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Revenue mobilization in African Countries: Does Natural Resource Endowment Matter?

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Abstract

Natural resource endowment offers great opportunities for achieving high levels of growth and development notably via fiscal revenue mobilization throughout the entire chain of operations from exploration to production to exports. However, in the case of African countries, it is not clear whether resource-rich countries have been able to take full advantage of their resource wealth to mobilize government revenue. In fact it appears that they have often been outperformed by their resource-scarce counterparts in this regard. Is the low revenue performance as a result of distorted incentives induced by the natural resource bonanza or the lack of capacity to harness the revenue potential from the natural resource industry? This paper explores these questions and provides empirical evidence based on data from a sample including African countries as well as countries from Latin America, Asia, and the Middle East for the period 1980-2007. The paper undertakes an econometric analysis to examine the factors that determine revenue performance in African countries from a comparative perspective, with a focus on the role of natural resource endowment. The results are consistent with the evidence from the literature, especially with regard to the role of economic structure (notably the share of agriculture in GDP), the tax base (per capita income), and trade. We compute an index of revenue performance that relates the actual revenue to the level predicted by the econometric model and we find that African resource-rich countries have been relative to their resource-scarce counterparts and compared to the oil-rich Middle Eastern countries. The paper concludes with some policy implications for African countries.

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1. Introduction

The role of government revenue and the capacity of governments to raise taxes for the purpose of financing economic development have preoccupied economists and policy makers for a long time. More than forty years ago, Kaldor (1963) raised the very important question of whether underdeveloped countries will "learn to tax", with the underlying view that for these countries to reach higher levels of living standards, they would need to achieve levels of tax effort that are significantly higher than observed at that time. Kaldor was in fact echoing an earlier call by Sir Arthur Lewis who posited that "the government of an underdeveloped country needs to be able to raise revenue of about 11-19 percent of GNP in order to give a better than average standard of service" (Martin and Lewis 1956). Indeed, the evidence clearly shows that tax effort rates are much higher for high-income countries than in low-income countries, supporting the notion that performance in tax mobilization is essential for reaching higher levels of income. A low level of government revenue is a constraint on the capacity to finance essential public investment programs and undertake adequate levels of spending on social services, which are essential for improving living standards.

What is less straightforward is what makes a country or a government capable of achieving high levels of revenue performance. As Bird, Vazquez and Torgler (2008) point out, most of the attention in the analyses of tax effort has traditionally been focused on the supply side (or "tax handles" in their words), mainly the availability of readily taxable activities such as trade/commerce and natural resources. However, as these authors rightly point out, "telling a country that wants to raise its tax levels to find and tax natural resources is not a particularly promising piece of policy advice." In reality, however, the problem is even much more complicated than presented by Bird and his colleagues. In fact, even finding natural resources does not necessarily guarantee a high level of revenue performance. Many countries have found natural resources but not all those that were lucky to find a bounty in their underground have been able to take advantage of the resources in raising government revenue.

African countries have generally performed poorly in tax revenue mobilization. The average tax-to-GDP ratio in sub-Saharan Africa increased only moderately over the past two decades. Two key problems are evident from the evidence. First, African countries have been unable to harness natural resource endowment for the purpose of revenue mobilization. Second, African countries have been unable to develop their capacity to mobilize non-resource sources tax revenue. In the case of resource-rich countries, this is a result of failure to utilize the natural resource bonanza to promote activities outside the natural resource industry, so as to diversify their production and export base. The problem goes beyond the issue of value addition in the natural resource industry – or moving up the value chain. It also and most importantly encompasses taking advantage of natural resource endowment to develop new "capabilities" to innovate within and outside the natural resource value chain. The objective of this paper is partly to stimulate a reflection on these issues in the case of African countries. It specifically seeks to contribute a reflection on the question of whether the low revenue performance is driven by distorted incentives induced by the natural resource bonanza – failure to develop non-resource tax revenue – or a result of

the lack of capacity to tax the natural resource industry. The paper provides empirical evidence on the coorelates of revenue performance based on data from a sample including African countries as well as countries from Latin America, Asia, and the Middle East over the period 1980-2007.

The rest of the paper is organized as follows. The next section provides some stylized facts on Africa's natural resource endowment. In the interest of the theme of the paper, the section discusses the role of fiscal policy for harnessing natural resource endowment for revenue mobilization. Section 3 provides a brief review of the literature on the determinants of tax efforts with an attempt to make inference for the case of African resource-rich countries. In other words, we seek to examine what factors, according to the empirical evidence, would suggest that resource-rich African countries should have a high level of tax effort and which ones would suggest otherwise. Section 4 consists of an econometric analysis of the determinants of revenue performance with a focus on the role of natural endowment and a comparison between African countries and other developing countries. Section 5 concludes with a summary of the findings and some policy implications.

2. Natural resources in Africa and the role of fiscal policy for revenue mobilization

A key challenge faced by all African countries is to achieve and sustain high levels of growth. In the case of natural resource-rich countries, another challenge is the high volatility of growth arising from the volatility of commodity prices and demand (Ndikumana 2009). Moreover, this group of countries faces the challenge of maximizing revenue from the natural resource industry and to manage these revenues optimally from an intertemporal and intergenerational perspective. This section touches briefly on these issues.

2.1 Africa's natural resource endowment

Africa is well endowed with abundant natural resources including 9.5 percent of global crude oil reserves and 8.2 percent of gas reserves are in Africa (Table 1). The majority of African oil reserves (and production) is located in Libya, Nigeria, Algeria, Angola, and Sudan, which together account for more than 90 percent of the continent's reserves (AfDB 2007; BP 2008).

Table 1: Proved oil reserves (trillion barrels)

	1980	1990	2000	2007	% of World total 2007
Total North America	92.5	96.3	68.9	69.3	5.6
Total South & Central America	26.7	71.5	97.9	111.2	9.0
Total Europe & Eurasia	98.3	80.4	108.5	143.7	11.6
Total Middle East	362.4	659.6	692.9	755.3	61.0
Total Asia Pacific	33.9	36.6	42.9	40.8	3.3
Algeria	8.2	9.2	11.3	12.3	1.0
Angola	1.4	1.6	6.0	9.0	0.7
Chad	-	-	0.9	0.9	0.1
Rep. of Congo (Brazzaville)	0.7	0.8	1.7	1.9	0.2
Egypt	2.9	3.5	3.6	4.1	0.3
Equatorial Guinea	-	-	0.8	1.8	0.1
Gabon	0.5	0.9	2.4	2.0	0.2
Libya	20.3	22.8	36.0	41.5	3.3
Nigeria	16.7	17.1	29.0	36.2	2.9
Sudan	-	0.3	0.6	6.6	0.5
Tunisia	2.2	1.7	0.4	0.6	
Other Africa	0.6	0.9	0.7	0.6	0.1
Total Africa	53.4	58.7	93.4	117.5	9.5
TOTAL WORLD	667.2	1003.2	1104.5	1237.9	100.0

* Notes: Proved reserves of oil - Generally taken to be those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions.
Source: BP (2008), Statistical Review of World Energy, London.

Similarly, Africa produces more than 60 metal and mineral products, including gold, platinum group minerals (PGMs), copper, nickel, diamonds, aluminum, uranium, manganese, chromium, bauxite and cobalt. Africa accounts for about 30 percent of global mineral reserves, including 38 percent of uranium, 42 percent of gold, 88 percent of diamonds, 60 percent of cobalt, 90 percent of the world's PGM reserves. However, exploration and development of mines in Africa has been primarily focused on gold and diamond.

Before the first oil shock on the 1970s, oil-rich African countries enjoyed favorable macroeconomic conditions: robust economic growth, manageable fiscal deficits and external debt, and external current account surpluses. These countries adopted pro-cyclical policies during in the 1970s in order to take advantage of the oil booms. The results were economic imbalances that caused major distress when oil prices plunged in the 1980s and stayed low for over a decade. The same was true of most mineral exporters, with few exceptions like Botswana (IMF, 2006).

Cautious fiscal policies in resource-rich African countries can help reduce their macroeconomic vulnerabilities. In fact, a good number of countries have used natural

resource revenues to strengthen their external positions by reducing external debt (especially Algeria, Gabon and Nigeria); accumulate external reserves (Angola, Congo, Equatorial Guinea, Gabon, and Nigeria); reduce domestic and external arrears (Angola, Equatorial Guinea, Gabon, and Nigeria); and improve their non-oil primary fiscal balances (Cameroon, Angola, and Congo, Rep.) (IMF, 2007).

Over the last decade and before the current economic crisis, resource-rich countries had benefited from rising commodity prices, inducing substantial increases in production (ADB 2007, 2009). As a result, these countries enjoyed improvements in terms of trade and fiscal balances. However, the current economic crisis has demonstrated the risk of heavy reliance on commodity exports, which exposes countries to high growth volatility. Thus, the diversification of production and exports away from natural resources remains a key imperative for national development policy in resource-rich African countries.

2.2 Revenue generation and the role of fiscal policy

The existing evidence suggests that African countries have not been able to fully harness their natural resource endowment. Growth has been erratic, the resource dividends in terms of social development have been limited, and management of resources has not been tailored to optimization of intergenerational transfer of wealth. In particular, policy making in resource-rich countries has not systematically considered the basic principle of optimization in consumption and saving decisions, which recommends that temporary increases in income ought to be saved.

The lack of rationality in consumption and saving behavior among resource-rich countries may be a result of both lack of capacity on the part of policy makers, but also myopic views induced by the nature of the polity in which policy making takes place. In particular, the lack of adequate systems of accountability and transparency causes policies to be skewed towards the short-term. Thus, consumption tends to take priority over investment while also private interests take precedence over public interests. As a result, changing natural resources management for better intergenerational transfer of wealth – i.e., for transforming transitory income into permanent income – will require both improvement in the capacity to formulate and implement foresighted economic policies, but also institutional reforms to improve accountability and transparency.

In this section, the paper discusses the role of fiscal policies for harnessing natural resource endowment through revenue generation and management as well as saving and expenditure management decisions. The public sector is the primary conduit of the impact of natural resource booms on the economy. The extraction of natural resources and their exports have the potential to generate large rents for the government, which can finance public investment, public consumption and transfers. Thus government revenue from natural resources has potentially large multiplier effects on private sector activity and ultimately on national income.

Fluctuations in commodity exports lead to large swings in government expenditures. This causes high procyclicality of public expenditures, a key source of income volatility. Procyclical fiscal policy can thus be a source of the negative effects of resource exports volatility on growth. In particular, resource booms tend to finance

government consumption booms, an important channel of the "resource curse" (Collier and Goderis 2007).

The key challenge for resource-rich countries is to insulate fiscal policy from the volatility of revenues from primary commodities. This involves effective strategies for managing revenues and managing expenditures. On the revenue side, the primary objective is evidently to maximize the rents from natural resource extraction and tax on exports. The challenge is to design of an efficient fiscal regime for harnessing the revenue potential of natural resources. Revenues need to be managed to achieve self-insurance and asset diversification for the purpose of smoothing and sustaining expenditures during busts. On the expenditure side the objective is to minimize procyclicality and achieve an efficient balance between public consumption and public investment.

Revenue management – the fiscal regime

The starting point in revenue maximization is the design of an efficient fiscal regime that maximizes government revenue while not discouraging private investment in the resource industry. This typically involves *knowledge-intensive* negotiations between government and private companies, whereby each party seeks to maximize its rewards while shifting the risk on the other party. The risk arises from the fact that, in addition to uncertainty about inherent quality of the resources (e.g., content of underground mines), future prices are also unpredictable. Typically, during booms governments tend to apply high levies while down turns call for more lenient levies. This implies that levy rates that are set upfront will naturally be assessed as too stringent during downturns (benefiting the government and penalizing companies) and too lenient during upswings (benefiting companies and short changing the government). The government obviously prefers collecting revenue upfront as much as possible. However, any upfront decision involves a sacrifice for one side and a gain for the other.

There are several fiscal regimes to choose from, and each one has its own advantages and drawbacks. The main ones are:
(1) *Royalty regimes*: these include either specific levies (based on the volume of extracted resources) or ad valorem levies (based on the value of resources extracted). These regimes have the advantage of generating revenue for the government as soon as extraction commences. They are deemed relatively easy to administer.
(2) *Tax regimes*: these include income tax (which may be set higher than the general corporate income tax rate), and the resource rent tax (or RRT, imposed only on positive accumulated cash flow). The disadvantage of the RRT is that in addition to back-loading government revenue, the scheme may generate no revenue at all in case the accumulated cash flow turns out to be negative.
(3) *Production sharing schemes*: here the government retains ownership of the resources while contracting exploration and exploitation of the resources to private companies. The profit sharing arrangement may be complicated, notably by the uncertainty over profitability and the complexity of the negotiations over allowable recoverable costs.

The choice of a particular fiscal regime will influence the amount of rents that the government eventually collects from natural resources. In the case of African

resource-rich countries, the key constraint to revenue generation from natural resources is the lack of adequate capacity in contractual technology. Decisions need to be made upfront when information is scarce, while technology for predicting future prices and revenues is tremendously scarce in Africa. Thus the field is less than level; and the odds are quite often stacked against African countries. The situation resembles that of David against Golliath, except that in this case Golliath inexorably wins. Indeed, more often than not, African resource-rich countries are short changed in exploitation contracts in terms of government revenue generation.

Savings decision and portfolio allocation

The next important decision facing governments of resource-rich countries consists of saving for the purpose of smoothing expenditures over the price cycle and for intergenerational wealth transfer. The decision is two fold. First, the government must decide the fraction of the revenue to be saved. Second it must decide the allocation of the saved revenue among various types of assets (domestic and foreign).

Two important factors should determine the fraction of income to be saved for given rate of population growth: the stock of resources in the ground and the expected trend of the price. The objective is to provide a level of welfare for future generations that is at least equal to today's population's welfare. Hence per capita consumption must not decline when commodity prices drop temporarily below their long-run path. This is achieved by not only keeping an adequate saving rate but also by wisely investing the saved revenue to generate appropriate rates of return. Here investment is construed broadly to encompass not only the purchase of physical and financial assets, but also to include investment in human capital. This includes health and education.

The decision on the allocation of resources involves a choice among various assets both domestic and foreign. The objective is portfolio diversification through a combination of domestic and foreign assets as well as return maximization. Some countries such as Nigeria and Libya have chosen to hold resource revenues in dedicated special purpose funds. This allows governments to accumulate funds during booms that can be drawn upon during down turns to smooth expenditures. Indeed, the government of Nigeria has resorted to the Fund following the decline in revenues during the economic crisis.

Expenditure management
The first challenge of fiscal policy in resource-rich countries is to achieve a *decoupling* of revenue volatility and public expenditures. Procyclical expenditure policy is the primary source of the negative growth impact of volatility of resource revenue and the "resource curse." To insulate public expenditures from resource volatility, governments may resort to a number of strategies, including the establishment of stabilization funds that can be drawn upon to sustain desired levels of public investment when revenues decline.

Public expenditure policies must also give priority to public investment that promotes growth and improves the climate for private sector activity. This includes investment in physical infrastructure as well as human capital investment (in education and health). Fiscal policy is often characterized by myopic fiscal policy favoring public consumption over investment. Indeed, evidence shows that African countries have not

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been able to take full advantage of the rising export revenues to increase public investment (Elhiraika and Ndikumana 2007). There is also a risk for public investment decisions to favor large projects often motivated less by economic considerations than political and rent-seeking interests. This notably arises through what El Badawi and Kaltani (2007: 49) refer to as "voracity effect" whereby the incumbent regime spends out the boom in expectation that the successor regime would also act in the same fashion.

3. Revenue performance: evidence from the literature and inference for African resource-rich countries

The empirical literature has shown great interest in uncovering the key determinants of revenue performance in light of the critical importance of tax and non-tax revenue in financing development. The factors considered in the literature include supply side factors or "tax handles" (Bird, Matinzz-Vazquez, and Torgler 2008) typically linked to the level and structure of economic activity, as well as demand side factors, institutional factors, and factors related to taxpayer behavior that influence compliance. In light of this literature, the question is what inference can be drawn for the case of African countries with regard to the expected level of revenue performance. Specifically, what does the evidence suggest on the expected performance of resource-rich countries relative to the resource-scarce countries with regard to revenue performance?

Why resource-rich African countries should achieve high revenue performance

According to the literature, a number of factors seem to exhibit a robust relationship with the revenue performance. One such factor is per capita income. The majority of econometric studies find that higher levels of per capita income are associated with higher levels of tax effort (see for example Bird, Martinez-Vazquez, and Torgler 2008). One explanation is that higher per capita income is an indicator of not only a large tax base but also a proxy for higher level of sophistication of the economy, implying a higher capacity to mobilize revenue. In that case, tax effort endogenously increases with the level of per capita income. Another explanation is related to the so called *Wagner's law* whereby the demand of government services is an elastic function of income. As GDP increases, the demand for government services rises, calling for increasing government revenue to finance these rising expenditures. This would suggest a positive relationship between tax revenue and government expenditures (Griffith and Griffith 2006). How does this evidence apply to African resource-rich countries in comparison to resource-scarce countries? The data clearly show that African resource-rich countries on average exhibit higher levels of per capita income than their resource-scarce counterparts. For the period 1996-2007, average per capita income was $1936 for oil-rich countries, $1017 for mineral rich countries, and $1129 for non-resource rich countries in Africa. Following the evidence from the empirical literature one would conclude that resource-rich African countries should exhibit higher levels of tax effort than resource-scarce African countries. This is visibly not the case according to the evidence as we demonstrate in the next section. Indeed, from the data for 2007 (most recent available), it appears that oil-rich countries are clustered on the lower end of the tax/gdp ratio scale (Table 2). Eight of the bottom ten countries in terms of tax/gdp ratio are oil exporters. Note also

that mineral-rich Botswana, South Africa, Namibia, and Ghana are among the are among the top ten on the tax/GDP scale. It is worth noting that there are also countries that rank high in governance and quality of institutions. In contrast, most of the lower-ranked oil-rich counterparts score poorly in the area of governance. This suggests that the ability to generate high tax revenue among resource-rich countries requires high quality of institutions.

Table 2: Top 15 and Bottom 15 countries in Tax/GDP

Top 15	Tax/GDP		Bottom 15	Tax/GDP
Lesotho	42.9		Burkina Faso	11.5
Swaziland	39.8		Guinea-Bissau	11.5
Botswana	35.2		Niger	11.0
Seychelles	32.0		Madagascar	10.7
Namibia	28.8		Sierra Leone	10.5
South Africa	26.9		Gabon	10.3
Cape Verde	23.0		Guinea	8.2
Morocco	22.3		Central African Rep	7.7
Ghana	20.8		Algeria	7.7
Malawi	20.7		Sudan	6.3
Djibouti	20		Nigeria	6.1
Senegal	19.2		Congo, Rep	5.9
Gambia	18.9		Angola	5.7
Kenya	18.4		Chad	4.2
Cameroon	18.2		Equatorial Guinea	1.7

Source: The Heritage Foundation; World Development Indicators
Color code: Gold = mineral rich; gray = oil rich

Another factor that has been found to be robustly related to revenue performance is the structure of economic activity. In particular, a high share of agriculture in GDP is associated with a lower level of tax effort. The evidence on the link between the share of mining and tax effort is more mixed. Some studies find a negative relationship (Stotsky and Wolde Mariam 1997; Eltony 2002) while others find a positive relationship (Tanzi 1981; Eltony 2002 [1]; Bahl 1971). The negative relationship between the share of agriculture and the tax effort may be attributed to the peculiar nature of agricultural activity which makes it harder to tax compared to commerce and manufacturing activity (Bahl 2003). This is especially pronounced in developing countries where a large share of agricultural activity is informal and of subsistence nature. Not only are these activities hard to tax from a technical point of view, but attempting to tax them may not be politically desirable given the potential voting

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[1] Eltony (2002) finds a negative effect of mining resource endowment on tax effort among oil producing Arab countries and a positive effect among non-oil Arab countries.

power of the rural/agricultural population. Moreover, tax on agricultural activities in a developing country context can have substantial regressive effects as it would primarily affect the income of the farmers who are among the poorest segments of the population. It is also argued that a large share of agriculture in the national economy implies that the government needs to spend less on public services which are typically concentrated in urban areas (Tanzi 1992). The implications of this evidence for the comparative levels of tax effort by resource endowment in African countries are quite evident. Given that resource-rich countries have a relatively smaller share of agricultural activities in GDP, they should exhibit a higher tax effort than resource-scarce countries. Failure to do so would be a demonstration of sub-optimal exploitation of the potential of the natural resource industry as a source of government revenue.

As indicated earlier, the mere endowment in natural resources is not sufficient to lead a country to a high level of revenue performance. The ability of a country to take advantage of its natural resource endowment depends on the government's capacity to generate revenue from the exploitation of resources throughout the entire value chain, from exploration, to exploitation, to transformation and exports. Harnessing natural resources for revenue generation is highly *government intensive* and requires a high level of human capital sophistication that is typically lacking in many African countries. Sophisticated negotiations with the resource exploitation companies take place in the context of a world plagued by uncertainty on demand for resources and the prices or rent to be generated from the resources. Given that African governments in resource-rich countries typically tend to have less information than international oil companies and also are less equipped with the expertise in this sector, they tend to get the short end of the bargain and end up with a level of revenue that is very much below the potential.

The empirical literature has also shown that the volume of international trade is an important determinant of tax performance. A high level of imports and exports is associated with higher tax/GDP ratios. The implication for African resource-rich countries is obvious. This group of countries has enjoyed rising levels of export revenue driven by increasing prices and demand for primary commodities until recently. Hence, this evidence suggests that this group of countries should exhibit higher levels of tax effort than their resource-scarce counterparts. Failure to do so would be an illustration of their inability to optimize revenue collection from imports and exports notably due to inefficiencies in customs systems. Smuggling and trade misinvoicing[2] are another possible reason for the inability of these countries to optimize their tax revenue from natural resources.

The literature further documents the importance of the sources or composition of tax revenue for the level of tax effort. Specifically, the evidence shows that countries that rely on income tax, profit taxes, and corporate gains tax tend to exhibit higher revenue performance. This is especially relevant for resource-rich countries given the potential for revenue mobilization from the oil and mineral sector typically operated by large multinational companies that enjoy high profit rates. However, in practice the ability of African countries to generate sizeable tax revenues appears to be very limited. This

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[2] See Boyce and Ndikumana (2001) and Ndikumana and Boyce (2003) for a discussion of trade misinvoicing in the context of estimation of capital flight.

is due to both lack of expertise in designing contracts that ensure optimal tax revenue but also pervasive leakages in the tax system due to corruption on the side of both the government and on multinational corporations. Indeed as the saying goes, "it takes two to tango."

Why resource-rich countries may be bound to achieve lower revenue performance

On the other hand, there are factors that have been identified as detrimental to tax effort or constraints to tax revenue mobilization. One of such factors is institutional weakness ranging from corruption, poor enforcement of rules, and inadequate regulation. These weaknesses result in tax evasion and various other leakages that undermine tax revenue mobilization. For example, Suliman (2005) found that tax evasion in Sudan represented up to one third of the potential tax yield, which he attributes to institutional inefficiencies.

The impact of institutions on tax effort operates through both the government side as well as the taxpayer's side. From the government side, the quality of institutions affects the readiness and capacity of the government to design the taxation system and to implement tax provisions. From the taxpayer's side, the institutional environment affects compliance. The literature suggests that taxpayer's compliance is typically a function of *government legitimacy, government effectiveness and credibility*. Legitimacy is in turn a function of democratic governance as well as distributional considerations, especially perceived inequality in the access to wealth and public services. Thus, state legitimacy is an essential precondition for the establishment of an adequate tax system. State legitimacy induces what Levi (1988) refers to as "quasi-voluntary compliance" by taxpayers and hence leads to a high level of tax performance for a given level of income and a given structure of economic activity. The argument implies that one of the reasons for low tax performance in African countries could very well be that in addition to low income, agriculture-based economies, and low government capacity, these countries also have not yet succeeded in consolidating legitimacy with regard to taxation. The question then arises as to whether this varies between resource-rich and resource-scarce countries. In other words, do resource-rich countries exhibit worse institutional environments and hence less legitimacy vis-à-vis taxation than resource-scarce countries? This question is worth exploring empirically.

Another reason that may prevent African resource-rich countries from reaching higher levels of tax effort could be their failure to take advantage of the natural resource bonanza to diversify their economies so as to expand the tax base and to minimize the variability of income. Evidence shows that natural resource-rich African countries are typically less diversified than their resource-rich counterparts, and that oil-rich countries have economies that are even more concentrated (AfDB 2007).

The literature also indicates that resource-rich countries may exhibit lower tax revenue performance because of the substitution between oil/mineral exploitation duties and tax revenue. Tijerina-Guajardo and Pagan (2003) provide some evidence in support of this argument in the case of Mexico. In such cases, reductions in resource revenues resulting in a decline in duties may not be compensated by an increase in tax

revenues, resulting in overall decline in government revenue. In the case of African resource-rich countries, the question is whether these countries are (1) able to design duty extraction mechanisms/contracts that optimize revenue and (2) able to generate tax revenue in non-resource sectors to compensate for fluctuations in resource duty. The evidence tends to show that during economic downturn, resource-rich countries suffer large declines in overall government revenue (see AfDB, OECD, and UNECA 2009), suggesting limited ability to compensate fluctuations in resource duties for tax revenue.

4. Econometric analysis

4.1. Data exploration

The data used in this analysis covers a sample of 81 countries, including 48 African countries for the period 1980-2007. A cursory analysis of the data already reveals some interesting stylized facts that confirm key findings from the empirical literature. The main ones are highlighted in this section.

Considering the past decade (1996-2007), the data show that Africa, on average, has done well in revenue mobilization compared to other regions. At an average of 26.6%, it leads Asia (13.6%) and Latin America (23.9%). Note however, that this is less than half of Middle East's average of 61.7%. Within the continent, non-resource countries are basically at par with oil-rich countries at about 29.7% while mineral-rich countries trail (24.8%). This will be further explored in the econometric analysis below.

The data are also quite revealing with regard to the factors that have been found to be prominent in explaining revenue performance. The most striking stylized fact is the negative association between revenue performance and the share of agriculture in GDP. As can be seen in Figure 1, higher shares of agriculture in GDP are associated with lower revenue/GDP ratios in African countries. The relationship holds for the full sample as well.

Figure 1: Revenue and share of agriculture in GDP – African countries
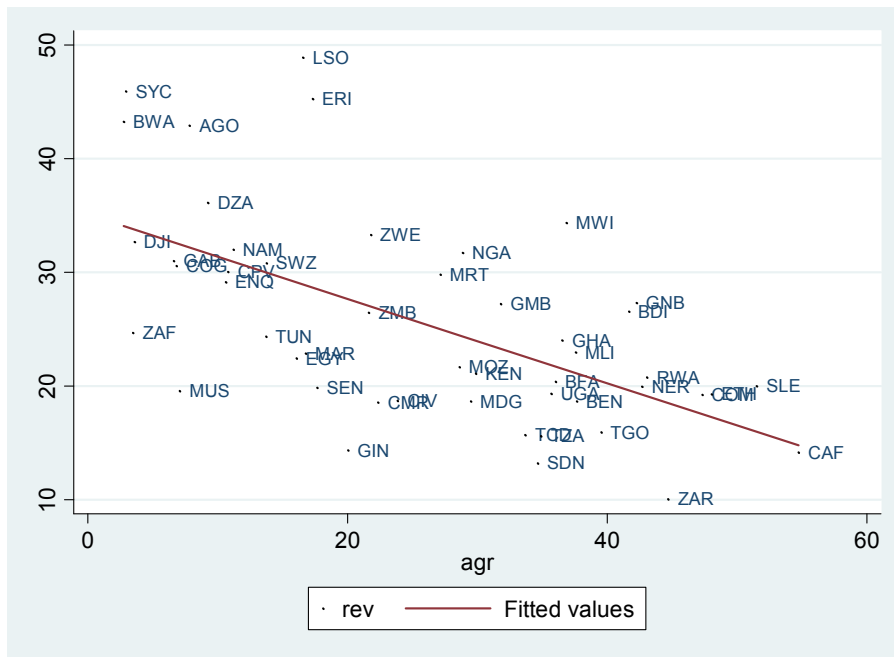
Trade and income appear to be positively related to revenue performance (Figures 2). The relationship is stronger for trade than for per capita income. The capacity to tax is also found to be associated with higher revenue performance. In this analysis the capacity to tax is proxied by measures of the institutional quality such as the indicator of "efficiency of revenue mobilization rating" (CPIA) and the various indicators from the *Worldwide Governance Indicators*. For example, better ratings on the measure of "control of corruption" are associated with higher government revenue, as can be seen in Figure 3.

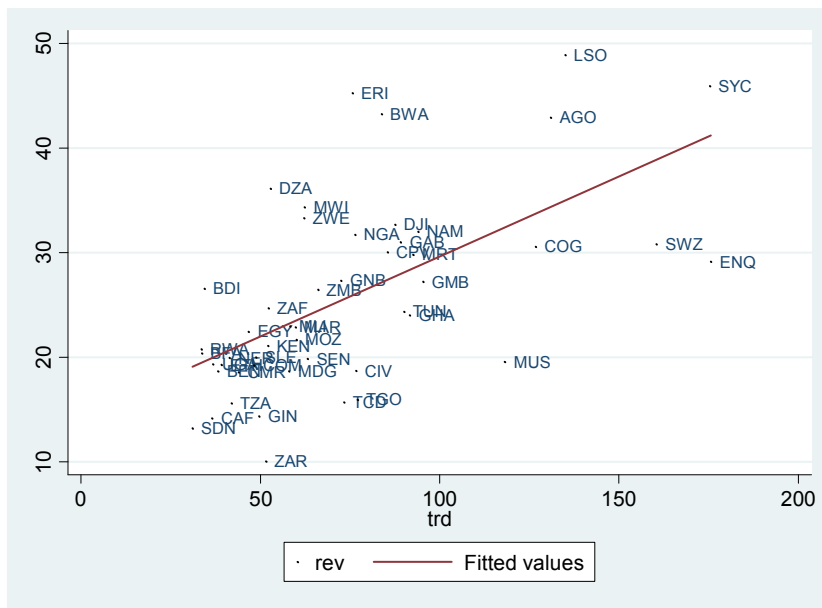**Figure 2: Revenue and trade (% of GDP) – African countries**

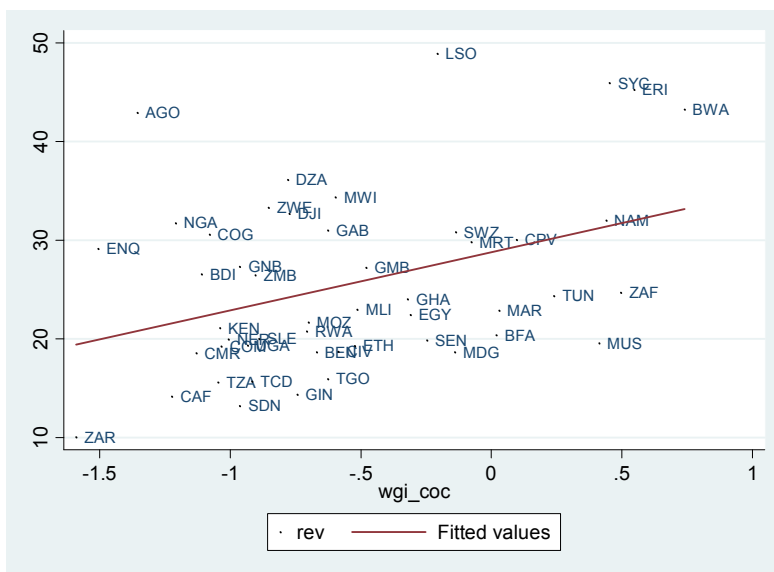**Figure 3: Revenue and control of corruption – African countries**

Table 3 summarizes the two-way correlations between government revenue – total and excluding grants – with some of the fundamental determinants of revenue performance. The results are pretty much consistent with the empirical evidence in the literature as discussed earlier in Section 3. The next step is to econometrically investigate these relationships with a focus on the case of African countries, especially resource-rich countries in comparison to resource-scarce African countries and other developing countries. This exercise is undertaken in the next subsection.

Table 3: Correlation of revenue with various indicators, 1996-2007

	Revenue/GDP		Revenue without grants /GDP	
	Correlation coefficient	*P-value*	*Correlation coefficient*	*P-value*
Oil price	0.1282	0.0003	0.1377	0.0035
Gold price	0.1288	0.0003	0.1414	0.0027
GDP growth	0.0072	0.8422	0.0402	0.4011
GDP per capita	0.0138	0.7021	0.1057	0.0265
Public investment	0.3124	0.0000	0.4674	0.0000
Private investment	0.2152	0.0000	0.5231	0.0000
Domestic investment	0.1445	0.0001	0.2236	0.0000
Government consumption	0.3464	0.0000	0.5524	0.0000
Trade	0.2806	0.0000	0.5164	0.0000
Manufacturing share in GDP	-0.1034	0.0043	-0.0208	0.6672
ODA	-0.2253	0.0000	-0.4091	0.0000
Governance index – overall	0.3128	0.0001	0.5109	0.0001
Governance index – control of corruption	0.3517	0.0000	0.5247	0.0000
Governance index – rule of law	0.2532	0.0000	0.3764	0.0000
CPIA – Efficiency of revenue mobilization	0.0576	0.5221	0.2911	0.0327

4.2 Regression analysis and discussion of key results

The econometric analysis is based on a simple reduced-form equation that relates revenue performance to its key determinants as identified in the literature and as illustrated by the stylized facts examined above. The analysis starts with a baseline equation that includes: a proxy of the tax base and the structure of the economy. With regard to the tax base, two measures are included: per capita income and the volume of international trade (as a percentage of GDP). Note that per capita income is also an indirect proxy of the capacity to mobilize revenue as discussed above in the literature review.

The structure of the economy is proxied by the share of agriculture in GDP as well as the share of oil exports in total exports. We also experiment with dummies for the endowment in oil and mineral resources. Table A1 provides a classification of African countries by resource endowment. We examine whether the results differ significantly between African countries and others by running the regression with the full sample, with African countries only, and with an Africa dummy. We also run the regressions with dummies for oil and mineral resource endowment.

The model is specified by taking into account country specific effects. We also explore the robustness of the results to any potential endogeneity of the regressors by utilizing the GMM estimator. The model is specified as follows:

$$REV_{it} = \alpha\, BASE_{it} + \beta\, STRUCTURE_{it} + \Gamma' X_{it} + v_{it} \qquad [1]$$

Where REV is revenue as a percentage of GDP; BASE is the measure of the tax base; STRUCTURE is the proxy for the structure of the economy; **X** is a vector of other auxiliary determinants of revenue performance; and v_{it} is an error term that includes fixed country specific effects μ_i as well as a random component that is white noise (ε_{it}):

$$v_{it} = \mu_i + \varepsilon_{it} \qquad [2]$$

The model is estimated alternatively for total revenue and for tax revenue a percentages of GDP. The results of the regressions are reported in Tables 4-6. They are broadly similar for total revenue and for tax revenue. They largely confirm the findings in the empirical literature. Specifically revenue mobilization is positively associated with the tax base as well as the level of development as measured by per capita income. The coefficient on per capita GDP is positive and significant in the full sample and for Africa, although for Africa it is not significant at the 10 percent level (p-value = 0.11, Table 4). Trade is also positively related to revenue performance while a high share of agriculture in GDP is negatively associated with a lower revenue/GDP ratio. The most striking finding is the negative relationship between oil exports and revenue performance. This result suggests that once performance in trade is accounted for, endowment in oil resources does not provide any additional advantage in terms of revenue mobilization. Even worse, the result implies that oil endowment creates a disincentive against tax revenue mobilization.

Table 4: Regression results for total revenue – fixed effects and GMM results

Explanatory variables*	Fixed effects		GMM**	
	Full sample (1990-2007)	Africa (1980-2007)	Full sample (1990-2007)	Africa (1980-2007)
Lagged revenue			0.542 (80.50)	0.615 (25.33)
Per capita GDP	0.185 (6.21)	0.041 (1.58)	0.170 (25.98)	0.064 (7.33)
Oil exports share	-0.007 (-2.07)	-0.005 (-1.63)	-0.005 (-4.80)	-0.002 (-0.66)
Trade/GDP	0.218 (6.55)	0.261 (8.84)	0.246 (36.03)	0.205 (18.47)
Agriculture/GDP	0.025 (0.73)	-0.135 (-3.65)	-0.068 (-7.99)	-0.078 (-3.05)
Within R-sq	0.07	0.10		
Between R-sq	0.21	0.58		
Overall R-sq	0.24	0.41		
Sargan score (p-value)			67.89 (1.00)	10.98 (1.00)
AR (2) test			-0.201 (0.84)	0.054 (0.95)
Observations	1118	1277	971	1183

Notes: The endogenous variable is **total revenue/GDP**. Figures in parenthesis are t-scores for the fixed-effects estimates and z-scores for the GMM estimates.
* All regression variables are in logarithm; therefore coefficients can readily be interpreted as elasticities.
** Two-step GMM estimation, where per capita income is explicitly considered as endogenous.

Table 5: Regression results for tax revenue – fixed effects and GMM results

Explanatory variables*	Fixed effects		GMM**	
	Full sample (1990-2007)	Africa (1980-2007)	Full sample (1990-2007)	Africa (1980-2007)
Lagged revenue			0.468 (17.33)	0.410 (9.16)
Per capita GDP	0.217 (7.88)	0.107 (2.51)	0.119 (14.27)	0.016 (0.38)
Oil exports share	-0.003 (-0.50)	-0.004 (-0.63)	0.001 (0.19)	-0.004 (-0.78)
Trade/GDP	0.120 (3.37)	0.186 (3.91)	0.104 (15.21)	0.110 (4.19)
Agriculture/GDP	0.105 (3.96)	-0.030 (-0.60)	0.01.7 (1.65)	-0.045 (-0.65)
Within R-sq	.013	0.08		
Between R-sq	0.04	0.43		
Overall R-sq	0.09	0.43		
Sargan score (p-value)			47.91 (1.00)	21.62 (1.00)
AR (2) test			-0.464 (0.64)	-0.577 (0.56)
Observations	568	276	462	

Notes: The endogenous variable is tax revenue/GDP and total revenue/GDP, alternatively. Figures in parenthesis are t-scores for the fixed-effects.
* All regression variables are in logarithm; therefore coefficients can readily be interpreted as elasticities.
** Two-step GMM estimation, where per capita income is explicitly considered as endogenous.

The analysis provides comfort that the results are not driven by potential simultaneity in the regressors, notably endogeneity of income. The GMM results reported here are from a specification that explicitly considers per capita GDP as endogenous.

Table 6 reportS the results with dummies for Africa, oil, and mineral resource endowment. According to these results, African countries as a group have performed better than average (positive coefficient). However, resource endowment is associated with lower revenue performance, especially for mineral resources. Hence, while the African country typically performs better than average in the sample, being endowed with natural resources does not offer any advantage in terms of revenue mobilization, quite to the contrary.

Table 6: Results with Africa and resource endowment dummies (OLS regressions)

Explanatory variables*	Full sample (1990-2007)		Africa sample (1980-2007)	
	Total revenue	Tax revenue	Total revenue	Tax revenue
Per capita GDP	0.017	0.391	-0.014	0.173
	(0.83)	(12.11)	(-0.82)	(3.81)
Trade/GDP	0.225	0.268	0.359	0.278
	(8.01)	(6.32)	(17.17)	(4.67)
Agriculture/GDP	-0.226	0.451	-0.220	-0.046
	(-8.27)	(10.27)	(-9.44)	(-0.68)
Oil-rich dummy	0.133	-0.213	-0.083	-0.112
	(3.35)	(-3.71)	(-3.30)	(-1.55)
Mineral-rich dummy	0.053	0.269	-0.133	-0.092
	(0.74)	(3.40)	(-5.73)	(-1.79)
Africa dummy	0.301	0.440		
	(7.40)	(8.19)		
Africa*oil dummy	-0.002	0.003		
	(-3.58)	(2.68)		
Africa*mineral dummy	-0.197	-0.273		
	(-2.54)	(-2.86)		
Adjusted R-sq	0.32	0.39	0.43	0.42
Observations	1132	598	1354	311

Notes: The endogenous variable is tax revenue/GDP and total revenue/GDP, alternatively. Figures in parenthesis are t-scores for the fixed-effects estimates.
* All regression variables are in logarithm; therefore coefficients can readily be interpreted as elasticities.

To provide further inference on revenue performance, we use the econometric results to examine whether resource-rich countries have taken advantage of their endowment to achieve superior levels of revenue mobilization. To do so, we compare the actual total revenue to the level of revenue that is predicted by the model in equation [1] above. For any country or group of countries, a ratio of actual revenue to potential revenue that is greater than one implies that the country or group of countries has achieved and exceeded its potential of revenue mobilization. A ratio less than one implies under performance in terms of revenue mobilization. Table 7 summarizes the findings of this analysis. The results show that as a whole, for the period 1990-2007, Africa has done well relative to other regions, although it trails the Middle East in revenue performance. Its performance index is 1.042 compared to 1.063 for the Middle East; but it is much higher than that of Asia (0.867) and Latin America (0.764). However, an even more interesting result is the within-group differences in performance. It appears that resource-scarce African countries strongly dominate their resource-rich counter parts in revenue mobilization with an index of 1.103 compared to 1.032 for mineral-rich countries and 0.996 for oil-rich countries. The latter group

has underperformed per our definition given that its actual revenue/GDP ratio is less than the potential ratio.

Table 7: Actual vs. potential revenue and performance ratio

Region	Actual revenue (% of GDP)				Potential (predicted) revenue (% of GDP)				Revenue performance ratio (actual/potential)			
	Mineral rich	Oil rich	Resource-scarce	Sample	Mineral rich	Oil rich	Resource-scarce	Sample	Mineral rich	Oil rich	Resource-scarce	Sample
AFRICA	22.7	25.1	25.8	24.6	22.1	25.2	23.4	23.6	1.032	0.996	1.103	1.042
ASIA	12.6	23.6	16.7	18.1	12.2	22.4	20.9	20.8	1.033	1.056	0.801	0.867
LAC	16.5	20.1	24.2	22.4	25.1	25.1	31.5	29.3	0.657	0.800	0.768	0.764
MIDEAST		66.1	34.3	57.7		64.6	31.1	61.3		1.025	1.102	1.063
Sample	22.3	32.8	24.9	26.5	22.0	30.1	24.5	25.5	1.011	1.089	1.016	1.040

5. Conclusion: caveats, key findings and policy implications

This paper attempted to explore the revenue performance in African countries with the aim of investigating whether resource-rich countries have been able to take full advantage of their resource endowment to maximize revenue mobilization. They are compared to their resource-scarce counterparts in Africa on the one hand and to other developing countries in other regions on the other hand.

A key finding is that African resource-rich countries have not performed any better than their resource-scarce counterparts with regard to revenue mobilization. This could be due to several factors. The first possible reason is that these countries lack the capacity to optimize the revenue generation from natural resources. This requires the ability to design and negotiate exploration and exploitation contracts that maximize government's rents without discouraging private investment in the resource industry. Contract negotiations in this sector are quite complex and require specialize skills and experiences that African government technocrats often do not possess. As a result, African countries are short changed in their dealings with international companies in the natural resource industry. An indirect piece of evidence from this paper for this presumption is the fact that African oil-rich countries are outperformed by oil-rich countries in the Middle-East which have relatively more experience in the industry.

One policy implication from this finding is that African resource-rich countries should utilize the revenues from resource exports to invest in human capital development specifically aimed at the acquisition of specialized skills for the natural resource industry. This can be done by setting a target for budgetary allocation into industry-specific human capital development and also by the establishment of a Resource Industry Skills Development Fund that would collect a pre-determined portion of the proceeds from natural resource exports. This would allow to take advantage of resource booms where part of the revenue would be channeled into the Fund to be utilized over time to support higher investments in specialized skills for the development of the resource industry.

The second possible reason for the low revenue performance among resource-rich countries is the failure to take advantage of resource revenue to develop non-resource activities so as to broaden the tax base. In addition to moving up the value chain in the resource industry, resource-rich countries need to design strategies to develop new "capabilities" that utilize both the revenue derived from the resource industry and the skills developed in the sector. This is one of the ways to overcome the resource curse associated with the natural resource bounty. Indeed, this is one of the reasons why developed countries which are endowed in natural resources were able to grow and develop from and out of natural resources. Thus Finland went from exporting wood and paper, to specializing in wood-cutting making machinery, to automated machinery (wood-cutting and others), to becoming a leader in high-tech electronics

(Nokia).[1] Can African resource-rich countries follow this example? What are the prerequisites for achieving this transformation? These questions should be at the heart of the debate over Africa's strategies for taking advantage of its natural resources to achieve and sustain high growth rates and improve competitiveness.

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[1] The example and the notion of "diversification" as development of new "capabilities" are drawn from the presentation by Ricardo Hausman on "High Band Width Growth Policies – Why and How" at the International Growth Center's "Growth Week" conference in London on 24 September 2009.

References

African Development Bank – AfDB, 2009. *Oil and Gas. Oxford*: Oxford University Press.

AfDB, 2007. *African Development Report 2007: Natural Resources for Sustainable Development in Africa*. Oxford University Press, Oxford.

AfDB, OECD, United Nations Economic Commission for Africa (UNECA), 2009. *African Economic Outlook 2009*. Paris and Tunis.

Arbache, J.S. and J. Page, 2007a. "More Growth or Less Collapses? An Investigation of the Growth Challenges of Sub-Saharan African Countries." World Bank Policy Working Paper 4384.

Arbache, J.S. and J. Page, 2007b. "Patterns of Long Term Growth in Sub-Saharan Region." World Bank Policy Working Paper 4398.

Bahl*, R. W.,* 1971. "A regression approach to *tax* effort and *tax* ratio analysis." *IMF Staff Papers*.

Beny, L. N. and L. D Cook, 2008. "Metals or Management? Explaining Africa's Recent Economic Growth Performance", December. See: http://www.aeaweb.org/annual_mtg_papers/2009/retrieve.php?pdfid=476

Bird, R. M. & J. Martinez-Vazquez & B. Torgler, 2008. "Tax Effort in Developing Countries and High Income Countries: The Impact of Corruption, Voice and Accountability." *Economic Analysis and Policy* 38 (1), 55-71.

Boyce, J. K., and L. Ndikumana, 2001. "Is Africa a net creditor? New estimates of capital flight from severely indebted sub-Saharan African countries, 1970-1996." *Journal of Development Studies* 38(2), 27-56.

BP, 2008. *BP Statistical Review of World Energy 2008*. London, UK.

Collier, P. and B. Goderis, 2007. "Commodity prices and growth: Reconciling a conundrum." *World Economics* 8 (2), 1-15.

ElBadawi, I. and L. Kaltani, 2007 " The Macroeconomics of Oil Booms: Lessons for SSA." Unpublished mimeo, presented at the AERC Senior Policy Seminar on "Commodity Booms" Yaoundé, Cameroon, February 27- March 1st

Elhiraika, A. and L. Ndikumana, 2007. "Reserves Accumulation in African Countries: Sources, Motivations, and Effects." Forthcoming in the *Proceedings of the African Economic Conference 2007*.

Eltony, M. N., 2002. "The determinants of tax effort in Arab countries." Mimeo, Arab Planning Institute.

Hnatkovska, V. and n. Loayza, 2003. "Volatility and Growth." World Bank Policy Research Working Paper, WPS3184, World Bank, Washington, DC, August.

IMF, 2006. "World Economic Outlook", International Monetary Fund, Washington, DC.

IMF**,** 2007. "Regional and Economic Outlook: Sub-Saharan Africa", World Economic and Financial Surveys, International Monetary Fund, Washington, D.C.

Kaldor, N., 1963. "Will underdeveloped countries learn to tax?" *Foreign Affairs* 41, 410-419.

Levi, M., 1988. *Of Rule and Revenue*. Berkeley: The University of California Press

Martin, A. and W.A. Lewis, 1956. "Patterns of Public Revenue and Expenditure." *Manchester School of Economic and Social Studies* 24 (September), 203-244.

Ndikumana, 2007. "Corruption and Pro-Poor Growth Outcomes: Evidence and Lessons for African Countries." in *Governance and Pro-Poor Growth in Sub-Saharan Africa*, In Mbaku, J., M. Martin, and J. Karugia, (eds.). *Governance and Pro-Poor Growth in Sub-Saharan Africa*. Nairobi: AERC, Seminar Papers 184-219.

Ndikumana, L. and J.K. Boyce, 2009. "New Estimates of Capital Flight from Sub-Saharan African Countries: Linkages with External Borrowing and Policy Options." University of Massachusetts, Political Economy Institute (PERI) Working Paper 166. Forthcoming, *International Review of Applied Economics*.

Stosky J.G. and A. Wolde Mariam, 1997. "Tax Effort in Sub-Saharan Africa"; IMF working paper 97/107.

Suliman, K.M., 2005. "The Impact of Trade Liberalization on Revenue Mobilization and Stability in Sudan." *African Development Review* 17(3), 405-34

Tanzi, V. 1981.

Tanzi, V., 1992. "Structural Factors and Tax revenue in developing countries: a decade of evidence." In I. Goldin and L. A. Winters (eds). *Open Economies: Structural Adjustment and Agriculture*. Cambridge: Cambridge University Press, pp. 267-281.

Tijerina-Guajardo, J.A. and J.A. Pagan, 2003. "Government Spending, Taxation, and Oil Revenues in Mexico." *Review of Development Economics* 7 (1), 152-64

Torgler, B., 2005. "Tax morale and direct democracy." *European Journal of Political Economy* 21, 525-531.

Van der Ploeg, F and S. Ploelhekke, 2007. Volatility, Financial Development and the Natural Resource Curse, European University Institute, September.

World Bank, 2006. Where is the Wealth of Nations?, The World Bank, Washington, DC.

World Bank, 2007. *World Development Indicators,* The World Bank, Washington, DC.

Yager, T. R, O. Bermúdez-Lugo, P. M. Mobbs, H. R. Newman, and D. R. Wilburn, 2007. "The Mineral Industries of Africa." in USGS, *2005 Minerals Yearbook: Africa*, August 2007.

Table A1: African countries by resource endowment

Oil-rich countries	Mineral-rich countries	Others
Algeria	Botswana	Benin
Angola	Central African Rep.	Burkina Faso
Cameroon	Congo, DRC	Burundi
Chad	Ghana	Cape Verde
Congo, Rep	Guinea	Comors
Côte d'Ivoire	Mauritania	Djibouti
Egypt	Mozambique	Ethiopia
Equatorial Guinea	Namibia	Gambia
Gabon	Niger	Kenya
Nigeria	Sierra Leone	Lesotho
Sudan	South Africa	Liberia
	Tanzania	Madagascar
	Zambia	Malawi
	Zimbabwe	Mali
		Mauritius
		Morocco
		Rwanda
		Senegal
		Seychelles
		Swaziland
		Togo
		Tunisia
		Uganda

Note: Oil-rich and mineral-rich countries are those whose oil exports and mineral exports represent at least 20% of total exports.