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The Political Economy of Natural Resources

THE RISE IN WORLD PRICES OF NATURAL RESOURCES, COUPLED with the resource discoveries induced by high prices, is transforming Africa's opportunities. The economic future of Africa will be determined by whether this opportunity is seized or missed. The history of resource extraction in Africa is not encouraging. This article reviews and develops the political economy of natural resources as a guide to how Africa might avoid a repetition of that history.

The resource curse has been analyzed over several decades. Although it was initially controversial, the evidence is accumulating that it is both a reality and severe. For example, Collier and Goderis (2007) use co-integration techniques to study the time profile of the effects of resource revenues. An advantage of this approach is that whereas cross-section results, on which previous literature has largely been based, encounter familiar problems of interpretation, these results come from changes in global prices, which can reasonably be taken to be exogenous. They find that although in the short run an increase in export prices of commodities raises growth, in the long run growth is substantially reduced. Simulating the recent commodity boom for the typical African commodity exporter, they find that if global history repeats itself, after two decades output will be around 25 percent lower than it would have been without the booms.

Although the initial explanation for the resource curse, Dutch disease, was purely economic, it has gradually become evident that the key issues are political. The political economy of natural resources is about the interplay between politics and valuable natu-

ral assets. The interplay is potentially in both directions: politics can affect the exploitation of natural assets, and natural assets can affect politics. In principle, either of these could explain the resource curse, but there is a reasonable basis for thinking that both are important.

Figure 1 illustrates the simplest possible characterization. The vertical axis shows the social value of the national endowment of natural assets and the horizontal axis an ordinal measure of the quality of the political system, from poor to good. The NA locus depicts the social value of natural assets as a function of the political system: the better is the system, the more able is the society to harness the potential value of its natural assets. The PS locus depicts the political system as a function of the endowment of natural assets. The larger the endowment, the worse the political system. In general, as with any interdependent system, in equilibrium the two relationships are resolved simultaneously. As a result, the political systems best suited to harnessing natural assets are those least likely to develop once natural assets have become important in the economy.

However, it is conceptually useful first to consider each function separately. Section 1 focuses on how natural assets affect the political system. Section 2 focuses on how the political system affects natural assets. Section 3 brings the two together, discussing possible equilibria, and briefly discusses policy options.

1. HOW NATURAL ASSETS AFFECT THE POLITICAL SYSTEM

The core purpose of the state is to provide public goods. Exactly which public goods and services can reasonably be considered nonoptional varies considerably even among developed countries. However, two can reasonably be considered as meta-goods, necessary rather than optional: security and accountability. Without them development is liable to be frustrated. Without security against violence, property rights are void; and without accountability both property rights and the supply of other public goods depend upon the personal whim of the ruler. The presence of valuable natural assets can undermine both

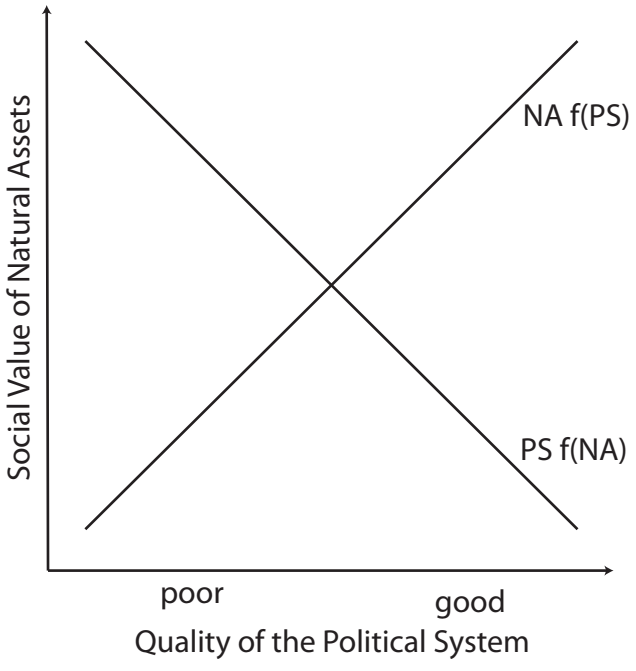

Figure 1

security and accountability. We first consider why security might be undermined and then why accountability might be undermined.

Why Natural Assets Interfere with the Security-Taxation Nexus

Tilly (1990) explains the historical emergence of effective states from an initial political structure of international military rivalry. International warfare created the need for the national public good of military spending. The resulting arms race between states created an escalating need for public money, of which the key sources were tax revenue and government debt. In order to raise debt at moderate interest rates, the state needed a secure revenue source, which reinforced the importance of tax revenue. In turn, efficient taxation required an administrative structure, fiscal capacity, which could only be built slowly. It also gave the state an interest in enabling private economic activity to flourish by providing support for legal institutions that could enforce contracts.

Finally, it was in the interests of such states to accept accountability to wealth generators. This reduced the cost of borrowing and, by curtailing risks of confiscation, promoted wealth generation. The governments that made these investments in capacity tended to win the wars and so a Darwinian process of natural selection reinforced internal pressures for the emergence of effective states.

Besley and Persson (2008) propose an economic formalization of Tilly. Their analysis has three layers: public policies, which can in principle be changed rapidly; institutions, which take longer to build and so are in the nature of investments in capacity; and the initial structure of political power, describing the interests the government represents. Different power structures and interests determine how much the government invests in institutional capacity for taxation and justice. They show that a political system that is not inclusive, and that has a high degree of regime instability, is less likely to build the capacity needed for an effective state. In turn, if these institutions are not built, subsequent policy choices on tax rates and the regulation of private economic activity are constrained.

The virtuous circle described by Tilly had ugly foundations in international warfare. Security was manifestly in the interest of the elite, but since invasion was also disastrous for the general population, it was relatively easy for people to cohere around a nationalist agenda. However, decolonization occurred following the most appalling international war in history and in the context of nuclear rivalry. Unsurprisingly, there was a sense that war was no longer an acceptable part of government behavior: it was too costly and neighborhood wars might escalate into global war. As a result of international pressure, including international mediation through the United Nations and regional groups such as the Organization of African Unity, the incidence of international war radically diminished. This did not imply that the new states were secure. On the contrary, they were highly insecure, but the threat was internal from rebellion rather than external from neighboring governments. The risk of rebellion was high because it was relatively easy. At low levels of income rebellion is cheap and

common (Besley and Persson). In the absence of an effective state, economic development is frustrated. The resulting economic stagnation compounds the risk of rebellion (Miguel et al. 2004). In one respect the high risk of rebellion acts like an external threat: it induces an increase in military spending in an attempt to increase security. However, since its objective is internal repression it does not have the same properties of nation-building as an external threat. Military spending for repression is not a national public good in contrast to defense against external threat. Its conventional nonrival properties are lost: the army that defends you represses me. Indeed, the military is itself often the main threat to the regime: coups are far more common than rebellions. In response, governments deliberately reduce the effectiveness of their military by dividing it into rival units with obscure lines of authority. Perhaps as a result of the deliberate emasculation of the army as a fighting force, military spending does not appear to be effective in discouraging rebellion. The risk of coups and rebellions create a continuous sense of regime insecurity.

Thus, the typical postcolonial state did not face an external threat and so did not need to build an effective and hence expensive military. In consequence, pressure to raise tax revenue was lower and so there was less need to invest in either fiscal capacity or a legal system that would have assisted private prosperity. Regimes faced two threats of insecurity—rebellion and coups—but both of these were counterproductive. Rebellion produced a military response designed for the internal repression of dissenting groups and so did not induce nationalism, and it undermined both the economy and state capacity. The coup threat encouraged rulers to weaken their armies. The two threats combined shortened time horizons and so discouraged investment in state capacity.

How Natural Endowments Deepen the Political Problem

Many postcolonial states have valuable natural resources and these compound the problem of insecurity. The increased risk coming from natural resources has long been discussed in the case study literature

(Klare 2001), but the first statistical analyses were by Fearon and Laitin (2003) and Collier and Hoeffler (2004). These initial statistical analyses suffered from various limitations (such as a sample subject to potential bias from missing data) and potential endogeneity (because the explanatory variable was the export of natural resources as a share of GDP). If GDP were to grow slowly for other reasons this ratio might be high and so the apparent causal relationship might be spurious. Hence, the results were controversial: see for example the special issue of the *Journal of Conflict Research* (2005) devoted to the topic. One alternative approach, which claimed to resolve the exogeneity problem, was to measure natural endowments not as a share of GDP but from a global snapshot valuation of subsoil assets for 2000 made by the World Bank. On this basis a high value of subsoil assets appeared to *reduce* the risk of civil war.

However, there is now much stronger statistical evidence for the original proposition. First, the 2000 snapshot of subsoil assets is itself subject to severe endogeneity problems: as discussed below, the value of subsoil assets is dependent on the amount invested in prospecting; and so developed countries have far larger discovered endowments than the poorest countries. Second, Collier, Hoeffler, and Rohner (2008) re-estimate the Collier-Hoeffler model on a much larger sample, and use the AMELIA program to address the remaining problem of missing data (the methodology is based on multiple imputation of missing values in the data matrix). Third, Besley and Persson and Collier, Hoeffler, and Soderbom (2004) both use international commodity prices as exogenous sources of change in resource revenues for commodity-exporting countries. Their results are consistent and complementary. Besley and Persson investigate how changes in prices affect the incidence of civil war. They find that an increase in prices significantly increases the incidence. Collier, Hoeffler, and Soderbom investigate the duration of civil wars once they have started. They find that a price increase of the commodities that a country exports significantly reduces the chance that a war will be settled.

Hence, the issue now is to establish the routes by which these adverse effects occur. The channels by which primary commodities

might relate to the risk of conflict have come under intense scrutiny and debate (Ross 2004a; Humphreys 2005; Rohner, 2006). Three channels seem likely. One is that primary commodity exports provide opportunities for rebel predation during conflict and so can finance the escalation and sustainability of rebellion. The most celebrated cases are the diamond-financed rebellions in Sierra Leone and Angola. Oil also provides ample opportunities for rebel finance, whether through "bunkering" (tapping of pipelines and theft of oil), kidnapping and ransoming of oil workers, or extortion rackets against oil companies (often disguised as 'community support').

A second channel is that rebellions may actually be motivated, as opposed to merely being made feasible, by the desire to capture the rents, either during or after conflict. Weinstein (2005) provides a convincing argument for this channel by endogenizing the motivation of the rebel group. He argues that in countries with valuable natural resources, many of the recruits will be motivated by loot-seeking rather than by any political cause. The rebel organization will not be able to screen out such recruits so that, even if the rebellion starts out with a political agenda, over time it is likely to become loot-seeking. The evolution of FARC—the Revolutionary Armed Forces of Colombia—from a rural protest movement to a multi-million dollar drug producer and trafficker may be an illustration. Combined with the financial feasibility effect, this implies that those rebellions that are most feasible, and so most common, are also those most likely to become motivated by loot-seeking. Natural resources can make rebellion attractive even if there is no realistic prospect of capturing the state itself. Indeed, loot-seeking may be easier during the lawless conditions that prevail during conflict than during peacetime. An intermediate position between the objective of wartime looting and the capture of the state is the secession of the resource-rich region. There is some statistical evidence that natural resources specifically increase secessionist wars (Collier and Hoeffler 2006).

These two channels need not be alternatives. A study by Lujala, Gleditsch, and Gilmore (2005) provides support for either of them. It

finds that conflicts are more likely to be located in the areas of a country in which natural resources are extracted.

A third channel is that the governments of resource-rich countries tend to be less accountable to their citizens. The provocation of rebellion might be one extreme consequence of a lack of accountability, but evidently there might be many other adverse consequences. I now therefore turn to this larger issue of whether resource revenues make a government less accountable.

Why Natural Assets Generate Divergent Elite Interests

To understand the effect of resource revenues on accountability requires first a broader discussion of the conditions under which the objectives of elites are reasonably congruent with those of ordinary citizens. Broadly, these are either that both happen to share overarching goals, or that elites have no choice but to deliver what ordinary citizens want.

One dimension of importance for congruence is the size of the elite relative to the population. Adam and O'Connell (1999) develop a simple model in which the ruling elite has a choice between a national public good and redistribution toward itself. The smaller the size of the elite, the stronger is the incentive to opt for redistribution. This is one reason why democratic accountability should improve government performance: attracting support by means of public goods instead of redistribution becomes more cost effective because democracy radically expands the required support base. However, public goods may become more cost-effective than patronage with a support base considerably smaller than that implied by universal suffrage and so some governments that are de jure autocratic may approximate the priorities of a democracy.

Since the 1990s, many failing states have democratized. If elections achieve accountability to a rational electorate, then it should be expected to improve government performance. Chauvet and Collier (2009) test whether this is the case using two measures of performance, the Country Policy and Institutional Assessment (CPIA) which is a rating

undertaken annually for all developing countries by the World Bank; and the International Country Risk Guide (ICRG), which is a commercial rating service. They find that on both measures elections have both cyclical and structural effects. The cyclical effect is consistent with political economy models. For example, if some good policies incur initial costs with benefits accruing later, and some bad policies have converse characteristics, then as the election approaches the government has an increasing incentive to adopt bad policies, which is what they find. The structural effect of elections is, however, normally consistent with the accountability model: the greater the frequency of elections, the better are policies and governance, except for extremely high frequencies when the adverse effect of short horizons dominates.

Electoral accountability might go wrong if voters have limited information and politicians are thereby able to embezzle the public purse with little fear of prosecution. Besley (2006) analyzes the implications of these characteristics. He shows that there is a point at which elections fail to discipline those politicians whose interests are divergent from those of voters. Beyond this point this type of politician finds power very attractive and this alters the pool of candidates facing voters. This selection effect may powerfully gear up the adverse consequence of poor incentives: in the extreme, voters may face no real choice because the entire pool of candidates consists of people who will abuse power.

However, even the context posited by Besley may be considerably closer to normality than what characterizes failing states. Commonly in these states incumbents can win elections by means of technologies that are excluded in a conventional election because they are illegitimate. Three such techniques are vote-buying, voter intimidation, and ballot fraud. In research currently under way, Collier and Hoeffler find that in conditions of poor governance, incumbents are far more likely to win elections than in conditions of good governance. A reasonable interpretation is that these illegitimate techniques are considerably more effective than the strategy of trying to be a good government. Chauvet and Collier (2009) introduce a measure of the quality of elec-

tions into their analysis of whether elections improve government performance. They find that where elections are of low quality, their normal structural effects cease to hold: elections fail to improve government performance measured both in terms of economic policy (CPIA) and economic governance (ICRG). This result is, of course, entirely consistent with economic reasoning: if governments can win elections by other means then, as implied by Besley, politics will attract crooks and democracy will become impotent.

How Natural Endowments Deepen the Political Problem

These generic problems are compounded by valuable natural assets. Potentially, governance might deteriorate in three distinct ways. First, in a democracy resource rents might reduce the efficacy of electoral accountability. Second, in an autocracy resource rents might reduce the incentive to use public goods as the means of benefiting the elite. Third, resource rents might alter the likelihood of democracy relative to autocracy. There is some support for all three of these possibilities.

Collier and Hoeffler (2009) investigate the effect of natural resource rents on the economic performance of democracy. Measuring performance by medium-term economic growth, they find that in the absence of resource rents democracies significantly outperform autocracies, whereas if rents are large relative to GDP, autocracies outperform democracies. The critical point at which the two have equivalent effects is when resource rents are around 8 percent of GDP: many resource-rich economies have a share well above this level. Hence, in some sense resource rents appear to undermine the normal functioning of democracies.

One way in which democracy might be undermined by resource rents is if governments use some of the money to maintain power by means of patronage. Not only does this waste the money, but more importantly it reduces accountability of government to the electorate. Patronage might range from jobs in public employment for supporters through to direct vote buying. There is reason to think that both are effective.

Robinson, Torvik, and Verdier (2006) build a rational choice model of democratic politics to show how public sector employment is liable to be effective as a means of patronage. Supporters know that their jobs are dependent upon their patron retaining political power. Resource rents provide the incumbent with the means to finance a large public payroll and so entrench unaccountable power. Vicente (2007) studies the effect of resource rents on political corruption in a unique natural experiment. The two West African democracies of São Tomé and Cape Verde are both islands and former Portuguese colonies with similar histories. However, São Tomé recently discovered oil. Vicente investigates whether the onset of oil revenues in São Tomé increased political corruption relative to Cape Verde. His measure of corruption was the allocation of international scholarships. He found that indeed oil significantly increased the relative political corruption of São Tomé.

Vote-buying is a more direct form of divorcing elections from accountability. Vicente (2007) and Collier and Vicente (2008) investigate vote-buying in two resource-rich democracies and show that it is both prevalent and effective. Again, resource rents expand the finance for such behavior.

Not only do resource rents make it more feasible to undermine elections, they also make it more desirable for the government to do so since they increase the financial rewards to the retention of power. However, the ability to benefit financially from resource revenues depends upon the ability of politicians to embezzle them. The barrier to such behavior is the checks and balances that financial bureaucracies conventionally incorporate as part of their constituting rules. Collier and Hoeffler (2009) develop a simple model in which resource rents facilitate the erosion of checks and balances. A crooked politician embezzles public revenues to fund vote-buying unless restrained by public scrutiny: expenditure on public goods is thus the residual left once the politician has embezzled. The key component of the model is that it endogenizes scrutiny. They assume that scrutiny is a public good that is only supplied to the extent that

citizens are provoked into it by the taxation of private incomes. The crooked politician thus faces a constrained maximization problem. In the absence of natural resources, if he does not tax he has more freedom to embezzle, but there is no revenue. If he taxes heavily there is plenty of revenue but little scope to embezzle it. Hence, there is a Laffer curve in embezzled revenue, with an optimizing rate of taxation. Resource rents change this optimization problem: the politician does not want to provoke scrutiny because although higher taxes would raise more revenue, embezzlement of the resource rents themselves would be curtailed. They show that within this framework resource rents always lead to worse governance and can easily lead to a reduced supply of public goods. They then test the model, investigating whether the number of checks and balances that a society has are affected by resource rents. They find that both in the short term and with lags as long as three decades, resource rents systematically erode checks and balances.

Now consider the effect of resource rents in autocracy. Robinson et al. (2006) show that the implications of their model for democracy readily extend to autocracy. Within the model of Adam and O'Connell (1999), resource rents would increase the value of transfers and so make the interests of the elite more divergent from those of ordinary citizens. Hence, even if the elite can hold the ruler to account, performance need not improve for the ordinary citizen.

The third route by which resource rents might deteriorate the polity is if they change the likelihood of democracy relative to dictatorship. Ross (2001) shows that this is indeed the case: resource-rich countries are more likely to be autocratic. He shows that this is not due simply to the high incidence of autocracy in the Middle East: on the contrary, the autocratic nature of politics in that region is likely to be due in part to its resource abundance.

Finally, resource rents might delay fundamental change of seriously dysfunctional policies. Normally, if a government embarks upon an economic strategy that destroys the economy, change will eventually be forced upon it by the decline of revenue. However, resource

rents are robust and so may weaken the impetus for decisive reform. Chauvet and Collier (2008) test this and find that resource rents significantly reduce the speed of exit from highly dysfunctional policies. A doubling of resource rents as a share of GDP approximately doubles the time taken.

A Provisional Summary

In this section I have considered whether the political system is a function of resource rents. The conclusion is that both security and accountability, which are the key attributes of an effective state that is congruent with the interests of its citizens, are likely to be adversely affected. In terms of figure 1, PS f(NA) is downward-sloping.

Manifestly, a state that provides neither security nor accountability has problems that are more fundamental than just the mismanagement of natural assets. However, resource-rich countries evidently have opportunities not open to others. Whether they harness these opportunities depends specifically upon their management of natural assets. This is the subject of section 2.

2. HOW THE POLITICAL SYSTEM AFFECTS NATURAL ASSETS

What decisions does a political system have to get right if it is to harness natural assets efficiently? Against this benchmark we can then assess why particular political systems might get some or all of these decisions wrong.

For most economic activities the role of government is peripheral; however, for the exploitation of natural assets government is center stage. Because they are natural, the ownership rights to these assets must be assigned socially: for practical purposes government has custodial rights on behalf of citizens who are collectively the owners. Government must manage the natural assets in its custody in such as way as to maximize their value to citizens. First, natural assets have to be discovered and extracted, and then the revenues must be well spent. Each of these poses substantial challenges.

Resource Extraction

To see the centrality of government in resource extraction, consider what happens in its absence. How would natural assets be exploited in a lawless society that lacks any capacity for making or enforcing property rights over natural assets so that physical control of the asset is all that matters? The outcome is characterized by three problems: maldistribution, rent-seeking, and inefficiency. Maldistribution comes about partly because the strong are advantaged over the weak. But it is compounded by chance: some territories are better endowed than others. If we imagine the population distinguished in the two dimensions of strength and luck, the natural assets are acquired disproportionately by those who are lucky and strong. Rent-seeking comes about because if ownership is conferred by physical control of territory, people will divert their effort into violence. Since violence can be offset by counterviolence, in equilibrium the value of the rents from the natural assets will be dissipated by the costs incurred by the violent. Inefficiency comes about because of the uncertainty as to whether control can be maintained in the future. If control is perceived as likely to be temporary, the private incentive is to deplete assets quickly, even if this is socially more costly than necessary.

A further consequence is that the absence of property rights interacts with the problem of information. As with inventions, unless discoveries of natural assets are protected, there is no incentive to undertaking search. It is more efficient to wait for others to find natural assets and then wrest control of them through superior violence. Hence, they remain undiscovered. Indeed, since the process of losing control of them is likely to be costly, there is even an incentive for suppressing discovery.

To summarize: in the absence of government the exploitation of natural assets is markedly socially dysfunctional. Few assets are discovered and those that are trigger violent and costly contests. Compounding these gross inefficiencies, outcomes are highly unequal, favoring those who are strong and lucky.

No area of the world has been continuously without government. However, Africa has only had government since relatively recent colo-

nial times, and postcolonial property rights have sometimes weakened with the end of the colonial period. The most evident way in which this relative absence of government might show up is in a reduced level of discovery. Exploration is a costly and risky investment and so known reserves are determined by the economic environment rather than simply being a geological given. As of 2000, the average square kilometer of the African landmass had beneath it only around $25,000 of known subsoil assets, whereas the corresponding figure for the landmass of the Organization for Economic Cooperation and Development (OECD) countries is $125,000. Since the subsoil assets of the OECD have been heavily exploited for a far longer period than those of Africa, it is likely that the true average value of Africa's subsoil assets exceeds that of the OECD. The contrast in known assets therefore points to sensitivity of prospecting to property rights. From Africa's perspective, the good news is that there is huge remaining potential for discovery.

A variant of complete lawlessness is the "finders-keepers" rule, whereby there is a free-for-all in prospecting but enforcement of ownership once a discovery has been made. This is essentially how the American Wild West was prospected. Even this is far from ideal. The distributional disadvantage is that the rents are captured by prospectors instead of being spread more widely. The rent-seeking problem arises from the fact that the chances of striking lucky on a plot are increased if neighboring plots have had lucky strikes. Hence, the profit-maximizing strategy is to acquire many plots and leave them idle until discoveries are made, free-riding upon the prospecting efforts of others. This produces the economics of a gold rush: whole territories may be neglected for many years, and then prospected in a surge following the first discovery. Both the period of neglect and the surge are inefficient. The period of neglect arises from a standard public goods problem: knowledge is a public good and so the outcome is a stalemate in which no one incurs the costs of acquiring knowledge. Eventually, a lucky strike occurs and this sharply increases the returns to search. In response, people crowd into search activities, lowering the chance of discovery for each other and driving down the expected returns to

search. Entry may be limited if the size of the plots is set by government, but if plots are very small the standard rent-seeking outcome is that the value of the rents to be acquired through search is precisely offset by the costs that people incur. The rents from natural assets are thus dissipated. The finders-keepers rule produces a long period during which private returns to search are below their social value, followed by a short period in which they exceed their social value.

Artisanal mining is in some respects analogous to the Wild West. As many prospectors crowd in to search, the size of plot is reduced, either in response to political pressure to accommodate more people, or through the sheer physical inability of individuals to retain exclusive control over a large area. This creates an externality: each additional prospector reduces the chance that other prospectors will strike lucky. Hence, the private return exceeds the social return. A second respect in which artisanal mining is inefficient is technological: artisanal mining is not able to reap the scale economies involved in mining, such as pumping out water. Since large-scale technology involves fixed capital investment, artisanal mining gives rise to a third form of inefficiency: plundering the future. With substantial fixed investment, the appropriate pace of exploitation is gradual, so that the installed capital can remain employed for a prolonged period. This implies that some areas will initially be left unprospected. In contrast, artisanal mining prospects all areas at once so that what would otherwise be future rents are dissipated in high current costs. The social inefficiency inherent in artisanal exploitation is demonstrated by the successful growth of De Beers. The company was able to buy out the claims of artisanal producers at their full value under artisanal exploitation and generate a large profit by internalizing these externalities.

Management of Revenues

The revenues from natural resources are distinctive in two key respects from other sources of government revenue: since they are derived from depleting a resource they are intrinsically temporary; and since

commodity prices are highly volatile, they are unreliable. It is generally recognized that unsustainable increases in consumption are undesirable: consumption habits may form and commitments may be made, which then need to be met, so that declines in consumption are very costly. Both depletion and volatility potentially give rise to unsustainable increases in consumption.

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

To date, most policy attention has been focused on the former of these issues—how much to save? This may be because one simple answer can be derived very easily from elementary economic analysis due to the concept of Permanent Income. This is the analytic foundation for the policy rule of sovereign wealth funds (SWF). However, the issue of how much to save cannot be addressed until the prior, and more important, issue of "what assets should be acquired?" has been considered. Developing countries are capital scarce, so that assets should be accumulated by investment within the country rather than in foreign financial assets, which will, on average, be lower yielding. In effect, the SWF needs to be built up within the country. The acquisition of high-yielding domestic assets instead of low-yielding global assets has two powerful implications.

One implication is that the high yield will in aggregate imply that resource-rich developing countries can expect rapid growth. As a consequence, the value to the society of consumption in the near-term is considerably higher than consumption in the distant future when the economy has become fully developed. It is therefore appropriate for a developing country to use its resource revenues to raise consumption *closer to* the level of the distant future, rather than to use them to raise *the level of* consumption in that distant future. This strategy contrasts with the Permanent Income Hypothesis (PIH), which provides a solu-

tion for a society wishing permanently to raise its consumption: *hence the PIH is entirely focused on the interests of the distant future.*

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

Volatility and Irreversible Increases in Consumption

Commodity prices are highly volatile and hence so are revenues. Potentially, this affects both consumption and investment. Cuts in consumption are socially very costly and it is sometimes suggested that this justifies the accumulation of a sovereign liquidity fund (SLF) to smooth expenditures. A SLW would differ from a SWF in its intended purpose and have both a different scale and a different composition of assets, which would need to be much shorter-term. Supposing that the government knew with certainty the Net Present Value of the resource rents, it could choose the maximum path of expenditure on investment consistent with maintaining high returns, and from this compute the appropriate increase in consumption. The function of a SLF would simply be to enable expenditure to stay on this path while actual revenues fluctuated around it. In fact, given the historical path of commodity prices, a SLF would have needed to be very large in order to achieve this smoothing function and in a capital-scarce economy this comes at a high opportunity cost. A more modest and realistic alternative is to avoid fluctuations in consumption not by a SLF but by initially using most resource revenues for investment. Fluctuations in investment are much less damaging than fluctuations in consumption: the analogue to consumption is the stock of capital, not its annual increment. Hence, the need for liquidity to moderate fluctuations in investment, though

genuine, is less daunting than that needed to smooth an initially high level of consumption.

How Politics Can Interfere with Decisions

While government is central to the successful harnessing of natural assets for development, decisions concerning both extraction and the use of revenues can be distorted by political processes.

Insufficient Prospecting. A time inconsistency problem arises when governments have to attract mineral companies to invest in prospecting. The companies face a "hold-up" problem. Regardless of what governments promise mineral companies, once the companies have made their investment they have lost their bargaining power: governments have an incentive to appropriate the resource rents. The commitment problem is in one sense standard to all investment. However, it is more acute in respect of natural resource exploitation. The capital investment required for resource extraction is typically far higher than for other activities and so more is at stake. Further, the investment is typically lumpy: a country has one particular exploitable asset that requires investment of a particular scale. Once this is made opportunities for further investment may be limited. This contrasts with most other investment, where opportunities gradually increase over time so that an initial deal is implicitly enforced by the prospects of further deals. Crucially, this is a problem not for the company but for the government. Since companies can anticipate that this will happen, they hold back investments in exploration. As a result, countries with large unexploited potential reserves lose out. For example, for many years the major resource extraction company Alcoa mined bauxite in Guinea. The company knew that it would be far cheaper to process the bauxite into aluminum prior to shipping, but this would have required a huge fixed investment of around $1 billion. The company's board recognized the time-consistency problem: the government of Guinea had no means of precommitting to refrain from capturing the profits generated by this investment once it had become irreversible. Hence, Guinea lost the opportunity for

what would have been its single largest investment because of a lack of commitment technology.

Too Rapid Extraction. If the society is divided and power is unstable, then whichever group is currently in power has an interest in converting as many natural assets as possible into irreversible specific capital that favors itself. For example, the ethnic group in power might locate infrastructure in its own geographic area. If the ruling group is sufficiently small, the most attractive form of asset acquisition might indeed not even be public goods but might be private wealth held in irreversible form by means of capital flight. Incumbent governments then have an incentive to incur excessive social costs of extraction, such as by agreeing to overgenerous deals to extraction companies, or to ignore social costs incurred in the region of extraction if it is inhabited by nonfavored groups. For example, ministers in the transitional government in the Democratic Republic of Congo (DRC) knew that they only had around three years in office. During this period many contracts were signed with resource extraction companies conceding very generous terms in return for signature bonuses that cashed in the value of the natural assets to the society. By 2006 royalty payments to the treasury of the DRC were generating only $86,000 per year despite several hundred million dollars of commodity exports.

Too Little Investment in National Public Goods. Natural assets are one form of national public good. The above argument not only induces the government to plunder these natural assets in order to invest in group-specific and private capital, but to underinvest in other forms of national public good. The plunder of natural assets can be accelerated by means of international borrowing against the natural assets as collateral. More generally, spending ministers will ally to oppose the national public good of saving. Profligate spending ministers and a weak minister of finance thus give rise to a common-pool problem. This leads to an upward bias in public spending claims, a tilt of the government spending profile from the future toward the present, and thus not enough saving for future generations. When the financial return on the common asset is higher than that on private assets voracious

natural resource depletion can not merely waste the natural assets but reduce overall growth.

Too Little Liquidity for Smoothing Shocks. Because commodity prices are volatile, there is a strong case for accumulating liquid international assets during periods of high prices so that spending can be smoothed during the onset of downturns. However, if governments borrow against natural assets they amplify shocks instead of cushioning them: the ability to borrow fluctuates pro-cyclically with commodity prices.

The lack of cushioning is not only due to the rapacious behavior of ill-motivated governments. Since governments do not control the behavior of their successors, governments that are prudent and well motivated face a time-consistency problem. In some polities such a government might reasonably fear that a successor government is likely to be ill motivated. In this case, savings in the form of financial assets accumulated by the current government may merely transfer spending power to the future ill-motivated government. In the worst case, by saving the windfall not only does the current government fail to raise future consumption sustainably, but it transfers public spending from a period when it is of high quality to one when it is low quality. As a result, the constrained optimal decision even for the current well-motivated government may be to avoid saving the windfall in the form of liquid assets. Note that it is the future ill-motivated government that faces the time-consistency problem. Because it cannot pre-commit not to liquidate accumulated financial assets for consumption, the current government does not accumulate them and so all future governments are worse off. The future ill-motivated government would be better off if it could pre-commit only to consume along the optimal path.

What Sort of Political Systems Are Best Suited to the Management of Resource Rents?

Not all political systems are equally prone to these problems. Over and above the desirability of stable and inclusive government, which Besley and Persson (2008) show are foundation characteristics for effec-

tive government, are there particular characteristics of polities that are well suited to the management of natural assets?

Collier and Goderis (2007) find that whereas a commodity boom always increases growth in the short term, the long-term effects are contingent. Although on average in the long term the effects on the level of GDP are adverse, in some countries they are positive. They find that the decisive differentiating factor is the initial level of governance. Above a threshold all countries experiencing commodity booms have had favorable long-term effects, whereas below it all cases the long-term effects have been adverse.

Can more precision be put on the concept of governance? Mehlum et al. (2006) find that the quality of institutions is particularly important in resource rich countries. Collier and Hoeffler (2009) start to pin down what institutions in particular might be important. They decompose democracy into checks and balances, proxied by a cardinal measure of up to 17 such veto points on executive power, and a residual which can be thought of as electoral competition and is proxied by the Polity IV index, a commonly used political science scale of democracy. They find that both have powerful and opposite interactions with natural resource rents: checks and balances significantly improve performance whereas electoral competition significantly reduces it. Thus, resource-rich countries appear to need a form of democracy with particularly strong checks and balances. This is consistent with the analytic conclusion of Robinson et al. (2006) that a key characteristic of a polity that is robust to the pressures of resource rents is effective institutional safeguards against their use for political patronage.

3. SOLUTIONS IN EQUILIBRIUM

To summarize, section 1 established reasonable grounds for thinking that resource rents erode the normal functioning of the polity, making it more prone to insecurity and less likely to be accountable. Similarly, section 2 established reasonable grounds for thinking that political systems that have weak institutions are liable to mismanage natural assets.

Mutually Reinforcing Actions

Returning to the simple conceptual framework of figure 1: both relationships matter. However, rather than being determined simultaneously, equilibrium may depend upon sequence: if a country gets a sufficiently good political system well before it gets its natural endowments, the system may be robust. Thus, countries such as Norway, which had well-established democracies with plenty of checks and balances prior to the discovery of oil, may be better characterized by an exogenous political system than by interdependence. The political system may only be endogenous if it has not had time to become entrenched.

For societies characterized by interdependence, what can be done? Conceptually, two approaches appear to be jointly necessary. One is to steepen the PS locus and the other is to flatten the NA locus. Steepening the PS locus means reducing the damage inflicted by natural resources on the political system. Flattening the NA locus means improving the management of natural assets in weak political systems. The two are complementary. If the only change is to steepen the PS locus, then the initial improvement in the political system is partially undermined as the value of natural assets increases in response. If the only change is to flatten the NA locus, then the resulting increase in the value of natural assets (for example, as a result of increased discoveries) tends to undermine the political system.

Reducing the Damage Inflicted by Natural Resources on the Political System

Recently there have been two voluntary international interventions designed to reduce the damage done by natural resources to the political system.

The first was the *Kimberley Process*, which, by establishing a certification process for diamonds, made it more difficult for rebel groups to sell illicitly acquired diamonds on the world market. By making rebellion harder to finance, this tended to reduce the effect of natural resources on the risk of civil war. In 2008, President Yar' Adua of Nigeria proposed that a comparable system be established for tracking

oil. Quite reasonably, he is concerned that the bunkering of oil in the Nigerian Delta is fuelling violence. A certification system for oil would make it more difficult for criminals to sell bunkered oil to refineries.

The second intervention was the *Extractive Industries Transparency Initiative*, which seeks to make scrutiny of resource revenues easier, thereby making it harder both for companies to cheat governments out of revenues that are due, and for government officials to cheat the country out of payments made by companies. As with the Kimberley Process, there is scope for extension. Transparency in revenues is a necessary first step toward transparency in expenditure but does not in itself ensure it. Further, even transparency does not ensure accountability: this depends upon an effective judicial system.

Improving the Management of Natural Assets Given the Political System

The management of natural assets can be improved within a given political system by both domestic and international actions.

Addressing the agency problem. In setting the tax and royalty rates, the government faces an internal agency problem. The government must delegate the negotiation to a small group of its members and resource extraction companies have a strong incentive to bribe these individuals. To protect itself the government needs to adopt a process that is transparent: secret negotiations are ideally suited to corruption. The agency problem is compounded by an information problem: the government has considerably less knowledge as to the true value of its natural assets than does the company. A solution to both the agency and the information problem is to auction the extraction rights, inviting bids on the royalty rate that companies would be willing to pay. The rate could be conditioned on any observable features such as the basic geology, world price, and accumulated past volume of extraction. An auction is a way of forcing companies to reveal the true value of a right to extract by placing them in competition.

Addressing commitment problems. In section 2 I discussed two distinct commitment problems, one concerned with extraction companies the other with future governments. If governments cannot make credible

commitments with resource extraction companies, one solution is to establish national extraction companies. Unfortunately, this often generates a different set of problems. An alternative is to accept the right to adjudication of disputes by international courts, backed by escrow accounts.

If a government is concerned about the possible mismanagement of future governments, a solution to the time inconsistency problem is to create a commitment technology which binds all future governments *and which they would themselves support* because they benefit from it. In OECD societies this form of problem has been recognized for monetary policy where the solution has been to grant independence to central banks. In resource-rich countries the time-consistency problem concerns savings out of windfall resource revenues. This is a fiscal problem and so the equivalent of independent central banks is to develop institutional commitments on fiscal policy. Ngozi Nkonjo-Iweala, the former finance minister of Nigeria, pioneered the idea of a fiscal constitution for African natural resource revenues through the Fiscal Responsibility Act that pre-commits governments to savings.

If the finance minister is concerned that spending ministers will gang up to press for excessive recurrent expenditure, then Chinese-style resource contracts provide a commitment technology. The Chinese mode of resource extraction is a package deal in which extraction rights are exchanged directly for infrastructure rather than revenues passing through the budget. In this case there is a trade-off between transparency and the common pool problem.

Improving information for decisions. Finally, as will be apparent from the first part of section 2, the effective harnessing of natural assets for development raises complex economic issues. Societies in resource-rich countries can only get these decisions right to the extent that they understand them. Just as there has been a role for the international community to address the problem of weakened governance, so there is scope for international action to improve understanding of difficult but crucial social choices (Collier 2010). This is the intention of the *Natural Resource Charter*, an initiative of independent academics and practitioners.

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