of	13.5										
proven oil	…	7.3	6.5	5.7	4.9	4.0	13.7	12.4	11.1	9.8	8.5
proven and 50% probable oil	…	17.6	16.0	14.3	12.8	11.3	29.0	26.5	24.0	21.7	19.3
proven and 50% probable oil and 50% proven and 25% probable gas	…	20.5	18.8	16.8	15.2	13.4	33.3	30.5	27.6	25.0	22.3
proven and probable oil and gas reserves	…	38.4	35.3	32.0	29.1	26.0	59.3	54.7	49.6	45.4	40.7
Nigeria, assuming the exploration of	39.5										
proven oil	…	14.2	12.9	11.6	10.3	9.0	23.2	21.2	19.1	17.1	15.1
proven and 50% probable oil	…	16.1	14.6	13.2	11.8	10.4	25.7	23.5	21.2	19.1	16.9
proven and 50% probable oil and 50% proven and 25% probable gas	…	23.5	21.1	19.1	17.2	15.3	36.1	33.1	30.0	27.1	24.1
proven and probable oil and gas reserves	…	33.7	30.9	28.0	25.5	22.7	51.2	47.1	42.8	38.9	34.8
Aggregate SSA OPC economy, assuming the exploration of	27.0										
proven oil	…	13.4	12.1	10.8	9.6	8.3	22.4	20.4	18.3	16.3	14.3
proven and 50% probable oil	…	20.0	18.3	16.4	14.7	13.0	31.7	29.0	26.2	23.6	20.9
proven and 50% probable oil and 50% proven and 25% probable gas	…	26.4	23.9	21.6	19.5	17.3	40.6	37.3	33.7	30.5	27.2
proven and probable oil and gas reserves	…	41.6	38.3	34.7	31.6	28.2	62.6	57.6	52.3	47.7	42.7

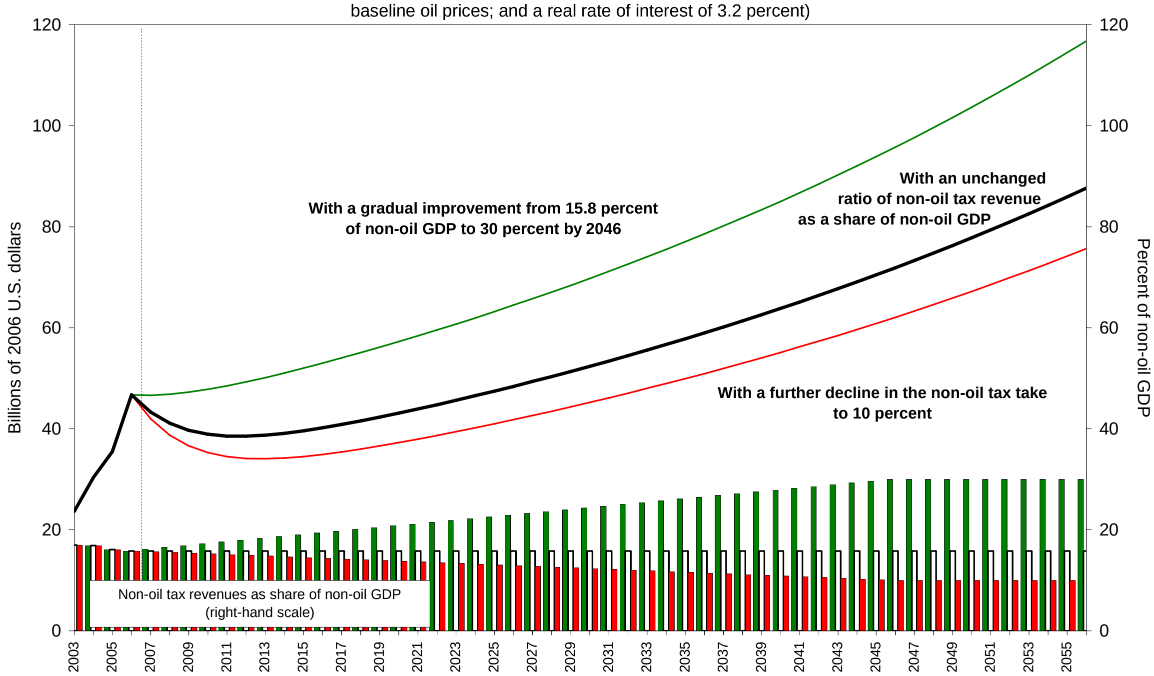
Source: Various IMF country databases; and author's calculations.

Figure 8. SSA OPCs: Real Growth and Sustainable Government Expenditure, 2003–55
(Billions of 2006 U.S. dollars; assuming the recovery of 100% proven and 50% probable oil reserves; baseline oil prices; and a real rate of interest of 3.2 percent)



Source: National authorities; and author's estimates and calculations.

Figure 9. SSA OPCs: Non-Oil Tax Take and Sustainable Government Expenditure, 2003–55
(Billions of 2006 U.S. dollars; assuming the recovery of 100% proven and 50% probable oil reserves; baseline oil prices; and a real rate of interest of 3.2 percent)



Source: National authorities; and author's estimates and calculations.

IV. Summary and Policy Implications

Previous boom-bust cycles taught governments to avoid an excessively close correlation between international oil prices and government consumption. To that end, the literature has developed a theoretical framework to define, on the basis of available estimates of oil (and gas) reserves, a long-term fiscal-policy strategy that has governments accumulate net financial assets during the years of oil production. From their returns, they can finance primary deficits in the post-oil years. The implication of this particular approach is, of course, that any current fiscal stance that is considerably more expansionary than is permanently sustainable necessitates an eventual adjustment. Governments thus face the choice between designing a gradual fiscal adjustment path while overall fiscal balances are in surplus, or having to contract fiscal policy sharply and abruptly once oil revenues start to decline, often to the detriment of the most disadvantaged segments of society.

Models based on Friedman's (1957) permanent-income hypothesis give oil producers fiscal benchmarks. In the present model, combining the PIH framework with the existence of "habits" (Leigh and Olters, 2006), a social planner solves an infinite-horizon utility-maximization problem with an intertemporal budget constraint. The optimal policy would then be to set spending on a constant path, equal to the expected annuity value of oil wealth and non-oil revenue. Governments invest a certain fraction of their oil revenues in alternative forms of wealth (in this case, financial). These assets generate a rate of return from which—when oil reserves are depleted—the government can finance a primary deficit indefinitely.

The corresponding fiscal benchmarks simulated in this paper imply that the current fiscal-policy stance of most SSA OPCs will need to be adjusted. Even on the basis of rather optimistic assumptions on key parameters, most SSA OPCs will not be able to maintain the current level of public expenditure. Relative to an average SSA OPC non-oil primary deficit of 27 percent of non-oil GDP in 2004–06, the corresponding estimates of a permanently sustainable deficit ranges between 11 percent (assuming the exploration of proven oil reserves) and 22 percent (assuming the exploration also of one-half of probable oil reserves as well as one-half of all proven and one-quarter of probable gas reserves).

For operational purposes, these benchmarks represent an indication of the degree to which fiscal positions will have to be adjusted. The implementation of a long-term fiscal-policy framework would be aided by the definition of a clear fiscal benchmarked, anchored in an appropriate definition of sustainability. This would provide policymakers, legislators, and civil society with a simple benchmark to distinguish sound and forward-looking policies from those designed only to address immediate demands. As the Maastricht fiscal-deficit criterion—with much less of an underlying economic foundation—has shown, such a benchmark can guide the public debate and, gradually, facilitate policy implementation.

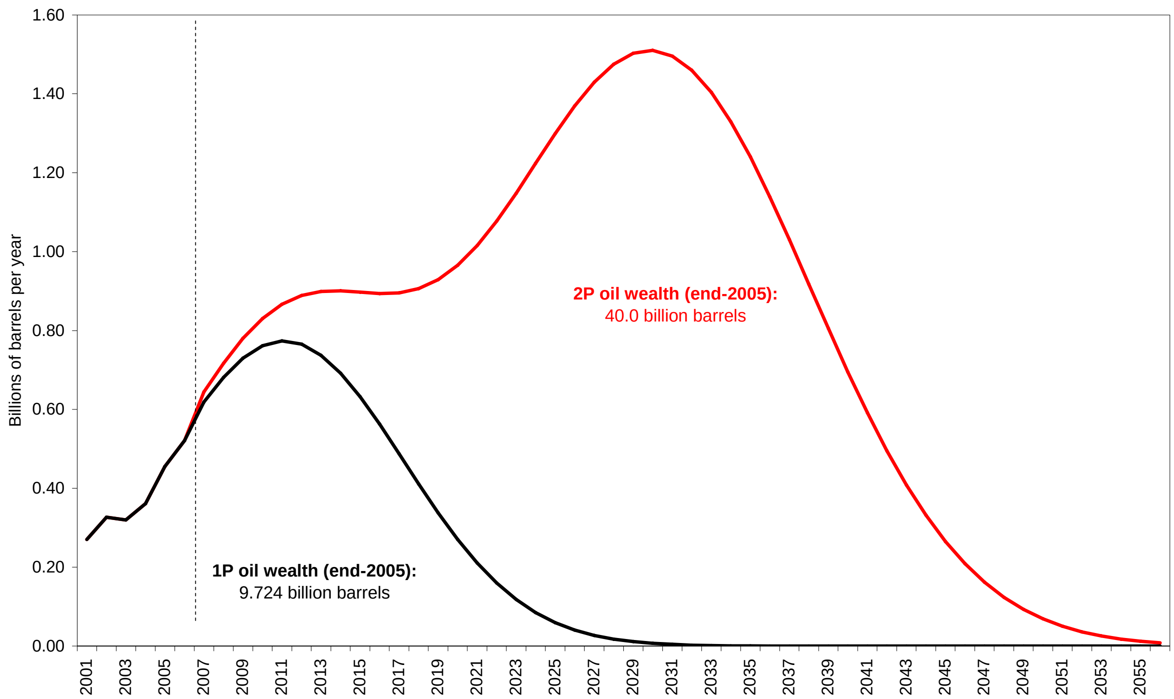
The oil market has proven more volatile than other markets, and uncertainty regarding future economic conditions gives risk-averse policymakers additional precautionary motives for fiscal restraint in years of overall surpluses. At the same time, an appropriate investment strategy for net financial assets, which might imply changes to the institutional environment (especially for those oil producers with regional arrangements), could increase the permanently sustainable non-oil primary deficit by a considerable margin. In addition, given the additional risks posed by the natural resource curse, comprehensively discussed in the literature, and the fragility of the current institutional framework, governments in SSA OPCs need to pay particular attention to measures aimed at raising the quality of public expenditure so as to ensure adequate growth and social pay-offs. Governments have the tools at hands to raise the rate of return from public expenditure and, in so doing, foster non-oil growth and increase their fiscal space of maneuver (that is, the level of government expenditure that is consistent with long-term sustainability).

The analysis presented herein, while capturing critical elements, remains incomplete. One avenue for future research would involve relaxing the assumption that government expenditure is consumption without any effects on productivity and growth. A richer model would allow for different rates of return on financial, physical, and social investments. Future work could also emphasize that some of the rates of return on non-financial assets are under direct control of governments, which could be raised by taking measures to ensure the maximum quality of public investments within a given expenditure envelope.

A clearly defined medium-term policy path, paired with efforts at improving public financial management, can help to prevent a repetition of previous boom-bust cycles and advance socioeconomic development in countries, where large segments of the population have only benefited marginally from the countries' oil wealth. If SSA OPC governments realize at a sufficiently early stage that their policies are not sustainable and—to paraphrase Solow (1974a)— take defensive actions, they will help to steer the economy away from a bust toward macroeconomic stability, sustainable rates of economic growth, and accelerated rates of socioeconomic development.

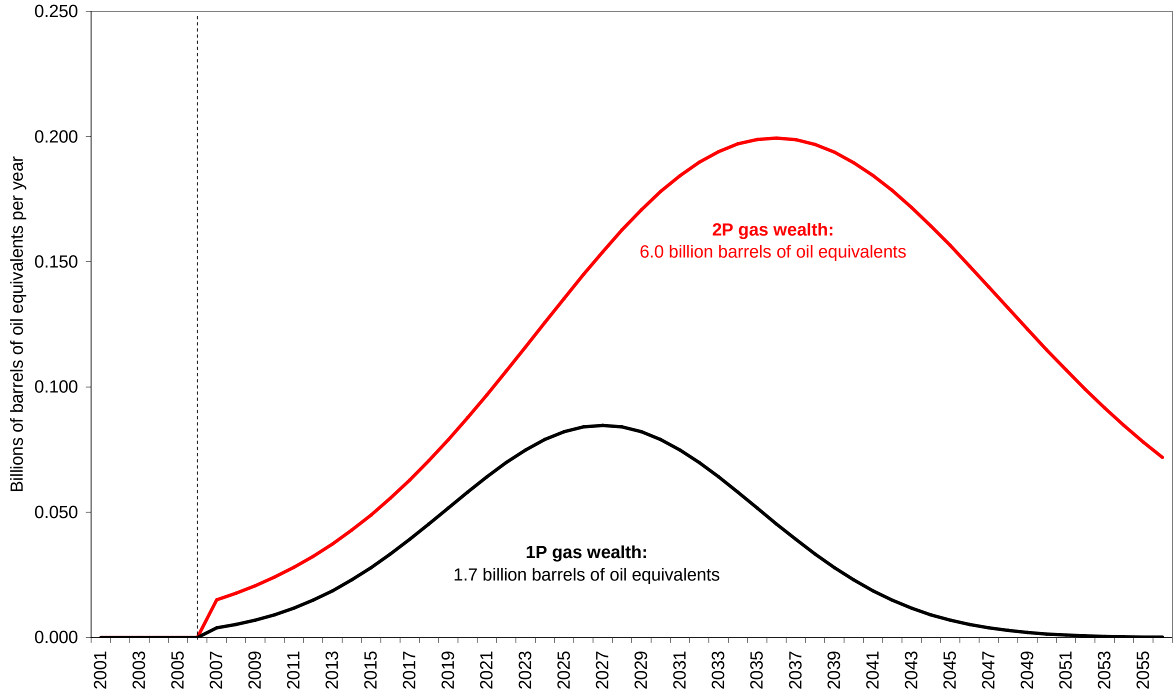
APPENDIX: OIL AND GAS PRODUCTION PROFILES BY COUNTRY

Table A1. Angola: Oil Production Profiles, 2001–56



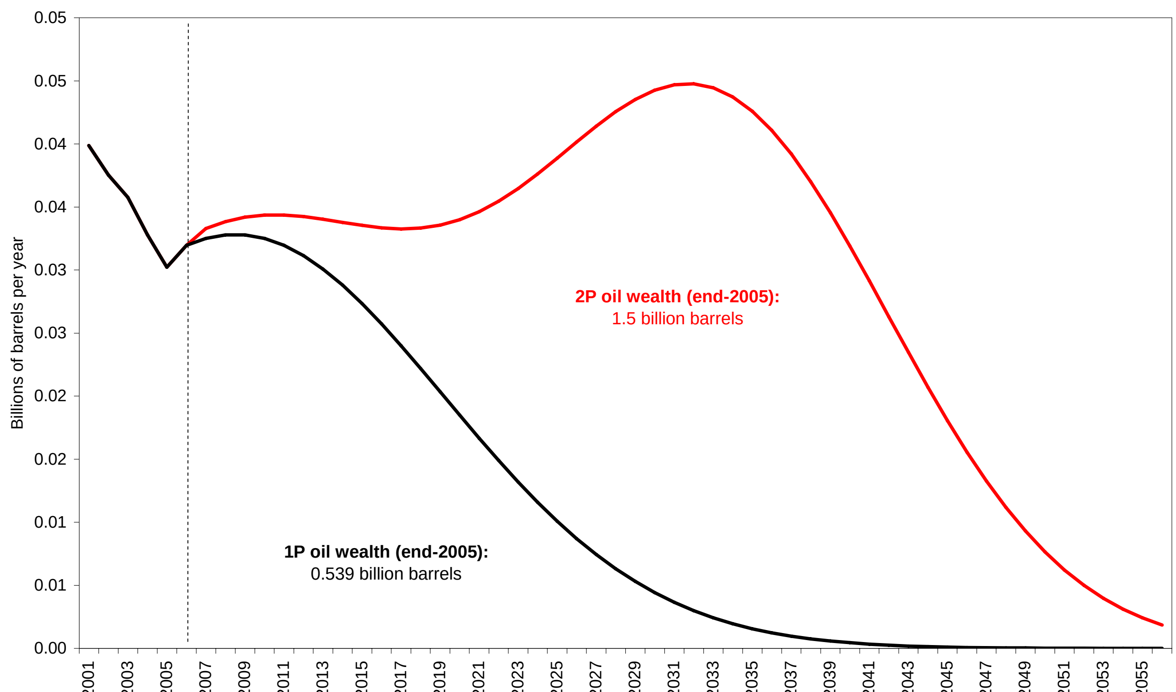
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A2. Angola: Gas Production Profiles, 2001–56



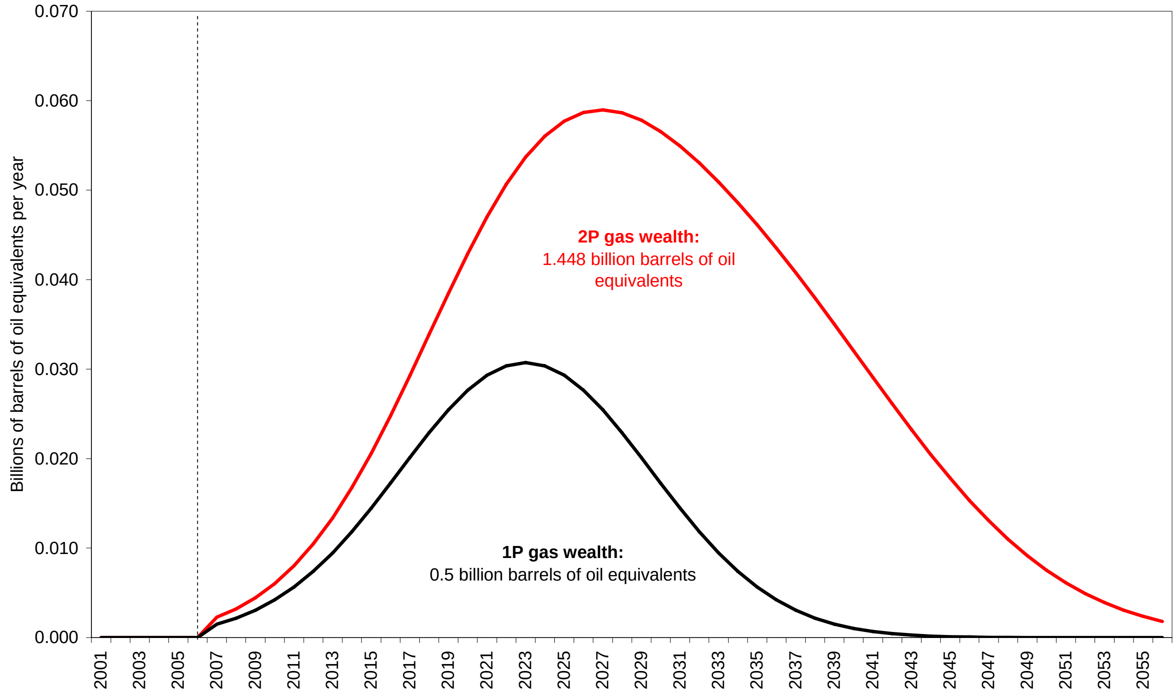
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A3. Cameroon: Oil Production Profiles, 2001–56



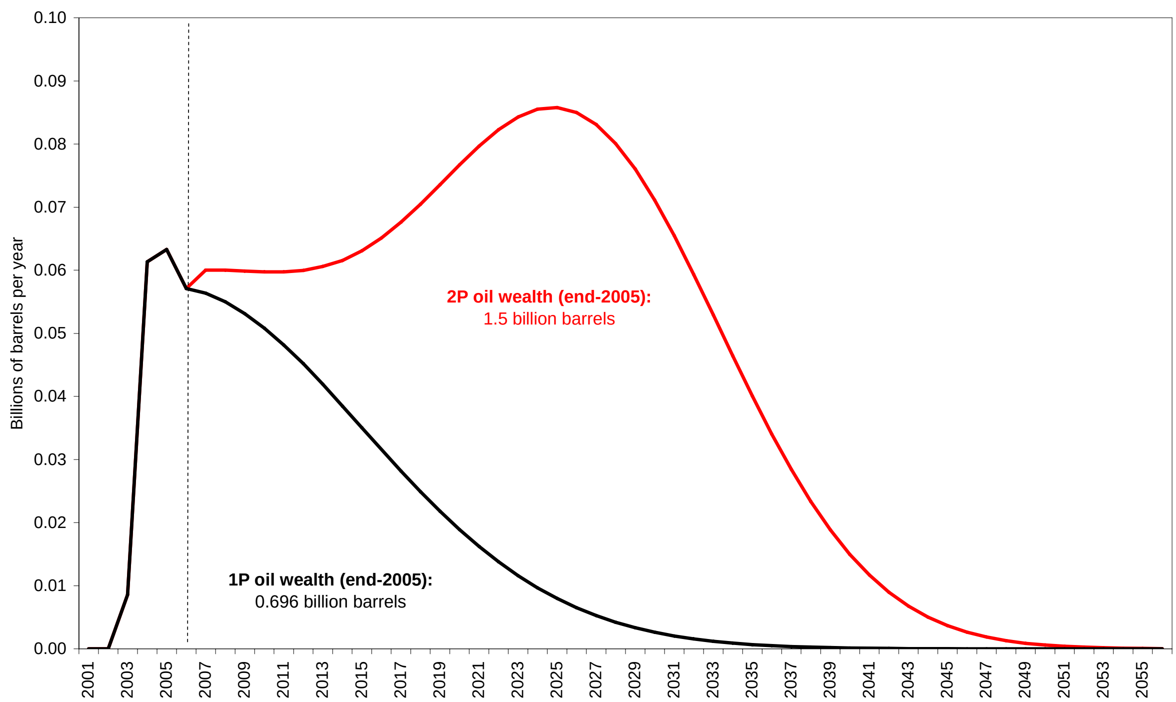
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A4. Cameroon: Gas Production Profiles, 2001–56



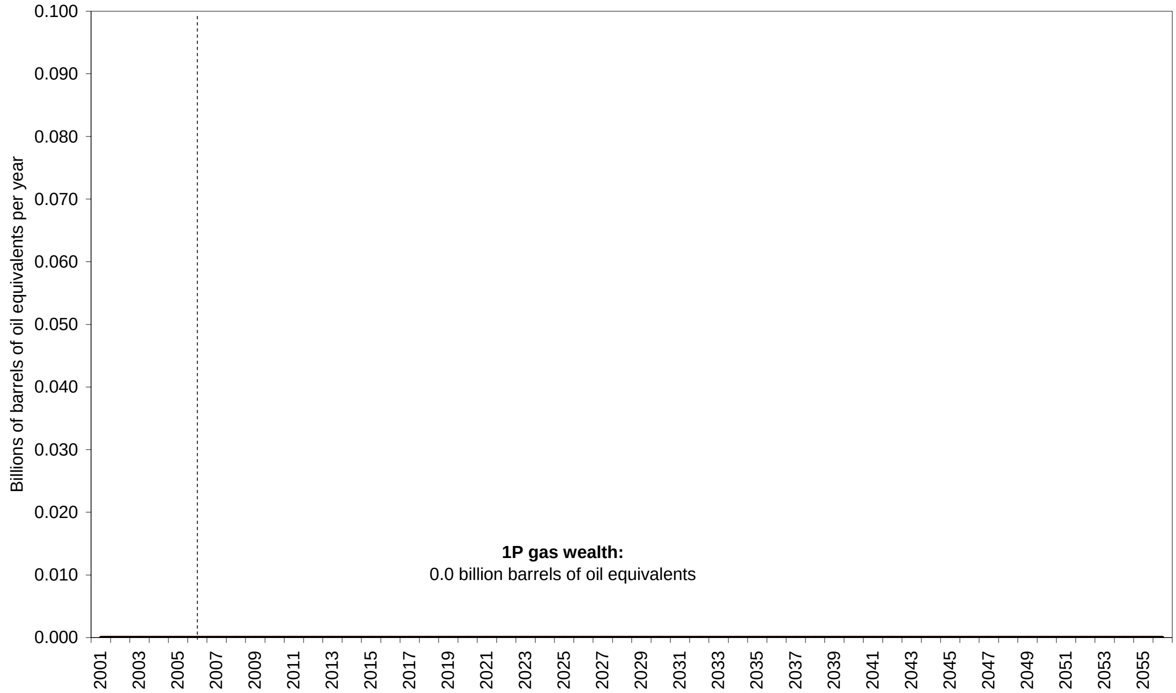
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A5. Chad: Oil Production Profiles, 2001–56



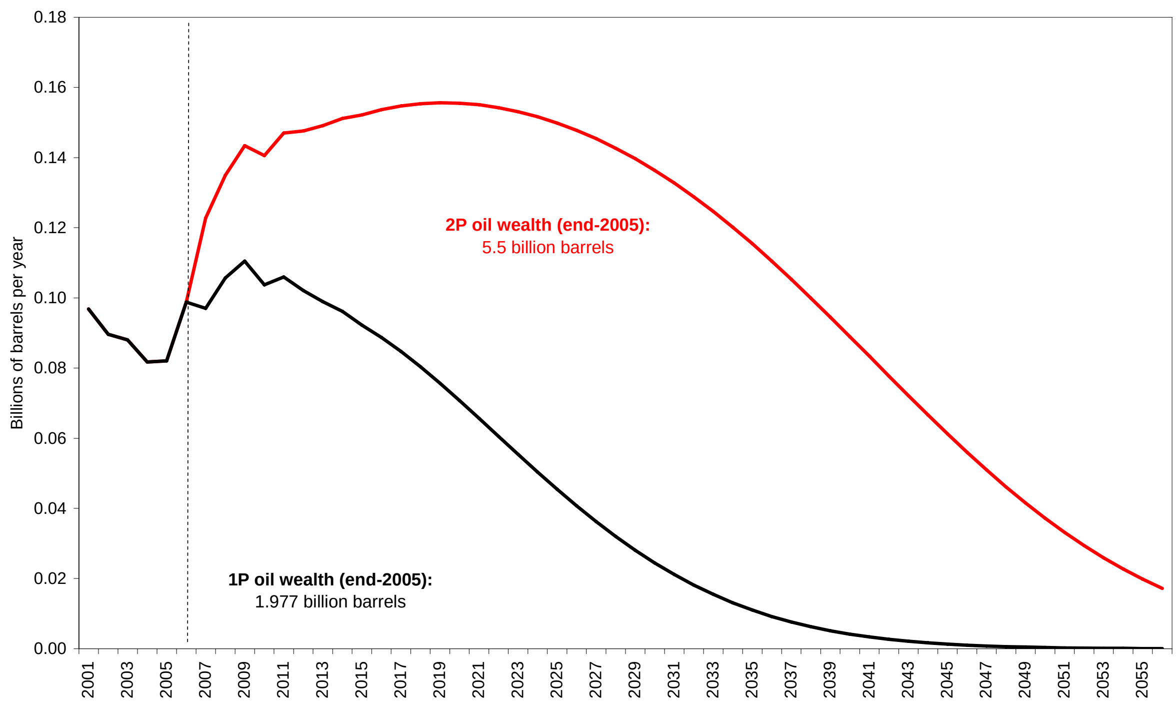
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A6. Chad: Gas Production Profiles, 2001–56



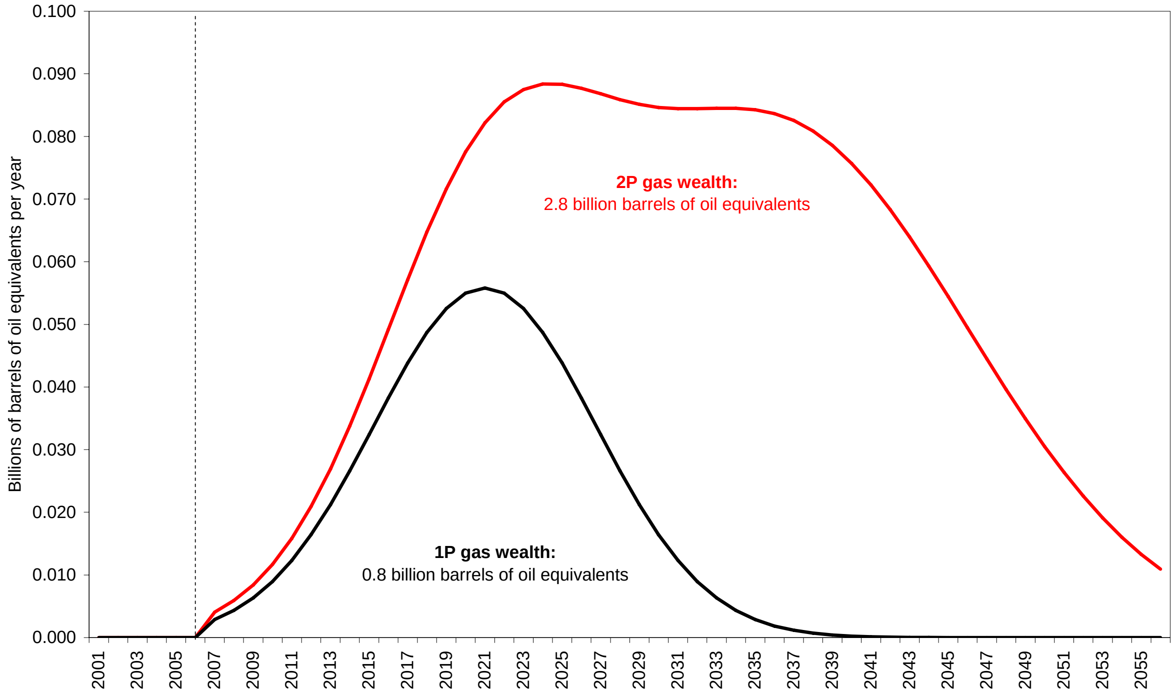
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A7. Republic of Congo: Oil Production Profiles, 2001–56



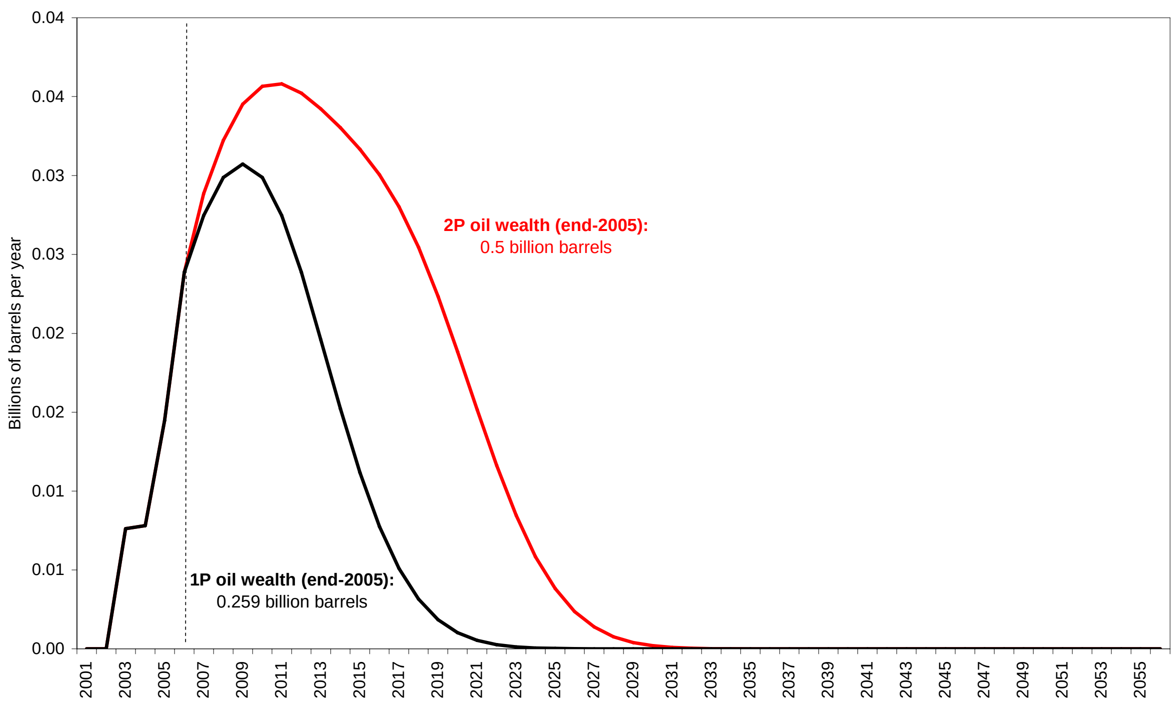
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A8. Republic of Congo: Gas Production Profiles, 2001–56



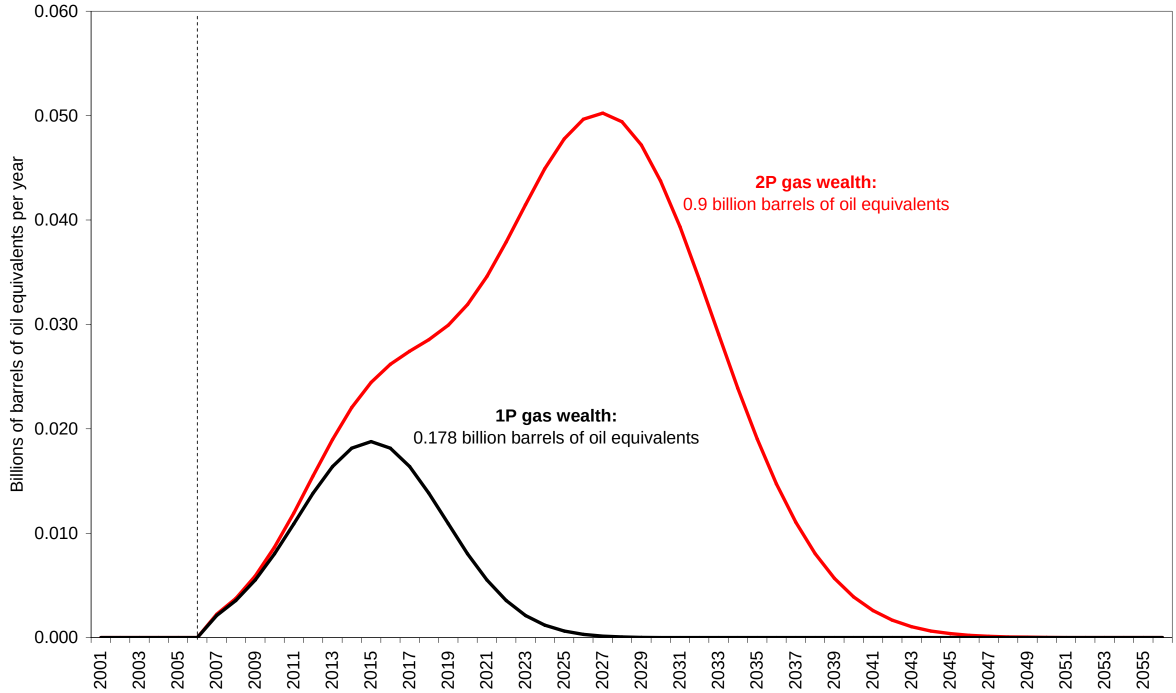
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A9. Côte d'Ivoire: Oil Production Profiles, 2001–56



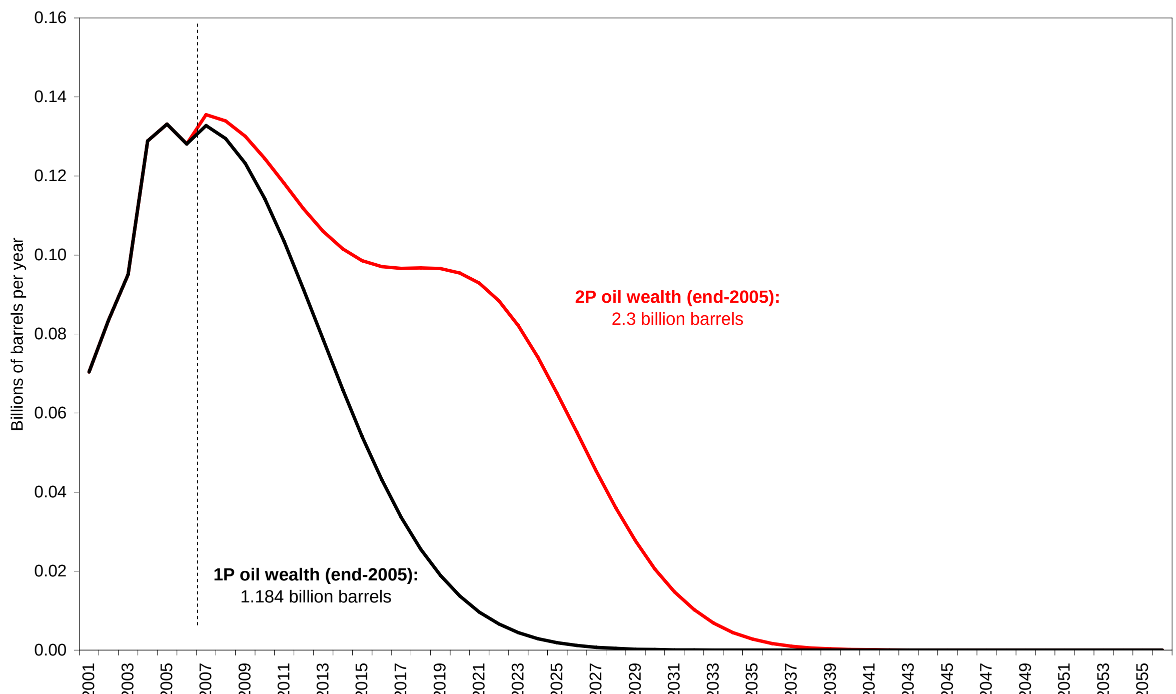
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A10. Côte d'Ivoire: Gas Production Profiles, 2001–56



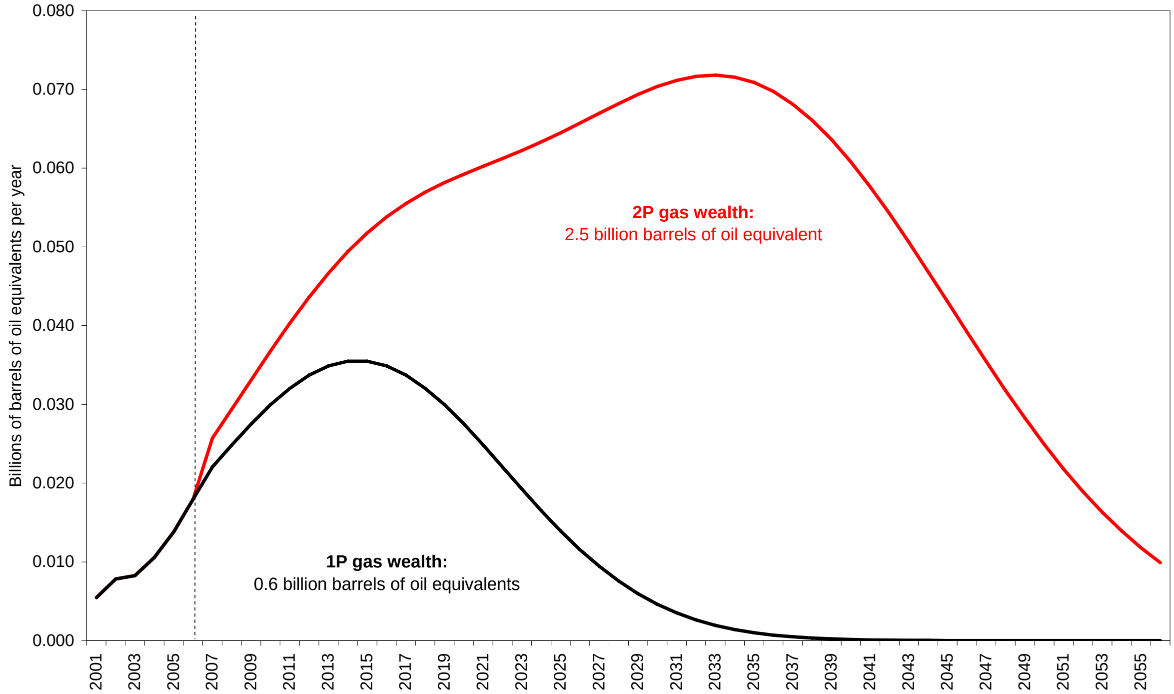
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A11. Equatorial Guinea: Oil Production Profiles, 2001–56



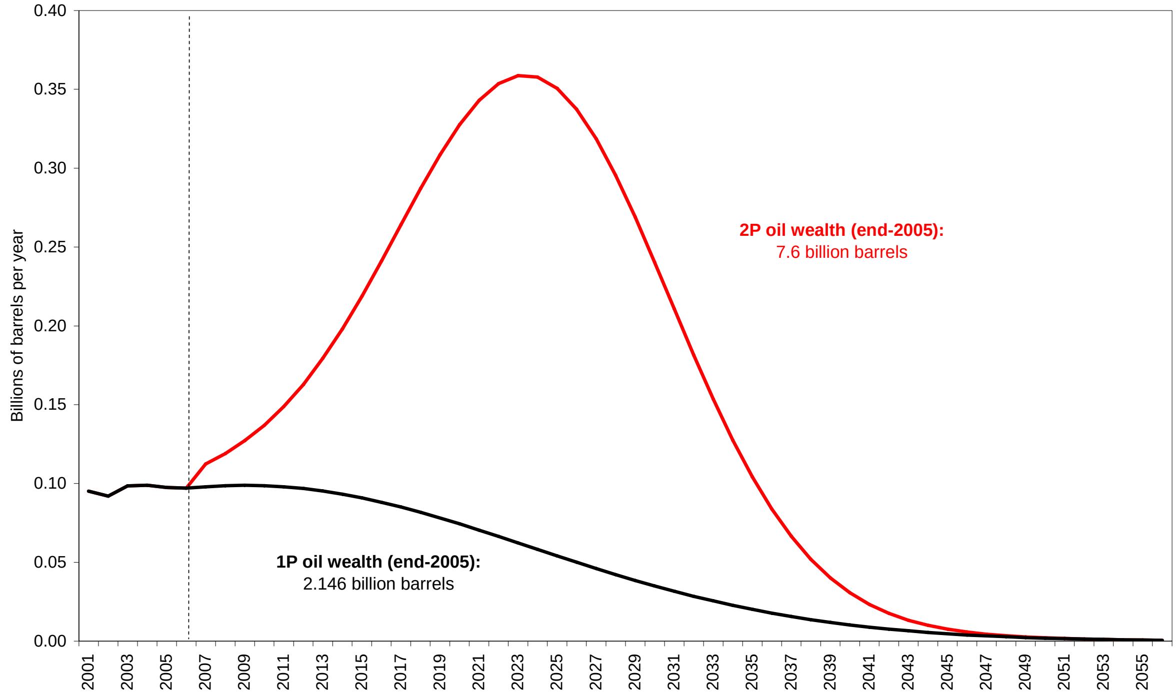
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A12. Equatorial Guinea: Gas Production Profiles, 2001–56



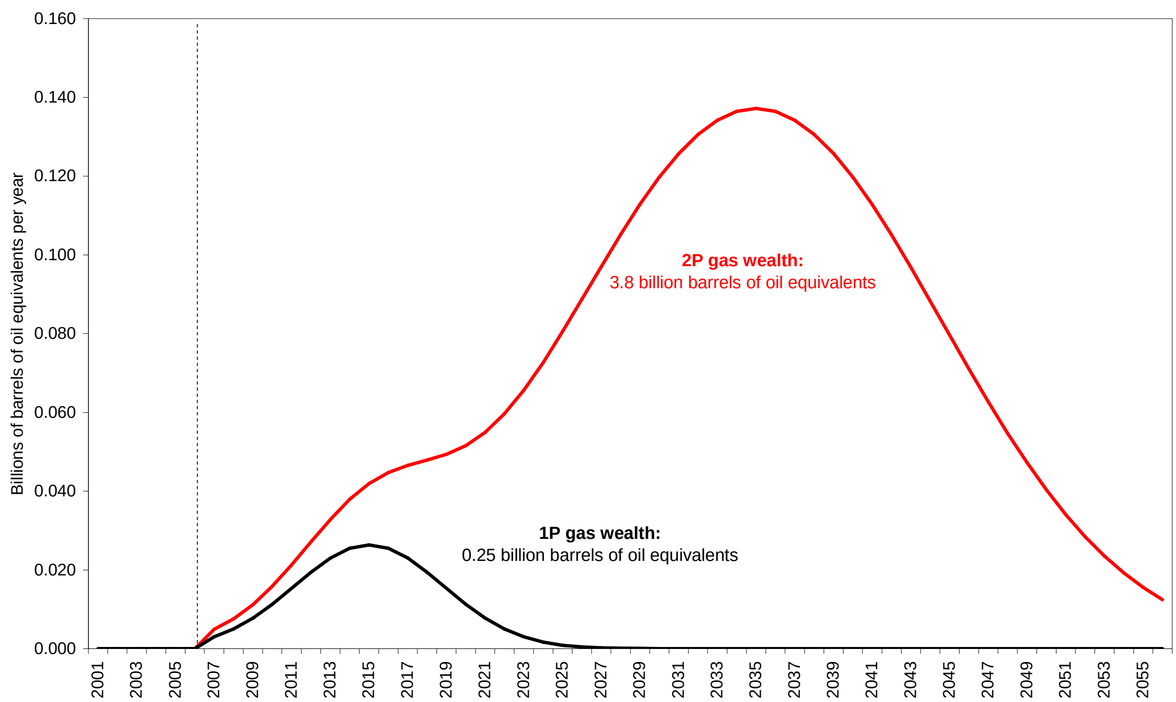
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A13. Gabon: Oil Production Profiles, 2001–56



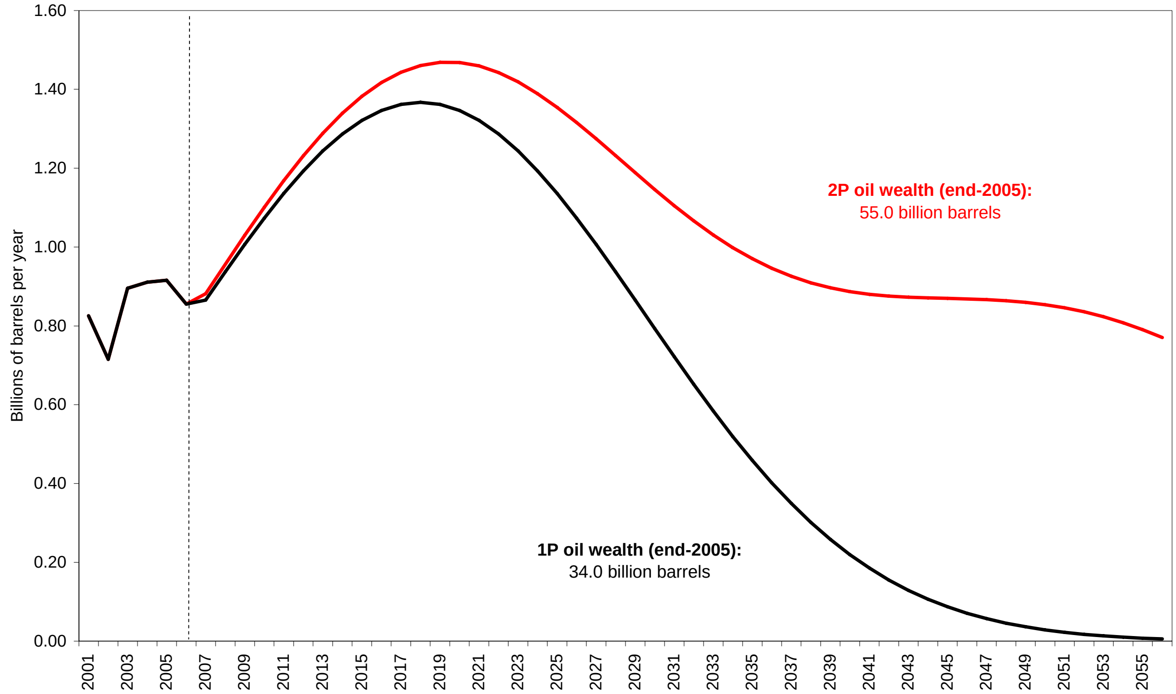
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A14. Gabon: Gas Production Profiles, 2001–56



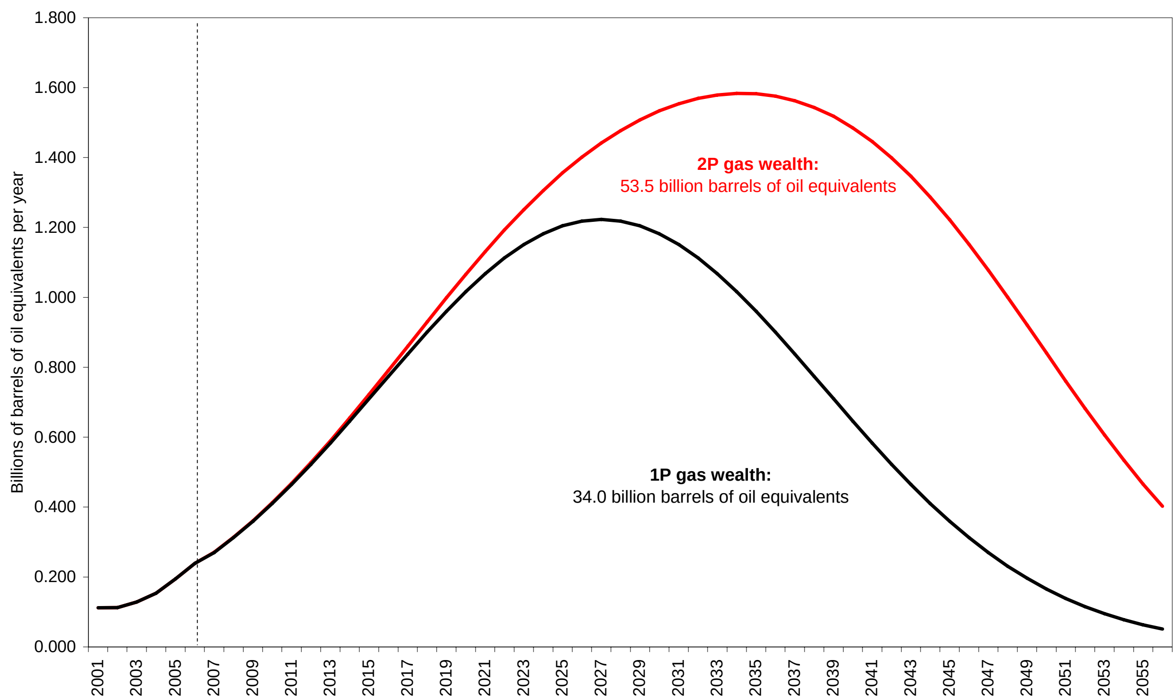
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A15. Nigeria: Oil Production Profiles, 2001–56



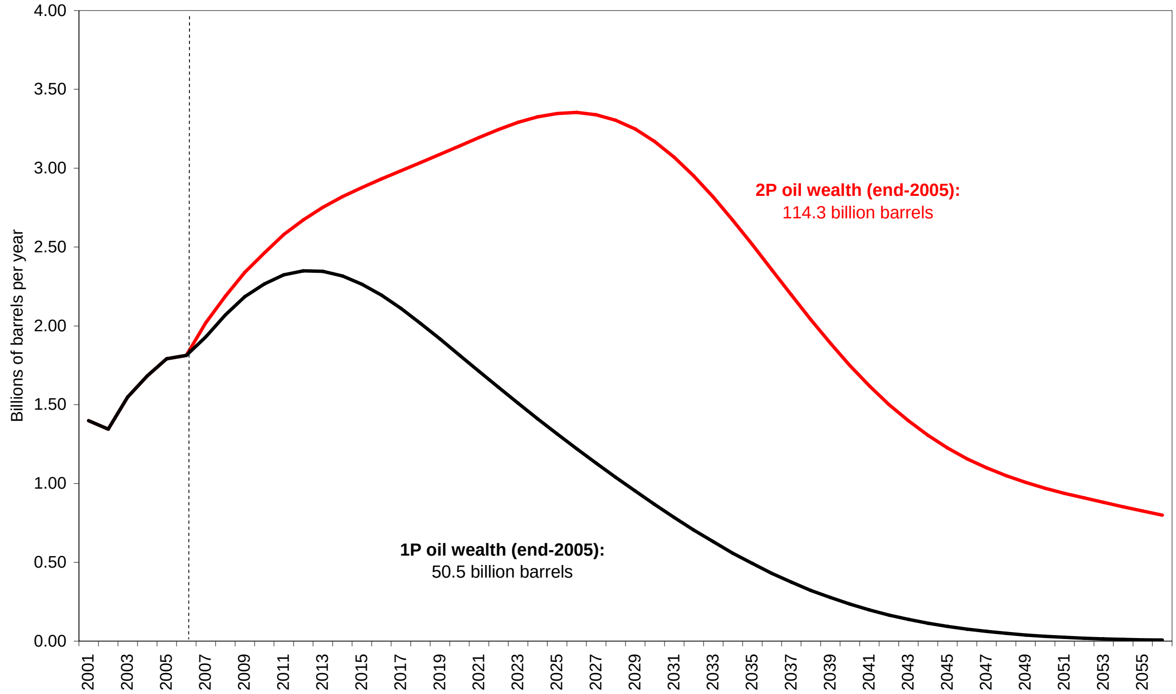
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A16. Nigeria: Gas Production Profiles, 2001–56



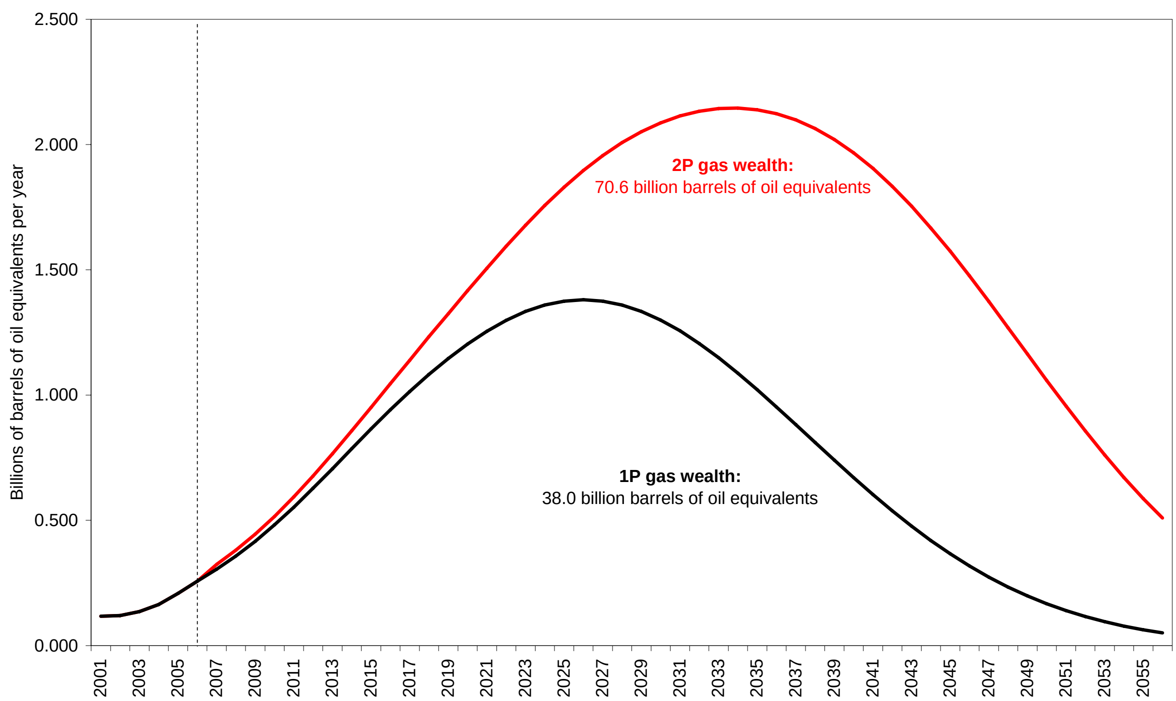
Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A17. SSA OPCs: Oil Production Profiles, 2001–56



Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

Table A18. SSA OPCs: Gas Production Profiles, 2001–56



Sources: Country authorities; published sources as per Table 1; and IMF staff estimates and projections.

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