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Using Natural Resources for Development: Why Has It Proven So Difficult?

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Abstract

Developing economies have found it hard to use natural resource wealth to improve their economic performance. Utilising resource endowments is a multi-stage economic and political problem that requires private investment to discover and extract the resource, fiscal regimes to capture revenue, judicious spending and investment decisions, and policies to manage volatility and mitigate adverse impacts on the rest of the economy. Experience is mixed, with some successes (such as Botswana and Malaysia) and more failures. This paper reviews the challenges that are faced in successfully managing resource wealth, the evidence on country performance, and the reasons for disappointing results.

JEL classification: Q3

Keywords: Natural resources, non-renewable, depletion, resource curse, Dutch disease, revenue management, diversification, genuine saving.

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1. Introduction

Using natural resources to promote economic development sounds straightforward. A country has sub-soil assets such as hydro-carbons and minerals which it seeks to transform into surface assets—human and physical capital—that can be used to support employment and generate economic growth. Such assets should be particularly valuable for capital-scarce developing countries, especially as revenues from their sale accrue largely in foreign exchange and can supplement the otherwise limited fiscal capacity of their governments.

In practice, this transformation has proved hard and few developing economies have been successful. Economic growth has generally been lower in resource rich developing countries than in those without resources. It was not until the 2000s (a period of rising commodity prices) that resource rich countries grew faster, although even then per capita growth was similar in both groups of countries (IMF 2012b). The term ‘resource curse’ was coined (Auty 1993) to capture the under-performance of resource rich economies, drawing attention to the weak performance of Bolivia, Nigeria and Venezuela, amongst others.

Successful use of non-renewable natural resources involves multiple stages. Resource deposits have to be discovered and developed. If and when this is done, resource revenues are divided between investors, government and other claimants. How are the terms of this division decided, and how are such revenues utilised by the recipients? There is likely to be intense pressure for current spending rather than investment in productive assets. Investment in the domestic economy needs to be directed to high social return projects, but these may be difficult to identify and to implement. Placing the revenues in offshore funds may be appropriate for capital-rich economies, but does little to boost economic development in a capital-poor country. Ultimately, it is the private sector that will create the sustainable jobs and economic growth, so

resource management has to be done in a manner that will support private sector investments. But, even if revenues are effectively utilized, resource exports can appreciate the exchange rate and prove damaging to other tradable sectors of the economy – the “Dutch disease”. An economy with substantial exports of natural resources can become overly dependent on a single volatile source of income, and this volatility can destabilize the macro-economy.

Subsoil assets are property of the state in almost all countries except the United States. Thus, to navigate these multiple stages successfully, governments in resource-rich countries need to be well-intentioned, far-sighted, and highly capable. Yet many resource-rich economies have weak governance that can be further undermined by the political forces that are unleashed with the prospect of resource wealth.

The multi-stage nature of the challenge means that no single answer can be given to the question posed in the title. While some countries have succeeded in using natural resources for development, others have failed, each in their own way. This paper discusses the challenges posed by each of these stages, the evidence on country performance, and some particular country examples. We start by outlining the scale of the issue and the main facts about resource-rich low-income countries. Following sections then turn to each of the main stages: the upstream issue of attracting investment in the resource sector and securing a flow of resource income; the economics and politics of managing revenue from natural resources; and the wider impact of substantial natural resource exports on the structure and diversification of the economy. Lessons in all of these areas, along with the future prospects for resource-rich low-income countries, can be drawn both from resource-rich countries that have succeeded in building on their resource base and from those which have not.

2. Facts

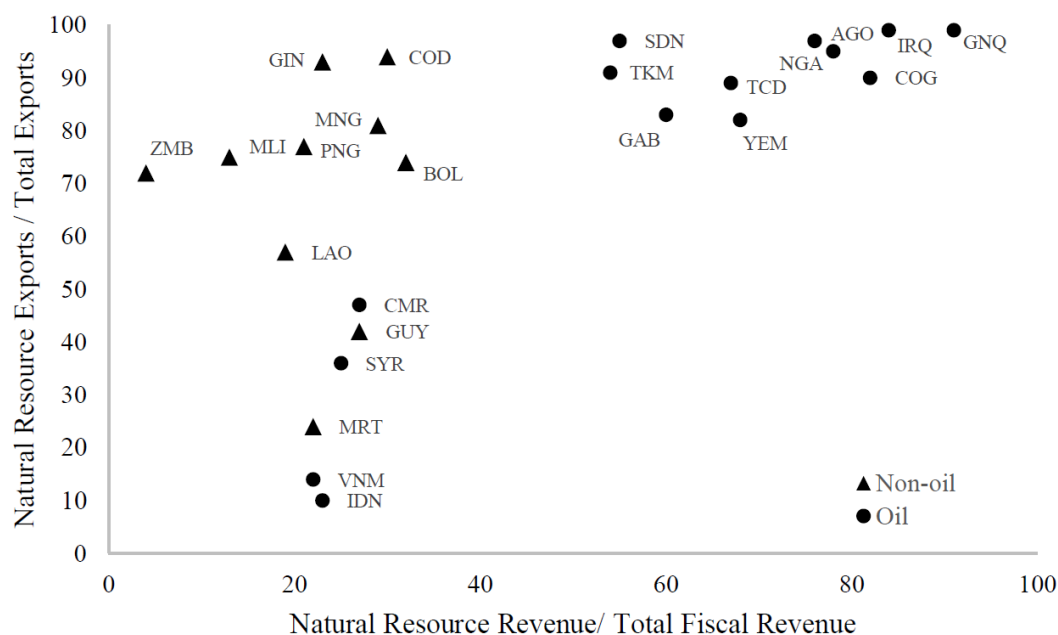
The IMF classifies 51 countries, home to 1.4 billion people, as “resource-rich.” This classification is based on a country deriving at least 20 percent of exports or 20 percent of fiscal revenue from non-renewable natural resources (based on 2006-10 averages as explained in IMF 2012b). In 25 of these countries resources make up more than three-quarters of exports, and in 20 of them resources provide more than half of government revenues. The upper middle income resource-rich economies are a mixed group, including countries from Latin America (like Chile and Venezuela), central Asia (Azerbaijan and Kazakhstan), and Africa (Libya and Algeria). The high-income resource-rich economies are mainly Middle Eastern oil exporters, along with Norway and Trinidad and Tobago. Of the twelve “prospectively” resource-rich countries, with new discoveries that are yet to be fully developed, nine are in Africa.

Our focus is on low- and lower-middle-income resource rich countries. There are 29 such countries, and these are listed in Table 1. For this group there are four key facts. First, for many of these countries there is extreme dependence on natural resources for fiscal revenues, export sales, or both. Figure 1 plots the fiscal and export dependency of the 24 of these countries for which reliable data are available. Ten of them receive more than half of fiscal revenue from resources, and in 18 resources constitute more than two-thirds of their exports. Fiscal dependency is particularly acute for oil producers.

Table 1: Resource dependent low- and lower-middle income countries.

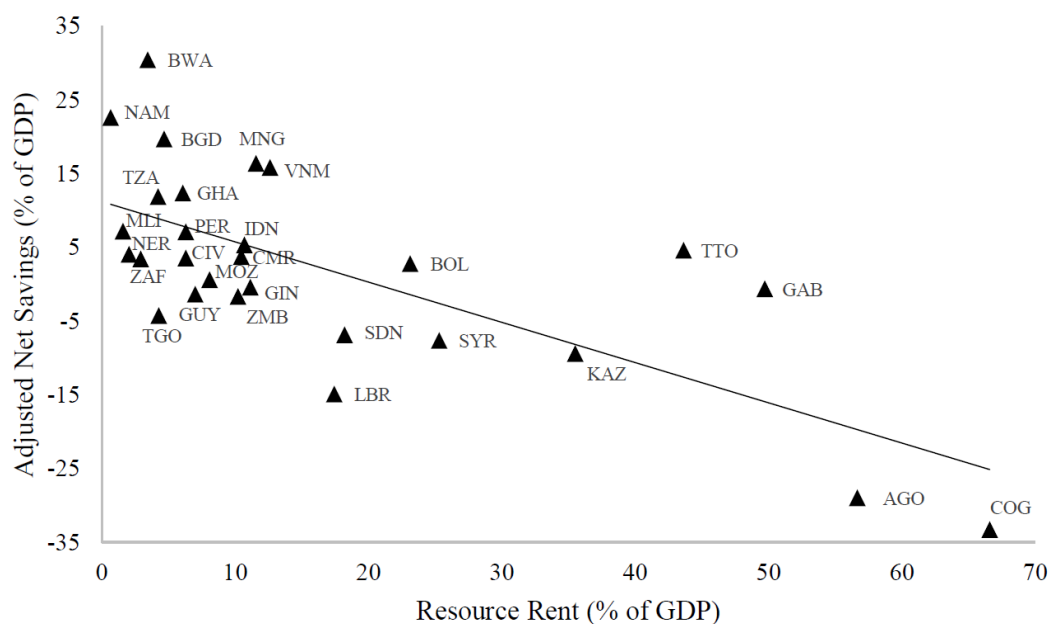
Country	Code	Type of natural resource	GNI per capita (2010 US\$)	Natural resource export % total exports (2006-10 ave.)	Natural resource fiscal revenue % fiscal revenue (2006-10 ave.)
Congo, Dem.Rep.	COD	Minerals & Oil	180	94	30
Liberia	LBR	Gold & Iron Ore	210	--	16
Niger	NER	Uranium	360	--	--
Guinea	GIN	Mining Products	390	93	23
Mali	MLI	Gold	600	75	13
Chad	TCD	Oil	710	89	67
Mauritania	MRT	Iron Ore	1,000	24	22
LAO PDR	LAO	Copper & Gold	1,010	57	19
Zambia	ZMB	Copper	1,070	72	4
Vietnam	VNM	Oil	1,160	14	22
Yemen	YEM	Oil	1,160	82	68
Nigeria	NGA	Oil	1,170	97	76
Cameroon	CMR	Oil	1,200	47	27
Papua New Guinea	PNG	Oil/copper/gold	1,300	77	21
Sudan	SDN	Oil	1,300	97	55
Uzbekistan	UZB	Gold & gas	1,300	--	--
Côte d'Ivoire	CIV	Oil & gas	1,650	--	--
Bolivia	BOL	Gas	1,810	74	32
Mongolia	MNG	Copper	1,870	81	29
Congo. Rep. of	COG	Oil	2,240	90	82
Iraq	IRQ	Oil	2,380	99	84
Indonesia	IDN	Oil	2,500	10	23
Timor Leste	TLS	Oil	2,730	99	--
Syrian Arab Rep.	SYR	Oil	2,750	36	25
Guyana	GUY	Gold & Bauxite	2,900	42	27
Turkmenistan	TKM	Oil & gas	3,790	91	54
Angola	AGO	Oil	3,960	95	78
Gabon	GAB	Oil	7,680	83	60
Equatorial Guinea	GNQ	Oil	13,720	99	91

Figure 1: Share of Exports and Fiscal Revenue from Natural Resources
(Average 2006-10, in percent)



Sources: World Development Indicators, World Bank; and IMF staff estimates.

Figure 2: Adjusted Net Savings and Exhaustible Resource Rent
(Average 2000-09, in percent of GDP)



Sources: World Development Indicators, World Bank; and IMF staff estimates.

Second, saving in these low-income resource-rich economies has generally been low. This is illustrated in Figure 2, showing the relationship between resource rents and adjusted net savings, both expressed as a percentage share of GDP, for a set of 28 middle and low income resource-rich countries. Resource rents are measured by the World Bank in its World Development Indicators as gross revenues from oil, natural gas, coal, minerals and forests minus their estimated extraction costs. Adjusted net savings are national savings plus education expenditure and minus depletion of natural resources (World Bank 2011). As is apparent, this measure of adjusted national saving is strongly negative for a large number of resource-rich low-income economies, and there is a negative correlation between resource rents and the savings rate.

Third, the growth performance of all the resource-rich economies as a group has been generally poor, although a few countries have done well—for example, Botswana, Malaysia, and Chile. This cross-country finding has been extensively researched following the seminal work of Sachs and Warner (2000) who found (after controlling for initial income per capita, investments in physical and human capital, trade openness and rule of law) that natural resource dependence had a significant negative effect on the growth of GDP per capita, with a 10 percentage point increase in the ratio of resource exports to GDP depressing average growth by 0.77–1.1 percentage points per annum. Important later contributions include Mehlum et al. (2006) who interact resource abundance with institutional quality and find the negative effect of resource-richness on growth to be present (and larger) only for countries with poor institutional quality, the break-even point being around the institutional quality of Botswana. More recent work has looked at some other dimensions of the connection from natural resource wealth to growth. For example, sub-national evidence finds that the local impact of extraction has positive effects (Cust

and Poelhekke 2015), but of rent distribution negative (Caselli and Michaels 2013). An extensive review of this literature which also discusses the endogeneity issues associated with different measures of resource abundance is found in Smith (2015).

Looking just at developing countries, there has been a recent improvement in the relative performance of resource-rich economies, with average per capita growth rates of resource rich developing economies equalling those of non-resource rich in the 2000s, after being 1 percent per year lower in the 1990s. Of course, much of the earlier 2000s was also a time of booming oil and commodity prices and of rising resource trade with China, so this remains a very modest growth performance. As Ross (2012) wrote of resource rich economies' growth performance: "[T]he real problem is not that growth ... has been slow when it should have been normal, but that it has been normal when it should have been faster than normal."

Fourth, resource revenues can be highly volatile. Some variability is largely predictable – due to opening of new fields and closure of depleted ones – but much is unpredictable, largely due to the volatility of commodity prices, particularly that of oil. There is a large literature on the measurement and causes of commodity price instability (see for example Arezki et al. 2014), and our concern is principally its impact on resource producers. The scale of the issue is vividly illustrated by the fact the World Bank's measure of resource rents, for the world as a whole, has fluctuated at between 1½ percent (1998) and 7 percent (2008) of world GDP over the last 20 years. Amongst resource rich developing economies, measures of volatility (for example, the coefficient of variation of export revenues) typically exceed those of non-resource rich countries by 50 percent for mineral-rich countries and more than 100 percent for oil-rich countries. Smoothing is made difficult by the long cycle of many commodity prices (particularly oil, elevated in the periods 1974-85 and 2003-2014 and with long periods of lower, but still variable,

prices in between). Volatility of fiscal revenues is transmitted into even greater volatility of government spending as a consequence of pro-cyclical public spending (IMF 2012a,b). A study by van der Ploeg and Poelhekke (2009) decomposes the effect of resource dependence on growth into a direct and a volatility effect, finding that the direct effect is positive but often dominated by the negative indirect effect through volatility.

3. Discovery, Development, and Rent Capture

Prerequisites for using natural resources to promote economic development are their discovery, investment in the mines or wells necessary for their extraction, and securing the subsequent flow of income. These upstream stages of resource management are complex, and the resource endowments of many developing countries remain under-explored and under-exploited.

Initial discovery and development of a natural resource deposit requires investment by firms with considerable technical expertise. In developing countries, these firms are generally foreign owned. Economic principles suggest that the host country – owner of the resource – should put in place a regulatory and fiscal regime in which the investor can make a normal rate of return, and rents over and above this rate are then captured by the resource owner, the state. The regime has a number of elements. Exploration and development licenses generally carry a fee, often determined by auctioning of the rights. Subsequent resource extraction is taxed through a combination of royalties on output, production-sharing agreements in which a certain fraction of production is taken by the government directly, and through corporate income tax, possibly at a rate specific to the extractive sector. Practice varies widely between countries. A straightforward example is the sale of US oil and gas exploration and development rights on the

outer-continental-shelf between 1983 and 2002. Sale was by first-price sealed bid and raised \$16 bn from fees (bonus payments) on winning bids, and a further \$14 bn from subsequent royalties on the 15% of tracts where exploration was successful and production took place (1982 prices, Hendricks and Porter 2014). The Libyan auction of 2005 offers a more complex example. Investors bid a production share and other terms with, for example, one particular winning bid giving government 88% of gross revenue; government paying 88% of operating costs and lower shares of exploration and development costs; and, once cost recovery is complete, the company's profits on the remaining 12% being subject to a tax rate rising from 10% to 50% (Cramton 2010).

Even this quick sketch of the regulatory and tax problem suggests a number of complicating factors that can deter investors and depress the revenues that can be captured by the state. First is the process through which licenses are allocated. Ideally, this should be through an auction process that is transparent, competitive, and can secure a high fraction of the rent for the state. Auctions are not appropriate in all cases, for example where there is a single dominant bidder. Thus, rather than using an auction Botswana negotiated rights to diamond extraction with dominant player De Beers. The use of auctions is now widespread (particularly for oil, less so for hard-rock minerals), but there are many instances of rights having been awarded in ways that are non-transparent, possibly corrupt, and not ending up with the best qualified investor. A recent example surrounds the Simandou iron-ore project in Guinea (Economist 2014).

Second, investments in discovery and extraction of non-renewable resources are inherently risky due to geological and price uncertainty. Investors are further deterred by uncertainty surrounding the local economic, institutional and political environment. The regulatory environment may be cumbersome and unpredictable. Weak infrastructure may

increase extraction costs. Security may be a concern, and the resource itself may be subject to theft. In Nigeria theft of crude oil (known as “bunkering”) is estimated to run at 10-15 percent of total production (Katsouris and Sayne 2013, Council on Foreign Relations 2015). Theft also occurs through corruption in award of contracts, as in the Petrobras scandal (Economist 2015).

Added to this, investors may be deterred by risk of hold-up. Investments are sunk and long-lived and governments, present and future, will have an incentive to change contractual and fiscal terms once the investment is in place. At the extreme, this is expropriation risk, but there is a broader risk of changes in rates of taxation and tax allowances. This incentive is countered by reputational risk that the government faces if it expects to develop future fields and, in some cases by a variety of legal mechanisms. Bilateral investment treaties offer investors protection against breach of contract. Where these do not exist, countries can offer contract specific stabilisation agreements that guarantee terms (or equivalent value), the credibility of which can be reinforced by offering international arbitration and waiving sovereign immunity. Some of these agreements have been breached (see the Zambian example that follows) but legal remedy has rarely been sought by investors, since this is a path that would severely damage the investor’s relationship with the host country. Nevertheless, they are judged to have offered some security to investors, principally by steering countries that have experienced changed circumstance towards contract renegotiation rather than unilateral action (Daniel and Sunley 2010).

Other inefficiencies arise in the regime for taxing output. Ideally, this should tax rents, leaving marginal extraction decisions unaffected. However, investors can disguise profits by accounting practises such as transfer mis-pricing (of inputs and, for specialty minerals, also of outputs). A response is to tax observable outputs, i.e. use royalties and production sharing

agreements, even though these are inefficient since they distort investment and extraction decisions (Mullins 2010). The tax regime also determines the time profile of revenues and risk sharing between government and investors. Government impatience and risk aversion militate towards royalties and production sharing agreements rather than pure profits tax.

What are the implications of these difficulties in the relationship between investor and host country? In some cases, government “take” (that is, the share of revenues) has been exceptionally low. An example is the Zambian copper industry which, following an unsuccessful privatization, was resold with a fiscal regime that was equivalent to an effective royalty rate of 0.6 percent, one-tenth that of comparable mining projects (Adam and Simpasa 2011). (These fiscal terms turned out to be unsustainable and were revised in 2008, breaching fiscal stability assurances; no action was brought against the government, see Daniel and Sunley 2010).

Response to low take – or more generally, to the dominant role of foreign investors – has led to “resource nationalism,” including the development of national resource companies to work with, or in some cases to take-over, foreign investors. In the oil sector, the formation of such national oil companies occurred largely in the 1970s, and they now control 90% of world oil reserves and over 70% of production. The experience of these companies has been mixed. Some of them have attained world class efficiency levels, like Saudi-Aramco and Petronas of Malaysia. Others have failed to provide effective management, in some cases leading to dramatic declines in output, like the Nigerian National Petroleum Corporation and Zambian Consolidated Copper Mines. Macpherson (2010) details further country experience.

The more widespread problem has not been that of low government take, but of a failure to undertake exploration and the follow-up investments at all. The deterrent effect of weak

institutions is studied by Cust and Harding (2014) who look at investment in areas with similar geology on either side of an international border. They find that lower institutional quality (a one standard deviation reduction in the political rights index produced by Freedom House) halves the number of wells drilled. A sharp example is the Albert Graben geological basin between Uganda and the Democratic Republic of the Congo, where all exploration (and substantial discoveries) has been on the Ugandan side. The scale of the problem is indicated by Collier (2007) who estimates that the value of subsoil assets per square kilometre in Africa is just one-quarter of those remaining in OECD countries, which seems mostly likely to be a consequence of lack of exploration, rather than resource-barren geology.

4. Managing Revenues

Despite these difficulties, many countries derive a high share of fiscal revenues from the natural resource sector (as shown earlier in Figure 1). What principles should guide the use of such revenues, how well have those principles been followed in practice, and why the divergence between principles and practices?

Principles

There are three key questions about the use of rents from extraction of non-renewable resources: 1) Should the use of these resources be focused on current consumption or investment? 2) For the investment component, what financial, physical capital, and human capital assets should be acquired? 3) Should the rents be handled by the government directly or handed to citizens? I address each of these questions in turn.

Concerning the question of whether revenues from non-renewable resources should be spent on current consumption or on investment, one ethical position is that of custodianship: the current generation should pass assets on intact to future generations. In contrast, a utilitarian would argue for spreading the benefits across present and future generations. Economists' usual characterisation of this approach is the permanent income hypothesis which implies that, following a discovery of an exhaustible natural resource, consumption should increase by the expected annuity value of the discovery, with revenues in excess of this being invested to build a stock of assets sufficient to finance the consumption increment in perpetuity. However, this rule needs modification in a developing economy that is capital-scarce and accumulating capital as it converges to a higher income path. The consumption increment should then be somewhat front-loaded; less should go to future generations (who will have higher incomes in the future anyway) and more to current poverty reduction. In effect, this change brings forward (and therefore flattens) the path of consumption growth in the economy (van der Ploeg and Venables 2011). But even with this modification, the theory suggests a high savings rate from resource revenues.

Concerning the question of what assets should be acquired with resource revenues that are saved, at the aggregate level this is a choice between domestic and foreign assets. For a capital-abundant country, the usual answer is to accumulate foreign assets in a sovereign wealth fund, such as Norway's Pension Fund. For a capital-scarce country the priority is to build domestic assets—including human as well as physical capital. Scarcity not just of capital as a whole, but of public funds in particular, suggests that government investment in infrastructure and in public health and education systems should offer high social returns. However, scarcity of funds does not automatically imply that high return projects are immediately available. An

efficient path of investment needs to take into account domestic opportunities and the absorptive capacity of the economy.

While the priority is domestic investment, there are several reasons for supporting this with some accumulation of foreign assets. One is that the efficient path of domestic investment will, quite generally, be different from the actual path of revenue, often building up more slowly and being less volatile. This suggests the need for a “parking fund”; that is, a way of placing revenues offshore until they can be used efficiently in the domestic economy. Another reason is the need to self-insure against price uncertainty by building a “stabilisation fund”. Some insurance against price fluctuations can be provided by financial instruments. Much oil is sold forward—that is, a price is agreed upon in the present at which the oil will be sold in the future, typically at durations up to 6 months. Mexico goes further, purchasing options (in 2015, spending more than \$1 bn to guarantee a 2016 price of least \$49 a barrel on 212 bn barrels of oil). However, these financial instruments are relatively short run, so do not provide protection against the long swings of resource prices. Depositing revenues in a stabilisation fund when prices are high is a way of building such a protective buffer.

Concerning the issue of who makes these consumption and investment decisions, the broad distinction is between government and the private sector. Government, while distributing some revenues through current spending, can retain ownership of assets that are acquired. These may be public investments, or assets associated with lending to the private sector, perhaps through a development bank or simply by having lower government (domestic) debt than would otherwise have been the case. The alternative is that funds are given to the private sector by tax reductions or a programme of citizen dividends. An example is the US state of Alaska, where

fossil fuel revenues are placed in a fund, income from which is paid directly to citizens through the Permanent Fund Dividend Program.

The case for government control is derived from the scarcity of public funds in developing countries and the need to increase public investment in human and infrastructure capital. Resource revenues can fund such investments without imposing taxes that will be distortionary and can be hard to administer in low-income countries. Furthermore, government can smooth spending, both across generations and also in response to short-run business cycle fluctuations, mitigating the risk of resource-induced macro-economic instability. The potential benefits of distribution to the private sector are based largely on the poor track record of governments. Direct distribution to citizens may reduce the risk of corruption and improve the quality of investments undertaken, although the link from citizen dividends to efficient investment is questionable in a country with poorly developed financial institutions. Citizen dividend schemes also create their own political risks, as they may become highly politicised and subject to electoral bidding wars by populist politicians (Gupta et al. 2014).

Outcomes

If these are the principles, then how and why do the actual outcomes differ?

On the basic question of whether a significant proportion of the rents from extraction of non-renewable resources are being saved, Figure 2 earlier showed that savings rates (in any form, domestic investment or foreign funds) have generally been low for low-income resource-rich countries. Public investment as a share of GDP has been (until the 2000s) lower in resource-rich low-income countries than in other low-income countries (IMF 2012b). There is cross-country panel evidence that higher resource rents are actually associated with lower public

capital stocks, particularly in countries with weak institutions (Bhattacharya and Collier 2014). When government has sought to invest savings from resource revenues the results have often been inefficient in both design and implementation. There are numerous white elephant projects and resource-rich countries perform poorly on the IMF's index of public investment management efficiency (Dabla Norris et al. 2011).

Some countries have established sovereign wealth funds in which the state has invested resource revenues offshore. Botswana's Pula Fund has been successful in managing both long-run investments and stabilization. Spending by Botswana's government has been de-linked from current resource revenues, and revenues that do not meet government spending and investment criteria are invested abroad through the fund (IMF 2012b). Other experiences have been less happy. Nigeria's Excess Crude Account has played some role in stabilizing the economy but its effectiveness has been undermined by failure of many state governments to ratify the federal Fiscal Responsibility Act that set up the fund, by absence of sound legal foundation, and by 'ad hoc disbursements' (IMF 2011). Gautier and Zeufack (2011) study the experience of Cameroon, which was initially praised for setting up an offshore (and extra-budgetary) account to manage oil revenues, but from which about half of Cameroon's total oil revenue subsequently disappeared. The overall record on stabilisation has been poor, with multiple episodes of boom and bust. Collier and Venables (2011) offer a number of examples, including a study of Chile's successful Economic and Social Stabilization Fund.

Transfers of funds from the public sector to the private have been achieved to varying extents and by different means. Some of the transfer comes from lower taxes, with the average share of tax revenue in GDP being 0.2 percentage points lower for each 1 percent of GDP earned by government from resource revenues (Bornhorst et al. 2009). Citizen dividend schemes

are rare in developing countries. Mongolia established a scheme but it was scaled back dramatically in 2012 after exaggerated election promises led to transfers that exceeded resource earnings (Yeung and Howes 2015). Transfers of resource revenues to the private sector are often achieved through highly inefficient mechanisms, with fuel subsidies being the most notorious example, and oil exporters amongst the highest subsidisers. The price of gasoline in Venezuela is less than \$0.1 per gallon and Iran's energy subsidies peaked at 10% of GDP in 2010, shortly before a subsidy reform program was launched (see Coady et al. 2010, 2015 for the broader picture).

A more subtle issue arises with the interaction between public saving and private sector behaviour. At least some fraction of public sector saving will be perceived to ultimately accrue to the private sector—leading to expectations of lower future taxes or higher pensions, for example—which can lead to changes in private sector behaviour that may undermine government policy. In Kazakhstan the government acted prudently, saving around one-third of oil revenue in a sovereign wealth fund. But the private sector ran up foreign debt of a similar magnitude, leading to a severe crash in 2007-08 (Esanov and Kuralbeyeva 2011). It appears that foreign borrowing by Kazakhstan's banking sector was facilitated by the perceived collateral of sovereign assets.

Causes

These examples illustrate what has gone wrong with the management of revenues from extraction of natural resources, but why have matters so often gone so wrong? Part of the answer lies in technical difficulty; coping with massive fluctuations in export earnings or with private credit booms is challenging for any government. Part is due to weak governance which has, in

some cases, been further damaged by the presence of resource revenues. Here, I will focus on issues of fiscal discipline, patronage politics, and the situations in which resource revenues inflame conflict—up to and including civil war.

Many resource-rich countries have found it difficult to maintain *fiscal discipline* in the face of competing claims for a share of resource revenues. The literature has approached this problem in various ways, the simplest of which is a model in which groups are powerful enough to obtain public spending for their projects even though the projects yield low social returns (Velasco 1999; Tornell and Lane 1999). The groups might include spending ministries, regional governors or city mayors, all of whom have with legitimate claims on public funds. After all, it is the job of cabinet ministers or subnational government agencies to make a case for additional funding for their own departments or areas. However, since the tax base is shared while benefits of these projects accrue disproportionately to members of a particular group, each will overbid for funds, even if they recognize that their own projects have low returns and displace higher return commonly owned public assets.

The problem is exacerbated by weak government capacity. Limited capacity to appraise and implement projects means that, the larger are revenues, the greater the proportion of bad projects that get accepted. Limited capacity to police spending means that as revenues increase, corruption increases more than proportionately; the positive relationship between resource abundance and levels of corruption is established in a number of studies (for example, Ades and Di Tella 1999; Leite and Weidman 1999). More broadly, resource revenues enable government to postpone economic reforms. Normally, if a government embarks upon an economic strategy which imposes large costs across its economy, change will eventually be forced upon the government by the decline of revenue. However, resource rents provide a cushion. Chauvet and

Collier (2008) find that resource rents significantly reduce the speed of exit from dysfunctional policies, as measured by a low score on the World Bank's Country Policy and Institutional Assessment (CPIA) indicator.

How might these failures of fiscal discipline be countered? Managing expectations can help. There is usually little public or even official knowledge of the actual scale of resource revenues, and there is often a tendency to over-estimate wealth and ignore trade-offs. Combine these factors with individuals' uncertainty about how or when they might see benefits, and it is unsurprising that inefficient transfer mechanisms – such as fuel subsidies –become extremely hard to reverse. The implication is that transparency is important, so that revenue flows and spending are visible to parliament and civil society.

A centralised system of financial control and authority can help with fiscal discipline, too. In principle, a central finance ministry can balance the competing demands of spending ministries, regional authorities, or other lobby groups. However, to play this role effectively the finance ministry must have control of incoming revenues, along with sufficient political will and power to resist competing demands. Botswana has had a powerful Ministry of Finance and Development Planning that has controlled and prioritised spending. It recognised that, particularly after its diamond discoveries, the main constraint was not finance but implementation capacity. Foreign expertise was brought into the ministry to support implementation of rigorous project appraisal and cost-benefit analyses of public spending (Criscuolo, Criscuolo and Palmade 2008). In many other countries control is diffuse, often with national resource companies engaging in off-budget quasi-fiscal activities, such as running fuel subsidy or even social welfare programs. An extreme example is Venezuela where, in the mid-

2000s, the national oil company PDVSA was spending 40% more on social programs than on its oil and gas operations (MacPherson 2010).

The hand of the finance ministry can be strengthened by a ‘fiscal constitution’ that imposes ceilings on public spending from resource revenues or public funds more generally (Poterba and Von Haagen 1999; Primo 2007). Many resource rich countries have put fiscal rules in place, assigning shares of resource revenue to different funds, some domestic and some offshore. Experience is country-specific, but overall an IMF study concluded that there is no evidence that fiscal rules have had an effect on fiscal outcomes (Ossowski et al. 2008). Amongst resource rich countries Chile’s fiscal constitution has been largely successful (Frankel 2011). Ghana established funds in its Petroleum Revenue Management Act of 2011, and deposited some revenues in Heritage and Stabilization funds. But strong fiscal rules governing the small resource sector coexisted with lax budget rules elsewhere, allowing government current spending to increase dramatically, creating fiscal and external deficits that necessitated an IMF rescue program early in 2015 (IMF 2015).

Spending pressures are magnified by the prevalence of *patronage politics*, which distorts public spending to favour partisan groups. This distortion can have an intertemporal dimension, with the current government spending heavily on its favoured group, and passing on too little capital (or too high levels of debt) to the next government (Alesina and Tabellini 1990; Alesina and Drazen 1991). Revenues can be used by the incumbent government to increase the probability of staying in power. For example, the government can initiate spending which it can credibly commit to continue if it wins the election, but which the opposition party would cancel. Public sector employment in which the government hires its supporters is a good example. Robinson, Torvik and Verdier (2005, 2006) show that it is possible that a substantial fraction of

resource revenues are dissipated this way and, if public employment is of lower social value than the alternative, real income can be reduced by a resource windfall.

Resource politics plays out in democracies, and also enables autocrats to remain in power. Ross (2012) shows that the democratic transitions that affected many countries in the 1980s and 1990s left most oil states untouched, a finding that is not due to simply to the high incidence of autocracy in the Middle East.

Wealth from natural resources can also increase *conflict risk*. As case studies (Klare, 2001) and statistical analyses (Fearon and Laitin 2003; Collier and Hoeffler 2004) show, it can provide both the motive and the means for insurgency, while also providing funds for the government (or those with access to government funds) to equip itself to retain power. Besley and Persson (2008) find that an increase in commodity prices (a measure of resource revenues exogenous to each country) significantly increases the incidence of conflict. Collier, Hoeffler and Soderbom (2004) investigate the duration of civil wars and find that a price increase of the commodities that a country exports significantly reduces the chance that a war will be settled. Dube and Vargas (2013) add an interesting twist: using regional data for Colombia, they find that higher oil prices increased conflict while increases in coffee prices have the opposite effect, possibly by increasing the value of devoting labor time to coffee production.

While actual conflict can be devastating, the threat of conflict also matters in many situations where conflict does not actually occur. Resource rents alter the leader's probability of staying in power, and hence the economic, political and military strategies that are pursued (Caselli and Cunningham 2009). This is evident in the responses of countries to the threat of conflict. In Malaysia, past experience of ethnic conflict led government to commit to inclusive growth (discussed further in the following section). In Nigeria, the experience of Biafra's

attempted secession in 1967 led the country to fracture into 36 separate states. Each is militarily incapable of seceding from the 35 others but, by reducing central authority, the fracture has also diminished the effectiveness of resource governance—for example, limiting the implementation of the national Fiscal Responsibility Act.

5. Natural Resources and Economic Structure

Dutch Disease

Resource revenues change the structure of the economy, particularly in countries where they constitute a share of exports at the levels indicated in Figure 1. Other tradable activities will be displaced, partly as factors of production are drawn into resource extraction, and partly as they are employed to meet increased demand for non-tradables arising from domestic spending of resource revenues (Corden and Neary 1982). This phenomenon was christened the ‘Dutch disease’ following the experience of Holland with development and export of its natural gas. This changing structure of the economy has a counterpart in the balance of payments as higher resource exports lead to some combination of higher imports or lower non-resource exports together with (depending on elasticities) an appreciation of the real exchange rate.

Empirical work establishes the presence of these effects. Adverse effects on non-resource tradable sectors are documented for many countries—for example, the collapse of Nigerian agriculture (Ross 2012) —and cross-country empirical work confirms that resource exports are associated with smaller tradable goods sectors. Brahmabhatt et al. (2010) find that countries in which the resource sector accounts for more than 30 percent of GDP have a non-resource tradable sector 15 percentage points lower than the norm, while Ismail (2010) finds that

a 10 percent increase in a measure of oil revenues is associated with an average 3.4 percent fall in value added across manufacturing.

In itself, structural change in an economy is not necessarily a problem, but it can have a negative impact on real income if it interacts with market failures. In particular, if the non-resource tradable sector has increasing returns (either static, or as a result of dynamic learning-by-doing), then the effect may be to reduce the level and growth of real income (Torvik 2001; Krugman 1987; Sachs and Warner 1997). Research suggests that the level and composition of exports is particularly important for economic growth (Jones and Olken 2008; Hausmann et al. 2005) and there is evidence that resource exports crowd out the sort of other exports that drive growth. Harding and Venables (2016) study this by looking at the effects of resource exports on different elements of the balance of payments, finding that each \$1 of resource exports typically displaces 74 cents of non-resource exports (while drawing in 23 cents of imports and having a negligible effect on the capital account). Within non-resource exports, manufactures are more prone to crowding out than are agriculture or services. Ross (2012) makes the further point that the structure of employment in resource-rich countries has had an adverse effect on women's employment opportunities and wider emancipation.

How can these adverse effects be avoided? One route is economic management to mitigate effects, and another is pro-active policy to grow other sectors of the economy. We discuss each in turn.

Mitigation

Whether a resource driven spending boom displaces other economic activity or expands activity as a whole depends on the supply response of the economy. An economy in which

labor is fully employed is likely to experience a contraction of its non-resource tradable sector as employment shifts to meet expanding demand for non-tradables. However, in a developing country with a substantial quantity of un- (or under-)employed labour, booming demand for non-tradables can draw labour into employment. This mitigates the Dutch disease and, with this increase in employment and income, the balance of payments will adjust to higher resource exports less by a reduction in non-resource exports and more by drawing in additional imports.

This mitigation is more likely to work if two conditions are met. First, the economy has to be flexible and not encounter other supply bottlenecks. This means openness to trade, ease of entry of new firms, labor market flexibility, and ease of migration to urban centres. Potential bottlenecks – such as in urban and transport infrastructure, power supply, and the labour skills – need to be identified and addressed in the early stages of a resource boom, measures referred to by Collier (2010) as ‘investing-in-investing’. Second, since these adjustments necessarily take time, spending should not ramp up too rapidly, suggesting use of a ‘parking fund’ as discussed above.

A further issue arises as some economic variables may adjust faster than others – especially the exchange rate. In a flexible exchange rate regime expectations may cause early appreciation, the exchange rate jumping up at the date of resource discovery and possibly before significant spending effects are felt. The decline of tradable sectors may then precede the expansion of non-tradable sectors creating recession, at least in areas of the economy not directly experiencing resource related activity. An example is Zambia in the period 2005-6 which experienced capital inflow due to a high nominal return on government debt and a high copper price, leading to abrupt appreciation and damage to non-resource exports (Adam and Simposi 2011). This was also part of the UK’s experience with North Sea oil (Eastwood and Venables

1982). At a cross-country level, the empirical work of Arezki et al. (2015), studying the effect of giant oil discoveries, finds that the discoveries alone have an initial negative effect on employment, investment and GDP. The response to these expectations driven changes is monetary and exchange rate policy that moderates upwards pressure on the exchange rate.

In summary, mitigating adverse structural change requires fiscal policies that smooth spending (and involve parking revenues offshore), microeconomic policies to increase the flexibility of the economy and anticipate bottlenecks, and monetary or exchange rate policies that control appreciation of the currency.

Diversification

The call for policies to grow non-resource sectors and thereby diversify the economy is widely heard, yet few resource rich countries have been successful. What can, and has been done? Resource revenues are a source of public funds and, as is widely recommended, these can be used to fund public investments complementary to private investment, such as investment in human capital, in public infrastructure, and possibly also in utilities. As discussed above, many resource rich economies have missed this opportunity.

Other policies can target specific sectors or firms. A frequent policy has been to promote sectors with backwards and forward linkages with the resource sector. Backward linkages arise from the resource sector's use of local inputs, and studies show that the local effects of such spending are significant, although quantitatively small (Aragon and Rud 2013, Cust and Poelhekke 2015). A number of countries have a domestic content requirement policy to strengthen these backward linkages, but such rules have generally not led to transformative growth of new activities (see the Economist 2015 for a discussion of Brazil's experience with

Petrobras). Rigid rules are gamed, and in any case do not come free; part of any cost increase they cause is borne by the host country through reduced tax and revenue receipts. There are a few exceptions, where internationally competitive sectors have grown in this way, but the examples of the Norwegian marine engineering sector or of internationally competitive national resource companies (like Saudi Aramco or Petronas) are hard to replicate in lower-income countries. Promising new initiatives offer a more flexible approach in which natural resource firms work closely with selected local firms in order to raise their capability to qualified supplier status (for example, in meeting engineering specifications), thereby raising their potential to compete on world markets (Sutton 2014).

Forward linkages involve further processing of the natural resource either for local use or prior to export. The viability of this approach depends on the wider capabilities and comparative advantage of the local economy. Resource-rich economies have not had much success in trying to move into highly capital intensive sectors such as petro-chemicals or steel plants. However, domestic use or processing of the resource makes more sense if shipping costs are high, so there is a wedge between the world price and the domestic price. Historical transport costs meant that 19th-century economic development was often close to natural sources of coal and iron ore. In the modern economy, shipping costs are relatively low for oil and most bulk minerals, but much higher for natural gas. While the capital costs of large scale gas developments (such as the offshore developments planned in East Africa) can be met only by the prospect of export sales, the price wedge means that some fraction of output should be used domestically, which raises the important prospect of relatively cheap electricity supply for the producing region.

Diversification strategies have also been pursued by using revenues to support investment sectors not directly linked to resources, either through development banks or direct government

industrial policy. As with industrial policy in other contexts, there are numerous failures and a few successes. Malaysia offers an example of success, as does Chile. Following ethnic riots in 1969, the Malaysian government committed to using economic development to narrow racial economic inequalities (Yusof 2011). A strong central government implemented a series of development plans, a centrepiece of which was to use resource revenues (in particular oil revenues, which grew rapidly from the mid-1970s) to diversify the economy. Within agriculture, investment programs raised productivity and implemented a transition from rubber to palm oil production. In manufacturing, the economy was open to trade and foreign direct investment, and pursued an industrial policy (including infrastructure development, particularly in special economic zones) which succeeded in developing a range of labor intensive activities including the electronics sector. Macroeconomic stability was maintained by fiscal prudence and some element of luck (as when rapidly increasing oil volumes offset the price fall of the 1980s). Elements of Malaysia's success are due to its location in a booming region and its commodity mix (rubber and tin as well as oil). But most importantly, the government recognized that inclusive economic growth was necessary for future stability, and government capacity was sufficient to implement this policy effectively.

6. Concluding Comments and Future Prospects

It is straightforward to catalog the failures of resource-rich countries. Some have failed to attract investors, and thus failed to receive much income from their deposits of non-renewable resources. Many have failed to use resource revenues to finance investment at levels sufficient to support continuing non-resource growth and, together with the impact of resource revenues on

volatility and Dutch disease, other potentially dynamic sectors of the economy have failed to develop. While there is heterogeneity in country experience, underlying these symptoms are two common causes. One is the technical difficulty of handling resource revenues that are risky, volatile, and time-limited. The other is that governance has been unable to resist short-run spending pressures and commit to long-run investment and growth strategies.

What recent changes have affected the performance of resource-rich economies, and what are future prospects?

Recent decades have seen significant improvements in aspects of governance in resource-rich countries. The quality of economic management as a whole has improved, in Africa in particular, as witnessed by improved scores on the World Bank's CPIA indicator, and by much improved economic performance, growing at over 5.5 percent annually in the period 2000-14, more than twice the rate of the 1980s and 1990s (World Development Indicators). The resource sector has seen several major initiatives to improve governance. The Extractive Industries Transparency Initiative, launched in 2003, is now implemented by 48 countries, with 31 fully compliant and signed up to audit their resource revenues in a transparent manner (for background, see <https://eiti.org/>). Codes of best practise have been drawn up by international experts and adopted by governments and regional bodies (an example is the Natural Resource Governance Institute, <http://www.resourcegovernance.org/>). There is a growing realization that if spending is to be controlled successfully there has to be not just formal processes of transparency or fiscal rules, but also citizen awareness and understanding of the possibilities and problems created by resource discoveries. Countries that have created a strong narrative of what can (and cannot) be done with resource revenues, such as Malaysia and Botswana, have found such citizen expectations to be self-fulfilling, as citizens come to see the benefits of improved

economic performance, and demands for spending outside the narrative are harder to justify and easier to resist.

Improved governance, in combination with the boom in commodity prices in the first decade of the 2000s, has promoted exploration and led to new resource discoveries, notably in Africa. New players have entered resource extraction and trade, in particular China. Accompanying these changes has been the increased use of “resource for infrastructure” deals, some of which are barter deals, and others part of wider trade and investment agreements (Halland et al. 2014). Brautigam and Gallagher (2014) estimate that, between 2000 and 2011, China committed \$80 bn of resource backed loans to Latin America and \$53 bn to Africa, of which \$13bn is to Angola alone. The loans to Angola principally finance infrastructure, but also include school and hospital projects. Much of the construction work is done using Chinese workers and inputs and repayments are made in oil, specified in quantity, not value terms (Cassel et al. 2010).

Such deals have potential benefits. They are a commitment to transform sub-soil assets into surface assets, rather than into current consumption, and to do so in a manner that is relatively rapid. However, the devil is in the details. The terms and conditions of these contracts are generally not transparent and some appear, on close investigation, to have offered poor terms to the host economy. The quality, design, and appropriateness of projects is sometimes questionable. Study of a 2008 agreement between the Democratic Republic of the Congo, China Exim Bank and two Chinese construction companies, worth up to \$6bn and giving copper and cobalt in return for infrastructure, points to lack of transparency and scrutiny, questionable project selection, and no process for assessing value for money (Global Witness 2011). To

deliver their potential benefits, resource for infrastructure deals need to develop scrutiny procedures that ensure value is being derived.

Finally, future prospects for resource-rich economies are dominated by the commodity price fall of 2014-15, viewed by some as the end of a “super-cycle” of commodity prices (for example, Goldberg 2015; Bershidsky, 2015). The combination of fundamental supply-side changes in energy markets (like fracking in oil markets) and the growing efforts at conserving the use of fossil fuels in response to concerns over climate change make it likely that, at least for hydro-carbons, prices will stay low. For resource-rich countries that have been accustomed to high commodity prices in the last 10-15 years, these changes are large negative shocks. Many will have to adjust to fill two gaps, one in the public finances and the other in the balance of payments. It is to be hoped that putting each on a better basis – increasing fiscal discipline and enabling a stronger non-resource export sector to drive growth – may improve the chances of benefiting from continuing, if reduced, revenues from extraction of non-renewable resources.

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Appendix:

Table: Resource dependent countries.

Country	Code	Type of natural resource	Population (2010, millions)	GNI per capita (2010, US\$)	Natural resource exports (% of total exports, 2006-10 avg.)	Natural resource fiscal revenue (% of total revenue, 2006-10 avg.)
Low income (LICs) and lower-middle income countries (LMICs)						
Congo, Dem. Rep.	COD	Minerals & Oil	65.9	180	94	30
Liberia	LBR	Gold/Diamond/Iron Ore	4.0	210	--	16
Niger	NER	Uranium	16.3	360	--	--
Guinea	GIN	Mining Products	11.0	390	93	23
Mali	MLI	Gold	15.2	600	75	13
Chad	TCD	Oil	11.9	710	89	67
Mauritania	MRT	Iron Ore	3.6	1,000	24	22
Lao PDR	LAO	Copper & Gold	6.3	1,010	57	19
Zambia	ZMB	Copper	13.9	1,070	72	4
Vietnam	VNM	Oil	86.9	1,160	14	22
Yemen	YEM	Oil	23.6	1,160	82	68
Nigeria	NGA	Oil	159.4	1,170	97	76
Cameroon	CMR	Oil	20.6	1,200	47	27
Papua New Guinea	PNG	Oil/Copper/Gold	6.8	1,300	77	21
Sudan	SDN	Oil	36.1	1,300	97	55
Uzbekistan	UZB	Gold/Gas	28.6	1,300	--	--
Côte d'Ivoire	CIV	Oil/Gas	20.1	1,650	--	--
Bolivia	BOL	Gas	9.9	1,810	74	32
Mongolia	MNG	Copper	2.7	1,870	81	29
Congo, Rep. of	COG	Oil	4.1	2,240	90	82
Iraq	IRQ	Oil	30.9	2,380	99	84
Indonesia	IDN	Oil	241.6	2,500	10	23
Timor Leste	TLS	Oil	1.1	2,730	99	--
Syrian Arab Republic	SYR	Oil	20.7	2,750	36	25
Guyana	GUY	Gold & Bauxite	0.8	2,900	42	27
Turkmenistan	TKM	Oil	5.0	3,790	91	54
Angola	AGO	Oil	21.2	3,960	95	78
Gabon	GAB	Oil	1.5	7,680	83	60
Equatorial Guinea	GNQ	Oil	0.7	13,720	99	91

Prospective natural resource exporting LICs/LMICs

Sierra Leone	SLE	Diamonds	5.8	340	--	--
Afghanistan	AFG	Multidimensional	28.0	410	--	--
Madagascar	MDG	Oil/Gas	21.1	430	--	--
Mozambique	MOZ	Gas/Bauxite, etc.	24.3	440	--	--
Central African Rep.	CAF	Diamonds/Gold	4.4	470	--	--
Uganda	UGA	Oil	33.1	500	--	--
Tanzania	TZA	Gold & Precious Stones	45.6	530	--	--
Togo	TGO	Phosphate	6.4	550	--	--
Kyrgyz Republic	KGZ	Gold	5.4	840	--	--
São Tomé & Príncipe	STP	Oil	0.2	1,030	--	--
Ghana	GHA	Gold/Oil	24.3	1,250	--	--
Guatemala	GTM	Multidimensional	14.7	2,740	--	--

Upper-middle income countries (UMICs) that are rich in natural resources

Ecuador	ECU	Oil	14.9	3,850	55	24
Albania	ALB	Oil/Gas	2.9	3,970	--	--
Algeria	DZA	Oil	36.0	4,390	98	73
Iran	IRN	Oil	74.3	4,520	79	66
Peru	PER	Minerals	29.4	4,900	8	19
Azerbaijan	AZE	Oil	9.1	5,380	94	64
Botswana	BWA	Diamonds	2.0	6,750	66	63
Kazakhstan	KAZ	Oil	16.3	7,500	60	40
Suriname	SUR	Minerals	0.5	7,640	11	29
Mexico	MEX	Oil	118.6	8,930	15	36
Russia	RUS	Oil	142.8	9,880	50	29
Chile	CHL	Copper	17.0	10,750	53	23
Venezuela	VEN	Oil	29.0	11,660	93	58
Libya	LBY	Oil	6.3	12,320	97	89

High income countries (HICs) that are rich in natural resources

Bahrain	BHR	Oil	1.3	24,710	81	82
Brunei Darussalam	BRN	Gas	0.4	n.a.	96	90
Trinidad and Tobago	TTO	Gas	1.3	16,700	38	49
Saudi Arabia	SAU	Oil	28.1	17,210	87	79
Oman	OMN	Oil	2.9	17,890	73	83
United Arab Emirates	UAE	Oil	8.3	26,370	41	76
Qatar	QAT	Gas	1.8	69,754	88	58
Norway	NOR	Oil	4.9	84,640	62	29