

Extractive industries and exhaustible resource management.

Extractive industries deal with the development, extraction and sale of exhaustible (non-renewable) natural resources. The sector covers mining of metals and minerals and the extraction of oil and natural gas. These two areas have very different histories. The mining of metals and other minerals dates back into prehistory, played a key role in the industrial revolution, and now generates revenues of \$1.6 trillion industry each year, more than 2% of total world income. It is dominated by large multinationals (including Anglo-American, BHP Billiton, Rio-Tinto, Vale), but ranges down through smaller firms to artisanal mining of precious metals and diamonds, a practice which still persists in some developing countries. The modern history of the oil and natural gas sector starts in the mid-19th century, overtaking coal as a source of energy by mid- 20th century and now supplying slightly more than half of world energy demand. Oil production accounts for around 2.5% of world income and 10% of world trade. The international oil companies (including ExxonMobil, Shell, BP, Chevron, Total, Conoco Philips) have lost the dominant position they held in mid-century in the face of rising competition from national oil companies such as Saudi Aramco, Gazprom, China National Petroleum Corporation, Petrobras, and Petronas.

This article summarizes ways in which the extractive sector is different from other economic sectors, reviews evidence on the impact of the sector in countries rich in resources, and discusses policies that can improve the management of exhaustible resources in these countries.

How are exhaustible resource sectors different?

The extractive sector has a number of features that are distinctive. First and foremost, it is dealing with depletion of an exhaustible resource. Higher production today means less at some future date, raising questions about the rate of depletion and about prospects of the resource running out. These concerns have led to voluminous literatures on the limits to growth imposed by resource exhaustion and on the implications of 'peak oil', despite the fact that the ratio of proved reserves to annual production is at an all time high. Concerns about resources running out are essentially unfounded because of the dual role of the price mechanism. As a resource

becomes scarcer, so its price will rise. On the one hand, this encourages the use (or invention) of substitutes and promotes new prospecting and discovery. On the other, the expectation of higher prices in future causes the current rate of depletion to slow; it becomes more worthwhile to hold the resource in the ground rather than deplete it immediately.

The inherent non-reproducibility of exhaustible resources makes them quite different from other goods and services produced in the modern economy. It means that they have a scarcity value which may be many times greater than the costs incurred in exploration, development and extraction. This asset value raises the question of who owns such natural assets and who receives the rents that are earned from their extraction. The question has an ethical dimension: should it be whoever discovers the resource? Or citizens of the territory in which it is discovered? And if so, the current generation, or current and future generations? The ethical standpoint would usually argue for ownership to be vested in a wide range of citizens – present and future – of the territory in which the resource is located. The discoverer of the resource has a right to a fair return on their investment, but not perpetual ownership of the resource, any more than an inventor should be given an infinite length patent on an invention. The point that present and future generations should benefit is an important one, but does not mean that the resource itself should be passed on, undepleted, to future generations. Best use may involve depleting the resource but being sure to invest much of the proceeds so that (at least) an equivalent asset value – in human and physical capital – is passed on to future generations. In practice, ownership of sub-soil assets is, in almost all countries, vested with the state (the US being the main exception). In all cases the state uses resources as a tax base, typically through a combination of selling development rights, royalties on output, profit taxes, and perhaps also state shares in production. This provides fiscal revenues which government can potentially use for the benefit of present and future citizens, although there is of course no guarantee that revenues will be used this way.

The third distinctive feature is unevenness in the distribution of resource endowments across countries. This follows partly from geology, and partly from the patchy and incomplete nature of prospecting. Some countries, particularly in the developing world, do not have detailed geological surveys and probably have major resource discoveries waiting to be made, as illustrated by recent oil finds in Ghana and Uganda, and the range of minerals identified in

Afghanistan. Many countries do not have significant resource endowments, while the counterpart is that some resource rich countries have economies that are excessively dependent on the resource sector. Non-renewable natural resources are a dominant feature of some 50 countries, with combined population of more than 1.4 billion people. Selected examples are given in Table 1, using data that precedes recent commodity price booms. In 24 countries extraction of non-renewable resources accounts for more than three-quarter of exports. In 18 they provide more than half of government revenues, and in 13 more than 40% of the entire national income. This excessive dependence on resources creates its own problems.

Table 1: Resource dependency: selected countries

Country	Resource	Government Mineral/ hydrocarbon revenues , 2000-05		Mineral/ hydrocarbon exports , 2000-05	
		% fiscal revenue	% GDP	% exports	% GDP
Algeria	Oil/ gas	70.5	26.3	97.6	36.8
Angola	Oil/ gas	79.8	33.4	91.8	68.0
Azerbaijan	Oil/gas	33.3	8.5	87.3	36.1
Botswana	Diamonds	62.5	20.6	79.5	32.3
Chile	Copper	9.4	2.2	39.1	11.7
Guinea	Bauxite	17.8	2.4	87.7	19.0
Iran	Oil/gas	65.5	14.7	82.2	24.2
Kazakhstan	Oil/gas	25.1	6.3	52.6	24.1
Libya	Oil/gas	80.2	43.2	97.1	53.6
Mongolia	Copper/ gold	8.2	2.9	51.2	26.3
Nigeria	Oil/gas	78.9	32.3	97.2	46.2
Norway	Oil/gas	24.0	13.0	60.0	19.8
Sudan	Oil/gas	49.8	8.3	80.6	12.9
Trinidad & Tobago	Oil/gas	36.4	9.3	59.9	28.4
Uzbekistan	Gold	n.a.	n.a.	29.8	8.6
Venezuela	Oil/gas	48.8	15.8	82.5	25.8

Data source: IMF Guide on Resource Revenue Transparency (2007).

The fourth main feature of the sector is the technical complexity of developing and extracting many natural resource deposits. Development of a mine or oil field is likely to involve extremely large and long-lived investments and, particularly in some sectors (such as off-shore oil) very high levels of technical expertise. Technical complexity arises not only in

extracting the resource, but also in managing the environmental risks associated with extraction. Countries are therefore likely to be dependent on international expertise to develop resource endowments, and such expertise is the core competence of many of the large multinational firms in the sector. However, it poses governments difficult challenges of how to manage relationships – contractual, fiscal and regulatory – with such companies.

Natural resources: blessing or curse?

Given these features, how successful have resource abundant countries been in securing benefits from their extractive sectors? Historically, extraction and use of resources has been a major driver of economic growth and rising living standards. Coal and iron-ore were key inputs to the industrial revolution in the UK and other North European countries. Economic growth in late 19th and early 20th century USA was highly resource intensive, drawing on deposits of virtually the entire range of industrial minerals.

This historical performance was based on using resources primarily as inputs to domestic industry. This is quite different from the situation of countries where extractive industries are of a scale and type which means that their primary use is not (and cannot feasibly be) as inputs to domestic industry, but instead involves production for export. The return on resource exports is then a supply of foreign exchange which can, in principle be saved and invested either in the domestic economy or in foreign assets, for example by building a Sovereign Wealth Fund. In practice countries' have had very mixed experiences in achieving this.

Three sorts of problems can arise, and have led commentators to refer to the 'resource curse'. The first is that political pressure to use revenues for immediate consumption has been hard to resist. Savings rates have often been low and resource revenues have been dissipated in higher salaries for government employees, badly designed and implemented spending projects, and unsustainable welfare transfers. The second problem is that revenues have had a corrosive effect on the quality of governance. Revenues have been subject to theft and have, in some cases, increased corruption in society more generally. It is argued that, by providing government with a revenue stream other than taxation, citizens' scrutiny and ability to hold government to account is diminished. Third, even for a well-intentioned and effective government, management of

resource revenues is extremely difficult. Commodity prices are volatile, and corresponding revenue flows have fluctuated widely. Economies that receive large flows of foreign exchange from natural resources are prone to the 'Dutch disease', a term coined after the experience of the Netherlands with natural gas revenues in the 1970s. These foreign exchange earnings have the effect of appreciating the exchange rate and thereby damaging other export sectors. This may cause a period of high unemployment as the economy adjusts to its new situation. Furthermore, the export sectors that are damaged may be quite dynamic; in developed countries high-tech sectors, or in developing countries rapidly growing labor-intensive manufacturing. These sectors are drivers of long term growth and damage to them may permanently retard the overall growth of the economy.

What is the evidence on country experience in managing these pitfalls? There is a large empirical literature which investigates circumstances under which countries are likely to experience a resource curse. Simple correlations suggest that countries with high levels of non-renewable resource exports tend to have relatively low rates of saving and investment (particularly if depletion of the resource is counted as 'disinvestment'); low levels of education; high inequality; high income volatility; and slow economic growth. Of course, such correlations are averages, which mask enormously varied performance. Amongst resource rich countries are some of the worst performing countries in the world (Nigeria, Sierra Leone, Democratic Republic of the Congo (DRC)) and some of the best performing (Botswana, Norway, Malaysia). Studies therefore control for other country characteristics as they seek to identify the impact of resource revenues. Their findings can be broadly summarized as follows. The impact of resource wealth is conditional on a number of other country characteristics, above all on the quality of governance. Thus, countries such as Norway and Botswana have been effective in using revenue to promote economic growth and raise indicators of human development. However, the interaction of poor governance and resource wealth has proved toxic, as witnessed by Nigeria, Sierra Leone, and the DRC, and also established more generally by the statistical research. A further twist comes as resource wealth also *changes* the quality of governance. For countries with good initial governance, resources may slightly improve governance, but for countries with poor governance, resource wealth makes things worse. There is thus a vicious circle in which

poorly governed countries fail to benefit from resource abundance, and resource abundance may make governance quality even worse.

Policy initiatives for resource management

The empirical literature on the resource curse paints a broad-brush picture of what can go wrong, and the policy challenge is to identify key points of failure and measures that can feasibly be put in place to rectify these failures. The overarching consideration is, as we have seen above, the quality of governance as a whole but this, by its nature, is extremely difficult to change.

However, there are particular aspects which are important for resource management. Many failures have been associated with lack of transparency in government dealings, and lack of citizen awareness of issues. Public debate of the issues can improve the quality of policy decisions, and also helps to shape citizens' expectations of what can be expected from a resource boom. Transparent provision of information is necessary for such debate to occur. It is also a necessary condition for holding government to account for resource revenues and for decisions that are taken. This is a field in which there are many policy initiatives, including those of non-governmental organisations such as Publish What You Pay, the Revenue Watch Institute, and also of the Extractive Industries Transparency Initiative,¹ under which member countries agree to full independent audit of resource revenues.

In addition to the overarching issue of governance, there are many decision points ranging from prospecting and exploration through to the macro-economics of spending revenues, which need to be got right if a country is to benefit from resource revenues. Policy initiatives in this area include the Natural Resource Charter, the activities of the International Council on Mining and Metals, and various World Bank initiatives.² At the top of this decision chain is the need to design contractual terms and fiscal regimes that are sufficiently attractive (and secure) to attract exploration and development, while at the same time ensuring that rents are captured by government. This balance has not always been met. Incentives for exploration in many developing countries have been blunted by lack of clarity in fiscal and contractual regimes and by fear of expropriation. At the other extreme there are cases where government has failed to

¹<http://www.publishwhatyoupay.org/>, <http://www.revenuewatch.org/>, <http://eiti.org/>

² <http://www.naturalresourcecharter.org/>, <http://www.icmm.com/>

capture a sufficiently high share of revenues, Zambia's 0.8% royalty on copper production being a good example.

Revenue management brings its own challenges, the first of which is managing extreme volatility in income flows. If this volatility is not to be transmitted to the domestic economy, revenues should be saved during boom periods, preferably in offshore accounts or foreign exchange reserves which can then be drawn down during periods when prices are low. A number of countries now have such Stabilisation Funds, Chile's Copper Stabilization Fund (now Economic and Social Stabilization Fund) being a good example. This accumulates funds when the government's fiscal surplus (driven partly by the price of copper) is high, and reached \$20 billion at end 2008. \$8 billion was drawn down during the recession of 2009 when the price of copper fell, successfully cushioning in the impact of the fall on Chile.

Stabilization funds can be used to secure short-run smoothing, but there is also the issue of how to ensure that benefits are divided between present and future generations. This requires high levels of saving investment although, particularly in developing countries, this has to be balanced against immediate priorities of reducing poverty. Given a level of savings, choices have to be made concerning the form that the corresponding investment should take. Some countries have set up long-run Sovereign Wealth funds to invest funds abroad for the benefit of future generations. An example is Norway's Government Pension Fund, now holding some \$500 billion of accumulated oil revenues to be used for meeting future pension liabilities once oil reserves have been exhausted. For developing countries investing in the domestic economy is a better choice than investing in foreign assets. It enables countries to build up scarce stocks of human capital and infrastructure. This can bring employment and economic expansion to the current generation, as well as passing on assets to future generations. Furthermore, such public investment may stimulate the private sector investment that is needed for economic growth. In many developing countries public investment in infrastructure is low because of lack of government funds, and private investment is low because it is deterred by lack of infrastructure (in ports, transport systems, and public utilities such as electric power) and of labor skills. Resource wealth provides a way of breaking out of this vicious circle. Malaysia provides an example of a country that was successful in using resource wealth to grow other sectors of the

economy and diversify away from excessive resource dependence. However, identifying and implementing such investments effectively is difficult, requiring considerable government capacity. There are numerous examples of wasteful use of revenues on projects that have never achieved viability.

Conclusions

The extractive sector provides countries with opportunities to improve economic performance and raise the well-being of current and future generations. While some countries have successfully used resource revenues to transform their economies, the record has too often been that of the 'resource curse', with poor economic performance and unbalanced economic structures. It is the responsibility of resource rich countries, together with support from the corporate sector and the international community, to ensure that the opportunities created by resource booms do not continue to be lost.

Anthony J. Venables

Further Readings

International Monetary Fund (2007) *Guide on Resource Revenue Transparency*, Washington DC.

Collier, P., A. M. Spence, R. van der Ploeg, and A.J. Venables (2010) 'Managing resource revenues in developing economies', *IMF Staff Papers*, 57, 84-118

Collier, P. (2010) 'The plundered planet; how to reconcile prosperity with nature', Allen Lane, London.

Ploeg, van der R. 'Natural resources: curse or blessing?', Oxcarre research paper no. 5, Oxford, forthcoming *Journal of Economic Literature*