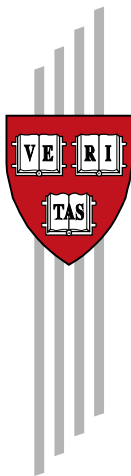


**The Natural Resource Curse:  
A Survey of Diagnoses and Some Prescriptions**

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## **The Natural Resource Curse: A Survey of Diagnoses and Some Prescriptions**

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### ***Abstract***

Countries with oil, mineral or other natural resource wealth, on average, have failed to show better economic performance than those without, often because of undesirable side effects. This is the phenomenon known as the Natural Resource Curse. This paper reviews the literature, classified according to six channels of causation that have been proposed. The possible channels are: (i) long-term trends in world prices, (ii) price volatility, (iii) permanent crowding out of manufacturing, (iv) autocratic/oligarchic institutions, (v) anarchic institutions, and (vi) cyclical Dutch Disease. With the exception of the first channel – the long-term trend in commodity prices does not appear to be downward – each of the other channels is an important part of the phenomenon. Skeptics have questioned the Natural Resource Curse, pointing to examples of commodity-exporting countries that have done well and arguing that resource exports and booms are not exogenous. The relevant policy question for a country with natural resources is how to make the best of them.

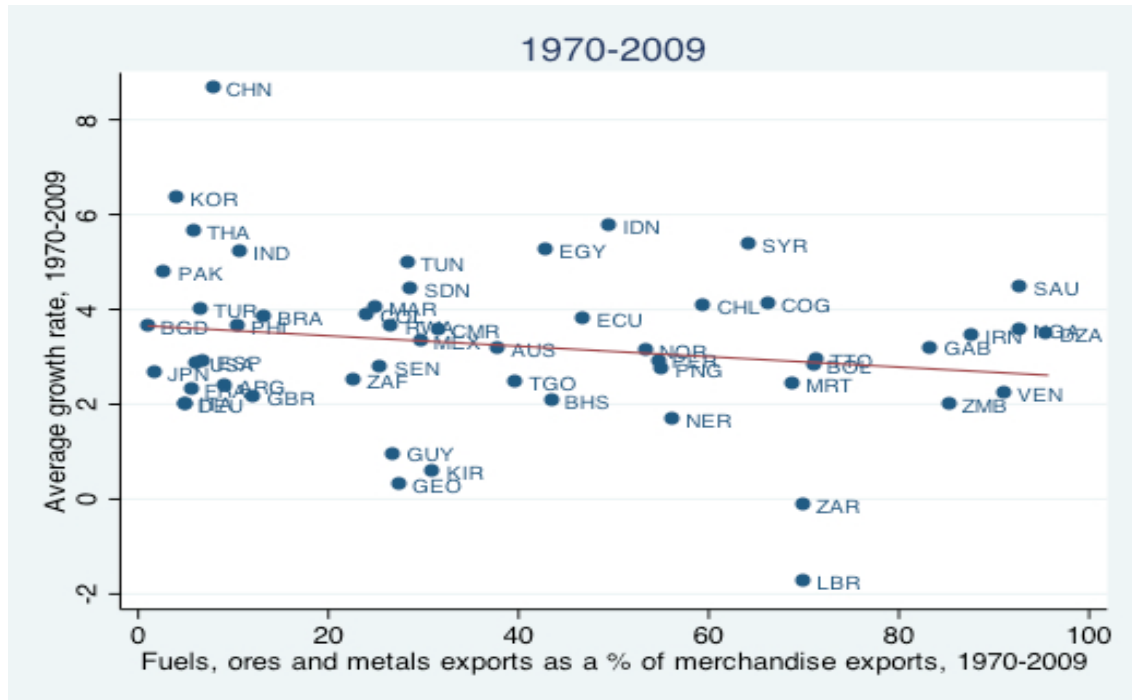
## The Natural Resource Curse: A Survey of Diagnoses and Some Prescriptions

Oil, minerals, and agricultural resources can bring great riches to those who possess them. Yet countries that are abundantly endowed with such natural resources often encounter pitfalls that interfere with the expected superior economic performance. Possibly undesirable side effects include reallocation of production away from the manufacturing sector. The crowding out of manufacturing comes not just via expansion of the natural resource sector itself, but also via expansion of the government and non-traded goods sectors. The artificial inflation of these sectors in turn comes via relative prices (real appreciation of the currency) or government spending, or both. One interpretation is that this phenomenon is cyclical, with the effects reversed when commodity boom turns to commodity bust. Another interpretation is that it can be permanent: countries endowed with natural resources more often develop social structures in which autocratic or corrupt political elites finance themselves through physical control of the natural resources. Meanwhile those governments that lack these endowments have no choice but to develop decentralized, democratic and diversified economies with market incentives that are more conducive to the development of manufacturing.

Examples of the Natural Resource Curse are plain to see. Japan, Korea, Taiwan, Singapore and Hong Kong are rocky islands (or peninsulas) that were endowed with very little in the way of exportable natural resources. Nevertheless, they achieved western-level standards of living. Many countries in Africa, the Middle East and Latin America are endowed with oil, minerals, or other natural resources, and yet have experienced much less satisfactory economic performance.

Figure 1 shows a sample of countries, over the last four decades. Exports of fuels, ores and metals as a fraction of total merchandise exports appear on the horizontal axis and economic growth on the vertical axis. Conspicuously high in growth and low in natural resources are China, Korea, and some other Asian countries. Conspicuously high in natural resources and low in growth are Gabon, Venezuela and Zambia. The overall relationship on average is slightly negative. The negative correlation is not very strong, masking almost as many resource successes as failures. But the data certainly suggest no positive correlation between natural resource wealth and economic growth.

Figure 1: Statistical relationship between mineral exports and growth.



Data source: *World Development Indicators*, World Bank

Auty (1993, 2001) is apparently the one who coined the phrase “natural resource curse” to describe this puzzling phenomenon. Sachs and Warner (1995) kicked off the econometric literature, finding that economic dependence on oil and mineral is correlated with slow economic growth, controlling for other structural attributes of the country. Sachs and Warner (2001) summarized and extended previous research showing evidence that countries with great natural resource wealth tend to grow more slowly than resource-poor countries. They say their result is not easily explained by other variables, or by alternative ways to measure resource abundance. Their paper claims that there is little direct evidence that omitted geographical or climate variables explain the curse, or that there is a bias in their estimates resulting from some other unobserved growth deterrent. Other studies that find a negative effect of oil, in particular, on economic performance, include Kaldor, Karl and Said (2007); Sala-i-Martin and Subramanian (2003); and Smith (2004).<sup>1</sup>

Before considering possible policies or institutions to combat the natural resource curse, it is necessary to diagnose the problem. How could abundance of oil, or mineral and agricultural products, be a curse, lead to sub-standard economic performance? What would be the mechanism for this counter-intuitive relationship? Six major possible hypotheses have been proposed. This paper reviews all six. They are:

1. Long-run trend of world prices for commodities.
2. Volatility in commodity prices.

<sup>1</sup> Also Ross (2001). But Mitchell (2012) refutes him. Ross (2012) is chastened by the skeptics; his hypothesis is that the negative effect of oil began only after the oil price increases of the 1970s.

3. Permanent crowding out of manufacturing, where spillover effects are thought to be concentrated.
4. Autocratic or oligarchic institutions.
5. Anarchic institutions: unenforceable property rights, unsustainably rapid depletion, or civil war.
6. Cyclical expansion of the non-traded sector via the Dutch Disease.

Developing countries tend to be smaller economically than major industrialized countries, and more likely to specialize in the exports of basic commodities like oil. As a result, they are more likely to fit the small open economy model: they can be regarded as price-takers, not just for their import goods, but for their export goods as well. That is, the prices of their tradable goods are generally taken as given on world markets. The price-taking assumption requires three conditions: low monopoly power, low trade barriers, and intrinsic perfect substitutability in the commodity as between domestic and foreign producers – a condition usually met by primary products, and usually not met by manufactured goods and services. To be literal, not every barrel of oil is the same as every other and not all are traded in competitive markets. Furthermore, Saudi Arabia does not satisfy the first condition, due to its large size in world oil markets. But the assumption that most oil producers are price-takers holds relatively well.

To a first approximation, then, the local price of oil is equal to the dollar price on world markets times the country's exchange rate. It follows, for example, that a devaluation should push up the local-currency price of oil quickly and in proportion (leaving aside pre-existing contracts or export restrictions). An upward revaluation of the currency should push down the local price of oil in proportion. Throughout this paper we assume that the domestic country must take the price of the export commodity as given, in terms of foreign currency.

## **1. Long-run trend of world commodity prices**

The hypothesis that the prices of mineral and agricultural products follow a downward trajectory in the long run, relative to the prices of manufactures and other products, is associated with Raul Prebisch (1950) and Hans Singer (1950). The theoretical reasoning was that world demand for primary products is inelastic with respect to world income. That is, for every one percent increase in income, the demand for raw materials increases by less than one percent. Engel's Law is the (older) proposition that households spend a lower fraction of their income on food and other basic necessities as they get richer.

This hypothesis, if true, would readily support the conclusion that specializing in natural resources was a bad deal. Mere "hewers of wood and drawers of water" would remain forever poor (Deuteronomy 29:11) if they did not industrialize. The policy implication that was drawn by Prebisch was that developing countries should discourage international trade with tariff and non-tariff barriers, to allow their domestic manufacturing sector to develop behind protective walls, rather than exploit their traditional comparative advantage in natural resources as the classic theories of free trade would have it. This "Import Substitution Industrialization" policy was adopted in much

of the developing world in the 1950s, 60s and 70s. The fashion reverted in subsequent decades, however.

There also exist persuasive theoretical arguments that we should expect prices of oil and other minerals to experience *upward* trends in the long run. The arguments begin with the assumption that we are talking about non-perishable non-renewable resources, i.e., deposits in the earth's crust that are fixed in total supply and are gradually being depleted.

Let us add another assumption: whoever currently has claim to the resource – an oil company – can be confident that it will retain possession, unless it sells to someone else, who then has equally safe property rights. This assumption excludes cases where private oil companies fear that their contracts might be abrogated or their possessions nationalized.<sup>2</sup> It also excludes cases where warlords compete over physical possession of the resource. Under such exceptions, the current owner has a strong incentive to pump the oil or extract the minerals quickly, because it might never benefit from whatever is left in the ground. One explanation for the sharp rise in oil prices between 1973 and 1979, for example, is that private Western oil companies over the preceding two decades had anticipated the possibility that newly assertive developing countries would eventually nationalize the oil reserves within their borders, and thus had kept prices low by pumping oil more quickly than they would have done had they been confident that their claims would remain valid indefinitely.

At the risk of some oversimplification, let us also assume for now that the fixed deposits of oil in the earth's crust are all sufficiently accessible that the costs of exploration, development, and pumping are small compared to the value of the oil. Hotelling (1931) deduced from these assumptions the important theoretical principle that the price of oil in the long run should rise at a rate equal to the interest rate.

The logic is as follows. At every point in time the owner of the oil – whether a private oil company or state-owned -- chooses how much to pump and how much to leave in the ground. Whatever is pumped can be sold at today's price (this is the price-taker assumption) and the proceeds invested in bank deposits or US Treasury bills which earn the current interest rate. If the value of the oil in the ground is not expected to increase in the future, or not expected to increase at a sufficiently rapid rate, then the owner has an incentive to extract more of it today, so that it can earn interest on the proceeds. As oil companies worldwide react by extracting more today, they drive down the current price of oil. They drive the price below its perceived long-run level. When the current price is below its perceived long-run level, companies will expect that the price must *rise* in the future. Only when the expectation of future appreciation is sufficient to offset the interest rate will the oil market be in equilibrium. That is, only then will oil companies be close to indifferent between pumping at a faster rate and a slower rate.

If there are constant costs of extraction and storage, then the trend in prices will be lower than the interest rate, by the amount of those costs; if there is a constant convenience yield from holding inventories, then the trend in prices will be higher than the interest rate, by that amount.

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<sup>2</sup> The concern that insecure property rights leads to excessively rapid depletion is further explored as part of channel 5.

The idea that natural resources are in fixed supply, and that as a result their prices must rise in the long run as reserves begin to run low, is much older than Hotelling. It goes back to Thomas Malthus (1798) and the genesis of fears of environmental scarcity (albeit without the role of the interest rate). Demand grows with population, supply is fixed; what could be clearer in economics than the prediction that price will rise?

The complication is that supply is not fixed. True, at any point in time there is a certain stock of oil reserves that have been discovered. But the historical pattern has long been that, as the stock is depleted, new reserves are found. When the price goes up, it makes exploration and development profitable for deposits that are farther underground or are underwater or in other hard-to-reach locations. This is especially true as new technologies are developed for exploration and extraction.

Over the two centuries since Malthus, or the 70 years since Hotelling, exploration and new technologies have increased the supply of oil and other natural resources at a pace that has roughly counteracted the increase in demand from growth in population and incomes.<sup>3</sup>

Just because supply has always increased in the past does not necessarily mean that it will always do so in the future. In 1956 Marion King Hubbert, an oil engineer, predicted that the flow supply of oil within the United States would peak in the late 1960s and then start to decline permanently. The prediction was based on a model in which the fraction of the country's reserves that has been discovered rises through time, and data on the rates of discovery versus consumption are used to estimate the parameters in the model. Unlike myriad other pessimistic forecasts, this one came true on schedule, earning subsequent fame for its author. The planet Earth is a much larger place than the United States, but it too is finite. A number of analysts have extrapolated Hubbert's words and modeling approach to claim that the same pattern would follow for extraction of the *world's* oil reserves. Specifically, some of them claim that the 2000-2011 run-up in oil prices confirmed a predicted global "Hubbert's Peak."<sup>4</sup> It remains to be seen whether we are currently witnessing a peak in world oil production notwithstanding that forecasts of such peaks have proven erroneous in the past.

With strong theoretical arguments on both sides, either for an upward trend in commodity prices or for a downward trend, one must say that it the question is an empirical one.

Although specifics will vary depending on individual measures, it is possible to generalize somewhat across commodity prices.<sup>5</sup> Terms of trade for commodity producers had a slight upward trend from 1870 to World War I, a downward trend in the inter-war period, upward in the 1970s, downward in the 1980s and 1990s, and upward in the first decade of the 21st century. Simple extrapolation of medium-term trends is foolish. One must take a longer-term perspective.

What is the overall statistical trend in the long run? Some authors find a slight upward trend, some a slight downward trend.<sup>6</sup> The answer seems to depend, more than

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<sup>3</sup> Krautkraemer (1998) and Wright and Czelusta (2003, 2004, 2006).

<sup>4</sup> E.g., Deffeyes (2005).

<sup>5</sup> Although prices do not always move together for oil, minerals, and agricultural products, there is a surprisingly high correlation. Pindyck and Rotemberg (1990).

<sup>6</sup> Cuddington (1992), Cuddington, Ludema and Jayasuriya (2007), Cuddington and Urzua (1989), Grilli and Yang (1988), Pindyck (1999), Hadass and Williamson (2003), Reinhart and Wickham

anything else, on the date of the end of the sample. Studies written after the commodity price increases of the 1970s found an upward trend, but those written after the 1980s found a downward trend, even when both kinds of studies went back to the early 20<sup>th</sup> century. When studies using data through 2011 are completed some will probably again find a positive long run trend. This phenomenon is less surprising than it sounds. Real commodity prices undergo large cycles around a trend, each lasting twenty years or more.<sup>7</sup> As a consequence of the cyclical fluctuations, estimates of the long-term trend are very sensitive to the precise time period studied.

One should seek to avoid falling prey to *either* of two reductionist arguments at the philosophical poles of Malthusianism and cornucopianism. On the one hand, the fact that the supply of minerals in the earth's crust is a finite number, does not in itself justify the apocalyptic conclusion that we must necessarily run out. As Sheik Ahmed Zaki Yamani, the former Saudi oil minister, famously said, "The Stone Age came to an end not for a lack of stones and the oil age will end, but not for a lack of oil." Malthusians do not pay enough attention to the tendency for technological progress to ride to the rescue. On the other hand, the fact that the Malthusian forecast has repeatedly been proven false in the past does not in itself imply the Panglossian forecast that this will always happen in the future. One must seek a broad perspective in which all relevant reasoning and evidence are brought to bear in the balance.

## 2. Volatility in commodity prices

Commodity prices are highly volatile. The world market prices for oil and natural gas are the most volatile of all, but aluminum, bananas, coffee, copper, sugar and others are close behind.

Some have suggested that it is precisely the volatility of natural resource prices that is bad for economic growth.<sup>8</sup> Cyclical shifts of the factors of production (labor, land and capital) back and forth across sectors – mineral, agricultural, manufacturing, services – may incur needless transaction costs. Frictional unemployment of labor, incomplete utilization of the capital stock, and incomplete occupancy of housing are true deadweight costs, even if they are temporary.

What is the fundamental reason for the volatility? Low short-run elasticities. That is, for any given increase in price, demand does not fall much in the short run nor supply rise. Demand elasticities are low in the short run largely because the capital stock at any point in time is designed physically to operate with a particular ratio of energy or raw materials to output. Supply elasticities are also often low in the short run because it takes time to adjust output. The result is that when there is a shock, such as a bad harvest (reducing the supply of agricultural products) or a cold winter (raising demand for energy products), the corresponding price has to rise by a lot in order to clear the market.

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(1994), Kellard and Wohar (2005), Balagtas and Holt (2009) and Harvey, Kellard, Madsen and Wohar (2010).

<sup>7</sup> Cuddington and Jerrett (2008) find three "super cycles" in metals prices over the 150 years from 1850-2000, followed by the beginnings of a fourth.

<sup>8</sup> Blattman, Hwang, and Williamson (2007), Hausmann and Rigobon (2003) and Poelhekke and van der Ploeg (2007).



To say that a country endowed with commodities suffers more volatility than others is not to say that it would benefit from barriers to trade. The classical gains from international trade can apply also in the case of commodity volatility, as international integration offers opportunities to diversify shocks.<sup>9</sup>

### **3. Crowding out of manufacturing**

Outside of classical economics, diversification out of primary commodities into manufacturing in most circles is considered self-evidently desirable. Is industrialization the sine qua non of economic development? Is encouragement of manufacturing necessary to achieve high income? Classical economic theory says “no:” countries are best off producing whatever is their comparative advantage, whether that is natural resources or manufacturing. In this 19<sup>th</sup> century view, attempts by Brazil to industrialize were as foolish as it would have been for Great Britain to try to grow coffee and oranges in hothouses.

But some argue that countries only get sustainably rich if they industrialize (oil-rich sheikdoms notwithstanding) and that industrialization in turn requires an extra push from the government, often known as industrial policy. Matsuyama (1992) provided an influential theoretical model formalizing this intuition: the manufacturing sector is assumed to be characterized by learning by doing, while the primary sector (agriculture, in his paper) is not. The implication is that deliberate policy-induced diversification out of primary products into manufacturing is justified, and that a permanent commodity boom that crowds out manufacturing can indeed be harmful.<sup>10</sup>

On the other side, it must be pointed out that there is no reason why learning by doing should be the exclusive preserve of manufacturing tradables. Mineral and agricultural sectors can enjoy learning by doing as well. Some countries have experienced tremendous productivity growth in the oil, mineral, and agricultural sectors. American productivity gains have been aided by American public investment since the late 19<sup>th</sup> century, in such institutions of knowledge infrastructure as the U.S. Geological Survey, the Columbia School of Mines, the Agricultural Extension program, and Land-Grant Colleges.<sup>11</sup>

Although well-functioning governments can play a useful role in supplying these public goods for the natural resource sector, this is different than mandating government ownership of the resources themselves. In Latin America, for example, public monopoly ownership and prohibition on importing foreign expertise or capital has often stunted development of the mineral sector, whereas privatization can set it free. Moreover, attempts by governments to force linkages between the mineral sector and processing industries have not always worked.

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<sup>9</sup> Jacks, O’Rourke and Williamson (2011) find in three centuries of data that integration reduces commodity volatility.

<sup>10</sup> The resource curse works by this channel also in van Wijnbergen (1984) and Sachs and Warner (1995).

<sup>11</sup> Wright and Czelusta (2003, p.6, 25; 18-21).

## 4. Autocratic/Oligarchic Institutions

A prominent trend in thinking regarding economic development is that the quality of institutions is the deep fundamental factor that determines which countries experience good performance and which do not, and that it is futile to recommend good macroeconomic or microeconomic policies if the institutional structure is not there to support them. The theory is that weak institutions lead to inequality, intermittent dictatorship, and lack of constraints to prevent elites and politicians from plundering the country.<sup>12</sup>

Of the various possible channels through which natural resources could be a curse to long-run development, the quality of institutions and governance is perhaps the most widely hypothesized. Some studies focus on outright corruption.<sup>13</sup> The “rent cycling theory” of Auty (1990, 2001, 2007) holds that economic growth requires recycling rents via markets rather than via patronage. In high-rent countries the natural resource elicits a political contest to capture ownership, whereas in low-rent countries the government must motivate people to create wealth, for example by pursuing comparative advantage, promoting equality, and fostering civil society.

The theory is thought also to fit Middle Eastern oil exporters especially well. In this region, governments’ access to rents, in the form of oil revenue, may have freed them from the need for taxation of their peoples, and that this in turn freed them from the need for democracy.<sup>14</sup> The need for tax revenue is believed to require democracy under the theory “no taxation without representation.” Huntington (1991) generalized the principle beyond Middle Eastern oil producers to states with natural resources in other parts of the developing world.

This theory is related to the explanation by Engerman and Sokoloff (1997, 2000, 2012) as to why industrialization first took place in the northern part of the Western Hemisphere rather than the south. It is worth recalling that the European powers who acquired colonies in Latin America, with their gold and silver, were considered at the time to have done better than those who acquired colonies in North America. Indeed, in the Treaty of Breda (1667) the Dutch ceded their claim to New Netherland (New York) to the English in exchange for Suriname in South America and a century later the French were willing to give up Canada, so long as they could keep their sugar plantations on Guadeloupe.<sup>15</sup>

These two economic historians argue that lands endowed with extractive industries (“point source” sectors: oil, minerals, and plantation crops, as in Latin America) developed institutions of slavery, inequality, dictatorship, and state control.

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<sup>12</sup> Prominent econometric studies include Barro (1991), Acemoglu et al (2002), Easterly and Levine (2002) Hall and Jones (1999) and Rodrik, Subramanian, and Trebbi (2003).

<sup>13</sup> Hodler (2006) and Caselli (2006) find a natural resource curse via internal struggle for ownership. Leite and Weidmann (1999) find that natural resource dependence has a substantial statistical effect on measures of corruption in particular. Also Gylfason (2000) and Papyrakis and Gerlach (2004). Arezki and Brückner (2009) find that oil rents worsen corruption.

<sup>14</sup> Mahdavy (1970), Luciani (1987), Vandewalle (1998) and many others.

<sup>15</sup> Parker (2011, p. 138, 305).

The long-lasting effects are observable in policies with regard to suffrage, education, land and immigration. Meanwhile, other countries (in those climates originally suited to fishing and small farms, as in the Northeast United States) developed institutions based on individualism, democracy, egalitarianism, and capitalism. When the industrial revolution came along, the latter areas were well-suited to make the most of it. Those that had specialized in extractive industries were not, because society had come to depend on class structure and authoritarianism, rather than on individual incentive and decentralized decision-making.

Statistical studies across large cross-sections of countries followed the development of the theories of rent-seeking and democracy. Many of the studies find that economic dependence on oil or minerals is indeed correlated with authoritarian government.<sup>16</sup>

What commodities, exactly, are the worrisome ones? Sala-I-Martin and Subramanian (2003) and Bulte, Damania, and Deacon (2005) find that the resources that undermine institutional quality and thereby growth include oil and some particular minerals, but not agricultural resources. Isham, et al (2005) find that the commodities that are damaging to institutional development, which they call “point source” resources, are, in addition to oil: minerals, plantation crops, and coffee and cocoa.

## **5. Unsustainability and anarchy**

A different sort of institutional failure could be described as anarchy, as opposed to autocracy or oligarchy. Under this rubric falls three related pitfalls: unsustainably rapid depletion of resources, unenforceable property rights, and civil war.

### **a. Resource depletion**

Two hundred years ago, much of the island of Nauru in the South Pacific consisted of phosphate deposits, derived from guano. The substance is valuable in the fertilizer industry. As a result of highly profitable phosphate exports, Nauru in the late 1960s and early 1970s showed up globally with the highest income per capita of any country. Eventually, however, the deposits gave out. Not enough of the proceeds had been saved, let alone well-invested, during the period of abundance. Today, the money is gone and so is the tropical paradise: the residents are left with little more than a narrow and environmentally precarious rim of land, circling wasteland where the phosphates used to be.

What happens when a depletable natural resources is indeed depleted? This question is not only of concern to environmentalists. It is also one motivation for the strategy of diversifying the economy beyond natural resources into other sectors. The question is also a reason to save a good share of the rents from exhaustible natural

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<sup>16</sup> Barro (2000), Ross (2001), Wantchekon (2002), Jenson and Wantchekon (2004), and Ross (2006), Smith (2004, 2007), and Ulfelder (2007). But other studies reject the link from resources to lack of democracy: Karl (1997), Noland (2008), Dunning (2008), Wacziarg (2009) and Haber and Menaldo (2011).

resources, so that future generations do not suffer an exhaustion of total wealth or a diminution in the flow of consumption.<sup>17</sup>

Sometimes, as in the Nauru example, it is the government that has control of the natural resource and excessive depletion is another instance of a failure in governance. Politicians tend to extract at a rate in excess of the efficient path because they discount the future too much.<sup>18</sup> They discount the future because they are more intent on surviving the next election or coup attempt.

Privatization would be a possible answer to the problem of excessive depletion, if a full assignment of property rights were possible, thereby giving private sector owners adequate incentive to conserve the resource in question. But often this is not possible, either physically or politically. The difficulty in enforcing property rights over some non-renewable resources constitutes a category of natural resource curse of its own.

### **b. Unenforceable property rights**

While one theory holds that the physical possession of mineral wealth undermines the motivation for the government to establish a broad-based regime of property rights for the rest of the economy, another theory holds that some natural resources do not lend themselves to property rights whether the government wants to apply them or not. Overfishing, overgrazing, and over-use of water are classic examples of the so-called “tragedy of the commons” that applies to “open access” resources. Individual fisherman or ranchers or farmers have no incentive to restrain themselves, even while the fisheries or pastureland or water aquifers are being collectively depleted. The difficulty in imposing property rights is particularly severe when the resource is dispersed over a wide area, as timberland. Even the classic point-source resource, oil, can suffer the problem, especially when wells drilled from different plots of land hit the same underground deposit.

This unenforceability of property rights is the market failure that can invalidate some of the standard neoclassical economic theorems in the case of open access resources. One obvious implication of unenforceability is that the resource will be depleted more rapidly than is optimal calculations call for.<sup>19</sup> The benefits of free trade are another possible casualty: the country might be better off without the ability to export the resource, if doing so exacerbates the excess rate of exploitation.<sup>20</sup>

Common pool resources are those that are at the same time (i) subtractable (as are private goods) and (ii) costly to exclude users from consuming (as are public goods), while yet (iii) not impossible to exclude users from.<sup>21</sup> Enforcement of property rights is all the more difficult in a frontier situation.<sup>22</sup> The American “Wild West” saw legendary claim-jumping in the gold or silver rushes of the late 19<sup>th</sup> century and early 20<sup>th</sup>. Today,

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<sup>17</sup> Hartwick (1977) and Solow (1986).

<sup>18</sup> Robinson, Torvik and Verdier (2006).

<sup>19</sup> E.g., Dasgupta and Heal (1985).

<sup>20</sup> Brander and Taylor (1997). Hardwood forests are a strong example.

<sup>21</sup> Ostrom and Ostrom (1977).

<sup>22</sup> Barbier (2005ab, 2007) argues that frontier exploitation of natural resources can lead to unsustainable development characterized by a boom-bust cycle as well as permanently lower levels of income in the long term. Findlay and Lundahl (1994, 2001) study economic development in frontier countries of the late 19<sup>th</sup> and early 20<sup>th</sup> centuries.

anarchic conditions can apply in the tropical forest frontiers of the Amazon, Borneo or the Congo.

### c. Civil war

Domestic conflict, especially when violent, is certainly bad for economic development. Where a valuable resource such as oil or diamonds is there for the taking, rather than when production requires substantial inputs of labor and capital investment, factions are more likely to fight over it. Researchers have found that economic dependence on oil and mineral wealth is correlated with civil war.<sup>23</sup> Chronic conflict in such oil-rich countries as Angola and Sudan comes to mind. Civil war is, in turn, very bad for economic development.

## 7. Dutch Disease

The last of the six channels takes us into the macroeconomics of the business cycle. The “Dutch Disease” refers to some possibly unpleasant side effects of a boom in oil or other mineral and agricultural commodities. (The name is an arbitrary accident of history, originally inspired by side-effects of natural gas discoveries by the Netherlands in the late 1950s.<sup>24</sup>) The phenomenon arises when a strong, but perhaps temporary, upward swing in the world price of the export commodity causes some or all of the following side effects:

- a large real appreciation in the currency (taking the form of nominal currency appreciation if the country has a floating exchange rate or the form of money inflows and inflation if the country has a fixed exchange rate<sup>25</sup>);
- an increase in spending (especially by the government, which increases spending in response to the increased availability of tax receipts or royalties);
- an increase in the price of nontraded goods (goods and services such as housing that are not internationally traded), relative to traded goods (manufactures and other internationally traded goods other than the export commodity),
- a resultant shift of labor and land out of non-export-commodity traded goods (pulled by the more attractive returns in the export commodity and in non-traded goods and services), and
- sometimes a current account deficit (despite the enhanced revenue from commodity exports), thereby incurring international debt that may be difficult to service when the

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<sup>23</sup> De Soyza (2000), Fearon and Laitin (2003), Collier and Hoeffler (2004), Humphreys (2005) and Collier (2007, Chapter 2) all find that economic dependence on oil and mineral wealth is correlated with civil war.

<sup>24</sup> The name is due to *the Economist* magazine; Kremers (1986). Gregory (1976), Corden (1984) and Neary and van Wijnbergen (1986) gave us three of the first models.

<sup>25</sup> E.g., Edwards (1986). During the boom of 2001-2010, examples of fixed-rate oil-producing countries where the real appreciation came via money inflows and inflation include Saudi Arabia and the Gulf emirates. Examples of floating-rate natural resource countries where the real appreciation took the form of nominal currency appreciation include Australia, Chile, Kazakhstan, Mexico, Norway, Russia, or South Africa. (Chen and Rogoff, 2003, document the sensitivity of exchange rates to commodity prices in the cases of Australia and New Zealand. Frankel, 2007, does South Africa.)

commodity boom ends.<sup>26</sup>

What makes the Dutch Disease a “disease?” One interpretation, particularly relevant if the complete cycle is not adequately foreseen, is that the process is all painfully reversed when the world price of the export commodity goes back down. In that case the Dutch Disease is an example of the costs of volatility in commodity prices. A second interpretation is that, even if the perceived longevity of the increase in world price turns out to be accurate, the crowding out of non-commodity exports is undesirable, perhaps because the manufacturing sector has greater externalities for long-run growth (“de-industrialization”).<sup>27</sup> In that case, an example of the costs of crowding out manufacturing, the problem is a high level of commodity prices, not cyclical fluctuations per se.

The reallocation of resources across tradable sectors, e.g., from manufactures to oil, may be the inevitable response to the fundamentals of the global economy, regardless of national macroeconomics. But the movement into non-traded goods is macroeconomic in origin and requires a thoughtful strategy from the monetary authorities. “Letting the markets work” is not a fully adequate guide to policy.

The expansion of the non-traded goods sector, sometimes into the territory of overheating (inflation and asset bubbles) is not solely a result of real appreciation of the currency. Fiscal policy also plays a big role. Many authors have documented that fiscal policy tends to be procyclical in developing countries, especially in comparison with industrialized countries.<sup>28</sup> An important cause of procyclical spending is precisely that government receipts from taxes or royalties rise in booms, and the government cannot resist the temptation or political pressure to increase spending proportionately, or more than proportionately. Procyclicality is especially pronounced in countries that possess natural resources and where income from those resources tends to dominate the business cycle.<sup>29</sup> Two large budget items that account for much of the increased spending from oil booms are investment projects and the government wage bill.<sup>30</sup>

## Skeptics

Some skeptics question whether there really is a Natural Resource Curse. They point to examples of commodity-exporting countries that have done well, persuasively arguing that natural resource endowments do not necessarily doom a country to slow growth.

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<sup>26</sup> Manzano and Rigobon (2008) argue that the negative Sachs-Warner effect of resource dependence on growth rates during 1970-1990 was mediated through international debt incurred when commodity prices were high. Arezki and Brückner (2010a, b) find that commodity price booms lead to increased government spending, external debt, default risk and sovereign bond spreads in autocracies, and but do not have those effects in democracies.

<sup>27</sup> Van Wijnbergen (1984), Matsuyama (1992) and Gylfason, Herbertsson and Zoega (1999).

<sup>28</sup> Cuddington (1989), Gavin and Perotti (1997), Tornell and Lane (1999), Kaminsky, Reinhart, and Vegh (2004), Talvi and Végh (2005), Alesina, Campante and Tabellini (2008), Mendoza and Oviedo (2006), Ilzetski and Vegh (2008) and Medas and Zakharova (2009).

<sup>29</sup> Cuddington (1989) and Arezki, Hamilton and Kazimov (2011) show the correlation between commodity booms and spending booms.

<sup>30</sup> Gelb (1986) and Medas and Zakharova (2009), respectively.

Everyone recognizes that Norway is conspicuous as an oil-producer at the top of the international league tables for governance and economic performance.<sup>31</sup> Botswana and the Congo are both abundant in diamonds; yet Botswana is the best performer in continental Africa in terms of democracy, stability, and rapid growth of income,<sup>32</sup> while the Congo is among the very worst.<sup>33</sup>

The skeptics question the negative relationship even as a statistical generalization that holds on average. Delacroix (1977), Davis (1995), and Herb (2005) and Alexeev and Conrad (2009) all find no statistical evidence of the natural resource curse.

Why do different studies come to opposite conclusions? In some cases, the explanation for different results may be that resource wealth may raise the *level* of per capita income, while reducing or failing to raise the *growth rate* of income (or the end-of-sample level of income, if the equation conditions on initial income).<sup>34</sup> This is especially likely to make the difference if the data do not go back to a time before oil or minerals were discovered. Many authors argue that the important question is whether the country already has good institutions at the time that oil or other minerals are discovered, in which case it is more likely to be put to use for the national welfare instead of the welfare of an elite.<sup>35</sup> Arezki and Van der Ploeg (2007) use instrumental variables to control for the endogenous component of institutional quality and trade; they confirm that the adverse effect of natural resources on growth is associated with exogenously poor institutions and, especially, that it is associated with exogenously low levels of trade.

The skeptics argue that “resource dependence” and commodity booms are not exogenous. In some cases the crucial difference is whether “natural resource intensity” is measured by true endowments (“natural resource wealth”), or rather by exports (“natural resource dependence”). The skeptics argue that commodity exports are highly endogenous.<sup>36</sup> In other words, oil wealth is not necessarily the cause and institutions the effect; it could be the other way around.

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<sup>31</sup> Røed Larsen (2004). Norway is literally ranked number one out of 182 countries in the Human Development Index. In terms of real income, Norway is ranked number 5, just behind Qatar and the UAE. For comparison, the US is number 9 in real income, and 13 on the HDI.

<sup>32</sup> Engelbert (2000), Sarraf and Jimanji (2001), Acemoglu, Johnson, and Robinson (2003) and Iimi (2006) are among those noting Botswana’s conspicuous escape from the Resource Curse of its neighbors.

<sup>33</sup> Most African countries grew more strongly in the years 2000-10 than previously, in part due to rising mineral prices (Beny and Cook, 2009). But countries like the Congo and Chad remain in the bottom 5 per cent of countries in the Human Development Index. Oil-rich Nigeria ranks 142<sup>nd</sup> out of 169. (*Human Development Report*, 2010.)

<sup>34</sup> Rodriguez and Sachs (1999) and Alexeev and Conrad (2009).

<sup>35</sup> Mehlum, Moene, and Torvik (2006), Robinson, Torvik and Verdier (2006), McSherry (2006), Smith (2007), Collier and Goderis (2007), and Boschini, Petterson and Roine (2007). Bhattacharyya and Hodler (2009) find that natural resource rents lead to corruption, but only in the absence of high-quality democratic institutions.

<sup>36</sup> Maloney (2002) and Wright and Czelusta (2003, 2004, 2006). Even recorded reserves, the most common measure of endowments, are somewhat endogenous as well, since they reflect discoveries, which in turn respond to both world prices and the productivity of the exploration industry, global and local.

The endogeneity can arise in several different ways. Industrialization may determine commodity exports rather than the other way around. The reverse causality could explain the negative correlation: those countries that fail at manufacturing have a comparative advantage at commodity exports, by default. Or the reverse causality might have a positive sign: good institutions and technological progress are just as useful for developing natural resources as they are for the other sectors of the economy, as the United States, Canada, Australia and Chile have shown.<sup>37</sup>

## **Policies to avoid the pitfalls**

The conclusion is not that natural resource wealth need necessarily lead to inferior economic or political development, through any of these channels. It is best to view commodity abundance as a double-edged sword, with both benefits and dangers. It can be used for ill as easily as for good. That resource wealth does not in itself confer good economic performance is a striking enough phenomenon, without exaggerating the negative effects. The priority for any country should be on identifying ways to sidestep the pitfalls that have afflicted other commodity producers in the past, and to find the path of success.

Governments often adopt policies in the name of dealing with commodity price volatility that do not work or are actually harmful. These include commodity marketing boards, controls on exports, price controls, cartels and bans on derivative markets. But some institutional innovations can help avoid the natural resource curse and achieve natural resource blessings instead.

Of eight particularly promising ideas, three seek to design contracts so as to spread risk efficiently, three are designed to make macroeconomic policy less procyclical, and two are intended to protect funds from waste or corruption:

1. Indexation of oil or mineral contracts to world prices of the commodity.
2. Hedging of export proceeds on option markets, as Mexico has done.
3. Denomination of debt in terms of the world price of the export commodity
4. Chile-style fiscal rules, which prescribe a structural budget surplus and use independent panels of experts to determine what long-run price of the export commodity should be assumed in forecasting the structural budget.
5. An exchange rate policy that initially dampens upward pressure on the currency via sterilized intervention in the foreign exchange market, and only turns to currency appreciation when the commodity boom has proved to be long-lived or when inflation is no longer contained.
6. An inflation target for the central bank that emphasizes product prices, rather than the CPI on which the fashionable monetary regime of Inflation Targeting is usually based
7. Transparent commodity funds. Botswana's "Pula Fund" is probably a better model than the frequently touted Norwegian Pension Fund, because investments by the latter are subject to political influence.

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<sup>37</sup> Norman (2009) points out that the discovery and development of oil is not purely exogenous, but rather is endogenous with respect to, among other things, the efficiency of the economy.



8. Lump-sum per capita distribution of oil or mineral revenues, to make sure it doesn't end up in the bank accounts of corrupt officials.

We elaborate on each of these in turn.

### **1. Indexation of contracts to world prices.**

Contracts between producing countries and foreign mining companies are often plagued by “time inconsistency”: A price is set by contract, but later the world price goes up, and the government wants to renege. It doesn't want to give the company all the profits, and why should it? But this is a “repeated game.” The risk that the locals will renege makes foreign companies reluctant to do business in the first place. This limits the availability of capital to the country. The process of renegotiation can have large transactions costs, including interruptions in the export flow. Conversely, if the world price goes down, then the foreign firm may renege. The logical solution is indexation of the contracts: the two parties agree ahead of time, “if the world price goes up 10%, then the gains are split between the company and the government” in some particular proportion. Indexation shares the risks of gains and losses, without the costs of renegotiation or damage to a country's reputation from renegeing.

### **2. Hedging of export proceeds on option markets.**

Producers who sell their minerals on international spot markets, are exposed to the risk that the dollar price rises or falls. The producer can hedge the risk by selling that quantity on the forward or futures market. As with indexation of the contract price, hedging provides efficient sharing of risk and automatic adjustment to changes in world prices. Futures markets have one serious drawback from a bureaucratic or political point of view. If a government ministry hedges on the futures market, the Minister receives no credit for having saved the country from disaster when the world price falls, but is excoriated for having sold out the national patrimony when the price rises. Better, then, is a hedging strategy employed by Mexico: it uses options to eliminate only the risk of a *fall* in price in the price of oil.<sup>38</sup> In this way it retains the upside risk while reducing the downside risk.

### **3. Denomination of debt in terms of the world price of the export commodity**

This is a proposal for those countries that are borrowers despite their commodity wealth. A copper-producer should index its debt to the copper price. Then debt service obligations automatically rise and fall with the value of copper exports. Oil-producers should index their debt in terms of oil. And so forth. Debt crises hit Mexico in 1982 and Indonesia, Russia and Ecuador in 1998, when the dollar prices of their oil exports fell, and so their debt service ratios worsened abruptly. This would not have happened if their debts had been indexed to the oil price. Again, adjustment in the event of fluctuations in the oil price is automatic. This idea has been around for a long time, but has virtually never been put into practice. Potential issuers worry that there is not enough demand for

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<sup>38</sup> Duclaud and García (2011).

such bonds. One would think that airlines and utility companies would have a natural demand for oil bonds, electronic equipment manufacturers a natural demand for copper bonds, etc. It must be that bonds denominated in a particular kind of oil and carrying the credit risk of a particular country are too specialized a niche to generate the necessary liquidity to make a viable market. But then the World Bank might be able to make the market: It would lend to interested oil-producing countries in terms of oil in place of lending to them in dollars, and then offset its collective exposure to oil market conditions by selling to investors a bond denominated in a common oil price index.

#### **4. Chile-style fiscal rules**

Roughly one third of developing countries in the decade 2000-09 managed to shift from the historic pattern of procyclical fiscal policy to countercyclical fiscal policy. The progress was particularly dramatic in the case of Chile: it ran large surpluses during the copper boom of 2003-08, and was able to ease its fiscal policy substantially in the recession of 2009. This achievement was not solely the result of wise policy-makers choosing the right policies. They were helped by an institutional framework that was put into place in 2000, and that can offer useful lessons for others.<sup>39</sup>

Chile's fiscal institutions consist essentially of three rules. First, every government must set a budget target. Second, the target is phrased in structural terms: Deficits are allowed only to the extent that (i) output falls short of trend, in a recession, or (ii) the price of copper is below its trend. The target for the structural budget surplus was set at zero in 2008 under President Bachelet, which implied a substantial actual surplus because the copper price was high and the economy was booming. Third, ten-year trends are projected by two panels of independent experts, outside the political process. The result is that Chile avoids the pattern of 32 other governments, where forecasts in booms are biased toward over-optimism. This is why Chile ran surpluses in the 2003-07 boom. The United States and Europe failed to do so in part because their fiscal authorities made systematically over-optimistic forecasts during this period of expansion.

#### **5. An exchange rate policy that responds to a boom initially by accumulating reserves and then turning later to currency appreciation.**

One cannot prescribe an appropriate exchange rate regime without knowing a lot about a country. But for some countries that have been pursuing exchange rate targets of some sort, a sensible response to a natural resource export boom may run as follows. At the start, continue to intervene in foreign exchange markets to dampen somewhat the upward pressure on the currency in the early stages of the booms, while seeking to prevent the money supply from swelling (e.g., by raising reserve requirements on banks). The aim is to preserve the inflation-fighting credibility of the existing exchange rate anchor, while also accumulating some foreign exchange reserves which will be useful in case of a reversal of fortune. (Another motive for accumulating reserves, if the central bank has political independence and the natural resource fund does not, is to leave the funds where they cannot easily be raided by politicians with short horizons.

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<sup>39</sup> Frankel (2012), Frankel, Vegh and Vulentin (2011).

Subsequently, if the commodity boom has proved to be long-lived or domestic inflation is no longer contained, allow gradual appreciation, thus accommodating the terms of trade shock when it turns out to be persistent, rather than trying to artificially suppress it. But then a country that gives up the exchange rate as the nominal anchor for its monetary policy will need a new one...

## **6. An inflation target for the central bank that emphasizes product prices**

Among the list of possible nominal anchors for monetary policy, Inflation Targeting has been the most popular alternative to exchange rate targeting, over the last decade or two. For countries with terms of trade volatility, I have recently proposed a new alternative, which I call PPT, for Product Price Targeting.<sup>40</sup> The idea can be thought of as a modification of Inflation Targeting, with the important difference that the price index is output-oriented rather than consumption-oriented. The GDP deflator would do nicely, but it would be better to have a measure that is available monthly. The important point is that the index should give heavy weight to commodities that are produced for export, and should give little weight to commodities that are imported. The CPI does it the other way around.

Why is the difference important? On the one hand, if the export commodity is in the index, as under PPT, then monetary policy will automatically accommodate fluctuations in the export price: the currency appreciates when the world market for the export commodity is strong and depreciates when it is weak. This is a desirable property, that CPI targeting unfortunately lacks. On the other hand, if the import commodity is in the index, as under CPI-targeting, then monetary policy reacts perversely to fluctuations in the import price: the currency appreciates when import prices are high and depreciates when they are low. This exacerbation of terms of trade fluctuations is an undesirable property, which PPT fortunately lacks. Thus PPT is less procyclical than CPI targeting.

One way to think of it is that PPT delivers the best of both worlds in the classic debate over exchange rate regimes: it accommodates terms of trade fluctuation as floating is supposed to do,<sup>41</sup> and yet at the same time provides a nominal anchor, as exchange rate targeting and IT are supposed to do.

## **7. Professionally managed commodity funds.**

The proceeds of commodity exports should be used to establish transparent sovereign wealth funds, in order to assure that future generations share the bounty, while investing in assets that earn a higher rate of return than the paltry return on US treasury bills (where most central bank reserves are held). Botswana's "Pula Fund," built on earnings from the sale of diamonds, is worth emulating. The fund, invested entirely in securities denominated in other currencies, serves both as a sinking fund to offset the depletion of diamonds and as a buffer to smooth economic fluctuations. Management of the Pula

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<sup>40</sup> Frankel (2003, 2005, 2011).

<sup>41</sup> Broda (2004) and Edwards and Levy Yeyati (2005) support the textbook proposition that floating exchange rates stabilize the economy relative to fixed rates in the presence of trade shocks.

Fund is delegated to independent professionals with instructions to pursue only the financial interest of the people of Botswana, undistorted by any political goals. This makes it a better model for other resource-rich countries than the more widely touted petroleum fund of Norway.

## **8. Lump-sum per capita distribution of commodity revenues**

The Alaska Permanent Fund saves earnings from the state's oil sector. Alaska state law says that the Fund must distribute half of the investment earnings on an equal per capita basis. The theory is that the citizens know how to spend their money better than does their government. Certainly the system gives Alaskans a good reason to feel that they are full stakeholders in the Fund. Sala-i-Martin and Subramanian (2003) suggest that Nigeria should similarly distribute its oil earnings on an equal per capita basis. Birdsall and Subramanian (2004) make the same proposal for Iraq and Gelb and Majerowicz (2011) for Uganda.<sup>42</sup>

## **Conclusions**

Much theoretical reasoning and statistical evidence suggests that possession of natural resources such as hydrocarbons, minerals, and perhaps agricultural endowments, can confer negative effects on a country, along with the benefits. This paper has considered six channels whereby natural resources have been hypothesized to have negative effects on economic performance. The first, the Prebisch-Singer hypothesis of a negative long-term trend in commodity prices is counteracted by theoretical arguments for a positive trend, and empirical findings that there is no consistent trend either way. But the other five channels each have some truth to them.

(1) Commodity price volatility is high, which imposes risk and transactions costs. (2) Specialization in natural resources can be detrimental to growth if it crowds out the manufacturing sector and the latter is the locus of positive externalities. (3) Commodity endowments lead to autocratic and oligarchic institutions, characterized by corruption, inequality, class structure, and absence of rule of law. (4) Another possibility is anarchic institutions. Countries that are endowed with natural resources could have a proclivity for armed conflict. The absence of property rights can also exacerbate the incentive to deplete natural resource endowments too rapidly, leaving the country with little to show for them. (5) The Dutch Disease, resulting from a commodity boom, entails real appreciation of the currency and increased government spending, both of which expand nontraded goods and service sectors such as housing and render uncompetitive non-commodity export sectors such as manufactures. If and when world commodity prices go back down, adjustment is difficult due to the legacy of bloated government spending and debt and a shrunken manufacturing sector.

It is clear that some resource-rich countries do surprisingly poorly economically, while others do well. We have noted examples of both sorts: Norway, Botswana and

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<sup>42</sup> Ross (2007).

Chile, which have done very well with their endowments (oil, diamonds and copper, respectively), versus Sudan, Bolivia and the Congo which have done much less well. The Natural Resource Curse should not be interpreted as a rule that resource-rich countries are doomed to failure. The question is what policies to adopt to increase the chances of prospering. It is safe to say that destruction or renunciation of resource endowments, to avoid dangers such as the corruption of leaders, will not be one of these policies. Even if such a drastic action would on average leave the country better off, which seems unlikely, who would be the policy-maker to whom one would deliver such advice?

The paper concludes with a list of ideas for institutions designed to address aspects of the resource curse and thereby increase the chance of economic success. Some of the ideas that most merit consideration by countries rich in oil or other natural resources are as follows.

1. Include in contracts with foreign purchasers clauses for automatic adjustment of the price if world market conditions change.
2. Hedge export proceeds in commodity futures markets.
3. Denominate debt in terms of commodity prices.
4. To avoid excessive spending in boom times, allow deviations from a target surplus only in response to output gaps and long-lasting commodity price increases, as judged by independent panels of experts rather than politicians. Chile's fiscal institutions are a model.
5. In response to an increase in world prices of the commodity, initially dampen nominal currency appreciation, adding to foreign exchange reserves. But if the boom turns out to be longer lasting, allow more exchange rate flexibility, accommodating the shift in the terms of trade even though it means sacrificing the exchange rate as a nominal anchor for monetary policy.
6. If the new monetary anchor is to be Inflation Targeting, consider using as the target, in place of the standard CPI, a price measure that puts greater weight on the export commodity, such as an index of export prices or producer prices. My proposal is called PPT, for Product Price Targeting.
7. Commodity Funds should be transparently and professionally run, with rules to govern the payout rate and with insulation of the managers from political pressure in their pursuit of the financial wellbeing of the country. Botswana's Pula Fund is a model.
8. When spending oil wealth, consider lump-sum distribution on an equal per capita basis.

Needless to say, policies and institutions have to be tailored to local circumstances, country by country. But with good intentions and innovative thinking, there is no reason why resource-rich countries need fall prey to the curse.

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