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Management of Oil Wealth Under the
Permanent Income Hypothesis:
The Case of São Tomé and Príncipe

Alonso Segura

IMF Working Paper

African Department

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Prepared by Alonso Segura¹

Authorized for distribution by Samuel Itam

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Abstract

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This paper documents the protracted process of shaping the rules governing oil operations in São Tomé and Príncipe. It analyzes the institutional framework for oil sector development, which applies Milton Friedman's permanent income hypothesis to the management of oil resources. São Tomé and Príncipe is the first country in Africa to adopt this rule. Finally, the paper offers a preliminary quantitative analysis of the impact of oil sector development on government consumption and savings. It shows that the country's oil wealth could be significant, which would enable sustainable government consumption and intergenerational equity through a gradual buildup of the Permanent Fund for Future Generations.

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Author(s) E-Mail Address: asegura@imf.org

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I. INTRODUCTION

São Tomé and Príncipe is on the verge of becoming an oil-rich country.² Although oil production is not expected to begin until at least 2012, the first effects of the oil era are appearing in the form of oil signature bonuses and the efforts of policymakers to ensure transparent and accountable management of oil resources.

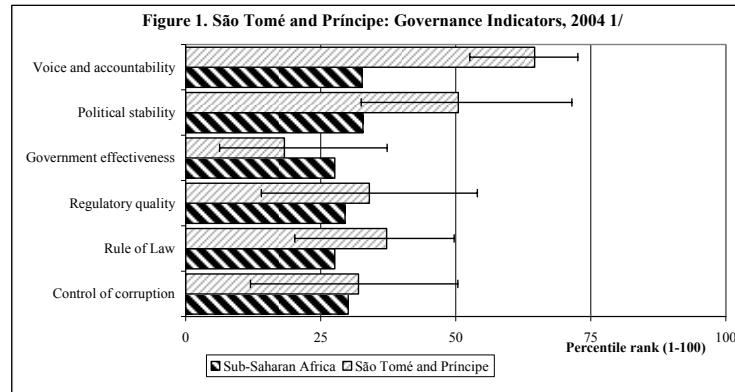
The process of shaping transparent rules to govern the relationship between oil companies and the government has been protracted. The Oil Revenue Management Law enacted in December 2004 may offer the best chance for the country to put in place strong governance and accountability provisions before oil production starts around 2012. Nevertheless, recent difficulties in the bidding for the Joint Development Zone (JDZ) hint at problems in implementing transparency guidelines, despite the sound legal framework. Addressing these challenges will require the São Tomé and Príncipe and Nigerian authorities to exercise resolute political will to enforce transparency rules in all oil-related transactions falling under their joint jurisdiction.

Adoption of a fiscal rule based on Milton Friedman's permanent income hypothesis (PIH)—São Tomé and Príncipe being the first country in Africa to approve such a rule—should guarantee sustainable government consumption and intergenerational equity while providing a predictable stream of oil revenues, so that the country can meet its pressing development needs. A preliminary quantitative analysis shows that, even under very conservative assumptions, the expected oil wealth of São Tomé and Príncipe is not only significant but will also be a stable source of financing for the budget and for the gradual buildup of the Permanent Fund for Future Generations. The oil financing can be budgeted starting in 2013; by 2033, it should converge to about US\$92 million (at constant 2006 U.S. dollars) in perpetuity. The Permanent Fund for Future Generations would gradually reach a steady-state level of US\$3 billion. These figures are noticeably high, considering that for 2006 the GDP of São Tomé and Príncipe is estimated at around US\$70 million.

II. GEOGRAPHICAL AND HISTORICAL BACKGROUND

São Tomé and Príncipe is an archipelago consisting of two islands and many islets in the Gulf of Guinea, one of the most active regions for oil exploration in the last decade. Approximately 300 kilometers from the African continent, it has a total land area of 1,001 square kilometers and a population of 160,000. Today São Tomé and Príncipe is one of the poorest countries in the world; the poverty level is above the sub-Saharan average, and the institutional framework is weak. In terms of governance indicators, however, the country is reasonably well-placed, ranking above the averages for the region (Figure 1).

² Throughout the paper, the term oil is used interchangeably with the broader term hydrocarbons.



Source: World Bank Governance Indicators.
1/ Higher rank reflects better governance.

For hydrocarbon exploration purposes, the country's territory can be divided into three distinct geographical zones: the offshore Joint Development Zone (JDZ) operated with Nigeria (Box 1), the offshore Exclusive Economic Zone (EEZ), and the onshore area consisting mainly of the islands of São Tomé and of Príncipe.

Box 1. Joint Development Zone (JDZ)

In 1998, São Tomé and Príncipe filed a territorial claim with the United Nations to establish an Exclusive Economic Zone (EEZ) based on the median line principle stipulated by the UN Convention on the Law of the Sea (UNCLOS). Nigeria contested the claim, arguing that the northern part of the proposed EEZ was within Nigeria's own EEZ. The area in dispute covered 34,548 square kilometers.

In February 2001, Nigeria and São Tomé and Príncipe signed a treaty for joint development of petroleum and other resources in the maritime areas contained in the areas they both claimed, which now constitute the JDZ. Although the countries did not renounce their claims to the zone, the treaty called for joint exploitation of natural resources for a period of 45 years, unless otherwise agreed after a review in the thirtieth year. The treaty can be extended by mutual agreement after the initial term.

The treaty grants Nigeria 60 percent and São Tomé and Príncipe 40 percent of the benefits and obligations arising from development activities carried out in the JDZ. The Joint Development Authority (JDA), based in Abuja, was created to manage exploitation of the resources in the JDZ. The JDA responds to the Joint Ministerial Council (JMC), composed of two to four ministers or officials of equivalent rank from each country. The JMC is the ultimate decision-making body for the JDZ. JDA and JMC decisions are made by consensus. If the JMC deadlocks, the disputes are referred for resolution to the heads of state of the two countries.

The JDZ, the northernmost zone, borders Nigerian territories of very intense hydrocarbon activity. Block 1 in the JDZ is, in fact, only a few kilometers south of Nigeria's Akpo field, which is believed to contain reserves as high as 1.0 to 1.5 billion oil equivalent barrels. Extensive seismic data for the northern part of the JDZ suggests very promising prospects for

commercially viable oil discoveries. Oil production prospects in the EEZ are so far less promising, although preliminary seismic data and drilling indicate some chance for commercial production. The potential for hydrocarbon discoveries onshore is considered low; the São Tomé and Príncipe authorities have no current plans for promoting exploration there.

Indications that there are hydrocarbons in São Tomé and Príncipe date back to colonial days. Attempts by the Portuguese colonial administration in 1974 to sign a concession agreement with Ball & Collins, an Anglo-American company, were abandoned when the country declared independence in 1975. Through the mid-nineties there were several failed attempts to jump-start petroleum exploration, including a five-year concession signed in 1989 with Island Oil Corporation, which briefly conducted onshore drilling before ending its operations.

São Tomé and Príncipe has granted—and, in several cases, later amended—rights on oil exploration and development to several oil companies since 1997. The amendments have generally come about after widespread criticism by major domestic and international stakeholders of possible economic and financial losses to the country under the original terms. Although the amendments generally did secure better terms, in several cases imbalances in profit distribution were not fully redressed in São Tomé and Príncipe's favor.

- In May 1997, a Memorandum of Agreement granted Environmental Remedial Holding Corporation (ERHC) and Procura Financial Consultants (PFC) large preferential rights over oil exploration and development within the country's territory, including surrounding waters. Notably, these included rights (i) to perform a full evaluation and feasibility study of oil, gas, and mineral reserves; (ii) to operate oil fields and concessions; (iii) to establish a joint venture with the government that would create a state oil company; (iv) to negotiate oil field leases with other international oil companies on behalf of the government; and (v) to issue regulations for the functioning of the hydrocarbons sector.
- In 2003, an amendment to the 1997 agreement curtailed some of ERHC's rights within the JDZ but did not amend those pertaining to the EEZ. Even after the amendment, ERHC retained preferential rights in no less than six blocks in the JDZ and four in the EEZ. These rights often included generous exemptions from payment of signature bonuses in oil exploration and development ventures.
- In September 1998, São Tomé and Príncipe signed a Technical Assistance Agreement with Mobil Exploration and Producing Services Inc. (now Exxon Mobil) to conduct seismic studies in what now constitutes the JDZ. It granted Exxon Mobil preferential rights to acquire up to 40 percent of a working interest in one JDZ block (a right the company applied to the exploration of Block 1) and the option to acquire up to 25 percent of the working interest in two additional blocks.

- In February 2001, the country signed agreements with PGS-Exploration-UK (Petroleum Geo Services, from Norway) granting the company exclusive rights to conduct seismic surveys in the EEZ until concession awards were granted. PGS has the right to sell the results of the surveys. PGS or its subsidiaries also hold preferential rights on shared participation in the exploration of two EEZ blocks.

III. OIL SECTOR INSTITUTIONAL FRAMEWORK

Over the past five years, São Tomé and Príncipe has created a number of institutions to ensure sound regulation of the hydrocarbons sector. The policy objective has been to address the “curse” of oil that has been identified in many resource-rich countries. This curse, often associated with resource waste and corruption, has been said to cause weak and ineffective institutions, slow progress in addressing poverty, and in some cases armed conflict. Against this background, São Tomé and Príncipe has drafted a number of laws to make management of oil revenues balanced, transparent, and accountable. Crafting the laws and enabling regulations has been an open democratic process in which representatives from all political factions and social segments participated, in consultation with international experts.

There are six milestones on the path to setting high transparency, accountability, and governance standards in oil revenue management in São Tomé and Príncipe:

- The General Law on Petroleum Exploration and Exploitation of August 2000 provides the legal framework for development of the oil sector. It states that all reserves and reservoirs of liquid and gaseous hydrocarbons belong to the state. It stipulates that petroleum operations are to be conducted either by the state, directly or through a state-owned petroleum company, or by commercial companies licensed by the state. The law specifies that the state can only enter into the type of production-sharing agreements (PSAs) that are considered best international practice.
- The Treaty on the Establishment of the Joint Development of Petroleum and other Resources with Nigeria of February 2001 regulates hydrocarbon operations in the JDZ and establishes the Joint Development Agency (JDA) and the Joint Ministerial Committee (JMC) to manage oil activities there.
- Decree Law No. 3/2004 of June 2004 creates the National Petroleum Council to set national energy policies. The Council has 15 members, including the president, the prime minister, several other ministers, representatives of the civil society, and other individuals designated by the president and the prime minister.
- Law No. 5/2004 of June 2004 creates the National Petroleum Agency (ANP). The ANP is in charge of managing oil and gas exploration and development in line with the policies devised by the National Petroleum Council.

- The Abuja Joint Declaration, signed by the Presidents of Nigeria and São Tomé and Príncipe in June 2004, sets transparency guidelines to which all JDZ operations must adhere. The declaration also pledges adherence to the principles of the Extractive Industry Transparency Initiative (EITI).
- The Oil Revenue Management Law (ORML) of December 2004 regulates the payments, management, use, and oversight of revenues resulting from oil operations in the entire national territory, including both the EEZ and the JDZ. The ORML sets fiscal rules by which oil proceeds are to be used in annual budgets.

The ORML is the key legislation for open and transparent management of São Tomé and Príncipe's oil revenue. The law was devised in close consultation with international experts on fiscal frameworks for resource-rich countries.³ The basis for it is Milton Friedman's (1957) permanent income hypothesis (PIH), which implies constant government consumption (in real terms) of oil resources over time that is equivalent to interest income on the net present value of the country's oil wealth.⁴ The PIH fiscal rule entails use of the Permanent Fund for Future Generations to secure intergenerational equity and guarantee a permanent flow of resources that will foster economic development even after oil resources have been exhausted (Box 2).⁵

Beyond its sound fiscal properties, as expressed in the Permanent Oil Fund, the ORML contains provisions that, properly implemented, should ensure transparent and accountable management of oil resources. The transparency principles explicitly define an obligation to make public all oil-related transactions and specifically prohibit confidentiality clauses in oil contracts, including PSAs. To protect the integrity of the Permanent Fund and ensure full accountability, the ORML establishes the independent Petroleum Oversight Commission to monitor compliance with the law. The Permanent Fund is also subject to two regular audits, one by the Auditor General's Office and another by a reputable international auditing firm. The results of both must be made public. The ORML also gives guidelines for management and investment of the savings from oil proceeds.

³ The Earth Institute at Columbia University was the main external advisor when the ORML was drafted. The World Bank and IMF staffs were also consulted at several stages.

⁴ The ORML states that the use of signature bonuses has to be spread out to cover the period until oil production is expected to begin. Because the government budgets approved by parliament for fiscal years 2005 and 2006 have adhered to this principle, deposits have begun to build up in the National Oil Account.

⁵ See Section VI for some preliminary quantitative estimates of annual funding for the budget and the gradual buildup of the Permanent Fund for Future Generations.

Box 2. Permanent Fund for Future Generations

- All financial resources owed to the state as oil revenue are to be deposited in the National Oil Account (NOA), which the central bank is to open, on behalf of the government, with a foreign custodian bank. The NOA will comprise an Unrestricted Portion, in which current oil proceeds will be deposited, and a subaccount, the Permanent Fund (PF), for long-term savings for future generations. The balance in the unrestricted portion after fees and annual transfers to the budget will be transferred to the PF once a year.
- Liens and encumbrances on the NOA or any other oil resources, current or future, are prohibited. This effectively bars oil-backed forward borrowing.
- The NOA is to provide an annual single transfer to the budget each year. In pre-production years, the amounts are subject to formulas that take account of the stages of oil exploration and possible production. Once oil production starts, annual transfers to the budget will be based on a PIH framework to preserve the country's oil wealth and support government spending indefinitely even after oil resources are exhausted.
- The annual funding amounts are to be spent according to the priorities set forth in the country's Poverty Reduction Strategy, with 7 percent of the annual amount reserved for the autonomous region of Príncipe and 10 percent for local governments.
- The resources deposited in the NOA are to be managed by a Management and Investment Committee composed of five members, among them the minister of finance and the president of the central bank. Investments domiciled in the country are prohibited. Private managers can be hired.
- A Petroleum Oversight Commission is created to ensure permanent monitoring and auditing of all transactions related to oil revenues and resources. It includes representatives of the civil society.

Current challenges for the São Tomé and Príncipe authorities are to remove administrative bottlenecks that could prevent implementation and development of the institutional framework and to maximize local content in the provision of services to the oil industry. To address these concerns, a World Bank capacity-building and technical assistance credit contains a dossier on petroleum to provide extensive support to the government, particularly for the design of a medium- and long-term petroleum sector strategy. Here it will be important to identify areas where local content may be high, mainly related to support services, to maximize the impact of oil operations on the economy. This is particularly urgent because of the enclave effect of oil production in offshore platforms and because the first JDZ fields to be exploited will be headquartered in Abuja, where the oil industry is already strong.

IV. LICENSING OF OIL FIELDS IN THE JDZ⁶

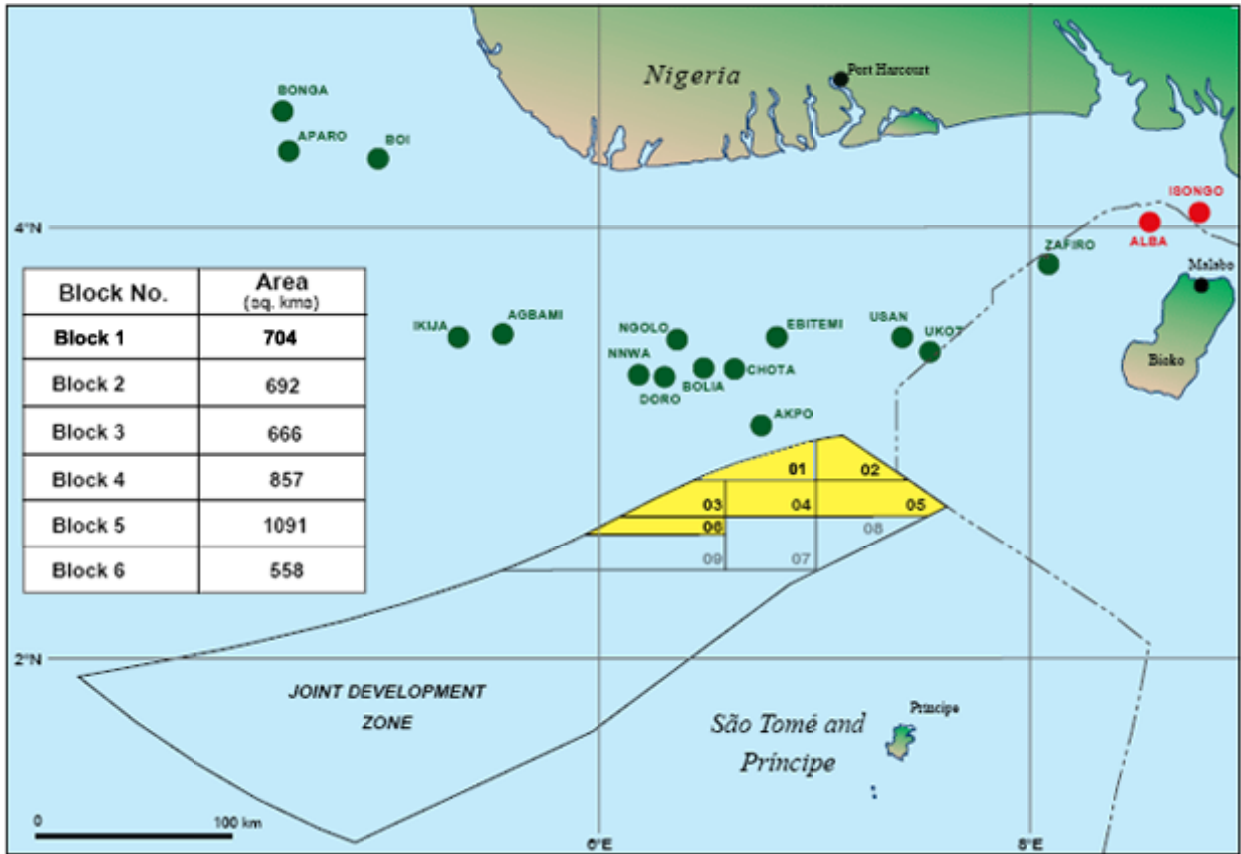
The first bidding round for licenses in the JDZ oil fields was successfully concluded in April 2004 with the awarding of Block 1 (Figure 2). Though bids for six more blocks were also received at that time, the JDA turned them down for both technical and financial reasons. The winning bid for Block 1 brought US\$123 million in oil signature bonuses; the awardees were Chevron Texaco (a 51 percent operating share), Exxon Mobil (40 percent) and the joint Nigerian-Norwegian Dangote Energy Equity Resources Limited (9 percent). Chevron Texaco was the designated operator for the consortium, while Exxon Mobil executed the preferential rights it had obtained in the 1998 agreement with the São Tomé and Príncipe government. The PSA was signed in May 2005, and initial drilling exploration was recently concluded in Block 1 (Obo-1 well).

A second bidding round, for licenses in Blocks 2-6 in the JDZ, was completed in May 2005, but while negotiations of PSAs with awardees are under way, the transparency of the auction has been questioned.⁷ PSAs for Blocks 2-4 were, in fact, signed in March 2006; negotiations for Blocks 5-6 are continuing despite the controversy over procedures followed in granting the awards. The process has been plagued by the withdrawal of several awardees, who were replaced by companies who were arguably less technically qualified. The controversies highlight once again the necessity of capacity building to ensure that the sound legal framework is actually applied and to strengthen regulatory bodies in the nascent oil sector. It also demonstrates the challenges of conducting operations in an area governed by a supranational authority.

⁶ See Appendix II for a list of awardees in blocks so far auctioned in the JDZ.

⁷ Shortly after the announcement of the winning bids, São Tomé and Príncipe's National Petroleum Council (headed by the president) issued a communiqué that recognized some deficiencies in the awarding process but indicated it would move forward because the national interests were not harmed. Subsequent inquiries by the Petroleum Affairs Commission, the National Assembly and the Attorney General concluded that the procedures used to select the oil companies had been seriously flawed, failed to meet minimum acceptable standards, and led to financial losses for São Tomé and Príncipe. Recommendations include a JDA restructuring of procedures for future bidding rounds to conform them to best international practices and a re-examination of ERHC's preferential rights in oil exploration in São Tomé and Príncipe.

Figure 2. Joint Development Zone (JDZ)



Source: National Petroleum Agency of São Tomé and Príncipe.

V. FISCAL RULES FOR OIL-PRODUCING COUNTRIES

An abundance of oil resources is a serious challenge for macroeconomic policies. On the one hand, large tax receipts from oil may allow oil-producing countries to significantly augment government spending to address poverty and improve basic public services in education, health, and infrastructure development. On the other hand, macroeconomic management in these countries is difficult because oil resources are exhaustible, which raises intergenerational considerations and exposes the need for balance between government consumption and saving for the long run. Policymakers must find the right mix of consumption today and tomorrow, as well as prioritizing poverty-alleviating spending programs. The uncertainty of estimates of oil receipts, stemming both from volatile international prices and imprecise assessment of reserves, further complicates the design of fiscal policy rules to govern the use of oil receipts.

Discussions on fiscal rules for oil-rich countries gravitate heavily to these considerations and the trade-offs they entail, particularly gauged against the need to ensure fiscal sustainability.⁸ The objective of fiscal rules is to guide fiscal policy, usually through constraints on policy design. The effectiveness of policy implementation can then be measured against indicators of fiscal performance. Usually, though in some cases not specifically, the goal of such rules is to guarantee fiscal sustainability. In the case of oil-rich countries, recent literature shows, monitoring the non-oil balance is a good benchmark for evaluating the fiscal stance. In designing fiscal rules, countries must also think about absorptive capacity constraints—at the technical, institutional and infrastructure levels—and the need to ensure an effective tracking system to minimize wasteful public spending. Ultimately, however, the decision on which fiscal rule to adopt is to some degree country-specific (depending on, e.g., size of the non-oil economy relative to oil resources, stage of development of the country, stage of oil production) There is no single optimal rule for this—or for guaranteeing fiscal sustainability.

Oil-producing countries have adopted a variety of fiscal rules over the years. One, the extreme “balanced budget rule,”⁹ implies spending all annual oil receipts while keeping the government’s overall financial position in balance. Although, as properly defined,¹⁰ this fiscal policy would be sustainable, it would privilege current over future generations in terms of their share of consumption of oil wealth. The rule would also subject government spending to “boom-bust” cycles depending on what was happening in international oil markets.¹¹ At the other extreme is the “bird-in-hand” policy, in which only the interest income accruing from accumulated oil revenues is spent consistently over time. While this policy mostly avoids the boom-bust spending cycle of the balanced budget rule, and is obviously fiscally sustainable, it may create social tensions because it public spending would be low while oil revenues are being accumulated during the period of oil exploitation. Also,

⁸ For example, see Kopits and Symansky (1998), Engle and Valdes (2000), Davis, Ossowski, and Fedelino (2003), and Katz and others (2004).

⁹ In the literature, this rule has also been referred to as “going on a binge” and “hand to mouth.”

¹⁰ In general, a sufficient condition for ensuring fiscal sustainability is that fiscal rules target a non-oil fiscal deficit that at most equals the financing provided by oil resources. Nevertheless, rules that frontload the use of oil proceeds, even when abiding by this principle, could arguably risk putting the country on a fiscal path that is not sustainable, since substantial fiscal adjustments are needed when oil receipts start dwindling as the resources are depleted. Often, these adjustments are hard to implement.

¹¹ A softer version of this policy would be to target a balanced budget over a longer period, perhaps three to five years, using a projection of oil prices and revenues. From an intertemporal perspective, however, it would still be biased toward current generations.

there could be a high opportunity cost in terms of foregone social and infrastructure spending in the early years at the expense of future spending.

Between these two extremes are several other fiscal rules,¹² among them constant expenditure rules, rules that target a price of oil and save any revenues generated by prices above that threshold, and rules that save a fixed percentage of oil revenues. The oil windfall not spent in these cases can be allocated to savings or stabilization funds, or both, to smooth out fluctuations in annual government spending. Some of these rules, however, do not guarantee fiscal sustainability or optimal intergenerational consumption of oil wealth.

A useful theoretical framework, with desirable intergenerational considerations, is the permanent income hypothesis (PIH) formulated by Friedman (1957).¹³ According to the PIH, both individuals and benevolent governments should be considered forward-looking, trying to smooth consumption over time in line with permanent income. Where there is zero population and productivity growth, the PIH implies constant government consumption out of oil over time that is equal to the annuity present value of expected oil wealth.¹⁴ By definition expenditures out of oil proceeds would be stable, thus avoiding boom-bust cycles.¹⁵ The added predictability this rule offers should in principle help policymakers avoid bottlenecks in absorptive capacity.

Formally, using the PIH sustainable government consumption of oil wealth (GC) at any point in time $t+1$ would be determined as follows:

$$GC_{t+1} = GC = r \times \left[F_t + \sum_{i=0}^I \frac{T_{t+1+i}}{(1+r)^i} \right] \quad (1)$$

where F_t is the value of the accumulated revenue in the oil fund at the end of the previous year, in constant prices; T_i is the oil revenue the government expects (net of production costs) in period i , in constant prices; r is the expected average real rate of return on oil wealth; and I is the number of years until oil production ends.

¹² See, for example, Wakeman-Linn and others (2004).

¹³ The PIH solves the problem of optimal consumption determined by maximization of a social welfare function in the presence of uncertainty.

¹⁴ If population growth is different from zero, the optimal consumption path would imply the use of a per capita PIH rule.

¹⁵ If key variables in the calculation of the annuity present value of expected oil wealth, such as the price of oil and the expected average real rate of return on oil wealth, are calibrated to reflect long-term values (including expectations for the future), the rule would have a built-in stabilization mechanism to smooth out short-term volatility.

The PIH can also be calculated per capita. Using this modification, policymakers target constant per capita government consumption of oil wealth over time. The modified rule would be determined as follows:

$$GC_{t+1} = (r - n) \times \left[F_t + \sum_{i=0}^l \frac{T_{t+1+i}}{(1+r)^i} \right] \quad (2)$$

where GC_{t+1} is government consumption in period $t+1$, n is the annual rate of population growth, and the other variables are as defined for equation 1.

Other variations of the PIH have also been considered.¹⁶ Often constant government consumption of oil wealth is targeted with reference to non-oil GDP. This, however, can only be done by mature producers or those where oil production is already declining, because the expected rate of return on existing oil savings plus the present value of expected future oil revenues would have to exceed the rate of growth of non-oil GDP. The contrary would imply that the annuity return on oil wealth would not keep pace with the growth of non-oil GDP.

Some have criticized the use of the PIH in managing oil wealth, especially by developing countries.¹⁷ When the initial capital of the economy, both physical and human, is low, the productivity gains of government social and capital spending of oil revenues could exceed the financial returns from oil savings. This can happen where there are production externalities from government spending, particularly from the impact of public investment on productivity and the incentives it generates for private capital accumulation. Under these circumstances, it could be advisable to frontload the use of oil resources. Future generations, though enjoying fewer oil resources for their own consumption, would benefit from the buildup of capital in the form of better public services, improved living conditions (health and basic education), and enhanced human capital. Absorptive capacity constraints are often used as an empirical counterargument to the excessive frontloading of spending, which may result in inefficient and wasteful spending.

To shed some light on this debate, there needs to be further research into measurement of the social rate of return of public investment. Recent cross-country studies¹⁸ point to a positive

¹⁶ For example, the optimal consumption path can be modified by introducing adjustment costs, such as habit formation, which in turn would introduce inertia into the convergence to the sustainable consumption level. For example, see Leigh and Olters (2006).

¹⁷ For example, see Takizawa and others (2004).

¹⁸ Calderon and others (2004), using panel data for over 100 countries for 1960-2000, show that GDP growth is positively affected by the stock of infrastructure assets and that income inequality declines with infrastructure quantity and quality. It therefore concludes that building infrastructure can be a highly effective way to combat poverty.

impact of a higher stock and quality of infrastructure on development indicators. While these initial results support the argument that favors a more frontloaded approach to the use of oil resources, especially by developing countries, there remains a question of how to map this general conclusion into an operational rule about how much a country should spend of its oil wealth, and how, at any given point.¹⁹ Here more analysis is needed.

VI. APPLICATION OF PIH TO SÃO TOMÉ AND PRÍNCIPE: PRELIMINARY PROJECTIONS

São Tomé and Príncipe’s Oil Revenue Management Law (ORML) of December 2004 applies the PIH framework to the country’s Permanent Oil Fund for Future Generations. São Tomé and Príncipe became the first country in Africa to apply such a rule, demonstrating its concern for efficient use of oil resources and for intergenerational equity.²⁰

The PIH framework in São Tomé and Príncipe has a number of features that reflect policymakers’ concerns about the intertemporal use of the country’s oil wealth. Formally, the calculation of government consumption—the annual funding amount—is determined each year as follows:

$$GC_{t+1} = r \times \left[F_t + \sum_{i=0}^l \frac{T_{t+1+i}}{(1+d)^i} \right] \quad (3)$$

where d is the discount rate and the other variables are as defined for equation 1.

- a. Equation (3) applies the PIH in constant-dollar terms. A per capita rule was rejected because the São Tomé and Príncipe authorities decided it would unduly backload needed spending on health, education, and infrastructure, which, in their view, would have a very high rate of return for the São Tomé and Príncipe economy. The authorities also decided that (i) a per capita PIH

¹⁹ Perhaps a way out could be the adoption of a fiscal rule with an “escape clause” under which additional projects that fulfill certain measurable criteria for a high social rate of return, with transparent rules and proper oversight, could be implemented as long as they do not compromise fiscal sustainability. The fiscal rule would be modified to accommodate these projects.

²⁰ Even among developing countries, São Tomé and Príncipe was the first country to approve this type of rule. Though the Democratic Republic of Timor-Leste approved a similar rule recently, there the parliament can deviate from the spending amount set the PIH indicates (see Kim (2005)).

rule²¹ would yield a level of government spending that could be lower than what would be consistent with current donor support to the country; and (ii) the annual funding amount could possibly be very low if real rates of return were low and there was a marginal hike in the rate of population growth.

- b. The discount rate (d) and the long-run real rate of return (r) differ from each other.²² The ORML caps the long-run rate of return at 5 percent for setting the annual funding amount and states that the discount rate cannot be set below 7 percent. This feature was introduced into the Sãotomean formulation out of prudence, to acknowledge the uncertainties of future oil production. The discrepancy between r and d results in an initially low but gradually increasing annual funding amount as the Permanent Oil Fund is built up.²³
- c. All variables used in calculating oil wealth and the annual funding amount are defined to reflect expected long-term values (real rate of return and expected price of oil) and prevent manipulation. Only blocks under production or commercial development can be incorporated into the calculation of the annual funding amount. This guarantees not only transparency in calculating oil wealth and the annual funding amount but also yields a rule robust to short-term volatility of the underlying variables involved in their calculation.

The remainder of this section presents some preliminary calculations of the country's oil wealth and sustainable government consumption under the PIH. These calculations, which are based on seismic surveys for the Joint Development Zone (JDZ), use information on the size of commercial energy reserves and production profiles in adjacent deep-water oil fields in the Gulf of Guinea as benchmarks for scaling purposes in the baseline scenario (Table 1). The country's oil wealth and the path of sustainable annual government consumption out of oil proceeds have been computed using the PSA template developed by the World Bank's expert group on oil. The baseline model's parameters were calibrated to match the sample

²¹ See Section VIII for figures depicting the dynamics of the PIH per capita rule.

²² This is not uncommon: the discount rate is often set up to include country or industry specific risk, or both.

²³ Though measured against industry standards, this may be a reasonable floor for the discount rate, a higher rate might be recommended on grounds of valuation practices in the oil industry (see Johnson-Callari and Berkelaar, 2005). In practice, however, using a higher discount rate on the annual funding amount and the steady-state value of the Permanent Fund would have a relatively small effect.

PSA posted in the JDA's official website, which reportedly forms the basis for negotiations with prospective oil operators in the Joint Development Zone (JDZ).²⁴

Table 1. Sample of Deep-Water Discoveries in Gulf of Guinea

Field Name	Discovery Date	Production Start Date	Water Depth (mts.)	Recoverable Reserves ¹ (million barrels)
Bonga SW	2001	2007	1245	600
Bosi	1996	2006	1424	683
Nnwa-Doro	1999	2005	1283	500
Akpo	2000	2006	1366	1000
Agbami-Ekoli	1998	2006	1435	1000
Bonga	1996	2004	1125	735
Erha	1999	2005	1191	1000
Zafiro Complex	1995	1996	850	1200

Sources: Johnston (2003), <http://www.nigeriasaotomejda.com> (2006).

¹ At time of discovery.

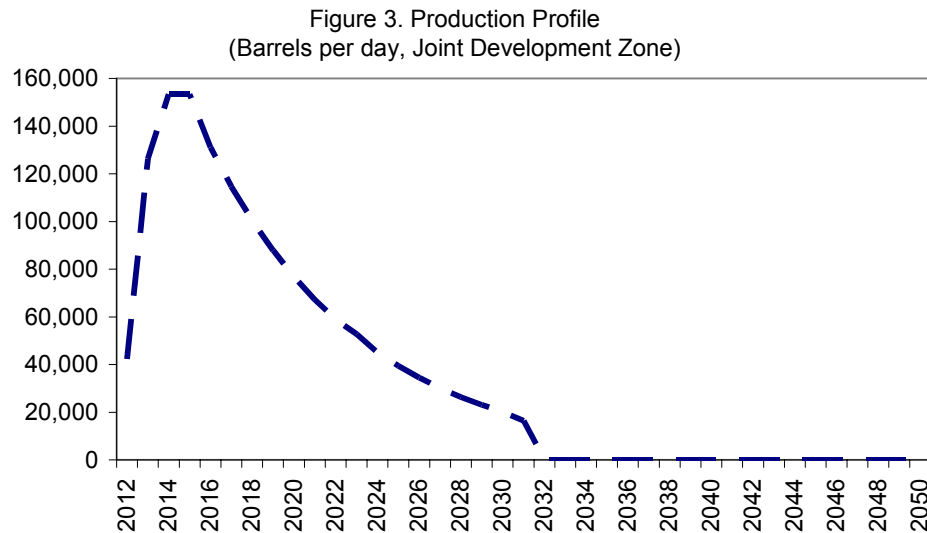
Recent exploration drilling in the Obo-1 well in JDZ Block 1, conducted by Chevron Texaco (the block operator), encountered indications of hydrocarbons in multiple reservoirs. The reservoir rocks and liquid samples collected will now need to be evaluated and interpreted within the information on the conditions of the surrounding area to determine the next step of the appraisal process. At this stage, however, is premature to determine whether or not the findings in Obo-1 constitute a commercial discovery. Estimates on oil reserves, annual oil production, and export receipts discussed here should therefore be considered speculative.

Taking this into consideration, the assumptions for the baseline estimates of the impact of prospective oil wealth for São Tomé and Príncipe are rather conservative. Indeed, the baseline assumes the discovery of only one commercially exploitable block in the JDZ that would have 500 million equivalent barrels of oil in reserves, equal to production of 70,000 barrels per day for twenty years, of which 28,000 barrels/day would be the Sãotomean share. This level of daily production is roughly that of an average-sized block in the Gulf of Guinea. It is assumed that oil production in the JDZ will begin in 2012.²⁵ The production profile is consistent with that of deep-sea wells: peaking at approximately 150,000 barrels per day in the third year of production and thereafter gradually declining

²⁴ For detailed information on the characteristics of the PSA modeled under the baseline scenario, see Appendix I.

²⁵ Should the discovery be large, production could begin as early as 2010, the operator of Block 1 recently suggested.

until depletion after twenty years (Figure 3). The oil price is assumed to be US\$30 per barrel, in constant 2006 U.S. dollars. The baseline discount rate was set at 7 percent and the long-run real rate of return at 3 percent.

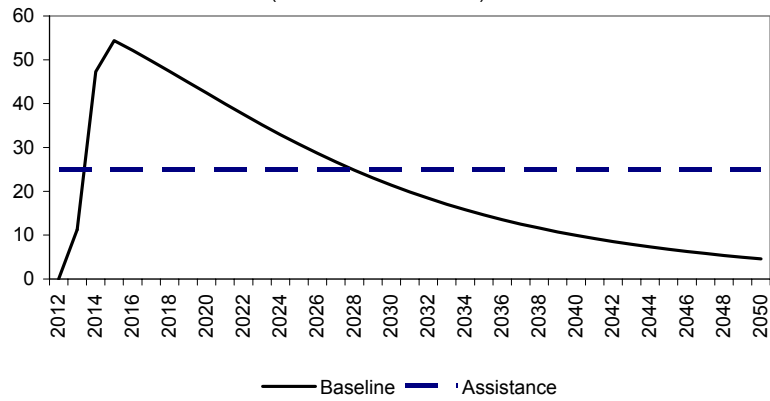


Source: Fund staff estimates.

In the baseline scenario, oil wealth accruing to São Tomé and Príncipe would be significant, with annual funding into the budget exceeding, for more than a decade, the levels of historic donor assistance (Figure 4), and converging to US\$91.9 million²⁶ (Figure 5), equivalent to 130 percent of projected 2006 GDP. By 2032 the Permanent Fund for Future Generations would stabilize at slightly above US\$3 billion (Figure 6), or 43 times 2006 GDP. As a ratio to projected GDP, the annual funding amount would peak at over 50 percent in 2015–16 (Table 2). Compared to current levels of donor support, the annual funding would be substantially higher for almost two decades and should in principle substitute for any decline in foreign aid once oil production takes off.

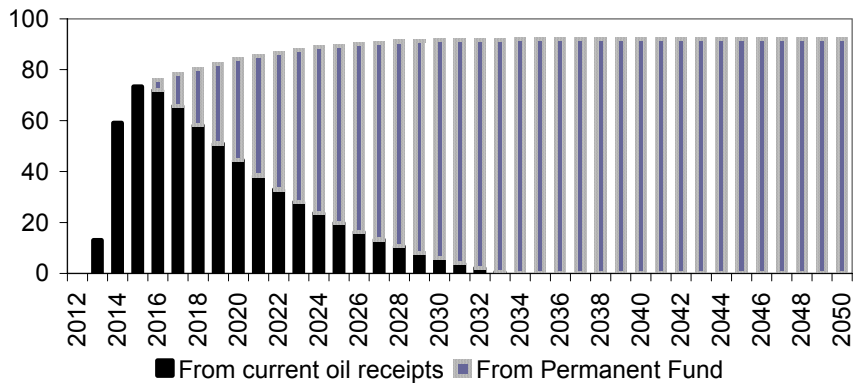
²⁶ In the remainder of the document, all references to dollar amounts are in constant 2006 U.S. dollars, assuming international inflation at 2.5 percent annually.

Figure 4. Annual Funding Versus Historical Net Donor Assistance
(Percent of non-oil GDP)



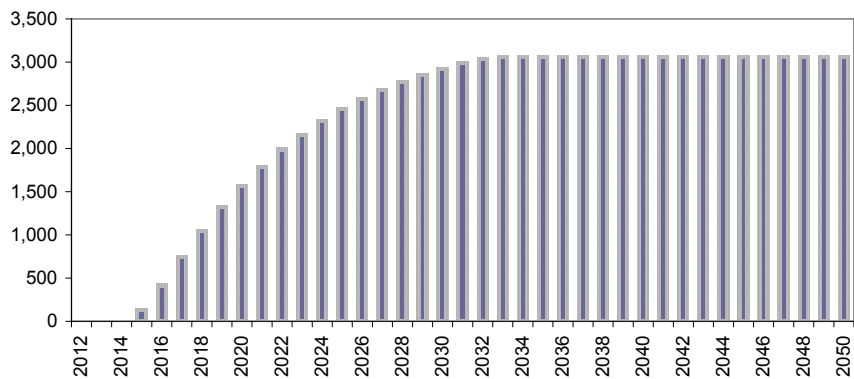
Source: Fund staff estimates.

Figure 5. Sources of Annual Funding for the Budget, 2012–50
(Millions of 2006 U.S. dollars)



Source: Fund staff estimates.

Figure 6. Buildup of Permanent Fund for Future Generations, 2012–50
(Millions of 2006 U.S. dollars)



Source: Fund staff estimates.

Table 2. São Tomé and Príncipe: Oil Flows Under Baseline Scenario ^{1, 2, 3}
(In millions of 2006 U.S. dollars)

	Oil Receipts	Annual Funding for Public Budget			Percent of non-oil GDP ⁶	Permanent Fund	
		Total	From annual production ⁴	From Permanent Fund ⁵		Balance	Percent of non-oil GDP ⁶
2012	25.9	0.0	0.0	0.0	0.0	0.0	0.0
2013	90.7	13.0	13.0	0.0	11.3	0.0	0.0
2014	306.6	59.0	59.0	0.0	47.3	0.0	0.0
2015	396.1	73.3	73.3	0.0	54.4	128.2	95.1
2016	364.6	75.9	72.0	3.8	52.1	414.6	284.7
2017	333.6	78.2	65.8	12.4	49.8	739.9	470.5
2018	300.5	80.4	58.2	22.2	47.3	1,042.0	613.5
2019	268.1	82.3	51.1	31.3	44.9	1,318.2	718.7
2020	237.6	84.0	44.5	39.5	42.4	1,567.3	791.2
2021	209.3	85.5	38.5	47.0	40.0	1,790.0	836.6
2022	183.5	86.7	33.0	53.7	37.5	1,987.7	860.2
2023	164.8	87.8	28.2	59.6	35.2	2,162.5	866.5
2024	140.1	88.7	23.8	64.9	32.9	2,318.5	860.3
2025	122.1	89.5	19.9	69.6	30.7	2,456.1	843.8
2026	106.2	90.1	16.4	73.7	28.7	2,575.2	819.2
2027	92.1	90.6	13.4	77.3	26.7	2,679.8	789.3
2028	79.8	91.0	10.6	80.4	24.8	2,771.6	755.9
2029	69.1	91.3	8.2	83.1	23.1	2,852.3	720.3
2030	59.6	91.6	6.0	85.6	21.4	2,923.2	683.5
2031	47.0	91.7	4.0	87.7	19.9	2,985.6	646.4
2032	0.0	91.8	2.3	89.6	18.4	3,038.5	609.1
2033	0.0	91.9	0.7	91.2	17.1	3,062.7	568.5
2034	0.0	91.9	0.0	91.9	15.8	3,063.2	526.5
2035	0.0	91.9	0.0	91.9	14.6	3,063.2	487.5
2036	0.0	91.9	0.0	91.9	13.5	3,063.2	451.3
2037	0.0	91.9	0.0	91.9	12.5	3,063.2	417.9
2038	0.0	91.9	0.0	91.9	11.6	3,063.2	387.0
2039	0.0	91.9	0.0	91.9	10.7	3,063.2	358.3
2040	0.0	91.9	0.0	91.9	10.0	3,063.2	331.8
2041	0.0	91.9	0.0	91.9	9.2	3,063.2	307.2
2042	0.0	91.9	0.0	91.9	8.5	3,063.2	284.4
2043	0.0	91.9	0.0	91.9	7.9	3,063.2	263.4
2044	0.0	91.9	0.0	91.9	7.3	3,063.2	243.8
2045	0.0	91.9	0.0	91.9	6.8	3,063.2	225.8
2046	0.0	91.9	0.0	91.9	6.3	3,063.2	209.1
2047	0.0	91.9	0.0	91.9	5.8	3,063.2	193.6
2048	0.0	91.9	0.0	91.9	5.4	3,063.2	179.2
2049	0.0	91.9	0.0	91.9	5.0	3,063.2	166.0
2050	0.0	91.9	0.0	91.9	4.6	3,063.2	153.7

Source: Fund staff estimates.

¹ Unless otherwise indicated, amounts expressed in millions of 2006 U.S. dollars assuming 2.5 percent annual foreign inflation.

² Assumes exploitable oil reserves of 500 million barrels in the JDZ, 40 percent being São Tomé and Príncipe's share.

³ Present value of flows calculated using 7% discount rate.

⁴ Includes interest accrued at the Unrestricted Portion of the National Oil Account pending the annual drawing or transfer to Permanent Fund.

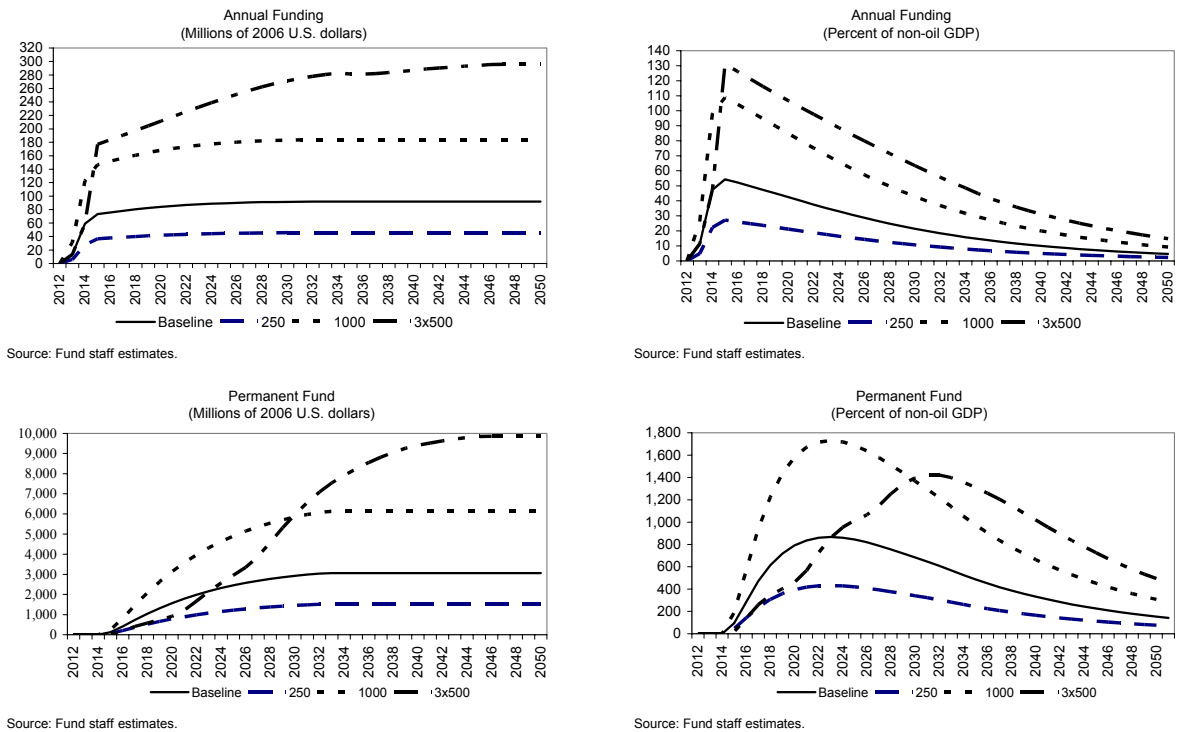
⁵ Assumes real return of 3% on Permanent Fund.

⁶ Assumes non-oil GDP growth rate of 6.25% on average for 2006-10 and 8% thereafter.

VII. SENSITIVITY ANALYSIS²⁷

The scale of oil wealth could vary significantly depending on the number, size, and quality of commercial oil discoveries. The baseline scenario assumes that only one medium-sized block in the JDZ is found to be commercially exploitable, and that São Tomé and Príncipe’s share of daily production would average 28,000 barrels/day. If oil reserves were twice as high as assumed (i.e., if there were one billion barrels), annual transfers into the budget would be US\$183.9 million and the Permanent Fund for Future Generations would converge to a steady state of roughly US\$6.1 billion. Both annual funding and the Permanent Fund would keep increasing as new reserves are discovered—which could eventually raise questions about the country’s absorptive capacity (Figure 7).²⁸

Figure 7. Sensitivity to Alternative Levels of Commercial Reserves in JDZ
(Millions of barrels)

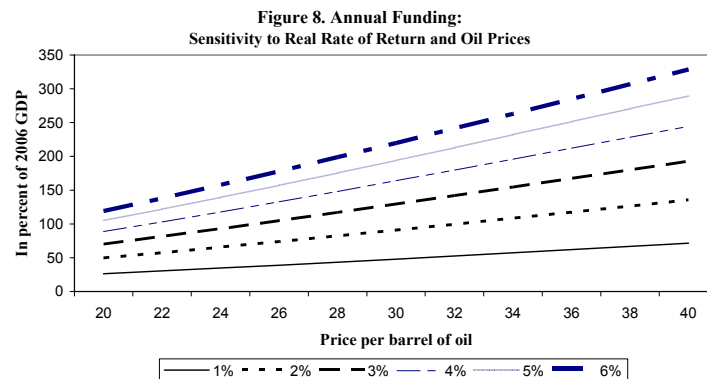


²⁷ See Table 3, at the end of this section, for a summary of results.

²⁸ If this were the case, the country could possibly switch to a per capita PIH rule at that point. See the next section for a simulation using the per capita PIH rule.

The annual funding amount and the steady-state level of the Permanent Oil Fund are very sensitive to changes in oil prices. Since oil prices are highly volatile,²⁹ the sensibility analysis covers a wide range of prices, but there is now a consensus that at least some of the significant oil price increases in the past two years have structural causes. Most forecasts predict oil prices to stay at or above US\$40 a barrel in real terms in the long run.³⁰ An increase in oil prices to US\$40 per barrel from the baseline assumption of US\$30 per barrel would imply a significant increase in annual funding (from US\$91.9 million to US\$137.0 million) and in the Permanent Fund (from US\$3.0 billion to US\$4.5 billion). The point elasticity of changes in the annual funding amount to changes in oil prices, evaluated at the baseline, is estimated at 1.49.

Changes in the real rate of return on oil wealth have important effects on annual funding (Figure 8). These amounts are very sensitive to changes in the real rate of return, since by definition (see equation 3, above) they are equal to the real rate of return multiplied by the present value of oil wealth. The point elasticity of changes in the annual funding amount to changes in oil prices, evaluated at the baseline, is estimated to be 0.74. For example, an increase in the baseline long-run rate of return to 4 percent would increase annual funding from US\$91.9 million to roughly US\$115 million in perpetuity.



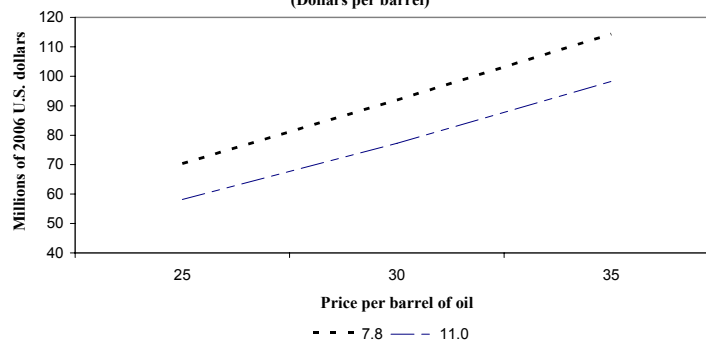
Source: Fund staff estimates.

²⁹ Numerous studies have characterized the path of oil prices as a random walk process, implying that the best predictor of tomorrow's price is today's price, subject to wide margins of error. See, e.g., Engel and Valdes (2000).

³⁰ The latest WEO projection for oil prices for 2008–11 is an average of US\$60.25. Even assuming a gradual nominal reduction of prices in dollars in the years following and a correction for the quality of Sãotomean oil, that projection would imply a higher-price scenario than US\$40 (2006 prices growing at 2.5 percent annually). Under WEO assumptions, the country's revenue windfall from oil would thus be substantially larger.

Changes in production costs alter the calculation of annual budget funding and the buildup of the Permanent Fund for Future Generations. A change in investment or operating costs would change the government take from oil taxes (levied on profits at a negotiated rate with oil operators) and oil profit (Figure 9).³¹ In the latter case, cost increases reduce the base and rate (the “R-factor”) used to assess the government’s return: The base would decline as profits net of taxes shrink with cost increases. Also, the R-factor, as defined in the JDZ Model PSA, declines as contractors’ accumulated costs increase (see Annex I). We calculate that an increase in total production costs per barrel from US\$7.8 (assumed in the baseline and considered average for deep-water wells) to US\$11.0 would reduce annual funding to US\$77.2 million and the steady state of the Permanent Fund for Future Generations to US\$2.6 billion. In the baseline, the elasticity of annual budget funding to changes in total production costs, assessed at -0.41 , is less than a third of that assessed for changes in oil prices. Also, it appears that oil production costs are less volatile, and therefore more predictable, than prices. Sensitivity analysis for changes in other variables, such as the oil tax rate, is presented in Table 3.

Figure 9. Annual Funding:
Sensitivity to Operating Costs
(Dollars per barrel)



Source: Fund staff estimates.

³¹ A third source of government revenue is the royalty, which in the case of the JDZ Model PSA is levied on gross revenue. With this mechanism, which is not standard in all PSAs, the government ensures itself a minimum take, even if production costs balloon.

**Table 3. Sensitivity Analysis at a Glance:
Baseline Versus Alternative Scenarios¹
(In millions of 2006 U.S. dollars)**

	Annual Funding	Permanent Fund Steady-State Level
Oil prices (per barrel)		
US\$20	49.9	1,663.7
US\$30 (Baseline)	91.9	3,063.2
US\$40	137.0	4,566.4
Real rate of return (r)		
1%	34.1	3,406.9
3% (Baseline)	91.9	3,063.2
5%	137.7	2,754.7
Discount rate (d)		
3%	89.2	2,974.5
5% (Baseline)	91.9	3,063.2
12%	94.4	3,147.2
Production costs		
US\$7.8 (Baseline)	91.9	3,063.2
US\$11	77.2	2,574.9
Tax oil		
40%	88.0	2,933.0
50% (Baseline)	91.9	3,063.2
60%	96.6	3,219.1
Oil reserves in JDZ (million barrels)		
250	45.8	1,527.9
500 (Baseline)	91.9	3,063.2
1000	183.9	6,129.8
1500	276.0	9,198.4
3x500 ²	295.8	9,860.3
Per capita rule ³	Increasing	Increasing

Source: Fund staff estimates.

¹ Baseline assumes: Oil price US\$30, r=3%, d=7%, production costs=US\$ 7.8 p/b, tax oil=50%, oil reserves=500 million barrels.

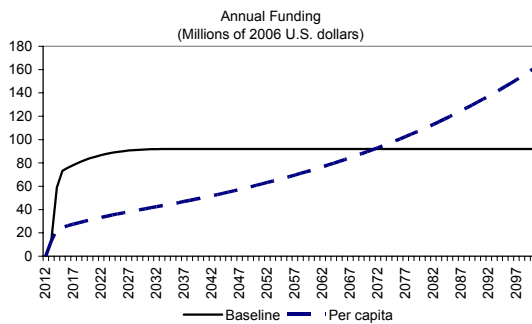
² Assumes three blocks with 500 million barrels of oil each, going into production at six-year intervals.

³ See Section VIII for figures showing the path of annual funding and the Permanent Fund under this rule.

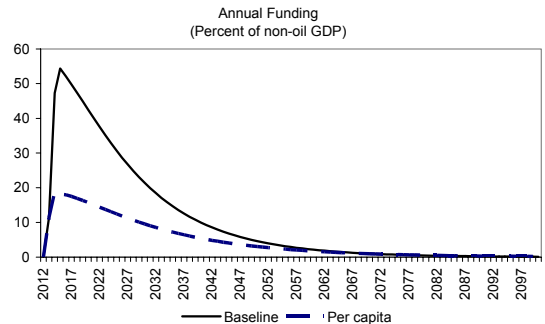
VIII. SIMULATING PER CAPITA PIH FOR SÃO TOMÉ AND PRÍNCIPE

The per capita PIH rule would imply that consumption of oil resources is back loaded compared to the adopted rule (Figure 10). Nevertheless, depending on the ultimate magnitude of the country’s oil wealth, absorptive capacity constraints might prevent the full and efficient use of annual funding amount predicted under the current rule. In that case, among the options available to the policymakers, one that would merit consideration is to modify the PIH to a per capita rule. Using the modified rule, both annual funding and the Permanent Fund would increase over time at the population growth rate to allow for convergence to a steady state on per capita terms. The annual funding amount predicted by the per capita rule would surpass annual funding in the baseline scenario as late as 2070; it would also imply significantly lower annual funding during the transition, especially in the early decades.

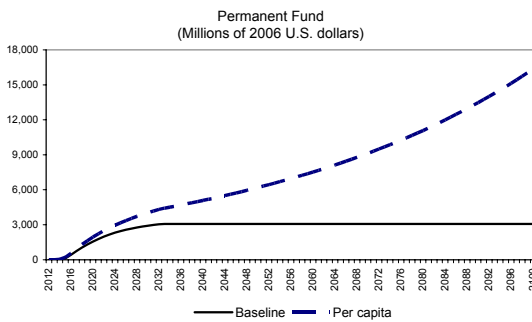
Figure 10. Baseline Versus Per Capita Rule



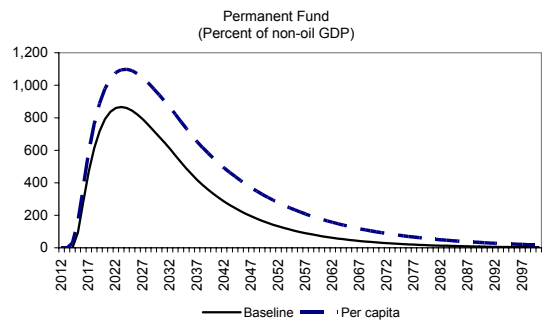
Source: Fund staff estimates.



Source: Fund staff estimates.

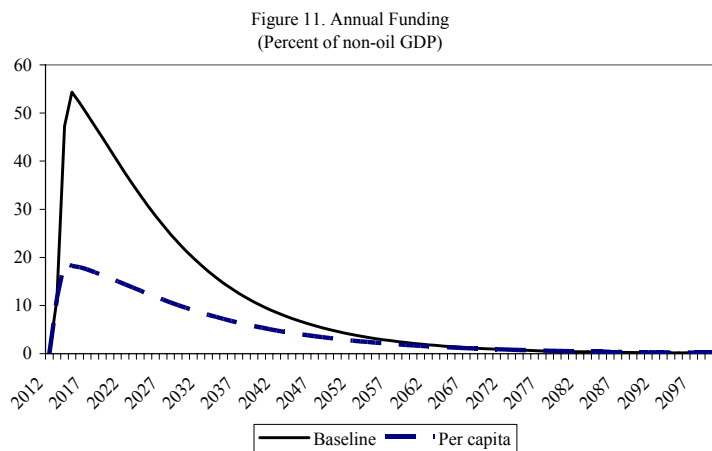


Source: Fund staff estimates.



Source: Fund staff estimates.

Nevertheless, were reserves in Block 1 significantly higher than assumed in the baseline, changing the rule would seem sensible (Figure 11).³² For example, annual funding as a share of non-oil GDP applying the per capita PIH to reserves of 1.5 billion barrels of oil would in the early years resemble the amount in the baseline (without per capita adjustment) but would allow for larger annual funding transfers afterwards. Given that São Tomé and Príncipe is likely to experience strong growth in non-oil GDP, both rules would predict decreasing annual oil revenues as a percentage of non-oil GDP, unless the return on the Permanent Fund exceeds the rate of growth of non-oil GDP, which is unlikely until production fades significantly.



Source: Fund staff estimates.

IX. CONCLUSIONS

São Tomé and Príncipe will likely soon join the small group of poor African nations that enjoys substantial oil wealth. Though this wealth will, if well managed, open an unparalleled opportunity to draw the country out of poverty, it also presents tremendous challenges for policymakers if they are to avoid the “curse” that has prevented most other resource-rich countries in Africa from improving living conditions for their populations.

São Tomé and Príncipe is a textbook example of the struggles that a small and poor country faces in attempting to exploit vast prospective oil wealth. But it is also an unusually positive one because of the efforts São Tomé and Príncipe is making to build a sound institutional framework; this should help to ensure that when such wealth materializes, the country will maximize the chances of managing it efficiently and transparently. São Tomé and Príncipe

³² Ultimately, however, any decision to modify the rule to allow for more savings than under the current PIH would be based to some degree on the situation at the time (see Section V).

has gone through a protracted process of shaping transparent rules to govern the relationship between oil companies and the government, trying to learn from past decisions what is likely to cause financial losses to the country. It is a clear example of best practices: policymakers, in consultation with international experts, have put in place a sound institutional framework before oil proceeds arrive. The Oil Revenue Management Law enacted in December 2004, is a solid basis for strong governance and accountability, though recent difficulties in the bidding processes related to the JDZ point to serious problems in implementing its transparency guidelines.

There are an array of potential fiscal rules that could be used to manage oil wealth responsibly. São Tomé and Príncipe is the first country in Africa to adopt a rule, based on Milton Friedman's permanent income hypothesis (PIH), that guarantees sustainable government consumption and gives pivotal consideration to intergenerational equity while giving the country a predictable stream of oil revenues to meet pressing development needs. Although the exact size of the country's oil wealth is still uncertain, the preliminary quantitative analysis presented here shows that, even using very conservative assumptions, it will be significant—enough to allow for stable financing of development needs, in perpetuity, from the returns of the Permanent Fund for Future Generations. It is a possibility that the country's oil wealth end up being so large relative to the size of the country, that absorptive capacity constraints could prevent full and efficient use of the annual funding dictated by the current PIH rule. If this were the case, the rule could, among other options, be modified to the more conservative per capita terms. In making such a choice, it will be necessary for policymakers in São Tomé and Príncipe to carefully weigh the returns on investment against further accumulation of financial resources, once better information on the potential oil wealth of the country is available.

Current challenges for São Tomé and Príncipe's policymakers are to remove administrative bottlenecks to improve regulatory and other institutions and maximize local content in the provision of services to the oil industry. It is imperative that full accountability and transparency characterize the development of the oil sector from its infant stages. This will require resolute political will and a process of building capacity and institutions so that regulatory and supervisory bodies are strong. It is also important to identify areas where local content may be high so as to maximize the multiplier effects of enclave offshore operations for the benefit of the country's population.

APPENDIXES

I. Model Production-Sharing Agreement in the Joint Development Zone
Table A1. Joint Development Zone
Model Production-Sharing Agreement

Bonuses	Signature	Bid \$30 million minimum
Rentals	\$200/km ² for oil prospecting license (OPL) \$500/km ² for oil mining license (OML) first 10 years \$200/km ² for OML after 10 years	
Royalty Rate	Production (P) in thousand barrels of oil per day (MBOPD)	
	<u>MBOPD</u>	<u>Royalty</u>
	0 - 20	0%
	20 - 70	5% {1-[(70-P)/(70-20)]}
	> 70	5%
Cost recovery limit	80% of production after royalty	
Taxation	50% tax oil levied on gross revenues net of royalties and production costs	
Investment allowance	50% of tangible capital costs	
Profit oil split	Contractor's Share	
	<u>R-Factor</u>	<u>Share</u>
	0 - 1.2	80%
	1.2 - 2.5	25%+ {[(2.5-R)/(2.5-1.2) x (80%-25%)]} 25%
	> 2.5	25%
	JDA's Share 1 – Contractor's share	
	R-Factor = Contractor-accumulated receipts/Contractor-accumulated costs	
Ringfencing	Yes	
Government participation	No provision for States to take up a working interest.	

Sources: Gomes (2003) and Johnston (2003)..

II. Licensing Rounds in the Joint Development Zone (JDZ)

Table A2. Standing Results from Bidding Rounds for Blocks 1-6 Within JDZ

Block/Company	Equity (%)	ERHC Rights (%)	Signature Bonus to JDA (US\$ million)	STP Share After ERHC Rights (US\$ million)
BLOCK 1 Chevron Texaco (operator). Exxon Mobil Dangote Energy/EER	51 40 9		US\$ 123.0	US\$ 49.2 (PSA signed, bonus paid).
BLOCK 2 Sinopec (operator)/ERHC/ADDAX Equator Exploration/ONGC Videsh A. & Hartman Foby Engineering Momo Oil & Gas (plus others).	65 15 10 5 5	30	US\$ 71.0	US\$ 7.1 (PSA signed).
BLOCK 3 Anadarko (operator). ERHC/ADDAX DNO / EER Equinox Ophir/Broadlink	51 25 10 10 4	20	US\$ 40.0	US\$ 8.0 (PSA signed).
BLOCK 4 ADDAX (operator)/ERHC Conoil Hercules Godsonic Oil and Gas OVERT	60 20 10 5 5	25	US\$ 90.0	US\$ 13.5 (PSA signed).
BLOCK 5 ICC/OEOC Consortium To be decided 1/ Sahara	75 15 10	15	US\$ 37.0	US\$ 14.8
BLOCK 6 Filtim-Huzod Oil & Gas To be decided ¹	85 15	15	US\$ 45.0	US\$ 11.3 (US\$ 18.0 if decision on ERHC upheld).

Source: National Petroleum Agency.

¹ JDA disqualified ERHC for not complying with JMC directives and timelines for negotiations; replacement or decision on re-bidding still not taken.

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