Managing Resource Revenues in Developing Economies

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Abstract

This paper addresses the efficient management of natural resource revenues in capital-scarce developing economies. We depart from usual prescriptions based on the permanent income hypothesis, since for capital-scarce countries it is preferable to invest domestically. Since revenue streams are highly volatile, governments should protect consumption from shocks by increasing it only cautiously. Volatility in domestic investment can to an extent be moderated by a buffer of international liquidity, but it is also important to structure investment processes to be able to cope efficiently with substantial fluctuations. To date, most of the resource-rich countries of Africa have not had investment rates commensurate with their rate of resource extraction.

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JEL codes: windfall revenue, permanent income, liquidity constraints, capital scarcity, buffer stocks, volatility, commodity prices

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1. Introduction

The revenues from exhaustible natural resources are distinctive in two key respects: since they are derived from depleting a finite stock of resources they are intrinsically temporary, and since commodity prices are highly volatile they are unreliable. It is generally recognized that unsustainable increases in consumption are undesirable: consumption habits may form and commitments may be made, so that declines in consumption are very costly. Both exhaustibility and volatility potentially give rise to unsustainable increases in consumption. This paper addresses the question of how best should the government of a resource-rich developing country avoid these costs while maximizing the increases in consumption which do not need to be reversed.

Depletion and irreversible increases in consumption

First, consider the issue of sustainability from the perspective of depletion. Since the revenues from exhaustible resources are transient, for an increase in consumption to be sustainable at least some of the revenue must be used for asset acquisition. Potentially, there are two key issues raised by an asset strategy: 'how much of the revenue should be used for asset acquisition?' and 'what assets should be acquired?'

To date, most policy attention has been focused on the former of these issues – how much to save? This may be because one simple answer can be derived very easily from elementary economic analysis based on the Permanent Income Hypothesis (PIH). This is the analytic foundation for the policy rule of Sovereign Wealth Funds (SWF). We will argue that this policy rule is seriously inappropriate for a developing country. Our key point is that the issue of how much to save cannot be addressed until the prior, and more important, issue of 'what assets should be acquired?' has been considered. Developing countries are capital scarce, so that assets should be accumulated by investment within the country rather than in foreign financial assets which will, on average, yield a lower return. In effect, the SWF needs to be built up within the country. The acquisition of high-yielding domestic assets instead of low-yielding global assets has two powerful implications.

One implication is that the high yield will in aggregate imply that resource-rich developing countries can expect rapid growth. As a consequence, the value to the society of consumption in the near-term is considerably higher than consumption in the distant future when the economy has become fully developed. It is therefore appropriate for a developing country to use its resource revenues to raise consumption *up towards* the level of the distant future, rather than to use them to raise *the level of* consumption in that distant future. This strategy contrasts with the PIH, which provides a solution for a society wishing permanently to raise its consumption and thereby placing relatively high weight on the interests of the

distant future. To achieve this objective, how much of the revenue should be used for asset acquisition? The path of consumption is determined both by direct government spending or transfers to consumers and by investment-driven growth of income, so optimal policy uses some resource revenues for early consumption and the remainder to raise the capital stock of the domestic economy. The analytical basis for this is outlined in Section 3, where we describe a theory of revenue management in a resource-rich but capital-scarce country. Consumption levels in the distant future are not augmented by income from a SWF but from having raised domestic investment, income and wages, and brought forward the growth path of the economy.

The other implication of using revenues for domestic asset accumulation is that the return on assets becomes dependent upon the domestic investment process. Although the economy is capital scarce, the investment process may not be able to deliver high returns. One issue is that beyond a point the sheer volume or rate of increase of investment may encounter both managerial and physical bottlenecks that depress marginal returns. To address this issue the economy needs a strategy for absorbing investment. The strategy has two elements: smoothing investment, and raising the overall average rate at which investment can be productive. We address these issues in Section 5.

Volatility and irreversible increases in consumption

Commodity prices are highly volatile and hence so are revenues. Potentially, this affects both consumption and investment.

One 'grand' strategy would be to build up a Sovereign Liquidity Fund (SLF) to smooth expenditures. A SLF would differ from a SWF in its intended purpose and hence have both a different scale and a different composition of assets which would need to be much shorter-term. Supposing that the government knew with certainty the Net Present Value (NPV) of the resource rents, it could choose the maximum path of expenditure on investment consistent with maintaining high returns, and from this compute the appropriate increase in consumption. In effect, that is the problem that we solve in Section 3. The function of a SLF would simply be to enable expenditure to stay on this path while actual revenues fluctuated around it. As we discuss, given the historical path of commodity prices, a SLF would have needed to be very large in order to achieve this smoothing function. There is too much uncertainty, both as to the future path of prices, and as to future resource discoveries, for this approach to be feasible: the NPV of resource rents is largely unknowable.

One policy designed to cope with this radical uncertainty in the NPV of revenues is the Bird-in-Hand Rule. This tries to address the unpredictability of revenues by proposing that all revenue should go into the SWF, so that consumption would only rise due to the rising interest earned as the fund accumulates. This variant of the PIH Rule has been advocated by

the IMF. We have already suggested that an international SWF is not appropriate for a capital-scarce country. Further, we argue that the rule is too conservative in that it precludes *any* near-term increases in consumption. However, given the costliness of reductions in consumption, any use of resource revenues for consumption needs to be complemented by a cushioning strategy. Potentially, this can come from one of three sources: offsetting changes in domestic investment; protection through a SLF; or insurance of revenue flows through the use of derivatives. We discuss these options in Section 4.

First, in the next section we briefly set out the historical record of the impact of resource revenues, focussing on their impact on saving and domestic investment.

2. The historical record

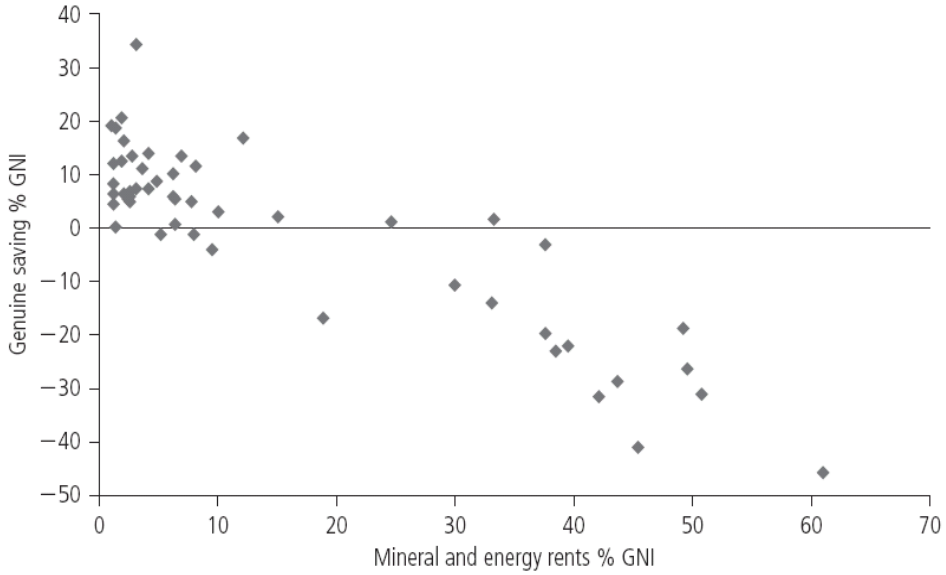
The historical record of managing resource revenues has been extensively researched and extensively reviewed (e.g., van der Ploeg, 2007), and the consensus is that while resource revenues have a positive effect on economic growth in countries with good governance, their effect in countries with poor governance has, on average, been negative. Cross-country evidence suggests that countries can escape the resource curse (Sachs and Warner, 2007) and turn the windfall revenue into a boon if they have good institutions (Mehlum, Moene and Torvik, 2006), are open to international trade (Arezki and van der Ploeg, 2008), or have well-developed financial systems (van der Ploeg and Poelhekke, 2008).[1] It is notoriously difficult to interpret the macroeconomic effects of commodity booms in cross-country studies, so it is useful to examine the dynamics more explicitly. Collier and Goderis (2007, 2008) use global data from 1960 onwards and find that, for the first few years following an increase in the price of commodity exports, non-resource output does indeed increase relative to what it would otherwise have been: people become more productive. However, within two decades the typical resource-extracting economy is producing less than it would have done in the absence of the boom. Simulating the current booms for the typical African commodity exporter, if global history repeats itself then after two decades output will be around 25 percent lower than it would have been without the booms. The key finding in both the cross-section and time-series empirical literature on commodity booms is thus that the resource curse is not cast in stone. Some societies have succeeded in harnessing commodity booms for sustained

[1] Democracy and resource rents also appear to interact badly (Collier and Hoeffler 2008). Democracies with no natural resource rents tend to grow more rapidly than autocracies, resource-rich democracies grow more slowly than autocracies. The degree of electoral competition determines the process by which a government acquires power, whereas the number of checks and balances determine the limits on how it can use power. Electoral competition damages the democratic process, whereas checks and balances are beneficial. The evidence suggests that resource rents gradually weaken checks and balances. The governance challenge for resource-rich Africa may thus be to strengthen checks and balances in the face of pressures to weaken them.

increases in production, while others have not, with the quality of governance playing an important role. Resource-exporting countries with good governance grow more rapidly in the long run as well as in the short run, Botswana being an African example. Unfortunately, during the period 1963-2003, the critical level of governance required to avoid the resource curse was above that prevalent in many other resource-rich African societies.

In this paper we focus on investment and savings. One strand of empirical work on savings has looked at 'genuine savings', taking into account the depletion of natural assets. The formal definition of 'genuine saving' is public and private saving at home and abroad, net of depreciation, *plus* current spending of education to capture changes in intangible human capital *minus* depletion of natural exhaustible and renewable resources *minus* damage of stock pollutants (CO_2 and particulate matter). The relationship between resource revenues and genuine saving shown in Figure 1 is at least superficially disturbing. Countries with a large percentage of mineral and energy rents of GNI typically have *heavily negative* genuine saving rates. A number of conceptual issues surround the use of this measure, including the fact that these different forms of investment might have different rates of return, so the composition as well as level of savings matter. If, for example, the domestic rate of return is double the world interest rate (at which, by the Hotelling (1931) rule, the rent on the resource is expected to increase), the depletion of $1m of natural assets would be fully offset by $0.5m of domestic investment. Despite the above qualification, the green accounting figures suggest that unless rates of return on domestic investment are very much higher than the world interest rate, investment in resource rich countries has been far too low.

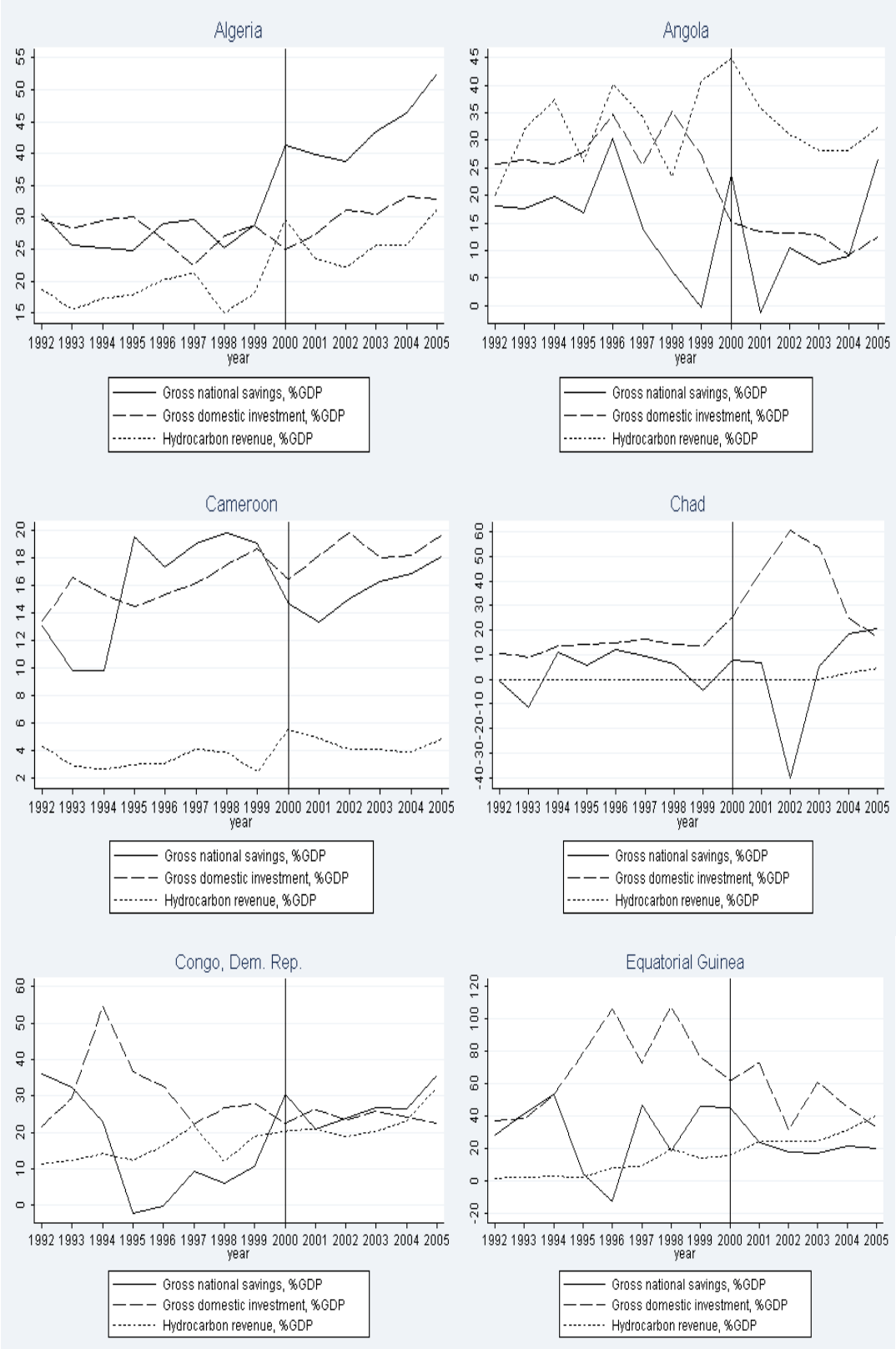
Figure 1: Genuine saving and exhaustible resource share

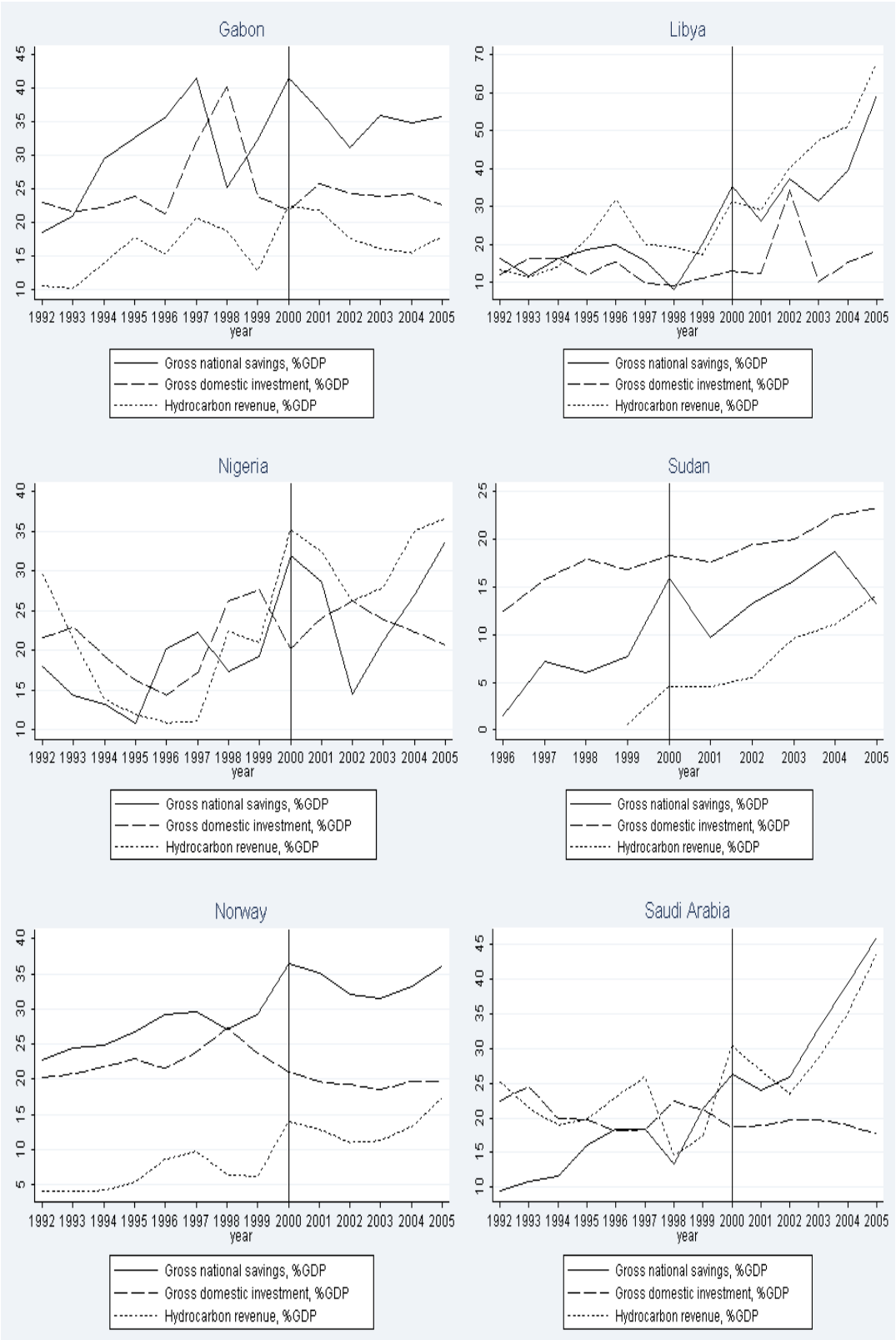


Source: World Bank (2006, Figure 3.4)

The actual paths of domestic investment and savings in selected oil rich countries are shown in Figure 2. The last two panels of this figure show Norway and Saudi Arabia where savings generally exceed and move in line with hydro-carbon revenues. Gross domestic investment appears unrelated to these revenues, indicating the acquisition of overseas assets. Other panels give African countries and indicate a similar pattern of co-movement of savings and hydro-carbon revenues for Algeria, Angola, Libya, Nigeria, and Sudan, at least since the late 1990s; for Angola, Libya and Nigeria the level of saving is however less than revenues. There is little evident relationship between resource revenue and domestic investment, this observation confirmed by simple statistical tests. In all these countries hydrocarbon revenues rose sharply. However, in none of them was there a substantial increase in the share of domestic investment. Only in Equatorial Guinea was domestic investment as a share of GDP at a level that might look appropriate when benchmarked against China. However, in this tiny economy investment is dominated by that of the oil companies building extractive capacity and so does not indicate a major push by the government to build capacity in other sectors.

Figure 2: Responses to hydrocarbon revenues in some sub-Saharan countries




Gabon
Libya
Nigeria
Sudan
Norway
Saudi Arabia
year
Gross national savings, %GDP
Gross domestic investment, %GDP
Hydrocarbon revenue, %GDP

3. Harnessing windfall revenue: the case of certainty

As discussed above, one fundamental difficulty of managing resource revenues is that they are radically uncertain. We address this in the next section. For the moment we abstract from uncertainty and assume that policy makers know the future flow of natural resource revenues. They nevertheless face a challenging set of decisions. How should the country plan the time path of spending and saving from the revenue flow, and what assets should be acquired for increases in consumption to be sustainable? Directing all of resource revenue to current consumption is both wasteful and inequitable, but so too is postponing the consumption benefits into the far distant future. The optimal inter-temporal profile of consumption depends on views about the value of consumption accruing at different times and to different generations, and about the rate of return that can be obtained by postponing consumption and investing in assets of different types. We explore the interaction between the consumption and investment sides of the equation.

3.1 Investment and Consumption in a Capital-Scarce, Resource-Rich Economy

On the consumption side, the social discount rate (*SDR*) measures the value of consumption one period in the future relative to consumption today, future consumption being discounted by factor $1/(1 + SDR)$. While future consumption is worth less than consumption today, this is offset by the fact that investment yields a positive return, and we denote by r^F and r^D the rate of return on foreign and domestic investments respectively. The choice of what to do with revenue today is informed by comparison of these rates, with efficiency requiring that it should be consumed today if *SDR* is greater than r^F and r^D, and otherwise invested in the highest return activity. The levels of consumption and investment undertaken will change these rates of return, so an efficient outcome will see them all equalised.

The classic utilitarian way to formulate a measure of aggregate social well-being through time is the present value of the utility of consumption, and this provides a basis for thinking about the *SDR*. According to this formulation the value of consumption at one date relative to another depends on two things, the rate of pure social time preference and the difference in per capita income (and hence the marginal utility of income) between dates. Many authors have argued that the rate of pure time preference (ρ) should be very low, since there is no ethical reason to attach less importance to future generations than the present.[2] While this suggests a low *SDR*, the second element captures the fact that we expect future

[2] According to this view, the only reason for it to be positive at all is the probability of human extinction and that future generations will not exist. These arguments have been re-evaluated in the context of climate change (Stern, 2006). An additional argument for using a low discount rate is that there is a probability that future generations may be much *poorer* than us (Weitzman, 2007).

generations to be richer than us. Equity then suggests that revenues should be used to increase consumption of the current, relatively poor, generation. This factors into the *SDR* by combining the expected rate of growth of consumption, $\dot{C}/C$, with society's attitude towards inequality as summarised by parameter σ (the elasticity of the marginal utility of consumption) which measures the value of marginal consumption to poor people relative to richer. Combining these terms, the social discount rate is $SDR = \rho + \dot{C}/\sigma C$. The parameter σ is often taken to be around unity (or perhaps somewhat less), so this social discount rate might range from around 10% in a fast growing economy to 2-3% in a mature or slow growing country.

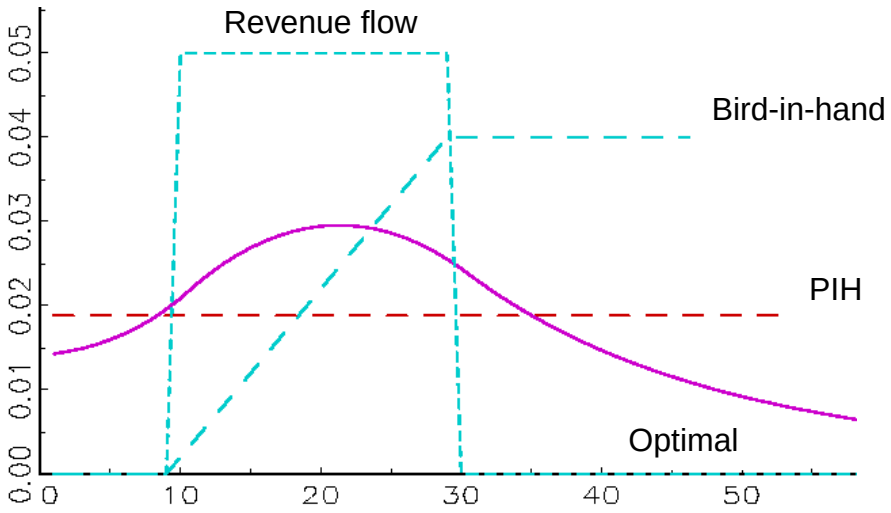
Turning to investment alternatives, the first distinction is between foreign and domestic investment. The rate of return on foreign investment, r^F, depends on whether a country is borrowing or lending on world markets. For a lending country – e.g., a country accumulating foreign exchange reserves or building up a sovereign wealth fund (SWF) – this rate can be regarded as exogenous to the country, the world interest rate, r^*. But for a country that has existing foreign debt and which is considering using resource revenue to pay down this debt the value of r^F may be higher, and increasing in the level of debt. Evidence on interest rate spreads (e.g., Akitoby and Stratmann, 2008) suggests that indebtedness raises the interest paid by countries, so the marginal value of paying down foreign debt may be large.

Most important, and most difficult to assess, is the return on domestic investment, r^D. Our starting point for thinking about this is that developing countries are capital scarce and likely to have a record of low saving and under-investment in both public and private assets. Lack of investment suggests that r^D should be high, but the argument is qualified by two points. One is that private returns may be reduced by lack of investment opportunity and lack of complementary public inputs. The other is that poor selection and implementation of investment projects might result in low returns; we return to this issue in section 5.1.

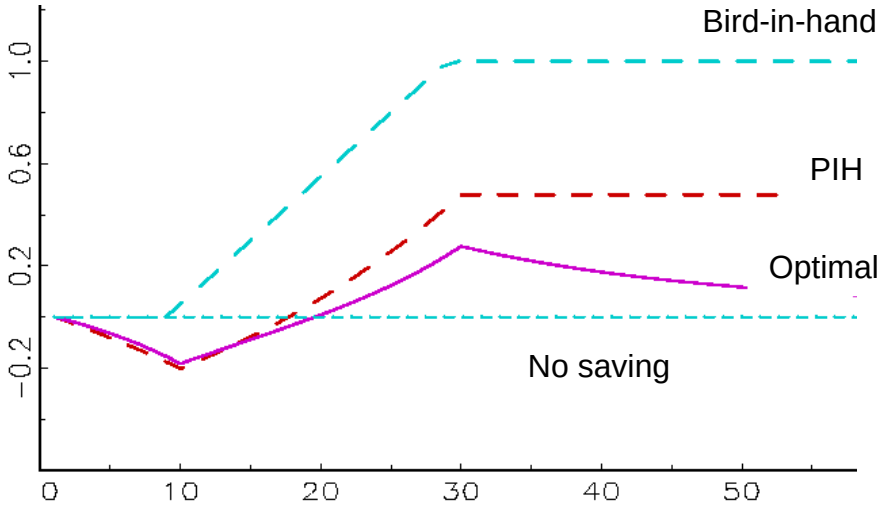
To study alternative paths of consumption and saving out of resource revenues, we structure discussion around the example illustrated in Figures 3(a) and 3(b), showing time profiles of incremental consumption and incremental national asset accumulation under different rules for consuming/saving a temporary anticipated windfall of revenue. For simplicity, the revenue flow is assumed to be a step function, as illustrated by the 'revenue-flow' line in Figure 3(a); we assume revenue flows for a 20 year period, anticipated to start in 10 years time and end in 30 years time. If society consumed the revenue as it came in – with no asset accumulation nor borrowing in advance of revenue flows – then the same curve would give the time profile of consumption. This would be a highly sub-optimal policy to follow, and we now discuss the alternative cases illustrated in the figures.

Figure 3: What to do with windfall revenue under alternative rules

(a) Profiles of incremental consumption



(b) Profiles of incremental asset holdings



3.2. Benchmark: Prescriptions based on the permanent income hypothesis

The benchmark case is where the revenue is used to give all generations an equal increase in consumption. This has a superficial attraction of appearing equitable, and has a rationale from the well-known permanent income hypothesis (PIH), under which a windfall is perceived as an increment to wealth, and consumption from the wealth is smoothed through time. This hypothesis is familiar from the tax smoothing literature (Barro, 1979) or the optimal use of the current account (e.g., Sachs, 1981), and underlies much of the advice for the setting up of a Sovereign Wealth Fund (SWF) proffered by the International Monetary Fund.

The dashed line PIH illustrates this strategy for our hypothetical resource revenue flow. The increment to consumption is constant, and equal to the interest that would be earned at a fixed world interest rate on the present value of the revenue, evaluated at discovery date $t = 0$. Notice that this strategy involves smoothing consumption from the date at which the resource windfall is 'discovered'. It therefore involves borrowing during the period in which permanent income exceeds actual income, but saving and accumulating assets when actual income exceeds permanent income. Thus, in Figure 3(b) the country borrows (has negative incremental assets) for the first 10 years, then starts to pay back this debt when resource revenues come in, then building up a savings fund. The size of the savings fund and level of consumption increment at all dates are such that interest payments on the fund (once resource revenue has come to an end) exactly finance the consumption increment. Since the level of consumption is determined in this way, the shares of revenue that are saved/ consumed at any date fluctuate with the magnitude of the current revenue flow.[3]

This benchmark case is optimal only under special circumstances. It is applicable for an economy able to borrow and lend at the world rate of interest and which has thereby aligned the rates of return on different activities, so $\rho + \dot{C} / \sigma C = r^D = r^F = r*$. The response to the windfall is therefore not to seek to push consumption forwards or backwards in time (changing $\dot{C} / C$), but simply to have a one-off increase in its level.[4] Furthermore, the incremental assets should be held in foreign assets, because additional investment in the domestic economy would increase the capital-labour ratio, pushing the return in the domestic economy below that on world markets. The resource discovery therefore has no impact on domestic non-oil income, consistent with unchanged growth of consumption, $\dot{C} / C$. While these conditions may apply in some high-income countries, they do not apply in developing countries implying that, should a developing country follow this rule, it would not be optimal.

3.3. Pragmatic conservative rule: Bird-in-hand consumption

The permanent income hypothesis makes the case for smoothing consumption through time, but implies that countries should borrow against future flows that enter permanent income. A more conservative strategy is that countries place resource revenues in a fund – possibly abroad – and only consume the interest on the fund (Bjerkholt, 2002; Barnett and Ossowski, 2003). This yields constant consumption once revenue flows have ceased, but leads to a slow

[3] Notice that the permanent income hypothesis holds true economic wealth constant at all dates from discovery onwards. Thus, borrowing in the early years equals the increase in the present value of resource revenue which is occurring as the windfall revenue becomes less far distant.

[4] An implication of this result is sometimes known as the Hartwick rule (Hartwick, 1977). Saving the whole of the revenue from a depletable asset will (if there is no population growth or technical change) result in a constant path of consumption, i.e. intertemporal egalitarianism.

build up of consumption. For our hypothetical economy, this strategy is illustrated by the dashed line labelled 'bird-in-hand' in Figure 3. This strategy yields a large increment in the consumption of future generations, but the cost is that consumption benefits are pushed far into the future – say, overtaking PIH only in year 20.

Conceptually, the permanent income hypothesis says consume the interest, but include the implicit interest on the resource in the ground as well as the actual interest on the resource once it has been converted into financial assets. The bird-in-hand strategy says ignore wealth until it has been extracted and converted into financial assets, and then apply the permanent income hypothesis (updated each period). It is a highly conservative strategy that allows incremental consumption to reach its maximum only once the resource has been depleted.

3.4. Optimal policy for a developing country

A feature of many developing countries is that they are capital scarce with domestic interest rate above the world rate and access to world capital markets restricted, perhaps by the country's credit rating. Poor access to international finance is likely to be compounded by a history of undersupply of public infrastructure and a poor investment climate. From this starting point, there is the potential of making high-return investments and putting the economy on a growth path that involves capital deepening, with the rate of return converging to the world rate and, accompanying this, wages, consumption and income on an upwards trajectory. What are the optimal profiles of consumption and investment (at home and abroad) out of natural resource revenue in such developing economies?

There are two forces at work. One is that developing economies are still converging to a higher level of consumption and income per capita. Consumption is therefore currently low and on a rising trajectory. This is a force for increasing consumption immediately – i.e., using some of the revenue for poverty alleviation. The other is that the rate of return in the economy is high – a force for investing, which in turn will lead to growth of the economy and thus to higher consumption in future. The efficiency condition (Ramsey equation), $\rho + \dot{C} / \sigma C = r^D$, has high values on both sides of the equation. Now the optimal response to our hypothetical resource revenue flow is illustrated by the curve labelled 'optimal' in Figures 3(a) and 3(b). The full analysis underlying this curve recognises that investment can take place in three sorts of assets; foreign assets (or debt reduction); public infrastructure; and private capital stock (van der Ploeg and Venables, 2008). The optimal consumption increment illustrates several points. There is a substantial jump in consumption at the date of discovery. However, this jump is not as large as in the permanent income hypothesis, because of the presence of high-return investment opportunities, both in the domestic economy and in paying

back foreign debt. Once resource revenue starts to flow, there is a large increase in investment, this taking the form of both lower public debt and an increase in public infrastructure investment. Both of these factors make private investment more attractive, so there is an increase in the private capital stock and consequent increase in income and wages. This finances the rapid growth in the consumption increment that is illustrated in Figure 3(a), while enabling direct public transfers to consumption to fall sharply.

The balance between consumption and investment depends on the return that can be earned on investment of the resource revenue. If r^D is high, then the initial jump in consumption is small. Instead, resources are devoted to investment and the output which this generates puts consumption on a rapidly rising path, so the Ramsey equation, $\rho + \dot{C} / \sigma C = r^D$, is satisfied. Conversely, low r^D means that the initial jump in consumption should be relatively large; there are few good investment opportunities, so consumption jumps up but can then only grow slowly.[5] The important point is that it is the presence of high-return investments that can put the economy on a path of growing income, wages and consumption that is crucial to the consumption–investment decision.

Looking beyond the point at which the resource flow stops, we see that the consumption increment and asset increment are both positive, but asymptotically converge to zero. The consumption decision therefore involves saving some of the benefits for distant generations, but does not involve establishing a savings fund to support a permanent increase in consumption.[6] Instead of building up an overseas fund, the resource wealth has been used to bring forward the development of the economy, this giving higher consumption at future dates, but with the increment steadily declining.

The asset story corresponding to this optimal case is in Figure 3(b). The curve is the increment to net national asset holdings, but does not include private foreign investment in the economy. Initial consumption is funded by borrowing (as in the PIH, but at a slightly lower level), which is then run down as assets are accumulated during the period of revenue flow. At the end of the period of revenue flow the incremental assets (those on the optimal path with resource revenue as compared to the path without such revenue) are gradually run down as the economy continues on its growth path.

The message from the socially optimal path is therefore an intuitive one. Immediate consumption for the current relatively poor generation is optimal, but so is investment to put consumption on a steeply rising path. The best way to achieve this is by investment in the domestic economy which essentially brings forward the economy's growth trajectory, benefiting all generations. This contrasts with accumulating revenues in a sovereign wealth

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[5] And if $r^D = r^*$ we return to the world of the permanent income hypothesis.

[6] Only if the resource discovery is very large, will it also be optimal to build up a permanent savings fund, and this will still be smaller than under the permanent income hypothesis.

fund, although as we will see in the next section some accumulation of foreign assets is desirable for smoothing volatility in revenue flows. The rate of return on domestic investment is the key variable.

4. Coping with revenue volatility

Above we considered only one half of the problem: how to manage depleting revenues. We now turn to the other half, how should resource-rich countries cope with the notorious volatility of commodity prices? Volatility of revenue is a prime reason why many developing economies with poorly developed financial systems have such miserable growth performance (e.g., van der Ploeg and Poelhekke, 2008). Volatility is in this sense the quintessential feature of the well-known resource curse.

Some of the fluctuation in resource revenues is predictable, due to geology and depletion of resources. We argued above that the response to this uneven time profile of revenues should be to invest primarily in domestic assets in order to increase income in future. But much of the volatility is profoundly unpredictable, as illustrated by the recent collapse in global commodity prices. Hamilton (2008), analyses oil prices, and points out the high estimated variance of price changes. From the stand-point of 2008 Q1 the predicted oil price in 2009 Q1 was $115 with 95% confidence interval $62 - $212; wide though this is, the actual price fell below $40. The price shocks are compounded by the fact that resource discoveries and investments are highly correlated with commodity prices. Hence, price crashes not only directly lower existing revenues, but also reduce prospecting and investment in extraction. Revenues can be hedged through future contracts, forward markets, commodity swaps and other financial instruments. However, to date only a few resource-rich countries (e.g., Mexico) have actually tried reducing exposure to commodity-price risk by these instruments. Indeed, a useful role for the IMF might be to offer such guarantees, using its specialized and expensive expertise in derivatives markets to substitute for the lack of it in client governments.

In the absence of substantial hedging options, the analytical and policy questions are; which other economic variables should fluctuate in response to fluctuating revenues, and which should be stabilised? There are three main options. The economy's net foreign asset position can fluctuate, smoothing the domestic economy. Consumption in the domestic economy can fluctuate, passing the impact on directly to local consumers. Or domestic investment can be varied, this creating a smoothed variation in the domestic capital stock. We discuss each of these options in turn, and their optimal combination.

4.1. Foreign assets and liabilities

A superficially attractive option is for government to smooth revenue fluctuations by borrowing and lending in international capital markets. A SLF would be set for investment when commodity prices are high and then be run down when commodity prices are low. If there were perfect symmetry in lending and borrowing then the expected size of this fund would be zero, and volatility would be absorbed at little or no cost. But in practice, the borrowing rate of many developing countries exceeds its lending rate. More radically, when commodity prices decline, which is when countries would need to borrow, they become less creditworthy, and may be shut out of capital markets altogether. The global economic crisis of 2008 illustrates this problem. This suggests that it would be efficient to build a SLF with positive average value, so the country is on average a lender not a borrower.

How large should such a fund become? The fund would need to be larger the greater the degree of prudence of the policy makers, the greater the volatility of the revenue flow, and the larger the difference between the marginal cost of borrowing and the marginal return to lending (or, more generally, the distribution of marginal utilities of the resource revenue). The standard approach to this question requires knowledge of the preferences towards prudence, of the marginal costs and benefits, and of the stochastic process driving the volatility. Recent work by Gelb and Grasmann, 2008 looks at the size of fund that might be required not to fully smooth domestic spending, but to maximise a benefit function in which there are diminishing returns to spending. They find that it is optimal to save a full 80% of the (incremental) revenues associated with a short (5 year) resource boom.[7] This is a much larger percentage than is suggested by applying the theory of precautionary saving in situations where there is no limit to how much the government can spend efficiently.[8]

However, there is a fundamental problem in that price booms and crashes are relatively rare events; for example since most resource-rich economies gained independence there have only been two oil booms. Hence, statistical analysis based on time periods of only two or three decades is likely to be unreliable. If a longer time span such as a century is used, then most of the observations are a period during which the structure of the global economy was so radically different that it is hard to believe that it has much pertinence for forecasting

[7] They let the welfare loss of public spending be given by a quadratic, so that marginal benefit of spending declines and beyond a certain level (say, 40% of non-oil GDP) becomes negative.

[8] If the interest rate and rate of time preferences are zero and the utility function displays constant absolute risk aversion, then a back of the envelope calculation shows that the optimal share of windfall revenue to save is $\varepsilon\upsilon^2/2$, where ε is the coefficient of relative risk aversion and υ the coefficient of variation of oil prices. The 95% confidence interval for the predicted oil prices of Hamilton (2008) suggest mean oil price of $137 per barrel and a standard deviation of $37.5, so that $\upsilon = 0.27$ over a one-year period. Given that a reasonable range for ε is 1-2, it is optimal to save between 3.75 % and 7.5 % of the windfall. If the windfall is expected to last much longer than a year, oil prices are much more unpredictable as the coefficient of variation increases with the square root of the length of the forecast period, so it is optimal to have a larger share of the windfall as a precautionary buffer.

the future. It may, therefore, be best to accept that resource revenues are intrinsically subject to radical uncertainty.

These arguments make apparent the problem with building an SLF. If it is to be large enough to offer a reasonable chance of successfully smoothing, it implies that domestic spending of the revenue is extremely low. This strategy has a high opportunity cost; as we argued in the previous section, there is a higher return using revenues for investment in the domestic economy rather than accumulating foreign assets. Essentially, the strategy of substantially stabilising the domestic economy by accumulating a SLF may require such a large fund that it runs into the same problems as an offshore SWF. Funds are not made available for domestic investment and consumption, and benefits are pushed too far into the future.

4.2. Fluctuating consumption

As we saw in section 2, much of the actual fluctuation in resource revenues has fallen on consumption. This is costly. The usual consumption smoothing arguments (the concavity of utility) are compounded by habit formation. Households and government find it costly to cut back consumption once a particular level has been experienced. Households may find it costly because habits form and utility suffers if they cannot be maintained. Governments may find it costly because they have entered into political commitments, such as hiring public sector employees, which cannot readily be reversed. Formally, this can be represented as utility in any period being dependent on consumption relative to habit consumption C_H, (say, lagged consumption), that is $C - \omega C_H$ where indicates the degree of habit persistence. Estimates of ω are high (of the order 0.6) indicating that it is socially costly to raise consumption when resource revenues come in and to bring down when revenues dry up. If habit formation is potent then the implication for policy is simply that consumption should never be required to decline.[9]

4.3. Fluctuating domestic investment

The third option is that domestic investment fluctuates. Our long run analysis of section 3 argued that it should be primarily domestic investment that responds to resource revenues; does this analysis carry over to shorter-run fluctuations? There are several arguments that suggest so.

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[9] The IMF has amended its standard permanent income guidelines for the non-hydrocarbon primary deficit of oil/gas-producing countries to allow for habit persistence in public spending on final goods. This has been applied to calculate fiscal benchmarks for Gabon (Leigh and Olters, 2006) and, more generally, for sub-Saharan African oil/gas-producing countries (Olters, 2007).

The purpose of a *flow* of investment is to contribute to the capital *stock*. This stock–flow relationship creates an inherent degree of smoothing between investment and the output that it produces, so fluctuating investment is consistent with a considerable degree of stability in productive capacity and output. In even the best functioning economies, investment is more volatile than other elements of national income, and coping with this volatility is not a fundamental problem for such economies. Volatility of investment is also likely to be less problematic than might initially appear likely since the strategy of using revenues for investment rather than foreign assets means that investment as a share of GDP will be high in such an economy.

Of course, such fluctuations are not entirely costless, and the role for a SLF is to smooth investment to the extent required to mitigate the costs of fluctuation, but such an SLF need not keep the rate of investment constant. Indeed, it is probable that what should really be avoided are sudden very large increases in investment, and for this it is not necessary to build up precautionary liquid balances. The accumulation of balances would be driven by the need to park savings in times of high revenues rather than the need to protect spending in periods of low revenues.

If volatility of investment is accepted, then this shifts the problem to what should in any case be the heartland of policy analysis in a resource-rich, capital scarce economy: how the domestic investment process should be managed. The policy implication is that government should focus on running a high long-term rate of investment, and facilitating substantial variation around this high level. Currently a typical investment rate for low-income Africa would be only 19 percent of GDP. An efficient use of resource revenues on the above principles might roughly double this level. This would require a very large change in the structure of the economy, for example, implying a much larger share for the construction sector, and much higher imports of capital equipment with its related distribution channels. These expansions open up design options which can better accommodate flexibility: for example, firms in the construction sector can structure their new employment and finance obligations in such as way as to survive sharp contractions.

An overarching policy implication is that SWFs and SLFs should not be the focus of government attention. Following a resource discovery, or a price hike, governments face a huge task of helping the economy to restructure to a radically higher level and volatility of investment. A SLF is likely to be a useful means of buying extra time during this adjustment, but overseas funds become counter-productive if, instead of buying more time, they delay the reconfiguration of absorptive capacity for investment.

5. Absorbing and implementing investment

So far, we have taken as given that domestic investment yields a high rate of return. In a capital-scarce economy this is very likely *potentially* to be the case: indeed, if it were not, the economy would be unable to develop. However, the very fact that the capital stock is low may indicate that there are problems in absorbing investment. It is possible that the return on the existing capital stock and small increments to it is high, but that for various reasons attempts to increase investment rapidly encounter severely diminishing returns. Such concerns are often flagged by the terms 'absorptive capacity' and 'Dutch disease'. We have also taken as given the idea that government can control the alternative use of funds; in practise it is usually operating indirectly, for example changing tax instruments that influence the behaviour of the private sector who are likely to be the ultimate decision takers. In the remainder of the paper we discuss these issues, addressing the ways in which policy implementation, at the aggregate level, at the level of project implementation, and in choice of spending channels, can mitigate potential problems.

5.1. Absorbing investment; aggregate issues

Spending resource revenues in the domestic economy (either on consumption or investment) raises demand for the goods and services being purchased. A major concern is that the economy's aggregate response to such a spending boom runs into diminishing returns, reducing the value of spending. The basic argument is that steep supply curves – particularly for non-tradable goods and factors – mean that spending translates into higher prices and crowds out alternative activities, rather than drawing more resources into use.

An easy case is when this does *not* occur is the Keynesian model of undergraduate textbooks. All supply curves in the economy are perfectly elastic and extra demand can be met without changing any relative prices or 'crowding out' alternative activities. An increase in demand draws underemployed resources into use and raises income. Due to multiplier effects, the final increase in income is larger than the increase in demand. Income will continue to rise until the increase in income (ΔY) equals the extra foreign exchange supplied by the windfall (ΔR) divided by the marginal propensity to import m, that is $\Delta Y = \Delta R/m$. Developing countries typically have un- (or under-)employed resources. Can they hope for real income growth several times larger than the resource revenue, in line with this model? In practice, supply curves are not horizontal, neither at the aggregate nor at the sector level. Hence, supply responses are dampened as prices rise and other activities are crowded out by resource-funded spending. Often, the first sector in which supply problems show up is the construction sector. Resource-funded infrastructure investment might coincide with private sector resource-related investment (e.g. office construction) leading to a construction boom

and a rapid increase in the price of non-traded inputs. As a consequence, the purchasing power of public expenditure is reduced and this brake on infrastructure investment creates other bottlenecks in the economy – in road capacity and traffic congestion for example. Sector effects aggregate into economy-wide changes in relative prices including higher wages and a higher price of domestic output as a whole relative to the price of foreign goods. This shows up as a real appreciation of the currency, and is the basis for the Dutch disease and crowding out of non-resource exports. Are these effects a matter of concern for government and a basis for policy intervention? After all, a steep supply curve may just be a fact of economic life and does not of itself constitute a market failure.

One frequent cause of concern is that the activities crowed out are particularly valuable. The Dutch disease argument is that private sector exports are crowded out by resource-funded spending *and* that these activities are of particularly high marginal social value. The basis for this may be external economies of scale arising from learning by doing or from pecuniary externalities that support the development of fast growing clusters of activity (e.g., van Wijnbergen, 1984; Sachs and Warner, 1997). In that case, a temporary decline of the potential growth engine of the economy – the traded sector – will lead to a fall in the rate of economic growth and thus to a loss in output. However, if domestic spending of resource revenues is concentrated on public investment that is complementary to these private sector activities – such as improvement of productive infrastructure or labour skills – then these adverse effects are mitigated.

A second point is to do with the factors that determine the shape of supply curves, both of individual sectors and in the aggregate. The fact is that supply curves are often steeper than they need be due to inefficiencies in the supplying sectors. What are the factors that hinder drawing new resources into a growing sector? They include regulatory or other barriers to setting up new firms, but also delays and costs in importing equipment, labour market regulations that make it difficult to hire labour and the legacy of previous under-investment in, for example, labour skills. This standard list of factors determines the investment climate, but their importance is amplified in the context of a coming spending boom.

5.2. Options for spending:

While the ultimate decisions are on consumption, investment, and the actual investment projects undertaken, many of the choices actually faced by government appear rather different as they are on intermediate spending channels, rather than final projects. Broadly speaking, there are four channels through which the government can allocate resource revenues. They can be distributed to the private sector through citizen dividends or through the tax/ benefit system. They can be use to increase public spending, either on public consumption or the construction of public assets. They can be retained as a government financial asset but lent on

to the domestic private sector, either by government lending (e.g., development banks or mortgage lending) or by reducing existing public debt. And finally, they can be retained as a government financial asset and lent to foreigners, by foreign reserve accumulation or establishing a SWF. These alternatives vary in three fundamental ways. Who gets ultimate ownership of the resource revenue and hence control of the macro level time path of spending from this revenue? Who gets control of the micro level spending detail – the choice of project? How do the alternatives map into the balance between consumption and investment? Table 1 outlines these alternatives and some of their direct implications.

Alternative 1 is distribution to the private sector, through lower taxes or social transfers. In this case, the government retains no ownership of the resource wealth and consequently has no macro-economic control over spending, once the transfer is made. I also decentralises the micro-economic detail of spending to private citizens, rather than seeking to implement projects through government ministries. Transfers will typically induce both private consumption and investment, and we denote the increase private consumption c (the marginal propensity to consume). The remaining fraction $1 - c$ goes to investment which adds to the private capital stock and becomes a private sector asset.

Table 1: Government choices – impact per $1 revenue

	Res-ource revenue	Consumption		Investment			Balance sheet	
		Private consum-ption	Govt. consum-ption	Private capital stock	Public capital stock	Foreign assets	Private assets	Govt. assets
1. Tax cut/ transfer	1	c	0	$1 - c$	0	0	$1 - c$	0
2. Public spending	1	0	g	0	$1 - g$	0	0	$1 - g$
3. Domestic lending/ debt reduction	1	z	0	$\gamma(1 - z)$	0	$(1-\gamma)(1-z)$	$-z$	1
4. Foreign assets/ SWF	1	0	0	0	0	1	0	1
Accounting identity	$R - C_p - C_g = I_p + I_g + I_F = A_p + A_g$							

Note: c – share of consumption from tax cut.
g – share of consumption in government spending.
z – share of consumption in private response to government debt reduction/ lending.
C – consumption, I – investment, A – change in assets.
Subscript p – private, g – government, F – foreign.
Sums across each row of the matrix satisfy the equation given in the bottom row.

Public spending, alternative 2 centralises control, both at the macro level, and the micro level of project design and implementation. This too will typically be some mixture of current

(fraction *g*) and capital spending, the latter part adding to the public capital stock (e.g., infrastructure) and becoming a government asset or possibly adding to the human capital stock when it is spending on education or health care.

The third alternative is for the government to retain the revenue as an asset, but to lend it on to the domestic private sector to spend or invest. In this way the government retains control of the macro-aggregate, but decentralises the micro-economic detail to the private sector. This could be new lending – e.g., through a development bank – or the reduction of existing domestic government debt. The private sector response will be to consume fraction *z* and invest 1 – *z*. It is possible (in this and also in case 1) that some of the private investment takes the form of acquisition of foreign assets, so only fraction γ goes into the domestic capital stock, the rest being invested abroad. Notice that in case 3 the government's balance sheet has improved, either by paying down domestic debt or through its financial claim on new lending. To the extent that the private sector has increased its consumption, its asset position has deteriorated. Finally, in case 4 government may simply acquire foreign assets (or pay down foreign debt), this having no direct impact on the private sector, and including the case of investment in an overseas fund or sovereign wealth fund.[10]

5.3. Transferring the absorption problem to the private sector through citizen dividends

One view of the optimal way to handle resource revenues is that they should be handed to private individuals through citizen dividends and, if government needs to raise funds for public expenditure, it should do so by taxing back some of the dividend. Some areas have limited citizen dividend schemes (such as Alaska and Alberta) and in all resource rich regions it can be conjectured that taxes are somewhat lower than they otherwise would have been. What are the pros and cons of transferring the proceeds directly to private individuals?

The main advantage is that, in countries with bad governance, it is important to get funds out of the reach of government as rapidly as possible as has been argued for the case of Nigeria (Sala-i-Martin and Subramanian, 2003). This argument, though correct, is of doubtful relevance – since the countries with the worst governance are unlikely to implement such a scheme, and those most likely to implement it have least need of it. The issues can be set in somewhat wider terms, via the argument that building state accountability requires taxation. Some authors argue that bargaining over tax is the basis of the social contract between the

[10] Note that the taxonomy links the discussion of resource revenue to that on scaling up aid (Gupta, et al., 2006). In IMF terminology a foreign exchange windfall is 100% 'absorbed' if it is matched one-for-one by an increase in the non-windfall current account deficit. Thus, cases 1 and 2 are 100% absorbed, case (iii) 1 – (1-γ)(1-*z*) absorbed, and case 4 zero% absorbed. A windfall is 100% 'spent' if it is matched one-for-one with the non-windfall fiscal deficit. Thus, alternatives 1 and 2 are 100% spent, while alternatives 3 and 4 are 0% 'spent'. Each of these alternatives has wider implications for the economy as a whole.

state and its citizens and a key building block in the development of democracy (Brautigam et al., 2008). According to this argument, government should only be able to spend the funds itself if it has taxed them back from the private individuals to whom the revenue has already been given. Of course, this has a disadvantage of administrative complexity as there are two layers of government process, initial distribution and then taxation.

The second advantage is to do with the micro-economic detail of spending. Private individuals are much better at identifying investment projects than are government officials, and have sharper incentives to implement them well and make sure they succeed. Underdeveloped credit markets mean that many high return investments do not get undertaken, and putting cash in the hands of individuals may remove credit constraints and cause such investments to be made. This argument is supported by the evidence that agricultural based resource booms have had much more positive effects than booms in 'point resources' such as minerals or oil, in part because individual farmers have increased investment in their small-holdings.

There are some counter-arguments. The first is to do with the fundamental problem of the inter-generational distribution of the benefits. Will private choices lead to the optimal time profile of consumption versus investment that we discussed in section 3? Individuals currently alive may give too little weight to future generations, and therefore invest too little (*c* is too high in Table 1). Put differently, the social discount rate that society uses should be less than market rates of return, and less than that suggested by studies of individual behaviour. This may be exacerbated if people overestimate the size and duration of the revenues. Society therefore has an obligation to increase savings rates by direct government action, and should not accept the pure outcome of individual choice. The argument has particular force for the proceeds of a resource windfall, which the current generation has no particular claim to 'own' any more than does any other generation. Furthermore, the timing of individual spending decisions might contribute to short-run booms and loss of macro-economic stability, since private individuals do not internalise the effects of their decisions on prices and the level of activity.

Even if individuals wanted to save at a sufficiently high level, they would not necessarily do so by undertaking their own investment projects. Efficiency therefore requires an effective system of financial intermediation which both rewards depositors and identifies investors who can best use the funds. Without such a system, the argument that the private sector has better information and incentives than the public sector is eroded. Of course, cutting in the other direction, substantial cash transfers to citizens would be a powerful force to promote development of a wider and deeper financial system.

The arguments above were couched in terms of a 'citizen dividend' or pure transfer. In practise, any transfer to the private sector is likely to take place through adjustment of tax,

subsidy or social protection schemes, and each of these has to be evaluated on its own merit. Recent empirical evidence suggest that for each $1 hydro-carbon resource revenue accruing to government, domestic tax revenue is reduced by around 20 cents (Bornhorst, et al., 2008). Resource revenues provide an opportunity for reducing distortionary taxation that may have a negative impact on economic activity, but it also provides the opportunity for maintaining highly inefficient subsidy programmes. For example, fuel subsidies may look politically attractive in an oil rich country, but are no less distortionary simply because the country is oil rich. Social protection schemes have many advantages, particularly in so far as they are associated with private sector accumulation in either human capital (e.g., transfer programmes conditional on school attendance) or physical capital (e.g., by allowing farm assets to be retained during an economic downturn or drought).

The balance of these arguments is country and expenditure channel specific, but some broad conclusions can be drawn. It is important that some fraction of revenues get into citizens hands quite early on. As we argued in section 3, it is important to raise consumption, and it is also likely that these flows would finance some very high return investments. Risk of large scale theft of revenues is diminished and, perhaps most importantly, it establishes the principle that the resource belongs to citizens, and is being used for the benefit of citizens as a whole, rather than for a small elite. But while these are arguments for the transfer of some fraction of revenue to individuals, it is not an argument for the transfer of all of it. Private individuals' choices alone will not lead to an efficient profile of consumption or spending, and there are pressing needs for direct investment in public, or publically funded, assets.

5.4. Transferring the absorption problem to the private sector through public lending and debt reduction

Public lending is an instrument that puts the micro-management of projects into the hands of the private sector, while retaining control of the macro-aggregates at the central level. This could be new government lending or the reduction of domestic debt.

Levels of government debt held domestically in African countries are generally quite low relative to GDP, but large relative to the banking sector, amounting to an average of 25% of total commercial bank deposits. What then is the effect of reducing the availability of government bonds? It should reduce domestic interest rates and induce asset holders to acquire other assets. Ideally this would be domestic assets, although the extent to which this occurs depends on investment opportunities in the domestic economy. One important mechanism may be that a reduction in government debt deprives commercial banks of the easy option of simply lending to government, and thereby induces them to be more pro-active in seeking out other lending opportunities.

What is the empirical evidence on the relationship between government debt and lending to the private sector? Evidence suggests that the response of private sector investment might be quite low, with one study finding that each $1 decrease in domestic debt was associated with a $0.15 increase in lending to the private sector.

The other side of debt reduction is new government lending, through institutions such as development banks. Unfortunately, the historical record of such banks has been extremely poor, although on a modest scale it may be worthwhile for resource rich countries to revisit and rethink this option. One suggestion is for lending for residential construction.

5.5. Scaling up public spending

Hence, realistically, if the resource revenues are to be used substantially for domestic investment, there is no alternative to this being led by the government. There is indeed considerable scope for radically higher levels of public investment in Africa. The Spence Commission on Growth and Development has recently suggested that the share of public spending devoted to infrastructure by African governments is markedly too low. Infrastructure is complementary to private sector investment, so benefits accrue directly and also indirectly via increased private sector activity.

Linking public expenditure of resource revenues to development has both macroeconomic and microeconomic components. The macroeconomics of public spending concerns the capacity to manage change, the balance between public consumption and investment, combating Dutch disease, and linking spending to a strategic vision. Change is demanding and so if spending rises too fast the processes of decision and implementation will inevitably deteriorate. Hence, a wise macroeconomic strategy is to impose a ceiling on the permitted rate of increase in spending. Incremental public spending needs to be linked to a strategic vision of the realistic opportunities facing the economy. Whether the economy is expected to grow predominantly through e-services, agriculture, resource extraction, or manufactures will imply different needs for public spending.

The microeconomics of public spending concerns ‘projects’. We use the term ‘projects’ generically, to cover investments and also initiatives to spend through current expenditures. Why are the benefits of projects often low? Are there issues that are particular to resource revenues? One problem arises due to limited technical capacity and information. Ideally, the government will have a stock of spending plans, each of them subject to rigorous ex-ante appraisal – a social cost-benefit analysis. However, assembling a set of prioritised spending plans and subjecting them to such analyses is hard in principle, requiring information and technical expertise that is lacking even in countries with a large government economic service. The problem is more acute in most developing countries. The other problem is to do with incentives. Even if the information and technical skills are present,

misaligned incentives may cause decision takers to act in a manner that is socially sub-optimal. One extreme of this is corruption – incentives to steal or divert revenues. Another example is rent seeking, occurring when effort is devoted to activities that may be legal but are socially unproductive, involving a zero (or negative) sum game to capture rents created by artificial scarcities.

Misaligned incentives arise easily in economies with partisan public investment projects. In a country with well-developed patronage systems, the government may be interested in investing primarily in their homelands while the opposition is interested in projects in their home regions. In that case, it can be shown that the incumbent will over-borrow and over-invest in its pet projects in order to tie the hands of potential successors who wish to invest in their own pet projects. These political distortions are greater the larger the probability of being removed from office, the more partisan investment projects, and the bigger the illiquidity of the investment projects (Beetsma and van der Ploeg, 2008). Effectively, governments prefer to put the windfall revenues in illiquid partisan investment projects rather than to save them in a liquid SWF. The key insight is that the challenge is not only to get a big increase in public investment in many developing countries, but to also make sure that it is the right type of public investment and that it is investment of high quality. The past has witnessed many white elephant projects, since it is the inefficiency of such projects that makes them politically appealing as credible devices of redistribution (Robinson and Torvik, 2005), which should of course be avoided. Misaligned incentives also come simply from 'market failures'; if people are unable to transact at prices that are equal or close to social marginal valuations, then decisions will be suboptimal.

These issues are particularly severe in the context of resource windfalls. Large-scale revenues come on stream abruptly and are likely to be volatile. Administrative systems lack the information and capability to scale-up expenditures rapidly, and this leads to inefficient spending programmes. This argument obviously reinforces the case made for smoothing expenditure. It also suggests that any initial jump in spending should be small, waiting until capacity to spend efficiently is developed. Further, there is often a lack of transparency surrounding resource revenues and this relaxes the disincentives to misappropriate funds. The response is at several levels. Increasing transparency and accountability limits the opportunities for theft of funds. Responsible governments may also be concerned that they will be followed by governments that are prepared to loot accumulated funds. It is therefore (second-best) optimal for governments to use expenditures in ways that are hard to loot, such as immobile capital investments or distribution to citizens.

These concerns can be crystallized into the need for two distinct hurdles: honesty and efficiency. In a well-functioning system honesty and efficiency are enforced in multiple ways. Some work *ex ante* and are about how decisions get authorised, while others work *ex post* and

are about evaluation. Enforcement is partly through top-down authority, partly through bottom-up pressure from citizens and their representatives, partly through peer groups, and partly through norms internalised by the public sector workforce. Table 2 presents a classification of the sixteen resulting mechanisms and gives examples of each. The quality of public spending depends on all these mechanisms, the balance between them depending on the needs and opportunities of each situation. A key political challenge posed by a bonanza in resource revenues is to upgrade these mechanisms as rapidly and as visibly as possible.

Table 2: A classification of accountability in public spending

Purpose and Timing of scrutiny	Top-down	Bottom-up	Peer Group	Internalised by Workforce
Honesty: ex ante	International competitive tendering for public investment projects	Civil society scrutiny of public spending in Chad through the *College*	Ethical norms set by an association of doctors	Opportunities for corruption resisted due to integrity
Honesty: ex post	Audit by Auditor General	Exposure of public corruption in the media	Peer group disciplinary processes in professions	Guilt and regret induce confession and restitution
Efficiency: ex ante	Cost-benefit analysis of proposed projects	Parliamentary approval of budget, and PRSP consultations	Presentation of spending plans by ministers in cabinet	Pride in skill induces high effort
Efficiency: ex post	Evaluation of completed projects	Comparison of benchmarked performance of service delivery in media	Comparison of examination results among headmasters	Failure induces an effort to learn from mistakes

Windfall revenues provide an opportunity for a quantum increase in public spending which is likely to change both the composition of public spending and the process by which it is undertaken, each of which are manifestly political issues. Two important political pressures are the bureaucratic tendency to defend existing budgets and lobbying from special interests. If aggregate spending has only been increasing slowly, the composition of budgets is likely to be inert due to bureaucratic defence so, as needs change, the frozen composition may gradually drift further from the ideal. However, one consequence of a frozen composition of spending is that the returns to lobbying are low and so there is little lobbying pressure. The net effect of budget inertia and weak lobbying is likely to be that although incremental money is scarce it can be well-used.

Both a sharp increase in the world price of commodity exports and the discovery of natural resources are high-profile public events so that the quantum increase in public

spending is fully anticipated by political actors. There is now plenty of incremental money free from the bureaucratic necessity of maintaining existing budgets and so the return to political lobbying sharply increases. Once lobbies have won spending increases, these tend to be locked in by bureaucratic defences against change. Realizing this, lobbies have an incentive to devote resources even in excess of the current increase in revenues. This generates the lobbying equivalent of the economics of a gold rush: lobbies rush to stake claims to future income streams from the assignment of rents.

Lobbying is subject to free-riding and so favours those components of public spending that confer large benefits on small groups. It can take a variety of dysfunctional forms, from financing election campaigns that create political obligations, through strike threats by public sector unions, to bribery of decision takers. In general, such an increase in political pressure squeezes the use of public money for those purposes which benefit everyone. The most generalised benefit is clearly to save the windfall in financial assets and so this will attract the least political support, but more generally lobbying will tend to reduce the return on incremental spending.

If citizens come to believe that the windfall will be captured by such special interests, they might themselves pressure for second-best alternatives that at least provide some benefits that are more widely distributed and highly observable. Again, savings will not be favoured since it is not observable. However, some observable and widely diffused benefits might be poor uses of the windfall, such as subsidised petrol or an increase in the national minimum wage.

Hence, the quantum increase is both an opportunity for increasing the return on public spending, since it relaxes the bureaucratic constraint, and a problem, since it generates a surge in lobbying which is likely to reduce the quality of spending. The challenge for the government is publicly to face down the lobbying surge. One approach is to establish explicit and transparent new decision processes for natural resource revenues linked to a clear vision of long-term development. While this runs counter to the ideal fiscal principle of a fully integrated budget in which all revenues are pooled, it might have superior informational properties. By spotlighting the new spending, it makes scrutiny easier and signals to citizens that the windfall will not be captured by special interests.

6. Conclusions

The arguments discussed through the paper provide the basis for the following conclusions.

Consumption of resource revenues should be smoothed, beginning early (perhaps before revenue flows) and certainly extending well beyond the period of peak resource

revenues. The mechanisms through which this extra consumption is delivered are likely to be a combination of lower taxation, social protection schemes, and above all higher income coming from domestic investment and growth of the economy.

The critical issue is therefore how to harness resource revenues for faster growth. Potentially, the extra revenues enable faster growth of the domestic economy both by increased supply of capital to the private sector, and by public sector investments that raise the productivity of private capital. Increased supply of capital to the private sector comes from a range of sources. Some may be at the level of the households, as people save some of the proceeds of lower taxes or social protection schemes. Some may be through asset substitution as reduced supply of government debt induces people – and more importantly the commercial banks – to seek out alternative investments. Some may possibly be through direct government lending if appropriate institutions can be developed that are able to lend funds in an honest, efficient and accountable manner.

However, probably the more important source of increased growth and private sector investment is the use of resource revenues to raise the marginal product of capital, both public and private. Although a quantum increase in the right type of public capital formation might normally be expected to lower its productivity, in conditions where the existing public sector performance is unsatisfactory a quantum increase can be an opportunity for procedural change. The productivity of private capital can be increased by the enhanced provision of public capital because the two are – or can be designed to be -- complementary. Public infrastructure can deliver lower cost and better quality supplies of transport, communications, power and human capital provided one ensures that there is no inefficient partisan bias in public investment and white elephants are avoided. While there are dangers of crowding out and Dutch disease effects, these can be offset by public spending designed to increase the competitiveness of private sector investments.

References

Akitoby, B. and T. Stratmann (2008). Fiscal policy and financial markets, Economic Journal, 118, 533, 1971-1985.

Alesina, A. and G. Tabellini (1990). A positive theory of fiscal deficits and government debt, Review of Economic Studies, 57, 3, 403-414.

Arezki, R. and F. van der Ploeg (2008). Can the natural resource curse be turned into a blessing? Role of trade policies and institutions, IMF Working Paper 07/55, International Monetary Fund, Washington, D.C.

Barnett, S. and R. Ossowski (2003). Operational aspects of fiscal policy in oil-producing countries, in J. Davis, R. Ossowski and A. Fedelino (eds.), Fiscal Policy Formulation and Implementation in Oil-Producing Countries, International Monetary Fund, Washington, D.C.

Barro, R.J. (1979). On the determination of the public debt, Journal of Political Economy, 87, 5, 940-971.

Basdevant, O. (2008). Are diamonds forever? Using the permanent income hypothesis to analyze Botswana's reliance on diamond revenue, Working Paper No. 08/80, International Monetary Fund, Washington, D.C.

Beetsma, R.M.W.J. and F. van der Ploeg (2008). Partisan public investment and debt biases: liquidity of government assets and the case for fiscal restrictions, mimeo.

Besley, T. (2007). The new political economy, Economic Journal, 117, 524, F570-F587.

Bjerkholt, O. (2002). Fiscal rule suggestions for economies with non-renewable resources, University of Oslo.

Bornhorst, F., S. Gupta, Sanjeev and J. Thornton (2008). Natural resource endowments, governance, and the domestic revenue effort: Evidence from a panel of countries, IMF Working Paper No. 08/170, International Monetary Fund, Washington, D.C.

Brautigam, D., O-H Fjeldstad and M. Moore (2008). Taxation and State Building in Developing Countries, Cambridge University Press, Cambridge.

Collier, P. and B. Goderis (2007). Prospects for commodity exporters: Hunky Dory or Humpty Dumpty? World Economics, 8, 2.

Collier, P. and B. Goderis (2008). Commodity prices, growth and the natural resource curse: Reconciling a conundrum, mimeo, Centre for the Study of African Economies, University of Oxford.

Collier, P. and A. Hoeffler. (2009). Testing the Neocon agenda: Democracy and natural resource rents, European Economic Review, to appear.

Corden, M. and P. Neary (1982). Booming sector and de-industrialization in a small open economy, Economic Journal, 92, 825-848.

Collier, P. and A.J. Venables (2008).Illusory revenues: tariffs in resource-rich and aid-rich countries, Oxcarre Research Paper 2008-04, University of Oxford.

Davis, J., R. Ossowski, J. Daniel and S. Barnett (2002). Stabilization and Savings Funds for Non-Renewable Resources: Experience and Fiscal Policy Implications, IMF Occasional Paper No. 205, International Monetary Fund, Washington, D.C.

Gelb, A. and S. Grasmann (2008). Confronting the oil curse, mimeo., World Bank, Washington, D.C.

Gupta, S., R.Powell and Y. Yang (2006). Macroeconomic Challenges of Scaling Up Aid to Africa – A Check List for Practitioners, International Monetary Fund, Washington, D.C.

Hamilton, J.D. (2008) 'Understanding crude oil prices'. University of San Diego.

Hartwick, J.M. (1977). Intergenerational equity and the investing of rents from exhaustible resources, American Economic Review, 67, 5, 972-974.

Hotelling, H. (1931). The economics of exhaustible resources, Journal of Political Economy, 39, 137-175.

IMF (2007). The role of fiscal institutions in managing the oil revenue boom, Fiscal Affairs Division, International Monetary Fund, Washington, D.C.

Leigh, D. And J.-P. Olters (2006). Natural resource depletion, habit formation, and sustainable fiscal policy: Lessons from Gabon, IMF Working Paper 06/193, International Monetary Fund, Washington, D.C.

Mehlum, H., K. Moene and R. Torvik (2006). Institutions and the resource curse, Economic Journal, 116, 1-20.

Olters, J.-P. (2007). Old curses, new approaches? Fiscal benchmarks for oil-producing countries in sub-Saharan Africa, IMF Working Paper 07/107, International Monetary Fund, Washington, D.C.

Ossowski, R., M. Villafuerte, P.A. Medas and T. Tomas (2008). Managing the Oil Revenue Boom: The Role of Fiscal Institutions, Occasional Paper 260, International Monetary Fund, Washington, D.C.

Ploeg, F. van der (2008). Challenges and opportunities for resource rich economies, Oxcarre Research Paper 2008-05, University of Oxford.

Ploeg, F. van der and S. Poelhekke (2008). Volatility, financial development and the natural resource curse, Oxcarre Research Paper 2008-03, University of Oxford.

Ploeg, F. van der and A.J. Venables (2008). Harnessing windfall revenues in developing economies. Economic development versus sovereign wealth funds, Oxcarre Research Paper 2008-09, University of Oxford

Sachs, J.D. (1981). The current account and macroeconomic adjustment in the 1970s, Brookings Papers on Economic Activity, 1, 201-268.

Sachs, J.D. and A.M. Warner (1997). Natural resource abundance and economic growth, in G. Meier and J. Rauch (eds.), Leading Issues in Economic Development, Oxford University Press, Oxford.

Sala-i-Martin, X. and A. Subramanian (2003). Addressing the natural resource curse: An illustration from Nigeria, IMF Working Paper 03/139, International Monetary Fund, Washington, D.C.

Segura, A. (2006). Management of the oil revenue under the permanent income hypothesis: the case of São Tomé and Príncipe, Working Paper No.06/183, International Monetary Fund, Washington, D.C.

Stern, N. (2006). The Economics of Climate Change. The Stern Review, Cambridge University Press, Cambridge, U.K.

Wijnbergen, S. (1984). The Dutch disease: A disease after all?, Economic Journal, 94, 41-55.

World Bank (2006). Where Is the Wealth of Nations? Measuring Capital for the 21st Century, International Bank for Reconstruction and Development/World Bank, Washington, D.C.