

## **AFRICA AND NATURAL RESOURCES:**

### **Managing Natural Resources for Sustainable Growth<sup>1</sup>**

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#### **ABSTRACT**

After an overview of the stylised facts about Africa's natural resources, we discuss the problems and challenges facing the management of natural resources in Africa. We highlight the paradox of plenty, which is that many resource-rich countries in Africa have bad growth performance. They typically also have low investment rates and high degrees of inequality. The curse is especially bad for point-source resources such as oil, gas and diamonds and less for diffuse resources. We point out on the basis of cross-country evidence that this paradox can be resolved if institutions are good, financial systems well developed and the economy open to international trade. We argue that the quintessential nature of the paradox of plenty arises from the very high volatility of commodity prices. This further strengthens the case for good financial systems. We subsequently focus on an analytical framework for the assessment of the management of natural resource wealth. We point out that rapacious rent seeking and the lack of effective mineral property rights has led to negative genuine saving rates and the gradual erosion of the wealth of many African countries. Although there may be a rationale for negative genuine saving if countries are investing heavily in new innovative exploration technology, this hardly seems the case for Africa. The challenge for policymakers in Africa is therefore how to get more incentive-compatible contracts and transparent accounts of mineral extraction. A key question is how to manage natural resource wealth and whether it should be used to save and invest or to boost purchasing power of the people. If it is spent, the challenge is to spend the resource revenues on productive purposes. We conclude with a discussion of the role of China and India in the new 'scramble' for Africa's natural resources.

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## I. INTRODUCTION

Many African countries are rich in natural resources. This has not always been a blessing. The huge revenues from commodity exports have been very volatile. Furthermore, these revenues are often temporary and thus sound fiscal policies are required to ensure that sufficient investment takes place in productive and human capital for when resources run out. This is a difficult task, since the volatility of commodity export revenues invites excessive public spending without proper scrutiny. The huge volatility of resource prices also harms both domestic and foreign direct investment and depresses economic growth by a large amount, especially if domestic financial institutions are poorly developed. Many resource-rich African countries also suffer from real appreciation of their exchange rates induced by the huge resource export revenues and aid flows. This really hampers prospects for non-resource exports in those countries. The sheer volume of resource revenues diverts attention away from the task of diversifying exports away from commodities to labour-intensive manufacturing exports. The rise of China and India make it extra difficult for Africa to carve a niche in labour-intensive manufacturing exports to the OECD economies. Something must be done, since Africa cannot afford to wait until wages in China and India have risen sufficiently for Africa to get a chance. Without proper checks and balances the huge resource revenues also encourage rent seeking and corruption on a massive scale and tend to undermine the quality of institutions. Transparency of the allocation of mineral right, the revenues generated, and how the revenues are spent, are thus essential. Outside credible international organisations preferably organised by reform-minded African institutions could play a useful role in extending the Extractive Industries Transparency Initiative into a Charter for Transparency of Resource Revenues and Payments. Unfortunately, many rich countries have negative genuine saving. They are thus depleting their natural resource wealth faster than they are building up other assets. The key challenge is therefore how to transform the often temporary resource revenues into a productive capital. Clearly, much can be done to improve the transport infrastructure, especially for the landlocked countries of Africa. Also, much can be done to invest in human capital and the skill necessary to set up a viable and competitive manufacturing base.

Section II presents some stylised facts on Africa's natural resources. Section III and IV discuss conventional economic and political economy explanations of the problems of natural resource dependence and the paradox of plenty. Section V explains why volatility of commodity prices can lead to boom-bust cycles in economic policy and depress growth

prospects especially if financial systems are poorly developed. Section VI presents cross-country evidence on the various determinants of the natural resource curse discussed in sections II-V and argues that volatility is a quintessential feature of the natural resource curse. Section VII discusses the viability of Africa's natural resources in the light of the negative genuine saving rates of many African resource-rich economies. Due to rivalry among competing fractions natural resource revenues are not used enough to transform exhaustible assets in reproducible assets such as physical, human or foreign capital. Consequently, natural resource reserves are in many instances squandered. Section VIII is concerned with the management of natural resource wealth in Africa. It highlights the importance of sound and credible contracts with efficient risk sharing, transparency of revenues and public sector financial management, and appropriate timing and composition of spending natural resource revenues. Section XI discusses the growing importance of China and India in the new 'scramble' for Africa's natural resources and the development of Africa and argues that this also offers Africa a unique opportunity to diversify its bundle of exports and develop a labour-intensive manufacturing base. Section X offers policy conclusions.

## **II. STYLISTED FACTS FOR AFRICA AND THE PARADOX OF PLENTY<sup>3</sup>**

Here we offer some stylised facts about why natural resources may stunt growth prospects of many resource-rich African economies:

- The scatter diagram in Figure 1 shows that countries with a large share of natural resource exports in GDP tend to have a worse growth performance.
- Figure 2 indicates that the dependence on natural resource exports is declining, but much less so in Sub-Saharan African than elsewhere in the global economy.
- Figure 3 tells us that world commodity prices are extremely volatile. The standard deviation of crude petroleum is highest of all the commodities and can be as high as 30 percent. Food prices are also very volatile, followed by ores and minerals, and the least volatile are agricultural raw materials. Still, the least volatile commodity prices are still much more volatile than volatility of income per head.
- Figure 4 and 5 indicate that countries with a large resource share of GDP and with a high standard deviation of the share of point-source resources in GDP tend to have a

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<sup>3</sup> Recent accounts of the economic performance of African and Sub-Saharan Africa can be found in Fosu and O'Connell (2005) and IMF (2007), respectively.

high volatility of growth in GDP per capita. Figure 6 suggests that countries with substantial volatility in output per capita tend to have lower growth in output per capita.

- Table 1 makes clear that this particularly hurts the African economies that primarily rely on commodity exports for survival. The African countries have very high volatility in the export value of resources and in the national income share of government and thus very high volatility of growth in GDP per capita. This is particularly true for many of the resource-rich economies, especially if they are land-locked and have poorly developed financial markets. Table 2 indicates that there is considerable variety in these summary statistics for individual African countries.
- Figure 7 informs us that the countries that enjoy the largest mineral and energy rents typically have negative genuine saving rates. This implies that countries rich in natural resources save less than their natural resource rents. Effectively, the erosion of their natural resource wealth exceeds their accumulation of other assets. This is a feature of many resource-rich African economies.

In the remainder of this paper we try to shed some light on these stylised facts. We believe that this offers important insights into the predicament of many African economies and on how some prospects for improvement may be gained.

### **III. DUTCH DISEASE AND THE NATURAL RESOURCE CURSE**

Here we present various arguments why a natural resource bonanza may harm the economy. The central point of these arguments is that windfall revenues from natural resources induce an appreciation of the real exchange rate and a decline of traded, non-resource sectors. Effectively, prospects of diversifying away from primary commodity exports and developing a labour-intensive manufacturing bases are ruined. As a result, the engines of growth will falter. Any hope for a big push to develop much of resource-rich Africa is likely to evaporate. What is needed is temporary foreign aid to many of the traded, non-resource sectors of much of resource-rich Africa. This can be in the form of temporary export subsidies or temporary exemptions from tariffs on exports to the developed economies. Section IV shows that natural resource booms increase rent seeking, corruption and conflict while section V shows that resource-rich countries suffer from very high volatility of output growth and thus poor growth prospects. These political economy factors undermine growth prospects as well and further exacerbate the prospects for development of much of Africa. Section VI summons some of the cross-country empirical evidence to back up the propositions of sections III-V.

### **III.1. Tough to diversify and boost manufacturing exports**

Substantial oil, gas or other resource revenues can lead to appreciation of the real exchange rate and de-industrialisation. This phenomenon of worsening competitiveness of the non-resource sector is very familiar from the United Kingdom in the eighties and the Netherlands in the seventies. The extra wealth generated by the sale of natural resources induces a demand for the local currency and thus an appreciation of the real exchange rate. The corresponding contraction of the traded sector and boom of the non-traded sector is known as the Dutch Disease. If African economies have substantial aid inflows as well as revenues from oil, gas and other commodity exports, the Dutch Disease effects will be amplified. In as far as the extra money is spent domestically; this pushes up the price of local goods and services. This sucks in labour, capital and other factors of production into non-traded goods and services, since it is more attractive to be employed in the non-traded than in the traded, non-resource sectors. This goes on until wages and returns to capital in the traded, non-resource and non-traded sectors are brought in line again. As a result, the traded, non-resource sectors suffer a decline unless there is an abundance of unused labour and capital which can be put to good use. Manufacturing exports thus become more uncompetitive and decline even further. Effectively, the extra spending power from natural resource revenues and foreign aid boosts spending on both locally produced and foreign produced goods and services. This is met by an expansion of the non-traded local economy and an expansion of imports.

Since the export structure of many African economies is not very diversified and relies extensively on commodity exports, there will not be much chance of achieving the goal of boosting labour-intensive manufacturing exports in countries flush with natural resource revenues. Many African countries suffer from trade barriers and cannot hope to compete with upcoming giants like China and India. Unless they get preferential trade agreements for labour-intensive manufacturing products, they will be doomed to rely on commodity exports for decades to come (see section IX).

In the longer run both capital and labour can shift from the traded, non-resource to the non-traded sectors. In an open economy Heckscher-Ohlin framework with competitive labour, capital and product markets, no resource use in production and constant returns to scale in the production of traded and non-traded goods, a natural resource discovery induces a rise in the wage-rental ratio if the non-traded sector is more (less) labour-intensive than the traded sector. In any case, there is a rise in the relative price of non-traded goods (an appreciation of the real exchange rate) and contraction of the traded, non-resource sector and a boom of the non-traded sector. Labour and capital shift from the traded, non-resource to the non-traded sectors.

Of course, the curse of natural resources can be avoided if the country invests their resource revenues abroad rather than spending it at home and lives in the future of the returns on their foreign investment. This would avoid an increase in the relative price non-traded products, i.e., an appreciation of the real exchange rate, and also avoid the devastating prospects for manufacturing exports. Only very rich resource-rich countries can afford such a 'rentier' strategy. Most African economies have large populations and are too poor to invest all their natural resource revenues abroad. They must face the challenge of diversifying their economies and building up a non-resource export base. This requires African economies to spend and invest their natural resource revenues in their own economies.

The traditional story of the Dutch Disease assumes that oil, gas, diamonds and other natural resources come without any effort out of the ground. In practice, countries invest labour and capital in exploration of natural resources. Not all of this will come from abroad. At least, exploration companies need to employ local labour. Apart from the hitherto discussed *spending* effects of a natural resource boom, there are thus also *resource movement* effects (Corden and Neary, 1982). De-industrialisation then occurs in the familiar way, namely via the usual appreciation of the real exchange rate (the *spending* effect). However, now labour is also drawn out of both the non-traded and traded, non-resource sectors towards the resource sector (the *resource movement* effect). If the exploration companies mainly employ local labour, the Rybczynski theorem implies that the movement of labour out of the non-resource towards the resource sectors causes output of the capital-intensive non-resource sector to expand. If the traded manufacturing sector is indeed relatively capital-intensive, this gives the possibility of *pro-industrialisation* provided the de-industrialisation effects arising from appreciation of the real exchange rate are not too large.<sup>4</sup> Although this offers a glimmer of hope, the manufacturing base of many African economies is very small and thus not much should be expected from this effect.

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<sup>4</sup> In the less likely case that the non-traded, non-resource sectors are more capital intensive than the traded, non-resource sectors, the real exchange rate will depreciate if labour is needed to secure the windfall natural resource revenues. The non-traded, capital-intensive sector expands and the traded sector contracts. This increase in the relative supply of non-traded goods fuels the depreciation of the real exchange rate. A real exchange depreciation may also result from a boost to natural resource exports if the traded sector is relatively capital intensive and domestic capital is needed for the exploitation of natural resources (Neary and Purvis, 1982). Since less capital is available for the traded non-resource sector, less labour is used and thus more labour is available for the non-traded sector. This may lead to a depreciation of the real exchange rate. This also happens if the income distribution is shifted towards consumers with a lower marginal propensity to consume non-traded goods (Corden, 1984). Hence, there are a variety of reasons why a natural resource boom may be associated with depreciation rather than appreciation of the real exchange rate. These seem not very relevant from an analytical or empirical point of view for most resource-rich African economies.

### III.2. Faltering Engines of Growth and the Dutch Disease

As *The Economist* argued more than two decades ago, it is a bit ungrateful to call a natural resource bonanza a ‘disease’. After all, a country which discovers and exploits new reserves of oil, gas, gold, diamonds, or other minerals will be wealthier for it and thus social welfare should increase. Normally speaking, the decline of the traded, non-resource sectors is the appropriate market response to an increase in natural resource revenues and in itself does not justify government intervention. The interesting question is therefore why a natural resource bonanza should be viewed as a problem, since it is optimal for countries to specialise in whatever is their comparative advantage. If African countries have an abundance of natural resources and are relatively better at exploring and exporting those than manufacturing goods themselves than other countries, what is the problem?

The problem is that many African economies are very poorly diversified and specialise mostly in agriculture and other primary commodities and in non-traded goods and services. They are, typically, not very good in exporting manufactured goods and services to the developed world. In fact, China and India are beating much of Africa in the conquest of the markets of developed economies. This is a pity, since Africa has abundant and relatively cheap labour and should also try to develop a labour-intensive manufacturing base. This will make their economies less dependent on the whims of weather and global commodity markets and thus less volatile. This should boost growth and social welfare (see section V). A related point is that only manufacturing offers scope for learning by doing, ongoing technical progress and sustained growth in living standards. Clearly, the traded, non-resource production sectors (mainly labour-intensive manufacturing) benefit much more from learning by doing and other positive externalities than the non-traded sectors. In that case, the exploitation and generation of substantial natural resource revenues justifies government intervention.

A major concern is that export sectors like manufacturing are hit by the worsening of competitiveness, but unable to recover when natural resources run out. This is particularly adamant when learning by doing implies that future productivity of the traded sectors increases with current production of traded goods (van Wijnbergen, 1984) or when productivity depends on cumulative experience (Krugman, 1987). By going into decline, India and China roar ahead while much of Africa forsakes the possibility of learning by doing and technical progress and developing their manufacturing base. An appropriate policy response is then to have a temporary subsidy or tax relief for the traded manufacturing sector to compensate for the loss in learning by doing. Of course, one must be careful with this

policy recommendation, since business will fiercely resist the dismantling of subsidies when resource revenues dry up. An alternative policy response is to grant the African resource-rich economies temporary tariff reductions and better access to the markets of the developed economies. Effectively, this means that those African economies would get a privileged trade position compared to countries like China and India. Of course, with the gradual dismantling of tariff throughout the world economy, it would only be a temporary relief. In any case, it may be just what African countries flush with natural resources need to develop and sustain a labour-intensive manufacturing base and to diversify their exports.

This argument in favour of temporary help to the non-resource export sectors of resource-rich African economies relies on learning by doing, but applies more widely. Without it growth prospects for those economies will be very poor indeed. For example, if manufacturing in contrast to agriculture enjoys learning by doing and demand for agricultural goods is relatively income-inelastic, a shift away from manufacturing towards agriculture will lower the rate of economic growth (Matsuyuma, 1992). Similarly, if human capital spill-over effects in production are generated primarily by employment in the traded sector and induce endogenous growth in both the traded and the non-traded sectors, export of natural resources lowers employment in the traded sector, hampers learning by doing and thus lowers the rate of economic growth as well (Sachs and Warner, 1995). These are all variants of the same idea: the appreciation of the real exchange rate and decline of the traded, non-resource sectors permanently lower income per capita even in the unlikely case that the rate of economic growth picks up after resource revenues dry up. We end with a dynamic variant of the story.

To illustrate how a natural resource boom might affect the *relative* productivity growth of the traded, non-resource and non-traded sectors, the adverse effects of the Dutch Disease on economic growth have been illustrated within the context of a dynamic dependent economy (Torvik, 2001). Both traded, non-resource and non-traded sectors contribute to learning. A foreign exchange windfall arising from the export of natural resources leads in this context to an appreciation of the real exchange rate in the short run, but a real depreciation in the long run. To illustrate how this works, allow the growth rate in productivity of each sector to increase with the number of people employed in that sector and suppose that these learning by doing effects are more substantial in the traded than in the non-traded sector. Suppose also that the elasticity of substitution between traded and non-traded goods in consumption is less than unity. It is then easy to demonstrate that an increase in natural resource exports leads initially to real appreciation and expansion of the non-traded sector. Over time the relative productivity of the traded relative to that of the non-traded

sector declines gradually. This induces gradual depreciations of the real exchange rate and falls in labour use in the non-traded sector. In the end this completely chokes off the initial expansion of the non-traded sector and eliminates the boom of the non-traded sector through gradual depreciation of the real exchange rate. The new steady-state level of production has also moved in favour of the non-traded sector, not due to reallocation of labour but due to the relative fall in the productivity of the traded sector.

### **III.3. Natural Resources, Staple Traps and Need for a Big Push**

Many resource-rich countries in Africa have a predatory state, little international trade, few incentives for the development of capital, weak linkages between the natural resource and other sectors of the economy, and lack of economic diversification into competitive manufacturing industries. It is therefore not surprising that such countries often follow a staple-trap path with growing income inequality and slow accumulation of social capital (Auty, 2001, 2004). However, historical accounts indicate that natural resource booms do not always worsen economic performance. If one distinguishes between an industrialised Europe, the ‘new economies’ (Australia, Canada and the US) and tropical subsistence agricultural economies without manufacturing, a natural resource boom can indeed lead to growth expansion (Findlay and Lundahl, 1994). After all, globalisation has led to rapid growth of countries like China and India and thus boosted the global demand and price of primary commodities produced both in the tropics and the ‘new economies’. This has raised the rental rate on land used in primary goods production, boosted the demand for labour in mineral-rich African countries and shifted factors away from subsistence-farming to mining. As a consequence, manufacturing also expands in Europe and the ‘new economies’ driven by the fall in the world interest rate. The real wage rises also in these African countries (with point-source resources, typically, captured by the landlords), which finances additional land clearance and allows the resource sector to expand. The ‘new economies’ profit from the backward and forward linkages to manufacturing, that is they benefit from competitive industrialisation. They also enjoy growing per capita incomes. The danger is that much of Africa never industrialises and stagnates into a staple trap, especially in point-source economies. Latin America has many point-source economies while East Asia has more diffuse economies, which may explain why the former have less impressive growth records (Sachs, 1999). The same argument helps to explain the poor growth prospects of African countries with point-source natural resources.

The key point is that the natural resource curse can be avoided with the right institutions and policies. Many African economies need a big demand push to generate

enough demand complementarities to expand the size of their markets and recover the fixed costs of industrialisation, and thus to get much of the poorest African countries out of low-income traps. In that case, natural resources are productively used to make the transformation from an economy relying almost entirely on exports of primary commodities to economies with a substantial labour-intensive manufacturing base. A natural resource boom can under the right circumstances be an important catalyst of growth, development and the transition from cottage industry to factory production only provided that learning by doing and increasing returns to scale are stronger in non-traded than traded sectors (Sachs and Warner, 1999). Unfortunately, in many African countries natural resource booms have done little to set in motion a dynamic growth process. A lot of that has to do with not implementing the right growth-promoting policies and, of course, with the traded, non-resource sectors being if anything relatively capital intensive. This suggests that it is extra tough to make the big push towards diversification and developing manufacturing in the resource-rich parts of Africa.

#### **IV. INSTITUTIONS AND THE NATURAL RESOURCE CURSE**

Here we offer arguments why booms in natural resource revenues often lead to rapacious rent seeking, corruption and armed conflict and thereby undermine growth prospects, albeit that these adverse effects can be avoided to an extent if the quality of institutions is good and the political system is blessed with effective checks and balances. In section VI.1 we provide cross-country empirical evidence for the proposition that the natural resource curse is less severe and may even be turned into a blessing for countries open to international trade and with a high quality of institutions. Since institutions are not necessarily cast in stone and can be improved in the course of a couple of decades (IMF, 2005), there is a challenge for resource-rich Africa to improve their institutions and soften the blows of the resource curse.

##### **IV.1. Natural Resource Bonanzas Invite Rapacious Rent Seeking**

The political economy of massive natural resource rents can be horrendous especially when combined with badly defined property rights, imperfect markets and poorly functioning legal systems. Such situations provide ideal opportunities for rent seeking behaviour of enterprises, politicians and their friends, thereby diverting resources away from more productive economic activities (Auty, 2001, 2004). Self-reinforcing effects arise if rent seekers compete and prey on productive entrepreneurs and can explain wide cross-country differences in rent seeking (Murphy, et al, 1993; Acemoglu, 1995). The idea is that each country has a limited

pool of talented people, who can either engage in productive entrepreneurship or in wasteful rent seeking. A larger number of rent seekers in resource-rich economies lower returns to not only rent seeking, but also to entrepreneurship with possibly large marginal effects on production. Since more entrepreneurs are likely to switch to rent seeking in times of a natural resource boom, there is a possibility of multiple (good and bad) equilibrium outcomes. More rent seekers induce negative external effects that depress profits for remaining entrepreneurs, which stimulate even more people to shift from productive entrepreneurship to wasteful rent seeking. It is also possible that increased entrepreneurship crowds out rent seeking. In particular, private business can invent and supply new substitutes for restricted imports and thus destroy the rents of quota licenses (Baland and Francois, 2000).

The so-called voracity effect also causes a drag on economic growth in fractionalised societies as can be seen after the oil windfalls in Nigeria, Venezuela and Mexico (Tornell and Lane, 1999). This effect implies that dysfunctional institutions and poor definition of property rights lead to a classical commons problem whereby there is too much grabbing and rapacious rent seeking of natural resource revenues. It supposes, in contrast, a fixed number of rent seekers. Capital can be allocated either to a formal sector where rents may be appropriated and an informal sector with lower returns and no appropriation or rent seeking. Competing groups in society can thus invest in private assets with relatively low returns or grab as much as they can from the stock of common natural resources. In a natural resource boom returns to capital investment in the formal sector rise, so that rent seekers can appropriate proportionately more without destroying the incentive to invest in the formal sector. This is the case if there is the possibility of sectoral reallocation or, alternatively, if the elasticity of intertemporal substitution is sufficiently high so that groups do not refrain from excessively increasing appropriation of natural resource revenues. Rapacious rent seeking then lowers the amount of capital left for investment in the formal sector and harms growth prospects. In effect, the increased profitability of investment is more than undermined by each group of rent seekers grabbing a greater share of national wealth by demanding more transfers. As the number of rent-seeking groups in society increases, the voracity effect becomes bigger and the growth rate declines. The surprising point is that higher natural resource wealth can make a country worse off, since the squabbling over the resource rents by rival fractions leads to excessive depletion of resources and depresses growth. This is also an important reason for the erosion of natural resource wealth and the negative genuine saving rates in much of Africa (see section VII).

## **IV.2. Natural Resource Wealth Induces Corruption**

There is much anecdotal evidence that suggests that corruption is rampant in resource-rich societies and that it is harmful for economic incentives. In fact, cross-country empirical evidence also establishes that increased corruption hampers economic growth (Mauro, 1995; Bardhan, 1997; Leite and Weidmann, 1999). Mineral wealth may prevent the redistribution of political power towards the middle classes and thus hamper the adoption of growth-promoting policies (Bourguignon and Verdier, 2000). The main thrust of these explanations is that natural resource wealth has an adverse effect on institutions, since excessive natural resource revenues allow governments to pacify dissent, avoid accountability and resist modernisation (Isham, et al., 2003). For example, waste, corruption and the granting of import licenses and other privileges to cronies rather than Dutch Disease effects operating through the real exchange rate seem to be why oil riches have had such disastrous effects on long-run performance of the Nigerian economy (Sala-i-Martin and Subramanian, 2003). Resource wealth makes it easier for dictators to buy off political challengers as President Mobuto has been able to do in Congo with its wealth on copper, diamonds, zinc, gold, silver and oil (Acemoglu, Robinson and Verdier, 2004). Natural resource riches allow politicians to bribe voters by offering them well paid, but unproductive jobs and inefficient subsidies and tax handouts (Robinson, Torvik, and Verdier, 2006). Those profiting from the natural resource sector may bribe politicians to provide specific semi-public goods at the expense of support to manufacturing, which lowers welfare if manufacturing enjoys returns to scale (Damania and Bulte, 2003). Natural resources also make it attractive for political elites to block technological and institutional improvements if that would weaken their power (Acemoglu and Robinson, 2005).

A resource bonanza encourages productive entrepreneurs to shift to rent seeking. When aggregate demand externalities are important, a natural resource bonanza can easily lower income by more than the extra income from the resource revenues and thus depress social welfare (Torvik, 2002). It is important to distinguish between countries with production-friendly institutions and others with institutions that tolerate rent grabbing (Mehlum, Moene and Torvik, 2006). Suppose that there is a fixed supply of people that have the talent to direct their activities at either rent seeking or productive entrepreneurship. Rent seeking and productive activities are thus competing activities. If there are more productive entrepreneurs, demand in the economy and profits of each entrepreneur increase. This supposes demand complementarities in production. In contrast, if more of the talented people are rent seekers (political insiders, bureaucrats, oligarchs, war lords, etc.), the gain per rent seeker declines. One can then distinguish two outcomes following a natural resource bonanza.

If institutions are strong and encourage productive entrepreneurship, profits of entrepreneurs increase. This means that eventually less people engage in rent seeking and more in productive activities. The rent of the resource bonanza is more than dissipated. Examples of resource rich countries with strong institutions are Australia, Canada, the US, New Zealand, Iceland and Norway, but also Botswana (Acemoglu, Johnson and Robinson, 2003a).

However, if institutions are weak, the legal system dysfunctions and transparency is low, rent seeking has a higher return and unfair take-overs, shady dealings, corruption, crime, etc. pay off. A resource bonanza thus elicits more rent seekers and reduces the number of productive entrepreneurs. In the long run profits fall and as a result the economy is worse off. Weak institutions may explain the poor performance of oil rich countries such as Angola, Nigeria and Sudan, diamond rich Sierra Leone, Liberia and Congo, and drug states like Columbia or Afghanistan. In those countries institutions are often destroyed by civil wars over the control of natural resources. Dependency on oil and other natural resources hinders democracy and the quality of governance (e.g., Ross, 1999). Also, timber booms have induced members of political elites to dissolve forestry management in South-East Asia (Ross, 2001).

Summing up, among the group of resource-rich African economies there are a few countries with strong institutions that enjoy higher growth but unfortunately many others with weak institutions that suffer from low growth resulting from corruption induced by substantial natural resource revenues.

### **IV.3. Natural Resource Bounties and Armed Conflict**

The presence of (especially point-source) natural resource rents may undermine the quality of institutions itself and induce armed and other forms of conflict. Unfortunately, this is or has been the reality of too many African states with abundant natural resources. Under democracy politicians are less able to appropriate resource rents for their own ends, but violent competition with other political fractions is costly as armies need to be paid and property may be destroyed. This suggests that higher natural resource rents biases the political choice away from democracy towards violent conflict especially if politicians are short-sighted; in contrast, higher income due to higher productivity in the economy makes democracy more likely (Aslaksen and Torvik, 2005). No one doubts that a boost to natural resource rents puts democratic institutions to a survival test. Of course, African states not blessed with proper democratic institutions find it tougher to implement reform towards more democracy.

There is a growing body of empirical evidence that rents on natural resources and primary commodities, especially oil and other point-source natural resources, increase

chances of civil conflicts and wars in Sub-Saharan Africa through weakening of the state or financing of rebels, sometimes even by multinational corporations. It is important to investigate whether civil strife and wars are the result of *grievance*, a sense of injustice about how a social group is treated (e.g., systematic economic discrimination), or *greed* possibly induced by massive rents of point-source resources as in Angola, Congo and Sierra Leone (Murshed, 2002; Olsson and Fors, 2004). The extent of primary commodity exports is the largest single influence on the risk of conflict and the effect is nonlinear (Collier and Hoeffler, 2004). For instance, a country with no natural resources has a probability of civil conflict of merely 0.5 percent, but a country with a share of natural resources in GDP of a quarter has a probability of 23 percent. Unfortunately, this suggests that many conflicts are driven by greed rather than grievance.<sup>5</sup> The empirical evidence also strongly suggests that conflict is more likely to erupt in countries with a low level of GDP per capita and low rate of economic growth. All three factors determining the onset of armed conflict – natural resources, low income per capita and low growth – are prevalent in large parts of the African continent. Collier (2007) argues that post-conflict countries are especially prone to eruption of conflict, but also more likely to make necessary economic reforms. It may therefore help if international troupes are stationed in post-conflict countries to preserve the peace for about a decade. The new government can then concentrate on reform, reduce spending on the military, and invest in education and badly needed (transport) infrastructure. Unfortunately, this is not high on the agenda of much of the developed world as ministers of development typically do not have enough clout to convince their defence colleagues to direct attention at military aid to give reform a chance and lift some of the poorest, post-conflict countries in Africa out of their poverty trap. In this context, it is important to note that insisting on reforming towards democracies is not necessarily very helpful in countries with abundant natural resources. In fact, resource-rich democracies tend to have lower growth unless these democracies have sound and effective checks and balances (Collier and Hoeffler, 2006).

In many resource-rich countries the government seems unable to provide basic security to its citizens, since the wealth of resources elicits violence, theft and looting often financed by rebels and competing war lords (e.g., Skaperdas, 2002; Mehlum, et al, 2002). The effect of natural resources on the incidence and duration of civil wars features also strongly in the political science literature (e.g., Ross, 2004; Fearon and Laitin, 2003). In fractionalised countries with many rival groups, fighting about natural resources may harm the quality of the legal system and thus undermine property rights. The resulting destruction of output

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<sup>5</sup> Effectively, natural resource wealth implies that opportunistic, rebel leaders crowd out ideological leaders and that government end up being corrupt and concerned with looting for themselves and their cronies rather than investing in public goods for the people (Weinstein, 2005).

outweighs the increase in output due to the resource boom, but not in homogenous countries. There will thus be an erosion of property rights and a natural resource curse if the number of rival fractions is large and natural resource revenues are substantial.

Fractionalisation and fighting about natural resource bounties can thus lead to over-dissipation of natural resource rents. Erosion of property rights when there are lots of natural resources can easily lead to a natural resource curse, especially if there are many rival fractions (Hodler, 2006). The idea is that each group manages to appropriate more natural resources if they fight more and the quality of the legal system is poor, but fighting also undermines effective property rights. If a country is homogenous, there is no fighting and thus no undermining of property rights. In that case, a natural resource bonanza always benefits consumption of its citizens. However, if there are rival fractions, natural resource revenues induce fighting and erosion of property rights. If the number of rivalling fractions is large enough, natural resources actually reduce private consumption and harm welfare.

There is some cross-country empirical evidence that the resource curse is more severe in countries that have many ethnic or religious fractions and many languages (Hodler, 2006). Oil increases the likelihood of conflict, especially separatist conflict. Lootable resources such as gemstones and drug tend to prolong conflict, but do not make conflict more likely to begin. There is no significant link between (legal) agricultural production and conflict.

The curse of natural resources is particularly relevant when rebel groups and rulers and their cronies fight each other about the control of especially point-source resources. For example, diamond abundance clearly depresses growth and more so in countries with weak institutions (Ollson, 2007). Although Australia and Russia are the biggest diamond producers in the world, Congo-Kinshasa, Botswana, South Africa are the next biggest diamond producers. In terms of diamond production per square kilometre Botswana is the biggest in the world. Many other countries in Africa have substantial diamond production as well. The wars of the Angolan rebel army were sustained by diamonds and similarly for the RUF rebel movement in Sierra Leone. Not surprisingly, those countries had disastrous growth performances. It is therefore good that the UN Security Council resolutions prohibited direct or indirect imports of 'conflict' diamonds.

It is possible to put forward a richer theory of coalitions formed along ethnic lines competing for resources (Caselli and Coleman II, 2006). In ethnically homogenous societies members of the losing coalition can defect to winners at low cost, which rules out conflict as an equilibrium outcome. Of course, the rent of each member of the winning coalition is diluted. In ethnically heterogeneous societies members of the winning coalitions can more easily recognize potential infiltrators by skin colour or other physical characteristics and

exclude them. We should therefore see more conflict in ethnically heterogeneous societies such as Rwanda, Sudan, Indonesia, Afghanistan, etc. and less violent conflict about resources in more homogenous societies like Belgium, Botswana and Nigeria. Religion or language is not such a good marker, since people can easily acquire such characteristics. Religious or language cleavages are thus likely to lead to conflict and a resource curse. Also, resource abundance generates power struggles and political instability, which raise the effective discount rate of the governing group (Caselli, 2006). Consequently, the elite invest less in long-run development. Initiatives like the UK Extractive Industries Development Initiative where participating governments and oil companies agree to publish detailed information on oil extracted, revenues and royalties paid to the government, may help to curb the amount of resource royalties that governments can appropriate for their own benefit (see section VIII).

## **V. VOLATILITY OF COMMODITY PRICES AND THE NATURAL RESOURCE CURSE**

Here we point out that volatile commodity prices imply volatile natural resource revenues and thus may invite less prudent macroeconomic and budgetary policies leading to boom-bust cycles. We then review various arguments why volatile resource prices may harm growth prospects, especially in economies with weakly developed financial systems. The empirical evidence for the negative effect of volatile streams of natural resource revenues on growth performance is discussed in section VI.2.

### **V.1. Boom-Bust Cycles in Economic Policy**

Commodity prices go through huge swings. Since many African resource-rich economies are highly dependent on natural resource revenues, this disorientates economic policy making and carries the danger that budgetary policies are less prudent than they should be. Although many African economies have reacted quite prudent to the recent current boom in commodity prices by saving a substantial part of the windfall natural resource revenues, this has not always been the case and the temptation to act in a short-sighted fashion and spend or borrow too much is always there. In fact, natural resource wealth may be used as collateral and encourage countries to engage in ‘excessive’ borrowing, which can harm the economy in the short and long run (Mansoorian, 1991). Heavy borrowing on the world market induces a depreciation of the real exchange rate in the long run. In an economy with overlapping

generations of households without a bequest motive, the generations alive at the time of the exploitation of the natural resource borrow against all future income from the resource exports. The consequence is that future generations have to bear the burden of servicing the debt. The consequent fall of aggregate demand causes a depreciation of the real exchange rate in the long run. Others have also found that resource rich countries have an incentive to borrow excessively (Manzano and Rigobon, 2001).

In general, a sudden increase in natural resource wealth reduces the critical faculties of politicians and induces a false sense of security. This encourages politicians to invest in projects that are not really necessary, keep bad policies in force, and dole out favours to political clientele which are impossible to finance once the natural resource revenues dry up. Politicians are likely to lose sight of the importance of growth-promoting policies, free trade and 'value for money' management. For example, after the discovery of natural gas in the Netherlands and the global oil price shocks during the 1970s and 1980s and the consequent sharp rise in unemployment, successive Dutch governments responded in an irresponsible way. They increased public employment and public spending, raised the level of unemployment and disability benefits, weakened eligibility conditions for benefits, raised the minimum wage, and implemented protective labour market legislation. It has taken more than twenty years to put the Dutch welfare state on a financially sustainable footing again.

There is no reason to think that African economies flush with natural resources may go for bad policies such as import substitution, prestigious (but often unnecessary) investment projects, and unsustainable budgetary policies. Others, like Venezuela at the moment, may use natural resource revenues to promote their pet ideology at the expense of the people of their countries. Another problem is that during commodity booms countries often engage in exuberant public spending as if the stream of natural resource revenues will last forever. This carries the danger of unsustainable spending programmes, which need to be reversed when global commodity prices collapse and the stream of commodity revenues dries up. A permanent income approach to the government budget, possibly allowing for habit persistence, may help to plan matters (IMF, 2007 and also section VII).

Indeed, many African countries have made the mistake of trying in vain to encourage industrialisation through prolonged import substitution using tariffs, import quota and subsidies for manufacturing. Neo-Marxist policy makers in these countries but also many other economists during the 1970s and 1980s were encouraged by the Prebisch hypothesis (i.e., the secular decline of world prices of primary exports) to attempt to avoid resource dependency through state-led industrialisation and import substitution. These policies may also have been a reaction to the appreciation of the real exchange rate and the decline of the

traded manufacturing sectors caused by natural resource wealth. The natural resource wealth in many of those countries may thus have prolonged bad policies.

Political scientists have advanced a number of reasons why states have a tendency to adopt and maintain sub-optimal policies (Ross, 1999). Cognitive theories blame policy failures on short-sightedness of state actors. They fail to take account of the adverse effects of their actions on the generations that come after the natural resource is exhausted, thus leading to myopic sloth and exuberance. These cognitive theories also highlight a get-quick-rich mentality among businessmen and a boom-and-bust psychology among policy makers. Political scientists point the finger at abuse of natural resource wealth by privileged classes, sectors, client networks and interest groups. They also emphasise the rentier state and fault a state's institutional weakness to extract and deploy resources, enforce property rights and resist the demands of interest groups and rent seekers. These insights from political science explain why governments of resource rich countries may be tempted to maintain bad policies.

Unfortunately, it is tough to provide convincing empirical evidence for the effect of policies on growth. A big problem is that cross-country regressions explaining growth performance in terms of economic policies are difficult to interpret (Rodrick, 2005). For the sake of argument, let the rate of economic growth be proportional to the distorted return on capital *minus* the costs of conducting policy *minus* the rate of time preference. Growth thus increases with productivity and the ability of the government, but decreases with the size of the distortion. Growth also depends on policy. One can only determine the effect of policies on growth if one has suitable controls for cross-country variations in productivity, ability of the government and the size of the distortion. In practice, these are very difficult to find. Furthermore, policy is also used for rent seeking. The marginal effect of policy on rent must then equal the marginal decline in growth. Policy thus increases with the size of the distortion, ability of the government, productivity and the corruptness of the government. We should thus observe negative correlations between growth and policy resulting from cross-country variations in corruptness or the size of the distortion. Only if governments are very corrupt and able, should we observe positive correlations resulting from variations in ability of the government or productivity. Even if there is no rent seeking, the estimated coefficient of policy on growth will be zero if the government maximises growth. In general, it is thus tough to deduce anything from estimated cross-country effects of policy on growth unless the determinants of policy are modelled and controlled for. Recent work on explaining growth performance using cross-country regressions concludes that monetary, fiscal and trade policies only explain cross-country variations in growth rates and income per capita because they are proxies for the quality of institutions (Acemoglu et al, 2003b; Easterly, 2005). In

other words, macroeconomic policies do not have a significant effect on economic development after controlling for the effect of institutions. We should bear this in mind when discussing cross-country results in section VI.

## **V.2. Depressing Growth Prospects and Financial Development**

It is worrisome that the main determinants of economic growth highlighted in the empirical literature – institutions, geography and culture – show far more persistence than the growth rates they are supposed to explain (Easterly, et al, 1993). Growth rates in income per capita are much more volatile than these explanatory variables. One possible candidate to explain the volatility of output growth is commodity prices. What natural resource lack in trend, they more than make up for in volatility (Deaton, 1999). A recent detailed examination of the growth performance of 35 countries during the historical period 1870-1939 led to the following conclusion (Blattman, Hwang and Williamson, 2007). Countries that specialise in commodities with substantial price volatility have more volatility in their terms of trade and thus enjoy less foreign direct investment and experience lower growth rates than countries which specialise in commodities with more stable prices or countries that are industrial leaders. These results are robust to controlling for initial income per capita, lagged population growth and the fraction of the population with primary schooling. Countries in the periphery with volatile commodity prices and fairly undiversified economies fall behind in their economic development. Another recent study uses data for 83 countries over the period 1960-2000 and also finds robust evidence for a strong and negative link between real exchange rate volatility and growth performance even after correcting for initial output per worker, enrolment in secondary education, trade openness, government consumption, inflation and banking or currency crises (Aghion, et al, 2006). Furthermore, the adverse effect of volatility on growth is weaker for countries with well developed financial systems.

The pioneering work of Ramey and Ramey (1995) takes a rather different tack. It investigates the link between volatility of unanticipated output growth (rather than volatility of the terms of trade) and growth performance. It uses the Heston-Summers data to provide cross-country evidence for a negative link between volatility and mean growth rates even after correcting for the effects of the initial level income per capita, population growth, human capital and physical capital on the rate of economic growth. Somewhat surprisingly, they find evidence for this negative link regardless of whether one includes the share of investment in national income in the relationship or not. They also estimate the relationship between volatility and growth in a panel model that controls for both time and country fixed effects.

They do this by isolating a measure of government spending volatility that is correlated with the volatility of output across both time and countries. The negative link between volatility and growth seems robust to a large set of conceivable controls that vary with time period or country. Yet another study provides evidence for a cross-section of 91 countries that policy variability in inflation and government spending exerts a strong and negative impact on growth (Fatás and Mihov, 2005). An increase in the volatility of fiscal policy corresponding to one standard deviation in the sample reduces long-term economic growth by about 0.75 percentage points.

It is possible to probe deeper into the reasons why poor countries are so much more volatile than rich countries (Koren and Tenreyro, 2007). A sophisticated statistical decomposition analysis yields four possible reasons: poor countries specialise in more volatile sectors; poor countries specialise in fewer sectors; poor countries experience more frequent and more severe aggregate shocks (e.g., from macroeconomic policy); and macroeconomic fluctuations in poor countries are more highly correlated with the shocks of the sectors they specialise in. As countries develop, their productive structure shifts from more to less volatile sectors. Also, the degree of specialisation declines in early stages of development and increases a little in later stages of development. Furthermore, the volatility of country-specific macroeconomic shocks falls with development.

Crucial and strongly related sources of macroeconomic volatility and thus of poor growth performance are lack of a sophisticated financial system, natural resource abundance, and whether a country is landlocked or not. Indeed, economies with a large share of natural resources in national income are typically not very diversified and very vulnerable to highly volatile world commodity prices. Natural resource revenues tend to be very volatile (much more so than GDP), because the supply of natural resources exhibits low price elasticities of supply. Furthermore, the African economies are most vulnerable to volatility of commodity prices. Dutch Disease effects may also induce real exchange rate volatility and thus a fall in investment in physical capital and learning, and further contraction of the traded, non-resource sectors and lower productivity growth (Herbertsson, et al., 2000). Volatile resource revenues are disliked by risk-averse households. Some argue that the welfare losses induced by consumption risk are tiny compared with those from imperfect financial markets, but a recent dynamic stochastic general equilibrium study of Zimbabwe suggests that the observed volatility depresses capital formation and output by about forty percent (Elbers, et al, 2007).

Why does volatility of natural resource revenues/exports and/or commodity prices depress growth? One possibility is that larger natural resource revenues make it easier to overcome negative liquidity shocks, but also that more volatile commodity prices harm

innovation and growth (cf., Aghion, et al, 2006). Figure 3 gives the cumulative density functions of standard deviations of various commodity prices on the world market during the period 1970-2003. They are concave, so more resource price volatility indeed hampers innovation and growth. Given the very high volatility in primary commodity prices and thus resource revenues and the poorly developed financial systems of many resource rich countries, it does not seem *a priori* surprising that many resource rich countries have such a poor growth performance.

With complete financial markets, long-term investment is counter-cyclical and mitigates volatility. However, if firms face tight credit constraints, investment is pro-cyclical and amplifies volatility (Aghion, et al, 2005). Well developed financial systems can thus soften impact of volatility. Of course, there are many other reasons why volatility may depress economic growth. Learning by doing and human capital accumulation is increasing and concave in the cyclical component of production (Martin and Rogers, 2000). In that case, long-run growth should be negative related to the amplitude of the business cycle. With irreversible investment, increased volatility holds back investment and may thus depress growth (Pindyck, 1991; Aizenman and Marion, 1991). The costs of volatility derive from firms making uncertainty-induced planning errors. These costs arise when it is costly to switch factors of production between sectors (Dixit and Rob, 1994). This may be relevant for many resource-rich economies in Africa having to switch factors of production from the traded, non-resource to the non-traded and resource sectors. However, if firms choose to use technologies with a higher variance and a higher expected return or if higher volatility induces more precautionary saving and thus more investment, there may be a positive link between volatility and growth. If the activity that generates productivity growth is a substitute to production, the opportunity cost of productivity enhancing activities is lower in recessions and thus volatility may boost growth (Aghion and Saint Paul, 1998). Ultimately, the question of whether anticipated or unanticipated volatility harms or boosts growth is an empirical issue.

In economies with financial market imperfections where only debt contracts are available and bankruptcy is costly, the economy and the real exchange rate become much more volatile if there is specialisation in traded goods and services and the non-resource traded sector is small (Hausmann and Ribogon, 2002). The reason is that shocks to the demand for non-traded goods and services – associated with shocks to resource income – are not accommodated by movements in the allocation of labour but by expenditure switching. This demands much higher relative price movements. Due to bankruptcy costs, interest rates increase with relative price volatility. This causes the economy to specialise away from non-resource traded goods and services, which is inefficient. The less it produces of these goods

and services, the more volatile the economy becomes and the higher the interest rate has to be. This causes the sector to shrink further until it vanishes.

It is well known that volatility is bad for growth, investment, income distribution, poverty and educational attainment (e.g., Ramey and Ramey, 1995; Aizenman and Marion, 1999; Flug et al, 1999). To get round such natural resource curses, the government could resort to stabilisation and saving policies and improve the efficiency of financial markets. It also helps to have a fully diversified economy, since then shocks to non-traded demand can be accommodated through changes in the structure of production rather than expenditure switching. This is especially important for inefficiently specialised countries such as Nigeria and Venezuela, but less so for diversified countries like Mexico or Indonesia or naturally specialised countries such as some Gulf States. Unfortunately, many resource rich economies are often specialised in production and thus tend to be more volatile.

## **VI. CROSS-COUNTRY EVIDENCE FOR THE NATURAL RESOURCE CURSE**

Although there are resource rich countries that benefit from their natural wealth, the economies of many other resource-rich countries are in a terrible state. Natural resource wealth may harm economic performance and make citizens worse off. There are well-known examples of countries whose abundance of natural resources have gone together with bad macroeconomic performance and growing inequality among its citizens, but also of other countries which have benefited from their natural resource wealth. A dramatic example is Nigeria (Sala-i-Martin and Subramanian, 2003). Nigeria has since 1965 been a major oil exporter and oil revenues per capita have increased tenfold in the next 35 years, but income per capita has stagnated since independence in 1960 making Nigeria among the 15 poorest countries in the world. During this period the poverty headcount ratios have almost tripled while the rich have grabbed a much larger part of income. Huge oil exports have not benefited the average Nigerian. Despite rapid accumulation of physical capital, Nigeria has suffered a declining TFP and capacity utilisation of manufacturing hovers around a third. Two thirds of capacity often owned by the government goes to waste. Successive military dictatorships have plundered oil wealth and many suspect transfers of large amounts of undisclosed wealth. Oil wealth has fundamentally altered politics and governance in Nigeria. Other oil exporters such as Iran, Venezuela, Libya, Iraq and Kuwait and Qatar experienced negative growth during the last few decades. The OPEC as a whole saw a decline in GNP per capita. The gold price

boom in the 1970's together with increased barriers to technological adoption helps to explain the de-industrialisation and disappointing growth experience of South Africa.

In contrast, Botswana has managed to beat the resource curse. Forty percent of Botswana's GDP stems from diamonds. It has the second highest public expenditure on education as a fraction of GDP, enjoys the world's highest growth rate since 1965. Its GDP per capita is ten times that of Nigeria. The Botswana experience is noteworthy, since it started its post-colonial experience with minimal investment and substantial inequality.

The United Arab Emirates also seem to have turned the resource curse into a blessing. The U.A.E. account for close to 10 percent of the world's crude oil and 4 percent of the world's natural gas reserves. The U.A.E.'s government debt is very small, inflation is low and hydrocarbon wealth has been used to modernise infrastructure, create jobs and establish a generous welfare system. Major strides in life expectancy and literacy have been made through universal and free access to education and health care. In anticipation of the depletion of its natural reserves, oil-rich Abu Dhabi has emphasised petrochemical and fertilisers, Dubai has diversified into light manufacturing, telecommunications, finance and tourism, and the other emirates have focused at small-scale manufacturing, agriculture, quarrying, cement and shipping services. By diversifying the U.A.E. is investing in sustainable growth.

It is important to move on to more systematic evidence on whether the natural resource curse is inevitable or not. We will therefore discuss the cross-country evidence for the natural resource curse. We first consider the evidence for the proposition that natural resource abundance has a negative effect on growth performance, but less so if the quality of institutions is high or the economy is relatively open to international trade. We then allow for the quintessential feature of natural resources: the very high volatility of its stream of revenues. The empirical evidence suggests that the natural resources and their volatility are key determinants of unanticipated output growth and that unanticipated output growth has a substantial negative effect on growth performance, especially in countries with poorly functioning financial markets.

### **V.1. Curse is Less Severe in Open Economies with Good Institutions**

The pioneering study on the empirical cross-country evidence shows that resource rich countries grow on average about one percentage point less during 1970-89 even after controlling for initial income per capita, investments during the period, openness and rule of law (Sachs and Warner, 1995). The revised cross-country regressions explaining the average growth in real GDP per capita during 1970-1990 are reported in the first column of results of Table 3. There is evidence of conditional convergence, since countries with a low (logarithm

of the) level of initial GDP per active member of the population catch up and grow relatively fast. Countries that invest a lot grow faster. Countries with a large number of years in which their economy is rated as open and whose citizens accept the rule of law more easily (on a scale from 1 to 6) also grow faster. Interestingly, even once account is taken of these traditional factors influencing growth, there is a strong negative effect of resource abundance (as measured by the share of exports of primary products in GNP in 1970) on the rate of economic growth. This is what has become known as the natural resource curse.

This pioneering study did not find any role for quality of institutions in explaining growth. The second regression reported in Table 3 uses a dataset with more countries, a longer data period starting with 1965 rather than 1970 and an index of institutional quality (on a scale from 0 to 1). This regression confirms that resource rich economies experience slower growth and that institutional quality is not significant at the 5 percent level.

However, the resource curse is not always inevitable. The third regression reported in Table 3 indicates that for countries with a high enough index of institutional quality (i.e., greater than  $14.34/15.4=0.93$ ) the natural resource curse is turned into a blessing (cf., Mehlum, Moene and Torvik, 2006). This holds only for 15 out of the 87 countries (among which the US, Canada, Norway, the Netherlands, New Zealand and Australia) in the sample. In fact, there are five countries that belong both to the top eight according to natural resource wealth and to the top 15 according to per capita income. Resource-rich countries with bad institutions typically are poor and remain poor. Many of them are in Africa. Other cross-country evidence strongly suggests that natural resources – oil and minerals in particular – exert a negative and nonlinear impact on growth via their deleterious impact on institutional quality rather than via a worsening of competitiveness (Sala-i-Martin and Subramanian, 2003). The adverse effect of resource abundance on institutional quality and economic growth is especially strong for easily appropriable ‘point-source’ natural resources with concentrated production and revenues and thus massive rents, i.e., oil, diamonds, minerals and plantation crops rather than agriculture (e.g., rice, wheat and animals) whose rents are more dispersed throughout the economy, and with easy appropriation of rents through state institutions.

What matters is thus the appropriability of resources, which is how easy it is to realise large economic gains within a relatively short period and having control over the resources. It is important to distinguish two distinct hypotheses (Boschini, et al, 2003). First, the *institutional* appropriability thesis states that natural resource abundance is only negative for economic development in countries with poor institutions. Second, the *technical* appropriability thesis states that the impact of institutional quality and abundant natural resources is more pronounced the more technically appropriable the country’s natural

resources are. Table 4 calculates the marginal effects of one standard deviation change in various measures of natural resource abundance that are increasingly technically appropriable on the average yearly growth rate of GDP between 1975 and 1988 for different types of institutional quality. These calculations are based on cross-country regressions with a sample of 80 industrialised and developed countries. The regressions control for trade openness, the average share of investment in GDP and initial level of income per capita. Going from top to bottom in Table 4, we see that better institutions are conducive to growth and thus that the *institutional* appropriability hypothesis is confirmed. Reading Table 4 left to right, the importance of good institutions increases in the technical appropriability of resources which confirms the *technical* appropriability hypothesis. The resource curse is thus not inevitable. Sierra Leone is hurt by diamonds, but Botswana is not.

Recent cross-country evidence establishes a significant negative impact of natural resources on income per capita even after controlling for institutional quality, trade openness and geography and also for an interaction term with institutional quality and trade openness (Arezki and van der Ploeg, 2007). The natural resource is thus particularly severe in countries with bad institutions and low degrees of trade openness. Adopting policies towards more trade openness and improving institutional quality may thus turn the resource curse into a blessing. Natural resources do not always harm growth performance.

The main lesson from cross-country evidence is that the natural resource curse is not cast in stone. Countries with high-quality institutions, well-developed financial systems and open to international trade suffer much less from the curse and may even escape it.

## **VI.2. Volatility is the Quintessential Feature of the Natural Resource Curse**

Many changes in resource wealth are triggered by sudden increases or decreases in commodity prices or discoveries of new reserves. This can easily lead to boom and bust cycles. The main adverse effects of natural resources on growth performance indeed seem to result from sensitivity to volatility of commodity prices on the world market. Natural resource revenues tend to be very volatile (much more so than GDP), because the supply of natural resources exhibits low price elasticities of supply. Cross-country evidence suggests that real exchange rate volatility seriously harms the long-term rate of productivity, especially in countries with low levels of financial development (Aghion, et al, 2006). Real exchange rate uncertainty exacerbates the negative investment effects of domestic credit market constraints. Empirically, IMF data on 44 commodities and national commodity export shares and monthly indices on national commodity export prices for 58 countries during 1980-2002 suggest that real commodity prices affect real exchange rate volatility (Cashin, et al, 2002). Countries with

abundant natural resources are thus likely to experience volatile real exchange rates. They also suffer from poorly developed financial systems and from financial remoteness, so that they are likely to experience bigger macroeconomic volatility (Rose and Spiegel, 2007) and have poor growth prospects (Aghion, et al, 2006).

Unfortunately, there are not many empirical studies that allow for the influence of natural resource abundance and its volatility on growth performance. Clearly, the stylised facts discussed in section II suggest that natural resources play a key role in understanding macroeconomic volatility and growth prospects. Once account is taken of the effect of cross-country variations in volatility on the rate of economic growth, the level of natural resource abundance may well exert a positive effect on economic growth. From a policy perspective, it is of the utmost importance to know whether any adverse *negative indirect* effect of natural resources on growth performance via volatility of unanticipated output growth dominates any adverse *positive direct* effect of natural resource abundance on economic growth. It is also of interest to investigate whether the adverse effect of natural resources on volatility and economic growth is weakened when there are well developed financial institutions (cf., Aghion, 2006). Furthermore, it is crucial to allow for the fact that landlocked countries typically experience lower growth rates and more volatility. To get meaningful results, one must control for the effects of initial income per capita, population growth, investment rates and primary schooling on growth.

These questions are motivated by the estimates of average yearly growth and its standard deviation by country groups for the period 1970-2003 presented in Table 1. These numbers suggest four stylised facts. First, developing countries suffer much more from volatility in output growth than developed countries. Whereas Western Europe and North America have a standard deviation of, respectively, 2.33 and 1.90 percent of annual growth in GDP per capita, the figures for Asia and Latin America are between 4 and 5 percent. However, sub-Saharan Africa and especially the Middle East & North Africa have the highest volatility. Their standard deviations of average annual growth in GDP per capita are, respectively, 6.52 and 8.12 percent. Second, countries with poorly developed financial systems appear to be much more volatile. Third, countries that depend a lot on natural resources are much more volatile than countries without natural resources. Countries with a share of natural resource exports in GDP greater than 19.3% have a staggeringly high standard deviation of output growth of 7.37 percent while for countries with a natural resource exports share of less than 6.1 per cent of GDP the figure is only 2.83 percent. Fourth, landlocked countries appear to suffer much more volatility than countries with easy access to waterways. Finally, the numbers reported in Table 2 indicate that the African countries share many similarities but

also many differences. Although these stylised facts are suggestive, they do not permit any causal evidence. For that we need a multivariate econometric analysis, control for all potential factors affecting economic growth and allow for endogeneity of explanatory variables (van der Ploeg and Poelhekke, 2007).

Table 5 provides cross-country empirical evidence on how much volatility of unanticipated output per capita growth depresses average annual growth in GDP per capita. The regressions control for the usual determinants of economic growth. Hence, countries that invest a lot in physical capital and to some extent in human capital enjoy a higher growth rate in income per capita. Similarly, countries with very high population growth rates tend to have worse growth performance and end up with lower incomes per capita. And, of course, poor countries which start off with a low level of income per capita catch up and grow faster *ceteris paribus*. This is known as *conditional* convergence. Interesting is that explaining volatility by regional blocks we see that Sub-Saharan African and to a lesser extent the Middle-East and North Africa are much more volatile and thus suffer much more from bad growth prospects. If Sub-Saharan Africa had the same volatility as East Asia and the Pacific, its average annual growth rate would be a half percentage point higher. Note that on top of all these factors explaining growth, there is some evidence of a traditional natural resource curse. In particular, a high share of point-source natural resource exports or rents seems to lower the rate of economic growth.

To gain a real understanding of the effects of natural resource abundance on economic growth, we need to dig deeper into the determinants of volatility. The regression reported in the first column of Table 6 does exactly that. It still finds that investment in physical and human capital boost economic growth while population growth depresses growth in income per capita. There is also again evidence for conditional convergence, so that poor countries catch up. More interesting is that there is no evidence of a direct effect of point-source natural resources on economic growth. However, due to two interaction terms, there is evidence that countries with well developed financial systems and relatively open to international trade benefit from their natural resource abundance. In other words, as long as the country is open, has well functioning financial markets *and* no volatility, point-source natural resources boost economic growth in income per capita. This flies directly in the face of the standard literature on the natural resource curse discussed in sections III, IV and V.1.

Probing into the deeper determinants of volatility, the results of Table 6 suggest that countries that are closed to international trade, have badly functioning financial markets, are landlocked and are abundant in point-source or diffuse natural resources have a much higher volatility in unanticipated growth in output per capita. Hence, landlocked, resource-rich

countries with significant trade barriers and badly developed financial markets experience much more volatility and thus suffer terrible growth prospects. These results suggest, in contrast to the previous literature, that volatility of commodity prices is the quintessential feature of the natural resource curse.

The counterfactual exercise reported in Table 6 compares the resource-rich countries with the OECD. The resource-rich countries can improve their growth rate by 0.46%- and 0.78%-points, respectively, if they invest as much in physical capital and in human capital as the OECD countries. This would outweigh the depressing effect of relatively high population growth (-1.00%-point) that many resource-rich countries have compared to the OECD economies. The big and major depressing effect on growth performance arises, however, from the very high volatility of resource-rich countries (3.35%-point). This is much bigger than the catch-up effect due to most resource-countries being relatively poorer than the OECD countries (-2.47%-point).

Table 7 reports the results of comparing Africa with the Asian Tigers. If Africa were to invest just as much in physical and human capital as the Tigers, it would gain an average annual growth of 0.82%- and 0.68%-points, respectively. If Africa's population growth rate were to be reduced in line with the Tigers, Africa would gain 0.49%-point extra annual growth. The catch-up of economic growth on account of Africa starting off with a lower income per capita than the Asian Tigers accounts for 1.01%-points to annual growth. The big push to economic growth occurs, however, if the volatility of unanticipated output growth in Africa is brought down to the level of the Asian Tigers. This would add a whopping 2.66%-point to annual growth. The big contributing factors to Africa's volatility are its volatile stream of mainly point-source resource revenues, its lack of fully developed financial markets and openness to international trade, and its disadvantages of being relatively more landlocked than the Asian Tigers.

In contrast to Collier and O'Connell (2006), we find that there is a difference between land-locked and coastal resource-intensive countries. We present in Table 8 a comparison of resource-rich and landlocked Africa versus the Asian Tigers. Resource-rich countries are those in the global top 25 and natural resource exports more than 17.31% of GDP during 1970-2003. We see again that, if those African countries would only invest more in physical and human capital and have lower population growth, they would be able to grow a lot faster. The key result is again how much potential growth is lost due to the volatility of unanticipated output growth. The main reasons for high volatility are again the heavy dependence on natural resources, badly developed financial markets and distance from the coast.

## VII. VIABILITY OF AFRICA'S NATURAL RESOURCES

We first establish that many resource-rich countries in Africa are squandering their natural resource wealth. They are saving and investing less in productive assets at home or abroad than their mineral and energy wealth is being eroded. As a result, so-called genuine saving rates are negative for many countries in Africa. One theoretical possibility for this is anticipation of better times (e.g., anticipation of improvements in exploration technology or commodity price hikes), but this seems unlikely. Extrapolating historical commodity price trends cannot explain the magnitude of the negative genuine saving rates. We therefore suggest that much of the negative genuine saving rates must be explained by rapacious rent seeking. Resource-rich countries of Africa therefore need credible and transparent rules for sustainable consumption and investment to ensure that exhaustible natural resources are gradually transformed into productive assets at home or abroad.

### VII.1. Much of Resource-Rich Africa Has Negative Genuine Saving

Many economies endowed with abundant natural resources varying from oil, gas and diamond to copper and tin have poor growth performance even after controlling for the quality of institutions, openness, investment rates and initial levels of income per capita (see section VI). These countries also save less than the rents from extracting and selling natural resources. If they were to save more, they might grow at a faster rate. To gain a better understanding of sustainable development, consider the World Bank (2006) numbers for *genuine* saving. Genuine saving is defined as 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<sub>2</sub> and particulate matter). Genuine saving thus defined corresponds to the increase in the wealth of the nation. The so-called *Hartwick rule* demands that any depletion of natural resources or damage done by stock pollutants must be compensated for by increases in non-human and/or human capital. This rule of zero genuine saving can be seen as a rule of thumb or motivated by max-min egalitarianism. It requires that resource-rich countries adopt a strategy of transforming their natural resource wealth into other forms of productive capital.

Figure 7 paints, however, a gloomy picture. Countries with a large percentage of mineral and energy rents of GNI typically have *negative* genuine saving rates. This means that many countries become poorer each year despite have abundant natural resources. They

squander their natural resources at the expense of future generations without investing in other forms of intangible or productive wealth. Figure 8 suggests that this may explain why Venezuela has negative economic growth rates while countries such as Botswana, Ghana and China with positive genuine saving rates enjoy substantial growth rates. Highly resource-dependent Nigeria and Angola have genuine saving rates of minus 30 percent, thereby impoverishing future generations on a massive scale.

Figure 9 counter-factually calculates by how much productive capital would increase by 2000 if countries would have invested all their natural resource rents from crude oil, natural gas, coal, bauxite, copper, gold, iron, lead, nickel, phosphate, silver and zinc in productive capital from 1970 onwards. These estimates only give an upper bound as they abstract from marginal extraction costs due to data problems. High natural resource dependence is defined as at least a 5 percent share of resource rents in GDP. The World Bank suggests that resource-rich countries with negative genuine saving such as Nigeria or Venezuela would experience increases in productive capital by a factor of five or four if the Hartwick rule would have been followed. This is also true for oil- and gas-rich Trinidad and Tobago and copper-rich Zambia. All the countries in the top right quadrant (except Trinidad and Tobago) have experienced declines in per capita income from 1970 to 2000.

## **VII.2. Rapacious Rent Seeking Rather than Anticipation of Better Times**

There are two crucial questions to be answered. First, why is it that so many resource-rich countries save so little? Second, is it really sub-optimal for them to save so little? Even if there are no government and market failures, countries *should* save less than their rents on natural resources and postpone extraction if they expect the world price of natural resource prices to rise in the future (Vincent, Panayotou and Hartwick, 1997) or expect marginal costs of extraction to fall in the future (van der Ploeg, 2007). In anticipation of better times countries with abundant natural resources thus run a current account deficit if the rents on natural resources fall short of the imputed interest on the value of natural resource reserves. This is more likely if the stock of reserves of natural resources is high. In practice, the adjustments to allow for future changes in resource prices are quite small if historical price trends are extrapolated (Hamilton and Bolt, 2004). Historical evidence on the US economy suggests that technical progress in extraction may be quite large if governments allow private property rights and collective learning takes place (David and Wright, 1997). There is no reason why forward-looking governments of today's resource-rich economies should not enjoy technical progress in exploration. It then makes sense not only to borrow for necessary

investments, but also to save less than the current Hotelling resource rents in anticipation of falling extraction costs.

However, in many African resource-rich countries political reasons may be more important in understanding why resource-rich countries save less than the Hotelling rents on natural resources (van der Ploeg, 2007). Figure 10 gives some weak evidence to suggest that fractionalised resource-rich countries are more likely to have negative genuine saving rates and not putting their natural resource wealth to good use. Squabbling and fighting rival groups trying to get their share of natural resource revenues at the expense of other groups induce a common-pool problem. Effectively, the power struggle makes competing groups more impatient and thus the country depletes resources faster and natural resource prices rise faster than suggested by the Hotelling rule. As a result, the country experiences negative genuine saving rates which depress growth and harm social welfare (the so-called *voracity effect*). The Hartwick rule must also be modified for these political distortions. The only way to sustain a constant level of private consumption is to save more on the current account than the current natural resource rents accruing to households. Of course, this may be difficult to realise in societies with badly defined property rights and rapacious rent seeking. The political distortions in the Hotelling and Hartwick rules are bigger if the country is more fractionalised. The negative genuine saving rates of many African countries thus seem to be due to their natural resource abundance and poor legal systems. Furthermore, these political distortions are bigger in more fractionalised, less homogenous societies.

Natural resource discoveries can induce governments to engage in exuberant public spending based on the incorrect assumption that windfall natural resource revenues are permanent. This gives rise to unsustainable spending levels with painful adjustments when the resource revenues run out. Alternatively, a fraction of natural resource revenues may be siphoned off by the political elite and its cronies and cannot be used by the people for consumption. This also implies that less of current natural resource rents will be saved. One must understand how the optimal rates of resource depletion, government spending, saving and investment survives are affected when politicians seek office and try to grab resource rents for themselves or pay off political opponents and are able to get away with it due to poor institutions, bad legal systems and poor checks and balances in the political system. Rapacious rent seeking rather than anticipation of better times may unfortunately be a much more important reason why many fractionalised resource-rich economies squander their rents on exhaustible resources and suffer such disastrous economic and social outcomes.

On a more pragmatic note, the matter of observed *negative* genuine saving rates is worse for many African resource-rich countries with high population growth rates. Such

countries need *positive* rather than *zero* genuine saving rates to maintain constant consumption per head. The standard neoclassical model of economic growth predicts that such countries have lower capital intensities and lower income per capita. Indeed the cross-country econometric evidence presented in Table 5 suggests that countries with high population growth have worse growth performance and end up with lower income per capita. In fact, in countries with high population growth rates, genuine saving may be positive while wealth per capita declines (World Bank 2006, Table 5.2). Such countries are on a treadmill and need to create new wealth to maintain existing levels of wealth per capita. They thus need to save more than their exhaustible resource rents, but rarely manage that. For example, sub-Saharan Africa has high population growth rates and shows substantial saving gaps of 10 to 50 percent of GNP. For Congo and Nigeria the saving gaps are as high as 110 percent and 71 percent, respectively.

## **VIII. MANAGEMENT OF NATURAL RESOURCE REVENUES**

The objective of maximising benefits to current and future generations of citizens can be broken down into four stages, relating to the stages from extraction, through revenue flows to expenditure. Here we therefore first discuss how efficient contracts could be written with the exploration companies and then discuss the appropriate choice of fiscal regime. We proceed with emphasising how important transparency of natural resource payments and spending of the resulting revenues is and offer some suggestions for more effective public sector financial management. We then discuss the timing of natural resource expenditures and especially how this can benefit future generations as much as possible. Finally, we discuss issues of whether natural resource revenues should be used for consumption and/or investment.

### **VIII.1. Contracting and the Fiscal Regime**

There is a complex interaction between licensing, contracting and taxation regimes for natural resources. They need to secure the dual objectives of efficiency and revenue transfer to the host country. Sound principles for the design of efficient contracts and the auction and allocation of mineral and energy rights are needed. Efficiency imposes a number of requirements. Of course, exploration companies should have incentives to participate. They should also be encouraged to extract efficient quantities and to invest in both production and exploration. This in turn requires that contracts are time-consistent, so that governments do not have an incentive to renege thereby creating uncertainty and expropriation threat.

Efficiency applies not only to the stream of output, but also to the allocation of production and price risks between parties to the contract. This allocation of risks depends on the ability of exploration companies and governments to bear risk and to trade risk on the international capital markets. The contract may also specify environmental conditions as well as the transfer of knowledge and other assets, tangible and intangible. In resource countries that are ruined by armed conflict an effort should be made to get exploitation companies involved at the peace negotiations table. Since the exploration companies have an interest to avoid conflict, they may have an incentive to help secure re-employment of ex-combatants. To avoid the political risk that a successful mining venture captures the state, it may help to make mining contracts conditional upon criteria for recognition of the political regime.

In an economy with an effective legal system auctions are an attractive option, since competition between firms will secure both efficiency – maximisation of net revenues – and maximum net transfer to the government. Auctions also have the merit of transparency. However, where the mining contract is multidimensional, matters become more complicated. If bidding is on a single variable – total royalty – then other aspects of the mining contract (risk sharing, knowledge transfer, and environmental safeguards) have to be established in some way and imposed as constraints in the auction of mineral rights.

From a public finance point of view the government has to deal with revenue collection, revenue management and revenue disbursement (e.g., McPherson, 2004; Humphreys, Sachs and Stiglitz, 2007). Efficient revenue collection requires adequate incentives, appropriate levels of government take, early and stable revenues, cost containment and administrative simplicity. The natural resource revenues can be collected through royalties, profit taxes or other tax packages, production sharing or equity participation by the state, bonuses, cost recovery provisions, and/or auctioning of concessions. This requires a clear separation of roles and responsibilities with adequate staffing, skills and resources. The legal status of state-owned companies requires special attention. Unfortunately, this is not the case for many countries suffering from a resource curse. Transparent tax collection should be accountable and transparent, so corporate audits, value for money audits, tax audits and national exploitation company audits are essential. Corporate social responsibility of the natural resource exploitation companies need to be stimulated. The government should publicly state its objectives with respect to revenue management from zero to peak production (stabilisation, risk sharing, savings in a fund, etc.), which instruments it is going to use (unified budgetary and asset management, special resource revenue funds, hedging, fiscal rules, etc.), and how it will disburse revenues.

The government also must explain how it is going to cope with increases in the world price of natural resources, avoid boom-bust cycles, manage the exchange rate, and coordinate the natural resource revenues with foreign-aid inflows. In particular, resource rich countries must aim to make their financial markets more efficient and attempt to diversify their economy in order to be less vulnerable to the adverse effects of real exchange rate volatility. Governments of resource rich countries are typically very dependent on this source of revenues and have to cope with serially correlated resource price shocks. They would benefit from loans, futures contracts, options, insurance and other financial instruments in order to hedge risks and have optimal risk sharing. Commitment and sovereign default risk are important factors to take account of. Finally, the government must ascertain the estimated impact of natural resource revenues on different sectors of the economy and investigate whether there is a case for intervention in non-resource sectors to restore competitiveness and promote employment and growth.

Resource rich countries should not spend their windfall profits and aim to maintain their revenues from income taxes in line with growth in national income, even though taxes are often difficult to collect, unpopular and distortionary. Slashing regular tax revenues tends to weaken the linkages between the government and its people. The natural resource revenues can be handed out to the people, put into a fund or directed at targeted public expenditures such as education and R&D.

### **VIII.2. Privatisation and Property Rights**

The IMF and the World Bank have advocated privatisation of state-owned oil and mining industries and tendering exploitation rights to private companies. The hope is that this will restore efficiency by restoring the profit motive and enhance transparency and accountability. It also fits in with a political agenda of cutting back interference of the state in the economy. Unfortunately, the evidence on privatisation is rather mixed. Often, the majority of assets end up in the hands of a few privileged companies. In the former Soviet Union this created a new class of very rich oligarchs while the Russian people hardly benefited from the new riches. Privatisation does not automatically yields the positive experiences of the US in the nineteenth century.

It helps to eliminate corrupt politicians and judges, to have well-defined property rights and to have a credible government that does not appropriate the returns from investment, but the crucial question is how to achieve that. China makes clear that despite the absence of formal private property rights, private entrepreneurs have felt secure enough to invest on a large scale, and conversely for Russia. Still, China has a more buoyant economy

than Russia. Signalling that property rights will be respected in practice may be more important than encoding them in law (e.g., Rodrik, et al, 2004). It is unclear how to gain political support for better institutions, since vested interests have squandered natural resource wealth in the past and fiercely resist institutional reform.

### **VIII.3. Revenue Transparency and Public Financial Management**

Crucial is not to squander the natural resource wealth in a short period over time, but to make it last for future generations as well. It is therefore crucial that public and corporate accountability and transparency of all activities to do with the exploitation of natural resources is of the highest standards. The accounts related to the production and exports of resources should be available to journalists, financial analysts and the general public. Resource rich governments should also publish what they borrow, since some are tempted to loot the public purse by saddling future generations with excessive debt using natural resource reserves as collateral. Unfortunately, many countries that are worst affected by the natural resource curse do not publish what they earn from exports and do not publish where the revenues go to.

Voluntary compliance is likely to fail, but exploitation corporations still have to deal with unrepresentative governments. Corporate ethics and codes of governance in resource-rich countries with poor institutions are thus crucial. Exploitation companies should publish their payments to all governments and may use their influence individually and industry-wide to support mandatory mechanisms for disclosure. Governments on whose territory exploitation companies are registered may require mandatory reporting of revenues to all governments, encourage corporate social responsibility and punish illegal exploitation of natural resources and collusion in the perpetuation of resource-driven conflict. Mandatory compliance may help. It also ensures a level playing field among exploitation corporations and avoids unfair competition from corporations unconstrained by human right or anti-corruption concerns. It helps if the scope of the Extractive Industries Transparency Initiative, launched in 2003, is broadened. The EITI has been endorsed by the African Development Bank and Cameroon, Gabon, Guinea and Nigeria have already produced reports.<sup>6</sup> The decision in Oslo last year to set up a permanent secretariat with a board representing all stakeholders, the decision to evaluate the EITI criteria by independent evaluators, and a detailed scoring system to map the road towards compliance offers hope for the future. The EITI criteria are:

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<sup>6</sup> Only Nigeria and Azerbaijan have published fully audited reports.

- regular publication of all payments by oil, gas and mining companies to governments and payments received by governments from those companies;
- a credible, independent audit of payments and revenues applying international auditing standards; reconciliation of payments and revenues by a credible, independent administrator and publication of the discrepancies (including theft etc.);
- extension of this approach to all companies including state-owned companies;
- active engagement of civil society in the design, monitoring and evaluation of the EITI process;
- a public, financially sustainable work plan for all the above drawn up by the host government, including measurable targets, an implementation time table, and assessment of potential capacity bottlenecks.

The EITI process is a tough one to implement and sustain, but it is crucial to reduce opportunities for revenue theft and prevent expenditure from being captured by favoured groups. It would help if the EITI process is broadened towards a Charter for Transparency of Resource Revenues and Payments.

It also helps if Western banks and international organisations deem debt incurred by corrupt governments at the expense of their people illegitimate and make a real effort to recover stolen assets. The World Bank has made fighting corruption its top priority even if this means insisting on a free press and meddling in politics. For example, debt relief for the Republic of Congo with far from transparent finances of the state oil company was given contingent on a three-year record of anti-corruption efforts.

Civil society should hold governments and exploitation companies accountable for their management of mineral resources. Posting all the relevant information with a global public information office could be a condition for aid and finance from international organisations. It is interesting that the chairman of the African Union, the Nigerian President Olusegun Obasanjo, has warned that corruption amounts to a quarter of GDP in Africa and that this occurs mainly in the oil, gas and mining sectors. He called the plundering of natural resources unpatriotic, but also attacked Western banks for allowing tainted money to be deposited.

To prevent natural resource revenues and expenditures being captured by favoured groups, the following actions can help and support the EITI:

- Establish a public financial management system in which budgetary allocations are open and transparent. This requires *ex ante* transparency, current monitoring and *ex post* evaluation of expenditures. Public procurement systems should be open and competitive.

- Fiscal rules are needed that constrain booms of expenditure. These can be conditioned on setting aside some proportion of revenues (e.g., Nigeria's excess crude account) for future generations or on specifying that the revenues should be used for, say, education or infrastructure. Such rules have benefits in terms of economic efficiency and also make it more difficult for government to manipulate expenditure levels for electoral or other purposes.
- Some of these fiscal rules may need to be embedded in a 'fiscal constitution'. This need arises from a *time consistency* problem: unless future policy makers are bound in advance not to raid accumulated financial assets, then even prudent current policy makers will never save windfalls. Whereas in the OECD economies the major macroeconomic time consistency problems have been monetary, and have been addressed by granting independence to central banks, in the resource-rich countries the major problems are likely to be fiscal.
- Establish *sustainable* expenditure patterns that become locked in by virtue of benefiting a wide section of the population in a highly visible manner. For example, free education services or social protection schemes commit stable expenditure flows in a visible manner, so that they are relatively difficult to cut and divert to a narrow group of beneficiaries.
- Independent voices are needed within the political system, financial sector and media. The central banks, provided that they have some degree of independence from government, have a role to play.

#### **VIII.4. Timing and Composition of Expenditures**

Even if political economy problems are overcome and the stream of natural resource revenues and what is done with it is completely transparent, there remain tough issues of how best to spend the natural resource revenues. The revenues can be used in the following ways:

- Accumulation of foreign assets;
- Domestic investment – public or private;
- Domestic consumption – public or private.

All these choices depend on information that is highly uncertain – resource reserves, future commodity prices and rates of return on exploration – and are interrelated. Much of the natural resource revenues are highly volatile, so short-run smoothing is required and boom-bust cycles must be avoided. Also, some way has to be found to spread the benefits of resource revenues to future generations (see section VIII.5). Furthermore, the issues of long-run absorption, resource depletion rates and offshore funds have to be faced.

The first choice is that between consumption and investment: how much of the natural resource revenues should be consumed now and how much saved for future generations? Section VII faced this issue head-on jointly with the optimal depletion of exhaustible resources. This led to political variants of the Hotelling and the Hartwick rules. Most governments will take the stream of natural resource revenues as exogenous and need to cope with it. The permanent consumption stream that can be supported in perpetuity is then the present value of the resource stock times the rate of return (e.g., IMF, 2007). Other rules of thumb are often put forward. The *share* of natural resource revenues that can be consumed in perpetuity is the expected long-run rate of growth of the resource price divided by the extraction rate. Both of these rules give steady consumption paths that do not fluctuate with short-run natural resource revenues, although they are of course subject to revision as information and expectations about reserves, commodity prices, interest rates, etc. change.

The next question is, given some long-run path for consumption, how should the remainder, investment, be allocated between domestic and foreign assets. The first criterion is that foreign assets should be used to reduce volatility and secure short- to medium-run smoothing of domestic expenditures (consumption and investment combined). Doing this involves forming a judgement about the expected long-run revenue path and using foreign assets to smooth deviations from this path.

The following issue is the longer run division of investment between foreign and domestic assets. The simple criterion is to invest wherever the social rate of return is highest which, in a capital-scarce developing country, should be largely domestic investments. In practice, the social rate of return is, of course, hard to measure. First, large domestic expenditures will change prices and crowd out other activities. This can occur at the macro level (think of the Dutch Disease discussed in section III) and at a more micro level (e.g., bidding the prices up of particular domestic inputs). Such changes reduce the social return on domestic investment. Second, the prevalence of market failures in developing countries, some with positive effects and some with negative effects on social returns to investment, makes it tough to establish the social rate of return. Market failures need to be evaluated case by case, although public investments to improve the environment for private business (think of infrastructure or economic reform) are likely to have a high return.

The final issue is whether consumption or investment should be private or public. Private expenditures would be promoted by tax cuts and low levels of public debt rather than by direct public expenditures on social policies and infrastructure. Whether private expenditures are more efficient depends on the economic environment – in particular access to capital markets – and on attitudes to intergenerational distribution of benefits. The

efficiency of public expenditures depends on both the quality of project selection and on the procurement practises used to implement projects.

### **VIII.5. Stabilisation Funds versus Citizen Dividends**

Due to the volatility of commodity prices, streams of natural resource revenues are typically very volatile. Of course, governments of resource-rich countries that have some power on the global commodity market may be able to use buffer stocks to stabilise commodity prices and avoid the harmful effects on their economies (Newbery and Stiglitz, 1981). Typically, the scope for stabilisation of commodity prices is limited. An alternative is to use financial instruments to hedge or insure against the risk of volatile commodity prices, but that is difficult for many African resource-rich economies with poorly developed financial systems. Another possibility to cope with volatile streams of natural resource revenues is to put the revenues in a Stabilisation Fund when commodity prices are high and draw from this Fund when commodity prices are low. Another characteristic of streams of natural resource revenues is that they typically do not last forever, so this gives another reason to put revenues from natural resources into a Stabilisation Fund. This way the country can spread the benefits of its natural resource wealth over a long time (cf., the Hartwick rule discussed in section VII). This ensures that future generations benefit from natural resource wealth as well.

If institutional quality is weak and transparency and accountability are poor, such a fund may be raided. Although Norway's Special Petroleum Fund seems to work, it is unlikely to work in countries with rapacious rent seeking and poor institutions and may be foolish in countries in dire need of sensible investments. Keeping natural resources under the ground may be a safer form of saving than putting it in a fund that is easily raided. Alternatively, the natural resource revenues can be used to cut government debt and/or invest in useful education and public infrastructure projects. The Alberta Heritage Savings Trust Fund was, in fact, raided by government for its own spending plans. This is less likely for the Alaska Permanent Fund, since the constitution was changed when this fund was established to safeguard its use against government raids and ensure that it distributes the income from the fund rather than the oil revenues itself to the people. The latter fund was privatised and managed like an endowment.

Norway's Special Petroleum Fund has clearly specified rules and procedures and publicly known stabilisation and savings objectives. The Special Petroleum Fund is professionally managed, fully integrated with the budget, and enjoys the highest degree of transparency and accountability. Venezuela also has a stabilisation fund, but its integration with the budget is problematic, its management is weak and the rules of operation have

quickly eroded. Although poverty is falling at last under President Hugo Chávez, it falls much less than it should given the country's vast oil bonanza. In contrast to Norway, institutional capacity is weak and the country is not very supportive of the fund. Azerbaijan has an extra-budgetary savings fund, which is professionally managed, accountable to the President and already fairly transparent. The transparency of the Kazakhstan's National Fund is diluted by Presidential control and limited professionalism. Nigeria has a heavy dependency on oil, a significant backlog of urgent physical and social infrastructure projects, and a volatile pro-cyclical budget. Nigeria faces big challenges, since its institutional capacity is weak and its past record on transparency and accountability is poor.

It may be more attractive from a political point of view to distribute the rents from natural resources automatically and instantaneously directly to the citizens of the country (e.g., Sala-i-Martin and Subramanian, 2003). These rents correspond to the government revenue after privation exploration companies have paid their costs and distributed dividends to their shareholders. The right of each citizen to an equal share of natural resource rents can even be inscribed in the constitution to establish the legal default of full direct distribution of natural resource revenues to the people. One could argue that the resource dividend should only be handed out to adults in order to avoid unintended increases in fertility or that it should only be given to women as the main drivers of economic development. Given that citizenship or residence will probably be an eligibility criterion for receiving the resource dividend, there is a clear danger of leakage and fraud. The administrative costs should, however, be manageable. The government can afterwards tax their citizens to fund investment projects, reduce government debt, and/or transfer revenues to a fund. The resource rents can also be used for micro-finance and housing guarantees or tied to social targets such as the Millennium Development Goals. The great advantage of this is that the burden of proof is with the government, which has to explain why it wants to spend money and get public support for its plans before it can tax its citizens. Citizens may not use their share of natural resource revenues wisely either, but less resources will be wasted on corruption and rent seeking. The reason is that it is much more difficult to mismanage the resources that come from taxes than those that fall from heaven like manna. One can distinguish between an *endowment* effect, which argues that people put more pressure on the government to abide by the principles of good governance as they feel the cost of waste and corruption as an out-of-pocket cost, and an *information* effect stressing that people get better informed about the magnitude of the resource rents and on how these are spent. Of course, a key issue is again how to implement such a natural resource dividend to the people in practice and overcome opposition from

vested interests. Clearly, it makes sense to establish these citizen's dividends at key constitutional moments.

## **IX. THE NEW SCRAMBLE FOR AFRICA'S NATURAL RESOURCES<sup>7</sup>**

During the last decade there has been a rapid increase in trade and investment flows between Sub-Saharan Africa and Asia, especially with China and India. Of course, India has a long history of trade and foreign direct investment in especially East Africa with its many expatriate Indian communities. But also China's trade and investment in Africa dates back decades with heavy early investments in infrastructure such as the railway system. Recently, the discussion of the role of China and India in Africa has highlighted the growing demand and control of natural resources by these emerging Asian powers in Africa. China and India have been growing fast and have rapidly developed modern industries which are in many ways close to the development stage of Africa. As they develop, the demand for natural resources, especially oil, by China and India is exploding. Although Africa now mainly exports natural resources to China and India, Africa increasingly has become attractive as a labour-intensive manufacturing base exporting goods to Asia. There is a growing Asian demand for processed commodities, light manufactured products and tourism and Africa has a great unused potential to fulfil this demand.

A recent World Bank study uses a wealth of survey data on African firms to discuss at length how at-the-border trade and investment policies (tariffs, NTB's, FDI regimes, etc.), behind-the-border domestic market conditions (bureaucracy, market structure, quality of institutions, infrastructure, skill shortages, etc.), between-the-border trade facilitation factors (transport, logistics, technical standards, migration) and complementarities between investment and trade affect the prospects for Africa developing a labour-intensive manufacturing base and non-resource export potential (Broadman, 2007). The main conclusion is that China and India's growing trade with and investment in Africa presents an exciting opportunity for growth and international integration of Africa in the global economy. It also allows Africa to diversify away from oil towards processed commodities and labour-intensive good and services for Asia. The increasing number of global Chinese and Indian firms with top-rate technologies can help to foster global and pan-African integration of African businesses. For Africa to really benefit from this opportunity, it needs to reform

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<sup>7</sup> This section is very much based on The World Bank study *Africa's Silk Road* (Broadman, 2007).

behind the border and between the borders and promote actions that leverage links between trade and foreign direct investment. For example, the natural resource revenues should be used to improve and modernise ports, road and rail transport, and telecom/IT capacity and much can be done to simplify custom procedures. Furthermore, something must be done to eliminate the escalating tariffs that constrain Africa's leading exports to China and India. African countries themselves should make sure to get rid of the anti-export bias in their import-tariff policies and avoid bias in investment decisions and disincentives for product diversification. It is important to realise that there is no need for one-size-fits-all policy reforms, since Africa's economies are very heterogeneous. Reforms should thus take into account of country-specific circumstances and this should reflect both the contents and the timing of the actions.

Improvements in Africa's export performance are indeed very much needed. Figure 11 shows that Africa's share of world exports has been steadily declining from more than 7 percent in 1948 to about 1.5 percent now. More worrying is that Africa (and Latin America) experienced a declining share of non-oil exports during the last fifteen years. As Figure 12 indicates, Africa's exports are still mostly raw commodities with very little value added. Also, Africa only accounts for 1.8 percent of global foreign direct investment flows. The increases in the price of oil and other raw materials have made the diversification and transformation of Africa's economies not any easier. Still, the volume of African exports to Asia has grown by one fifth during 2000-5. Exports to China have grown most spectacularly by almost one half during 2000-5 whereas exports to India only by one seventh. However, Asian exports to Africa have grown equally rapidly (more so than the EU or any other region). In fact, Asia's share of African exports is 27 percent in 2005 while African exports to Asia account for only 1.6 percent of global imports by Asia.

Much of the global demand for raw materials comes from China and India. These emerging economic powers account for almost 40 percent of world imports for precious stones and 30 percent for crude oil. A staggering 86 percent of African exports to China and India are oil, metals and agricultural raw materials. Only five oil and mineral exporting countries account for 85 percent of exports to China. South Africa only accounts for 68 percent of exports to India. Clearly, the major challenge is to ensure that the revenues of sales from Africa's natural resources to Asia are invested and used to develop a labour-intensive manufacturing and export base for Africa. China and India have an important role to play in this transformation as they also have many practical technologies to transfer to the African continent. The new quest by the big Asian drivers to secure Africa's natural resources must thus be accompanied by setting up labour-intensive manufacturing bases in African countries.

So far, however, much of Chinese's foreign direct investments in Africa are largely, albeit not exclusively, resource-oriented.

A final remark is in order. Many criticise China and India for doing business with unsavoury political regimes that do not conform to Western standards of democracy, accountability and transparency. Think of the recent policy frictions between the US and China over Sudan, which supplies about 7 percent of crude oil imports to China but not to the US. The US tries to isolate Sudan for political reasons whereas China believes Sudan is important for its energy security and its rapidly growing economy. China has a 40 percent stake in the Greater Nile Petroleum Company and Sinopec is constructing a 1,500 km pipeline to boost oil exports through Port Sudan. China has helped to revive Sudan's oil industry in the middle of a conflict zone. Many other examples of China's business interests in Sudan and other parts of Africa can be mentioned. China is also active to secure its oil interests in Angola, Nigeria and Equatorial Guinea. Others are worried that China is flooding Zambian markets with fake traditional medicines that claim to cure HIV/AIDS and tuberculosis rather than transferring effective medical expertise. Still, China is serious about its partnership with Africa. Undoubtedly, its demand for natural resources is the key driver, but China has also pledged to take over the World Bank as Africa's main providers of financial capital. In contrast to the 19<sup>th</sup> century scramble for Africa's resources, China seems to be prepared to invest in the most troubled countries of a continent that many Western companies and countries avoid. Rather than accusing China of neo-colonialism, the US and its allies would do better to seek cooperation with China to jointly develop Africa's supply of natural resources and labour-intensive manufacturing base. This way there will be a bigger chance to get China's support for campaigns for better governance, more transparency, less corruption and improved human rights in Africa.

## **X. POLICY CONCLUSIONS**

The first key message is that countries with a large share of primary exports in GNP have bad growth records and high inequality, especially if the quality of institutions and the rule of law are bad and restrictions to international trade are imposed. Resource-rich countries typically suffer from an overvalued real exchange rate and a shift of labour and capital from the traded to the non-traded sectors. Since the traded sectors are most likely to enjoy learning by doing and other knowledge externalities, the growth engine will falter or not pick up at all. This potential resource curse is particularly severe for point-source resources such as diamonds and

precious metals. The resource curse is, however, not inevitable. Resource-rich countries with good institutions, trade openness and high investments in exploration technology seem to enjoy the fruits of their natural resource wealth. Natural resource abundance may, however, undermine the quality of institutions. Furthermore, a resource boom reinforces rent grabbing and corruption, especially if institutions are bad, and keeps in place bad policies. Countries with abundant point-source natural resources are also prone to civil conflict and war.

The second key message is that resource-rich countries are vulnerable to the well-known volatility of commodity prices which has a strong negative effect on growth performance. More important, is that countries with well-developed financial markets and relatively open to international trade seem to benefit from their natural resources provided their economies are not too volatile. The quintessential feature of the natural resource curse is the volatility of commodity prices. Countries that are rich in natural resources, have lots of trade restrictions and bad functioning financial markets and are landlocked experience the greatest volatility and thus have to put up with depressing growth prospects. Unfortunately, this applies to much of resource-rich Africa.

The third key message is that to avoid or attenuate the natural resource curse, appropriate policies are called for. One of these may be a temporary subsidy or tax relief for the non-resource export sectors that are hurt by a worsening of competitiveness resulting from the natural resource bonanza and consequently forego learning by doing and other spill-over effects. But such subsidies are merited even in the absence of natural resources. Given the rapid growth of China and India, it is very tough for many African economies to diversify and develop a labour-intensive manufacturing base. This problem is aggravated by the natural resource curse. There are therefore good arguments for exempting especially the resource-rich economies of Africa from tariffs on exports of labour-intensive manufacturing to the developed world. This may just be the temporary boost those countries need to get out of their poverty traps. China and India are important players in the new scramble for Africa's resources, but they also provide a unique opportunity for Africa to develop and diversify its export base. China and India are not only important markets, but also interesting sources of new technology for Africa.

The fourth key message is that countries with large natural resource reserves are tough to reform, since the political elite and their cronies resist undermining of their resource rents. The staple trap view suggests two possible roads for successful economic reform. The experience of Indonesia and Mexico suggests that, if oil reserves per capita are low, *rapid* economic reforms will be more likely to occur as they nurture wealth creation. However, if natural resource reserves sustain rents for a long period in heavily distorted economies, more

*gradual* dual-track economic reforms may prove viable as long as the winners of reform can compensate the losers. This can be achieved by creating a dynamic market sector in early-reform geographic enclaves that offer domestic and foreign investors immediate access to post-reform conditions of infrastructure, institutions and incentives. Rapid expansion of the enclaves absorbs surplus labour from the less dynamic, distorted sectors of the economy, and thus builds a pro-reform political constituency. Such gradual dual-track reform may be relevant for resource-rich Algeria, Angola, Iran, Iraq, Nigeria and Saudi Arabia.

The fifth key message is that sound natural resource management implies that countries should invest their natural resource rents into reproducible assets such as physical and human capital. The objective is to transform exhaustible natural resource wealth into reproducible assets with a visible rate of return such as public infrastructure, education and foreign investment. However, a recent World Bank study suggests that many resource-rich economies in Africa squander their natural resource wealth and have negative genuine saving rates. They then grow less. The challenge is thus to make sure that the resource-rich countries invest their often temporary stream of natural resource revenues in productive assets and thus spread the benefits over a longer time and to future generations.

The final key message is that practical suggestions for efficient allocation of mining contracts and better management of natural resources are needed. Botswana, Canada, Australia and Norway suggest that it is possible to escape the resource curse. The first-best strategy is to improve the quality of institutions and the legal system and to insist on accountability and transparency of resource revenues, but vested interests may oppose that. It may also help to put natural resource revenues in a fund to ensure that the interest of future generations is safeguarded, but in countries with poor institutions such a fund will probably be raided. An interesting alternative is to change the constitution in order to guarantee that natural resource revenues are handed to the public. The government has to subsequently tax its citizens to finance its spending programmes and the burden of proof for spending resource revenues is with the government.

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**Table 1: Growth, Volatility, Financial Development and Resources in World****Regional Characteristics (% , 1970-2003, at least 10 obs. per country)**

Region	Yearly real GDP per capita growth rate		Export Value Share of GDP						Rent Share of GDP		Government Share	Financial Development
	mean	sd	Fuels, Ores & Metals		Agricultural Raw Materials, Foods		All Resources		Fuels, Ores & Metals		sd	mean
			mean	sd	mean	sd	mean	sd	mean	sd		
Middle East & North Africa (MENA)	1.18	8.12	22.24	9.30	2.51	1.52	24.75	9.07	26.98	11.20	5.82	41.41
Sub-Saharan Africa (SSA)	0.47	6.52	9.60	3.97	10.24	3.60	19.65	5.66	5.79	3.76	4.76	17.44
East Asia & Pacific (EAP)	2.47	5.00	6.81	3.45	10.04	3.11	16.71	5.49	4.44	2.44	2.72	51.77
Latin America & Caribbean (LAC)	1.47	4.54	4.99	2.64	9.66	3.70	14.59	5.34	6.31	3.26	3.98	34.87
South Asia (SA)	2.41	4.41	0.52	0.42	4.25	1.55	4.77	1.83	1.31	0.96	2.98	17.33
Eastern Europe & Central Asia (ECA)	2.56	4.34	2.07	0.66	3.50	1.03	5.57	1.54	2.23	1.23	2.52	22.70
Western Europe (WE)	2.35	2.33	2.71	1.00	5.20	0.95	7.86	1.60	0.55	0.52	1.53	76.08
North America (NA)	2.09	1.90	2.90	0.52	2.99	0.45	5.88	0.85	3.41	1.85	1.60	109.36
1 <sup>st</sup> q. Av. Fin. Development (<=16.2)	0.70	6.40	9.71	4.23	7.64	3.00	17.06	5.52	5.14	2.95	4.64	10.38
4 <sup>th</sup> q. Av. Fin. Development (>=52.9)	2.32	4.40	4.68	2.29	5.28	1.78	9.89	3.45	4.99	2.62	3.03	80.92
1 <sup>st</sup> q. Av. Resource Dep. (<=6.1)	2.73	2.83	1.17	0.48	2.23	0.64	3.41	0.93	1.65	1.11	2.38	64.96
4 <sup>th</sup> q. Av. Resource Dep. (>=19.3)	1.08	7.37	23.22	10.00	11.62	3.59	34.67	10.85	14.10	6.47	4.72	25.47
1 <sup>st</sup> q. Distance to waterway (<=49km)	1.76	8.12	6.72	3.41	8.22	2.65	24.75	9.07	6.03	2.50	5.82	41.41
4 <sup>th</sup> q. Distance to waterway (>=359km)	1.46	6.52	8.22	3.68	8.59	3.43	19.65	5.66	8.99	4.75	4.76	17.44

Note: *Means* are cross-country averages of country average growth rates or variable shares between 1970 and 2003. *Standard deviations (sd)* are the average cross-country standard deviations of country yearly growth rates or variable shares over the corresponding period.

**Table 2: Growth, Volatility, Financial Development and Resources in Africa****Summary Statistics of Growth and Resource-Dependence of African Countries (1970-2003)**

By Region and Country	Growth	Volatility	(% of GDP, based on at least 10 observations)									
	Average Yearly GDP/capita growth rate (%)	Standard Deviation of growth	Export Value Share of GDP				Rent/GDP		Government share of GDP	Financial Development		
			Fuels, Ores & Metals	Agricultural Raw Materials, Foods	Total Resources	Fuels, Ores & Metals						
<b>MIDDLE EAST &amp; NORTH AFRICA</b>												
Algeria	1.02	5.38	24.53	7.38	0.58	0.94	25.11	7.15	19.30	8.56	2.72	33
Bahrain	1.52	9.56	49.45	8.37	2.59	2.37	52.04	7.68	39.60	17.85	11.05	50
Egypt, Arab Rep.	2.8	2.99	3.84	2.51	2.95	2.50	6.79	3.03	9.07	8.15	3.66	34
Iran, Islamic Rep.	0.30	7.29	16.93	4.13	0.67	0.38	17.59	4.32	26.28	11.13	5.62	31
Iraq	-1.48	26.03							54.76	28.97	10.86	
Israel	1.82	2.76	0.45	0.09	2.69	1.18	3.15	1.19	0.46	0.92	6.87	63
Jordan	-0.39	6.21	4.50	1.95	3.78	1.32	8.28	2.51	1.06	1.00	7.00	58
Kuwait	-2.75	11.12	42.07	21.19	0.82	1.07	42.89	20.47	52.04	16.41	10.40	53
Malta	5.36	4.49	2.11	0.92	2.56	0.99	4.67	1.70			3.97	70
Morocco	1.74	3.95	4.18	2.39	5.06	1.15	9.25	2.62	1.89	2.17	2.60	34
Oman	1.54	6.34	33.76	16.87	2.74	2.31	36.49	14.90	43.62	12.22	2.74	24
Qatar	-1.86	7.07	54.66	26.57	0.16	0.13	54.82	26.65	47.28	15.99	6.75	28
Saudi Arabia	0.20	8.71	41.23	16.00	0.24	0.15	41.46	15.88	47.18	14.12	7.88	42

Syrian Arab Republic	1.93	6.96	12.89	5.01	3.69	1.59	16.58	6.15	19.13	10.31	7.19	8
Tunisia	3.18	2.93	6.74	3.83	3.41	1.15	10.15	4.01	7.08	4.78	0.86	56
United Arab Emirates	3.93	18.07	36.23	22.28	5.77	5.56	42.00	17.77	35.98	15.37	2.93	38
<b>SUB SAHARAN AFRICA</b>												
Benin	0.60	4.34	1.86	2.89	10.76	5.51	12.61	6.82	0.73	1.10	1.62	17
Botswana	5.98	5.20							2.55	2.20	5.25	13
Burkina Faso	1.30	3.41	0.07	0.10	5.33	2.12	5.40	2.19			3.75	12
Burundi	-0.16	5.87							0.05	0.07	5.16	10
Cameroon	1.00	5.08	5.27	3.85	10.92	4.51	16.19	4.08	7.65	5.79	2.03	18
Cape Verde	2.70	4.65									6.60	26
Central African Republic	-0.70	5.74	2.30	2.31	6.80	3.33	7.66	1.82	0.03	0.04	4.01	9
Chad	-0.35	7.92									7.28	9
Comoros	-0.79	4.48									5.63	12
Congo, Dem. Rep.	-3.58	8.02							4.57	2.51	5.29	2
Congo, Rep.	0.43	11.43	28.27	17.80	4.73	2.61	32.99	16.43	22.51	12.87	2.45	14
Cote d'Ivoire	0.16	4.90	3.19	2.03	27.37	3.43	30.56	3.75	0.99	0.97	5.08	29
Equatorial Guinea	6.84	20.29									8.83	11
Ethiopia	1.10	7.45							0.05	0.03	4.56	19
Gabon	-1.31	10.15	42.94	9.82	6.42	4.68	49.37	6.83	21.17	10.84	1.74	15
Gambia, The	0.05	4.07	0.13	0.13	17.37	14.50	13.85	15.39			5.79	15
Ghana	0.98	7.33	4.66	2.52	19.12	4.24	23.79	4.59	1.04	0.66	5.32	6
Guinea	0.69	3.17							4.62	2.85	1.16	4
Guinea-Bissau	-0.51	12.71									7.20	11
Kenya	0.22	2.67	2.98	1.43	10.30	2.59	13.29	2.99	0.00	0.00	3.67	27
Lesotho	3.14	7.67									8.46	13
Liberia	-5.32	18.87	42.73	8.38	16.64	3.45	59.37	8.30	28.15	20.12	5.06	27
Madagascar	-1.79	3.44	1.19	0.47	9.41	2.14	10.60	2.33	0.00	0.00	2.68	15
Malawi	1.57	5.09	0.11	0.17	20.50	2.23	20.61	2.16			1.42	12
Mali	1.67	5.05	0.46	0.83	11.44	4.45	12.92	5.43			4.44	17
Mauritania	0.34	4.22							22.20	7.58	7.65	28
Mauritius	4.09	3.12	0.25	0.28	11.75	2.92	11.32	2.59			1.34	40
Mozambique	1.12	6.22							0.05	0.08	3.97	19
Namibia	0.18	4.26							7.79	11.95	2.17	42
Niger	-0.93	6.29	7.35	5.20	4.20	1.35	11.56	4.79	0.07	0.06	4.55	10
Nigeria	0.47	5.45	30.80	9.43	1.35	1.11	32.15	8.66	31.20	12.03	3.19	12
Rwanda	0.62	13.26							0.33	0.44	5.91	7
Sao Tome and Principe	0.89	7.72									17.69	12
Senegal	-0.19	4.44	5.13	2.07	8.67	4.17	13.81	4.79	0.76	1.17	1.92	27
Sierra Leone	-1.88	4.99							2.33	1.72	2.61	5
Somalia	-2.10	7.56							0.00	0.00	4.78	
South Africa	1.05	1.78	4.31	1.36	3.81	2.10	8.12	2.84	5.76	4.00	1.73	87
Sudan	0.54	3.92	1.86	3.81	6.81	3.45	8.90	3.59	1.34	3.28	4.93	8
Swaziland	3.54	3.89							3.37	5.27	2.28	19
Tanzania	1.39	7.44							0.12	0.15	8.78	8
Togo	-1.53	4.90	9.64	4.58	9.64	3.07	19.28	4.90	2.74	3.45	8.09	20
Uganda	0.15	5.55	0.32	0.32	8.15	2.09	8.47	2.05	0.14	0.29	2.61	6
Zambia	-0.58	5.42	31.15	14.21	2.01	1.94	33.16	13.22	10.37	7.56	5.12	12
Zimbabwe	-0.51	7.64	3.48	1.36	12.24	4.52	15.73	5.25	2.58	1.24	5.45	24

**Table 3: Institutions, Openness and the Natural Resource Curse**

Annual growth in real GDP per capita	Sachs and Warner (1997a)	Based on data in Sachs and Warner (1997b)	Mehlum, Moene and Torvik (2005a)
Initial income	-1.76 (8.56)	-1.28 (6.65)	-1.26 (6.70)
Openness	1.33 (3.35)	1.45 (3.36)	1.66 (3.87)
Resource abundance	-10.57 (7.01)	-6.69 (5.43)	-14.34 (4.21)
Rule of law	0.36 (3.54)	-	-
Institutional quality	-	0.6 (0.64)	-1.3 (1.13)
Investments	1.02 (3.45)	0.15 (6.73)	0.16 (7.15)
Interaction term	-	-	15.40 (2.40)
Number of countries	71	87	87
Adjusted R <sup>2</sup>	0.72	0.69	0.71

**Table 4: Point-Source Resources, Institutions and the Natural Resource Curse**

Marginal effects	Primary exports share of GDP	Ores and metals exports as share of GDP	Mineral production as share of GNP	Production of gold, silver and diamonds as share of GDP
Worst institutions	-0.548	-0.946	-1.127	-1.145
Average institutions	-0.378	0.425	0.304	0.279
Average + one s.d. institutions	-0.288	1.152	1.062	1.183
Best institutions	-0.228	1.629	1.560	1.776

Note: Institutional quality is an average of the indexes for bureaucracy, corruption, rule of law, risk of expropriation of private investment and repudiation of contracts by government.

Source: Boschini, et al (2003)

**Table 5: Natural Resource Curse and Regional Volatility**

Dependent Variable:	yearly GDP growth 1970- 2003				
(constant 2000 international dollars, PWT 6.2)	(1)	(2)	(3)	(4)	(5)
	Arch	Arch	Arch	Arch	Arch
<b>Mean equation</b>					
					<b>Resource Rents</b>
Average investment share of GDP '70-'03	0.108*** (0.012)	0.109*** (0.017)	0.088*** (0.023)	0.074*** (0.026)	0.105*** (0.023)
Average population growth rate 1970-2003	-0.472*** (0.118)	-0.464*** (0.157)	-0.571** (0.222)	-0.625*** (0.196)	-0.794*** (0.212)
log per capita GDP 1970	-0.012*** (0.001)	-0.012*** (0.002)	-0.015*** (0.003)	-0.016*** (0.003)	-0.013*** (0.002)
Human capital 1970	0.001* (0.000)	0.001 (0.001)	0.001* (0.001)	0.001* (0.001)	-0.000 (0.001)
<b>Volatility (<math>\sigma</math>)</b>	<b>-0.110** (0.049)</b>	<b>-0.112* (0.066)</b>	<b>-0.171* (0.099)</b>	<b>-0.319** (0.133)</b>	<b>-0.312** (0.133)</b>
Point-source resources 1970			-0.090** (0.040)	-0.039 (0.038)	
Point-source rent share 1970					-0.236*** (0.082)
Diffused resources 1970			0.001 (0.023)	0.014 (0.023)	0.044** (0.017)
Financial development 1970			-0.003 (0.006)	-0.000 (0.005)	-0.008 (0.006)
Sachs Warner updated openness dummy 70			0.001 (0.005)	0.002 (0.005)	0.002 (0.003)
Point based resources * openness 70			0.020 (0.090)	0.030 (0.065)	
Point-source rent share * openness 70					0.207*** (0.064)
Point-source resources * Fin. Dev. 70			0.335 (0.219)	0.194 (0.186)	
Point-source rent share * Fin. Dev. 70					0.886*** (0.316)
Constant	0.110*** (0.011)	0.111*** (0.015)	0.136*** (0.022)	0.153*** (0.021)	0.134*** (0.017)
1 <sup>st</sup> Lag Error ( $\epsilon$ )		0.272*** (0.017)	0.273*** (0.021)	0.248*** (0.018)	0.220*** (0.018)
2 <sup>nd</sup> Lag Error ( $\epsilon$ )		0.030* (0.018)	0.002 (0.023)	-0.010 (0.020)	-0.006 (0.020)
<b>Variance equation</b>					
Sub-Saharan Africa				2.579*** (0.154)	2.648*** (0.156)
Middle-East & North Africa				1.726*** (0.161)	1.701*** (0.164)
Latin America & Caribbean				1.596*** (0.154)	1.571*** (0.155)
Eastern Europe & Centra Asia				1.429*** (0.272)	1.372*** (0.271)
East Asia & Pacific				1.024*** (0.160)	0.865*** (0.160)
South Asia				0.439** (0.195)	0.359* (0.197)
Western Europe				0.212 (0.155)	0.279* (0.154)
North America					Reference region (least volatile)
Constant	-3.823*** (0.118)	-3.961*** (0.119)	-6.629*** (0.192)	-7.803*** (0.150)	-7.763*** (0.150)
Country dummies in variance eq.	yes	yes	yes	no	no
Observations	3448	3448	2186	2186	2014
Log likelihood	5898.5	6020.2	4227.3	4017.6	3758.2

Standard errors in parentheses \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1.

Source: van der Ploeg and Poelhekke (2007)

**Table 6: What if Resource-Rich Countries Had Same Characteristics as OECD?**

Volatility, Financial Development and the Resourced Curse	A	B	C	=C-B	Conditional effect	
	sample mean	OECD mean	Top 25% resource dependent countries (> 17.31%)	Difference	on volatility	on yearly GDP/capita growth rate
GDP per capita growth	1.49%	2.23%	1.06%	-1.17%		
<b>Mean equation</b>						
Average investment share of GDP '70-'03	0.066 **	17.26%	23.08%	16.06%	-7.02%	0.46%
Average population growth rate 1970-2003	-0.674 ***	1.72%	0.75%	2.24%	1.48%	1.00%
Initial log per capita GDP 1970	-0.018 ***	8.362	9.271	7.933	-1.338	-2.47%
Initial human capital 1970	0.002 ***	4.140	6.700	2.985	-3.714	0.78%
<b>Volatility (<math>\sigma</math>)</b>	-1.187 ***	3.62%	2.17%	4.99%	2.82%	3.35%
Initial point based resources 1970	-0.004	4.35%	1.70%	12.91%	11.21%	n.a.
Initial financial development 1970	-0.019 *	29.07%	47.17%	18.04%	-29.13%	-0.55%
Sachs Warner updated openness dummy 70	-0.012 *	0.374	0.870	0.133	-0.736	-0.88%
Initial point based resources * openness	0.120 *	0.008	0.016	0.011	-0.005	0.06%
Point based resources * Fin. Dev. 70	0.253	0.009	0.007	0.023	0.016	n.a.
<b>Variance equation</b>						
Initial point based resources 1970	1.494 ***	4.35%	1.70%	12.91%	11.21%	-0.41%
Initial diffused resources 1970	0.961 **	7.27%	4.48%	10.43%	5.94%	-0.14%
Initial financial development 1970	-1.247 ***	29.07%	47.17%	18.04%	-29.13%	-0.85%
Sachs Warner updated openness dummy 70	-0.690 ***	0.374	0.870	0.133	-0.736	-1.15%
Distance to nearest navigable river or coast	0.001 ***	277.763	181.285	292.699	111.414	-0.19%
Estimated volatility Countries	4.04%	62	2.84%	23	5.11%	2.27%
						15

Note: Top 25% resource dependent countries in 1970: Algeria, Bolivia, Chile, Congo (, Rep.), Costa Rica, Ecuador, Ghana, Honduras, Malawi, Malaysia, Netherlands, Togo, Trinidad and Tobago, Venezuela (, RB.), Zambia

Source: van der Ploeg and Poelhekke (2007)

**Table 7: Counterfactual Exercises for Africa versus the Asian Tigers**

Africa and the Asian Tigers	A	B	C	=C-B	Implied conditional effect	
	sample mean	Asian Tigers	Africa	Difference	on volatility	on yearly GDP/capita growth rate
GDP per capita growth	1.49%	4.04%	0.35%	-3.69%		
<b>Mean equation</b>						
Average investment share of GDP '70-'03	0.063 **	17.26%	24.45%	11.30%	-13.15%	0.82%
Average population growth rate 1970-2003	-0.634 ***	1.72%	1.86%	2.63%	0.77%	0.49%
Initial log per capita GDP 1970	-0.018 ***	8.362	7.747	7.192	-0.555	-1.01%
Initial human capital 1970	0.002 ***	4.140	4.049	1.031	-3.019	0.68%
<b>Volatility (<math>\sigma</math>)</b>	-1.247 ***	3.62%	3.49%	5.62%	2.13%	2.66%
Initial point-source resources 1970	0.063 **	4.35%	4.32%	6.81%	2.49%	-0.16%
Initial financial development 1970	-0.023 ***	29.07%	26.89%	14.37%	-12.52%	-0.29%
<b>Variance equation</b>						
Initial point-source resources 1970	1.581 ***	4.35%	4.32%	6.81%	2.49%	-0.11%
Initial diffused resources 1970	0.765 **	7.27%	11.08%	9.27%	-1.80%	0.04%
Initial financial development 1970	-1.290 ***	29.07%	26.89%	14.37%	-12.52%	-0.45%
Sachs Warner updated openness dummy 70	-0.689 ***	0.374	0.746	0	-0.746	-1.32%
Distance to nearest navigable river or coast	0.001 ***	277.763	90.902	604.150	513.247	-0.93%
Estimated volatility	4.04%	3.43%	5.80%	2.37%		
Countries	62	4	15			

Note: Asian Tigers are: South Korea, Malaysia, Philippines and Thailand

Source: van der Ploeg and Poelhekke (2007).

**Table 8: Counterfactual Experiments for Resource-Rich and Landlocked Africa**

<b>Resource-Rich Africa versus the Asian Tigers</b>		sample mean	Asian Tigers	Resource-rich Africa	Difference	on volatility	on yearly GDP/capita growth rate
GDP per capita growth		1.49%	4.04%	0.25%	-3.79%		
<b>Mean equation</b>							
Average investment share of GDP '70-'03	0.063 **	17.26%	24.45%	14.96%	-9.50%		0.59%
Average population growth rate 1970-2003	-0.634 ***	1.72%	1.86%	2.75%	0.89%		0.56%
Initial log per capita GDP 1970	-0.018 ***	8.362	7.747	7.129	-0.619		-1.12%
Initial human capital 1970	0.002 ***	4.140	4.049	1.476	-2.574		0.58%
<b>Volatility (<math>\sigma</math>)</b>	-1.247 ***	3.62%	3.49%	6.55%	3.07%		3.82%
Initial point-source resources 1970	0.063 **	4.35%	4.32%	13.13%	8.80%		-0.55%
Initial financial development 1970	-0.023 ***	29.07%	26.89%	14.43%	-12.47%		-0.29%
<b>Variance equation</b>							
Initial point-source resources 1970	1.581 ***	4.35%	4.32%	13.13%	8.80%	-0.40%	0.50%
Initial diffused resources 1970	0.765 **	7.27%	11.08%	10.52%	-0.56%	0.01%	-0.02%
Initial financial development 1970	-1.290 ***	29.07%	26.89%	14.43%	-12.47%	-0.47%	0.58%
Sachs Warner updated openness dummy 70	-0.689 ***	0.374	0.746	0	-0.746	-1.37%	1.70%
Distance to nearest navigable river or coast	0.001 ***	277.763	90.902	552.571	461.669	-0.87%	1.09%
Estimated volatility		4.04%	3.43%	6.02%	2.59%		
Countries		62	4	6			

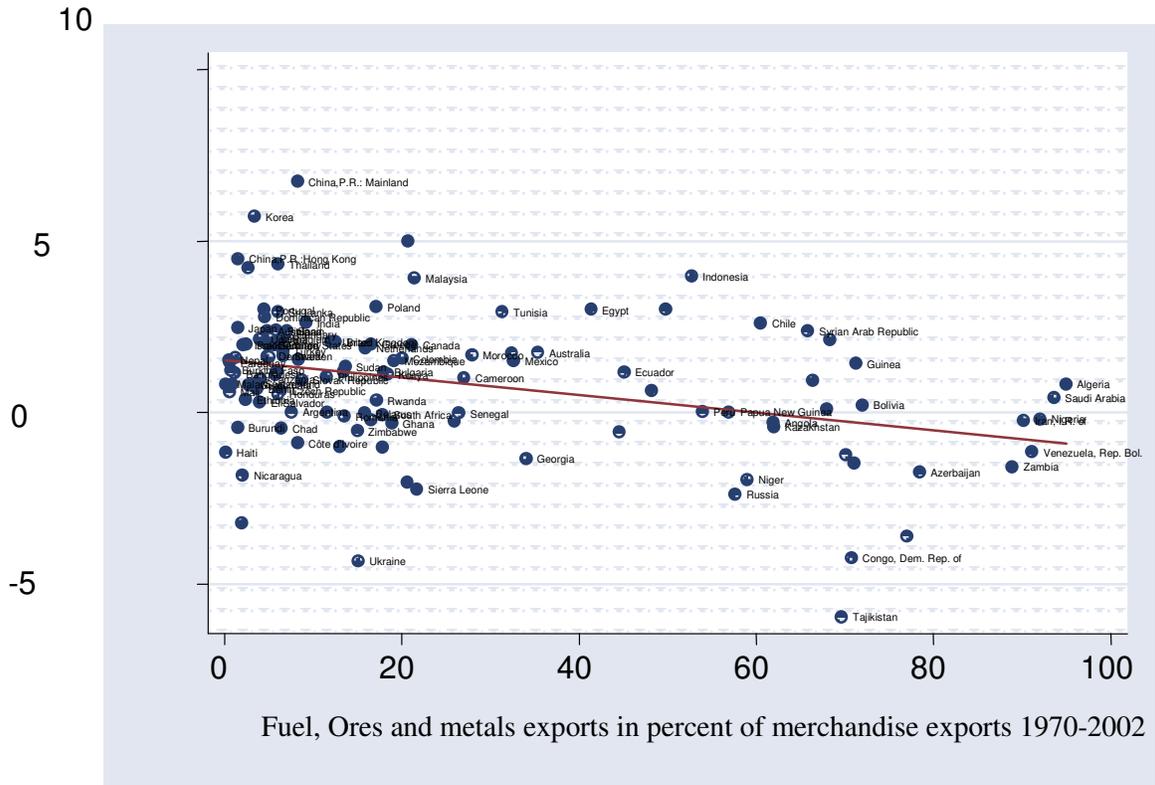
Note: Resource-rich African counties are: Algeria, Congo, Rep., Ghana, Malawi, Togo, Zambia. Asian Tigers are: South Korea, Malaysia, Philippines and Thailand.

<b>Landlocked Africa versus the Asian Tigers</b>		sample mean	Asian Tigers	Landlocked Africa	Difference	on volatility	on yearly GDP/capita growth rate
GDP per capita growth		1.49%	4.04%	0.22%	-3.82%		
<b>Mean equation</b>							
Average investment share of GDP '70-'03	0.063 **	17.26%	24.45%	12.13%	-12.32%		0.77%
Average population growth rate 1970-2003	-0.634 ***	1.72%	1.86%	2.57%	0.71%		0.45%
Initial log per capita GDP 1970	-0.018 ***	8.362	7.747	6.744	-1.004		-1.82%
Initial human capital 1970	0.002 ***	4.140	4.049	0.874	-3.176		0.72%
<b>Volatility (<math>\sigma</math>)</b>	-1.247 ***	3.62%	3.49%	5.52%	2.03%		2.54%
Initial point-source resources 1970	0.063 **	4.35%	4.32%	10.97%	6.65%		-0.42%
Initial financial development 1970	-0.023 ***	29.07%	26.89%	12.05%	-14.84%		-0.34%
<b>Variance equation</b>							
Initial point-source resources 1970	1.581 ***	4.35%	4.32%	10.97%	6.65%	-0.35%	0.44%
Initial diffused resources 1970	0.765 **	7.27%	11.08%	7.99%	-3.09%	0.08%	-0.10%
Initial financial development 1970	-1.290 ***	29.07%	26.89%	12.05%	-14.84%	-0.63%	0.78%
Sachs Warner updated openness dummy 70	-0.689 ***	0.374	0.746	0	-0.746	-1.56%	1.95%
Distance to nearest navigable river or coast	0.001 ***	277.763	90.902	979.419	888.516	-1.79%	2.24%
Estimated volatility		4.04%	3.43%	6.88%	3.45%		
Countries		62	4	5			

Note: Landlocked Africa are: Central African Republic, Malawi, Mali, Niger, Zambia. Asian Tigers are: South Korea, Malaysia, Philippines and Thailand.

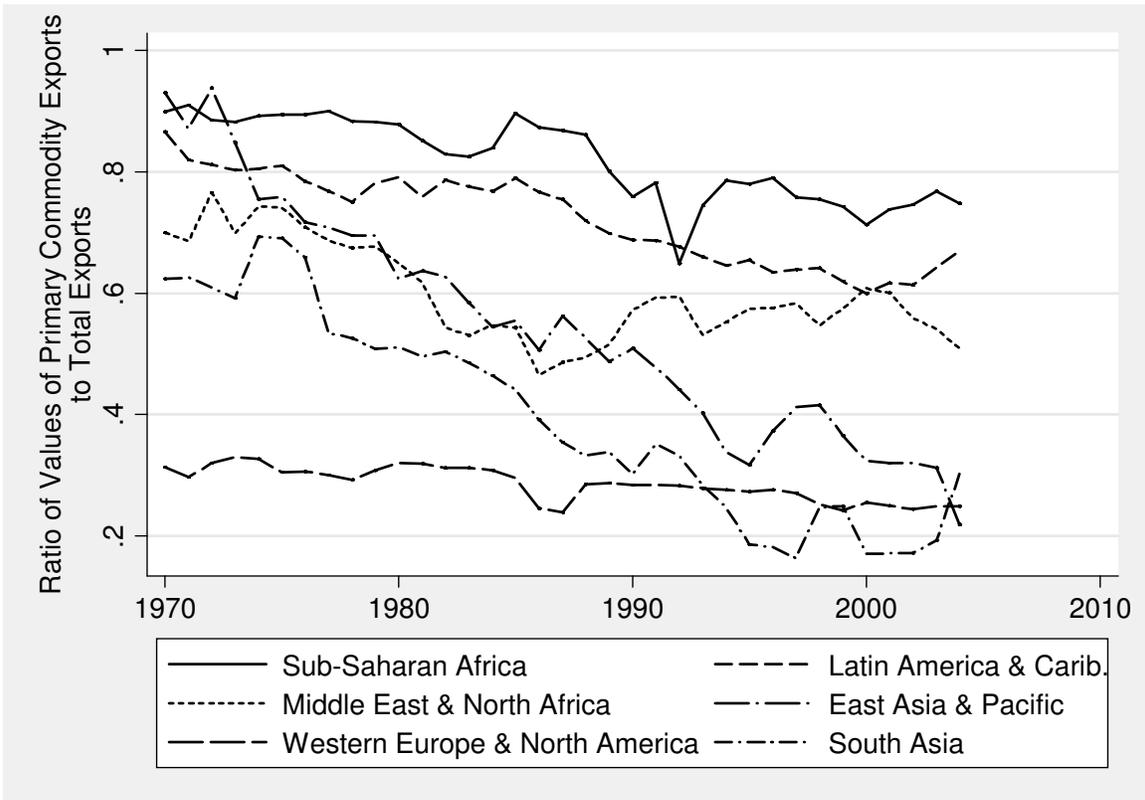
Source: van der Ploeg and Poelhekke (2007).

**Figure 1: Growth and Natural Resource Abundance**  
Average yearly real GDP per capita growth 1970-2002

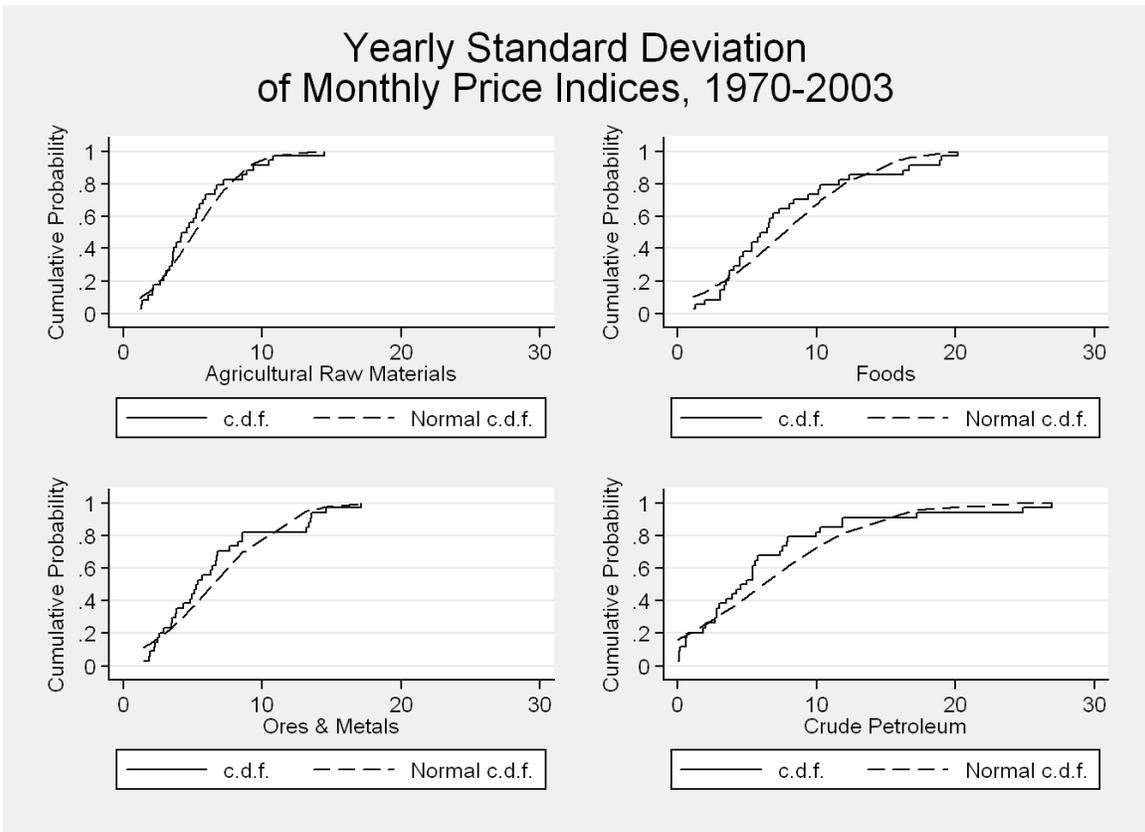


Source: World Development Indicators, 2004, World Bank

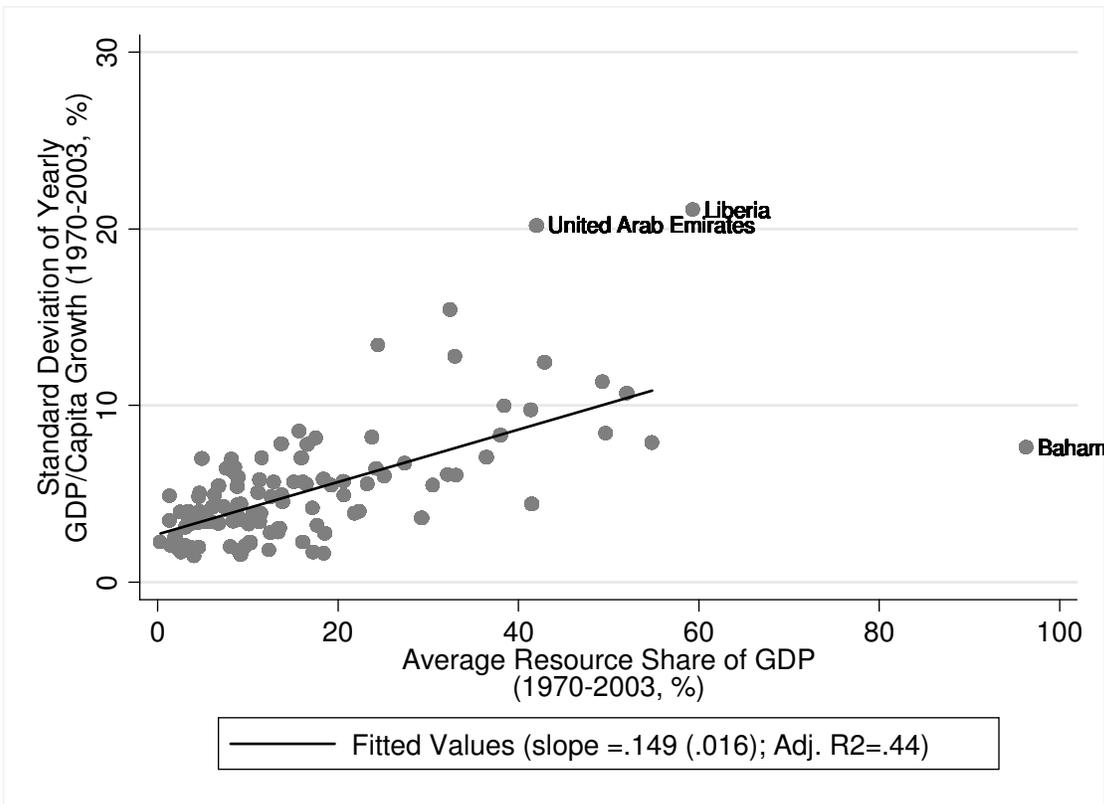
**Figure 2: Declining Natural Resource Dependence in the Global Economy**



**Figure 3: Cumulative Density Function of Volatility of Commodity Prices**



**Figure 4: Resource-Rich Economies Are More Volatile**



**Figure 5: Growth Volatility and Volatility of Point-Source Resources**

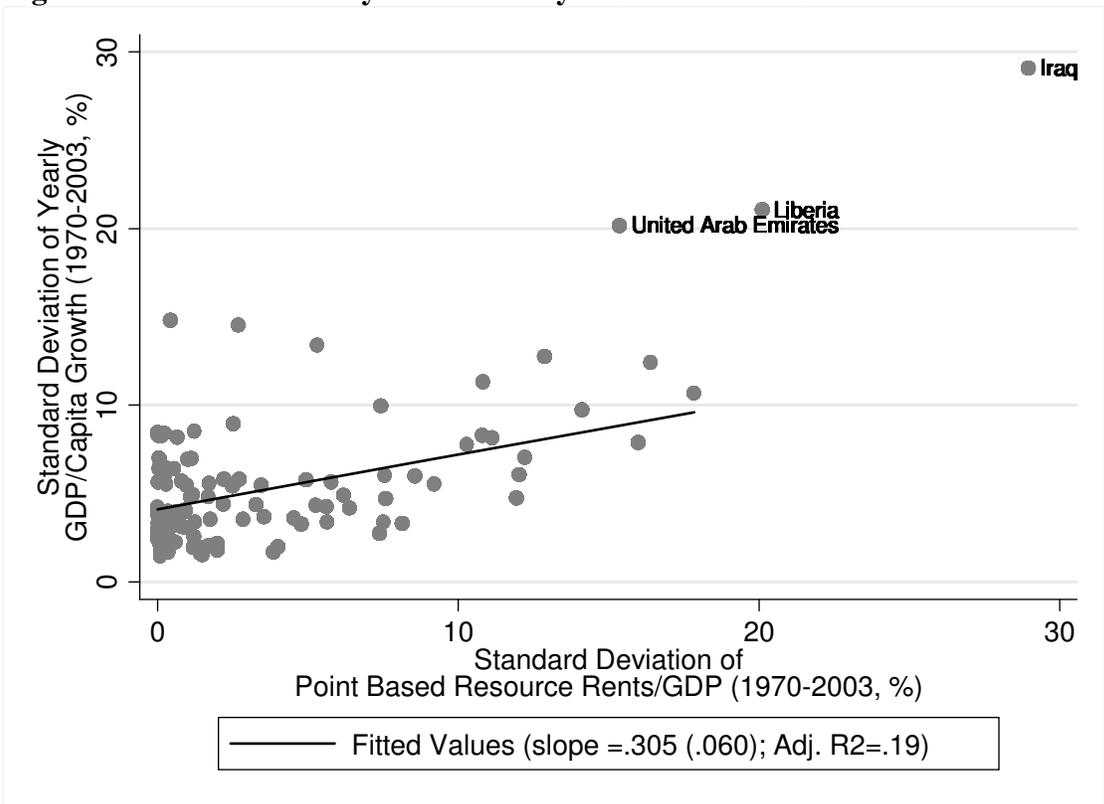


Figure 6: Volatile Countries Have Lower Annual Growth in GDP per Capita

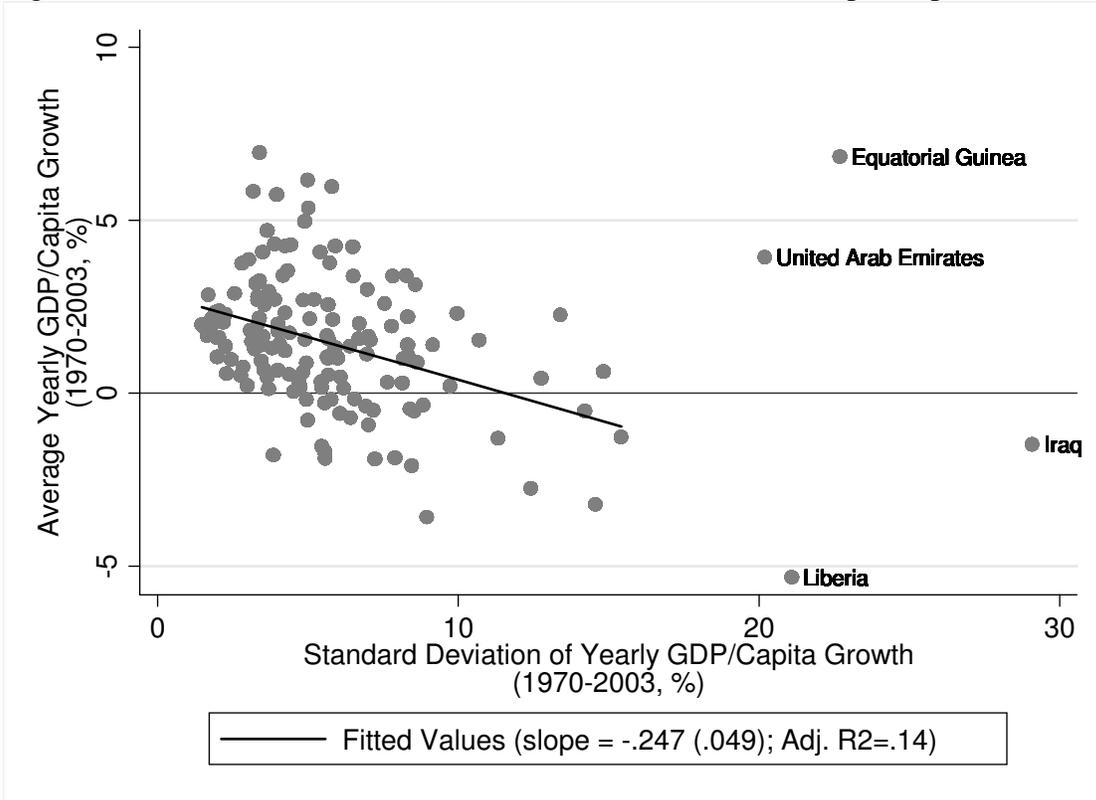
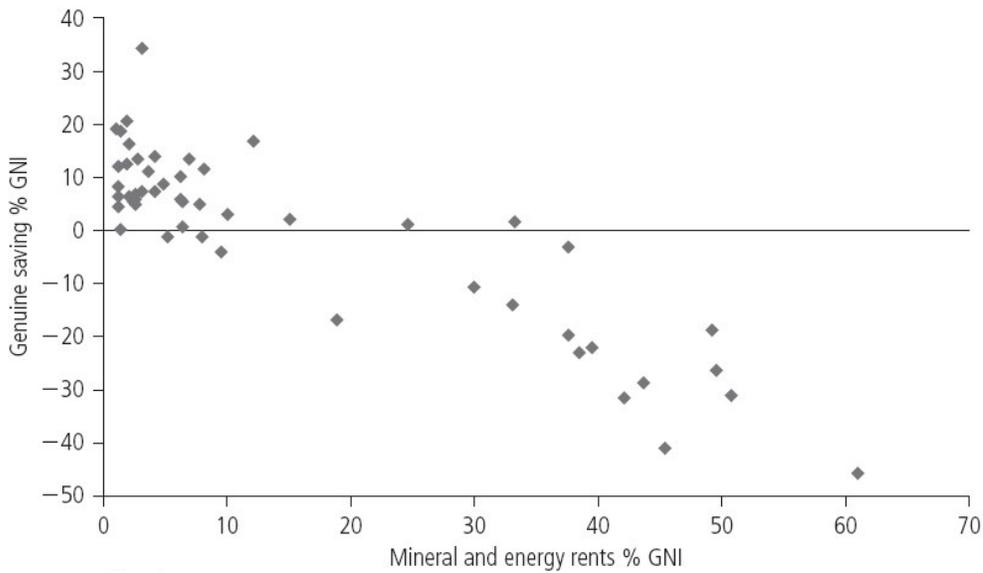
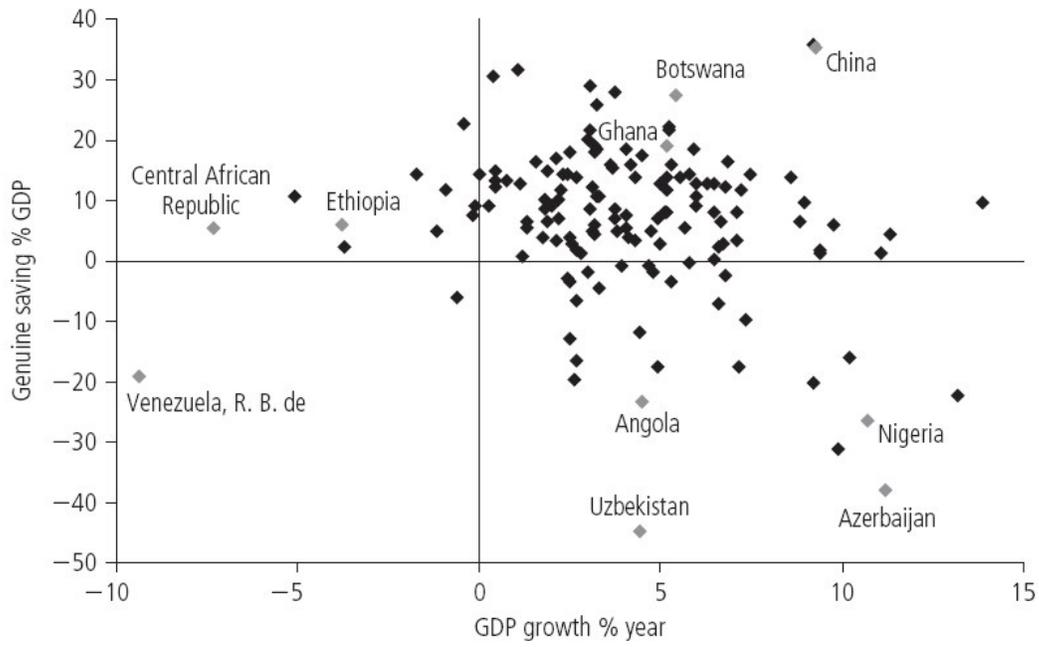


Figure 7: Negative Genuine Saving in Resource-Rich Countries

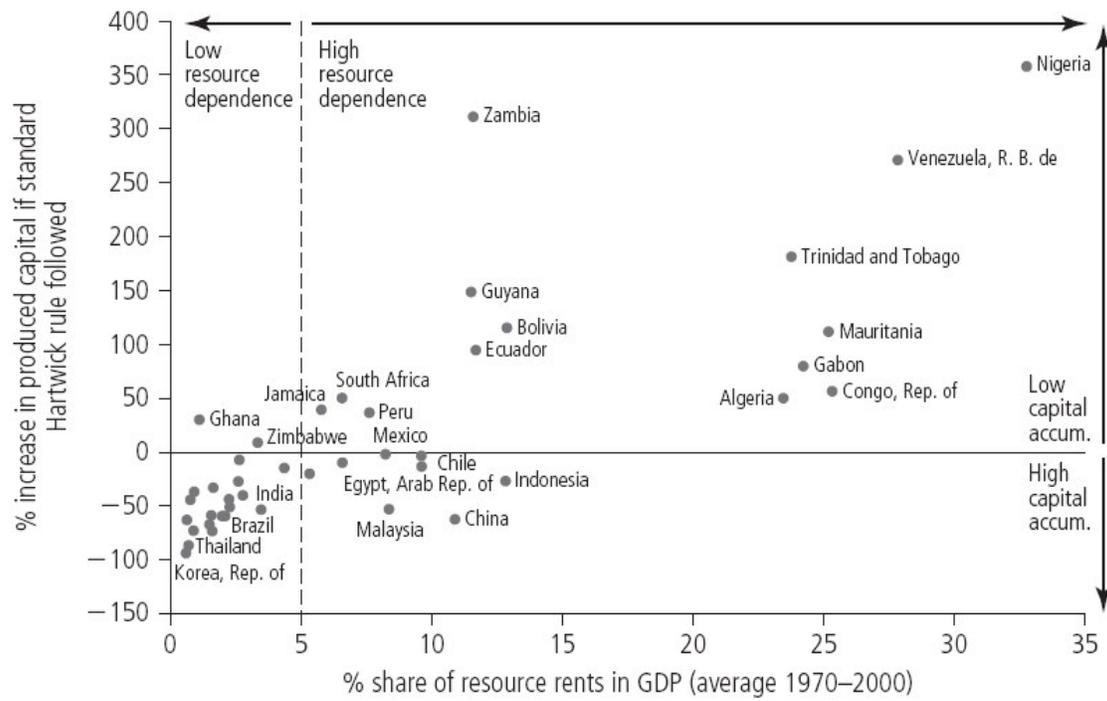


Source: World Bank (2006, Figure 3.4)

**Figure 8: Genuine Saving Rates Against Economic Growth, 2003**

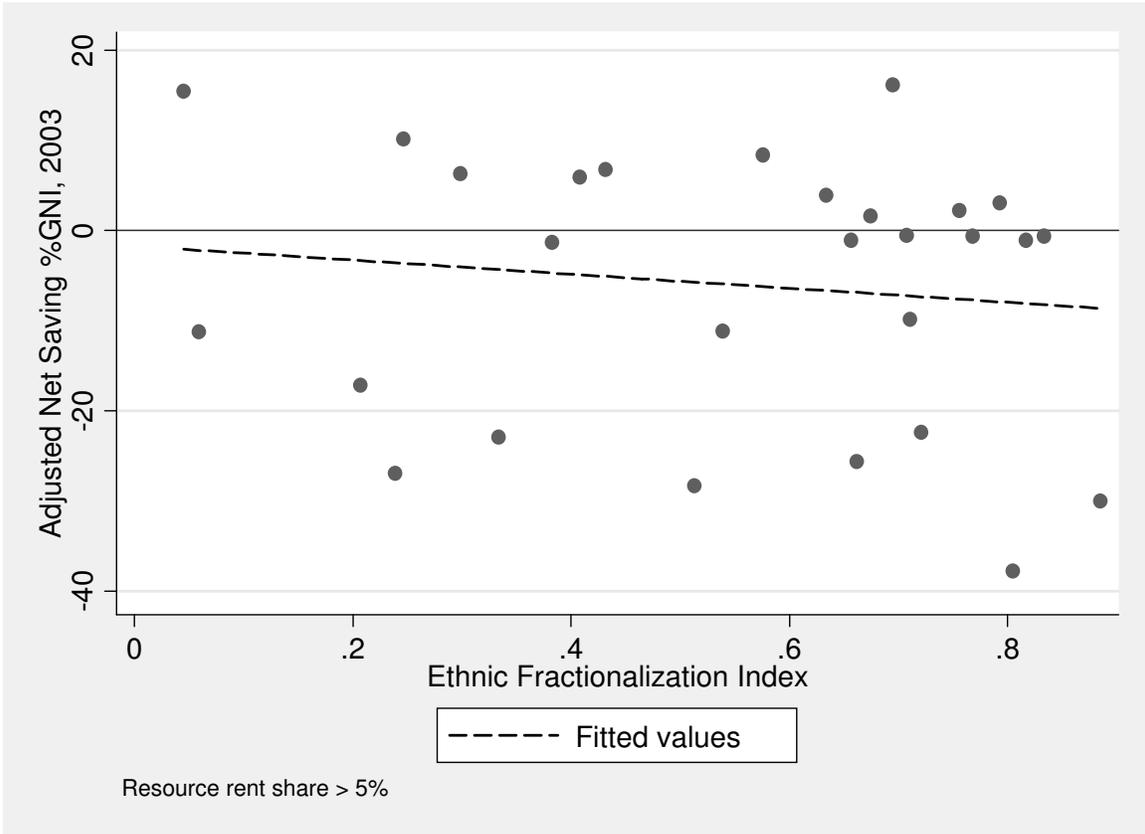
Source: World Bank (2006, Figure 3.6).

**Figure 9: Counterfactual Exercise of Imposing the Hartwick Rule**

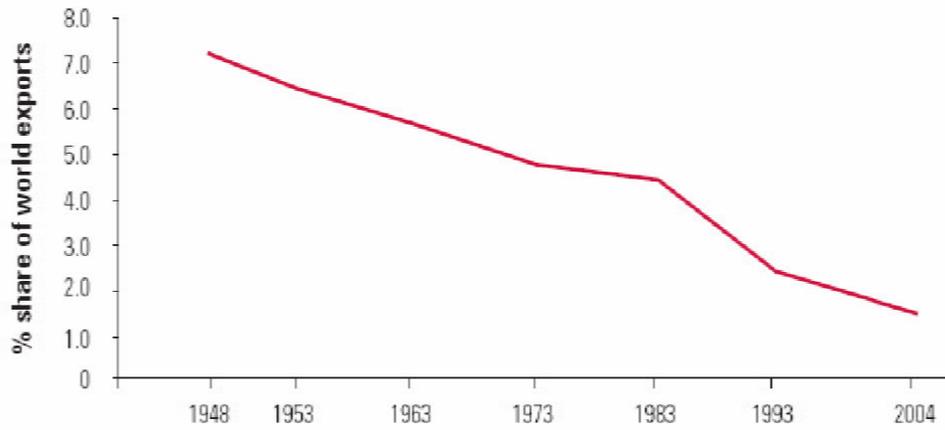


Source: World Bank (2006, Figure 4.1).

**Figure 10: Genuine Saving and Ethnic Fractionalisation for Resource-Rich Countries**



Source: International Country Risk Guide and World Bank (2006)

**Figure 11: Declining Share of Africa in World Exports**

Source: Africa's Silk Road (2007)

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**Figure 12: Africa Still Adds Little Value to its Raw Materials**

