Natural Resource Economics: The Resource Curse

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Thus far in our study of *natural resource economics*, we established the building blocks for economic analysis (e.g. supply and demand, efficiency and sustainability), reviewed the merits and issues of public policies, and identified classifications and techniques in the valuation of natural resources. Also, we analyzed applied problems in a number of natural resource economies, such as mineral, forest, land, water, and biodiversity.

However, in this paper, we wish to examine the overall effects of natural resources on national economies. Specifically, we address the counter-intuitive finding that economies abundant in natural resources have lower rates of economic growth than those that are resource-poor.* This phenomenon is also known as the "resource curse". Our aim is not to provide any new statistical analyses that explain the causal relationships (or lack thereof) behind this pattern, or even its existence. Rather, we discuss some positive evidence of the resource curse, focusing on how the trend may be related to various concepts that we have

*Sachs, J. D. and Warner, A. M. (1997). Natural Resource Abundance and Economic Growth.

developed in our study of natural resource economics.

Resource-poor economies have consistently outperformed resource-rich economies throughout history. In the seventeenth century, resource-poor Netherlands overwhelmed Spain, despite the abundance of gold and silver in the Spanish colonies. In the recent centuries, resource-poor countries such as Switzerland and Japan moved ahead of resource-rich countries such as Russia. In the past three decades, the fastest-growing nations have been Korea, Taiwan, and Hong Kong, each of whom are not endowed with substantial natural resources. Meanwhile, countries such as Mexico, Nigeria, and Venezuela, although abundant in natural resources, have gone bankrupt. To be more specific, consider oil, a heavily traded mineral resource. For the OPEC countries, between 1965 and 1998, growth in gross national product per capita decreased on average by 1.3%; in contrast, growth averaged 2.2% in the rest of the developing world.[†]

These findings contradict our intuition; the abundance of natural resources should increase wealth and purchasing power over imports, which in turn should promote investment and growth. Instead, countries rich in natural resources experience *negative* growth. On one hand, it is a possibility that natural resources are not at all a significant factor for positive economic growth. For example, the substantial decreases in transportation costs caused the physical availability of resources to peak. As a result of lowered import costs, countries such as Japan and Korea became world-class producers of steel, despite their dependence on iron-ore imports. This shows that natural resources do not have to be decisive factors

[†]Gylfason, Thorvaldur (2000). Natural resources, education and economic development.

in economic growth. On the other hand, it is surprising that possession of these resources might pose a *threat* to economic growth.

One hypothesis is that "easy riches lead to sloth". This hypothesis goes hand-in-hand with what we know of efficiency and sustainability. Whether we accept the theory of rational expectations, the theory of adaptive expectations, or another framework for human decision-making, we see that individuals consider the *future* into their decision-making process. When a natural resource is sufficiently abundant, an individual cannot gauge the relevance of sustainability in his or her everyday actions, since the critical thresholds for sustainability exist so far in the future. For nonrenewable resources such as mineral resources, we learned two modes of sustainable use:[‡]

i. considering the eventual transition to a substitute resource of greater abundance,

ii. or investing earned rents into other types of assets to maintain the overall productivity of the economy.

When there are copious levels of a nonrenewable natural resource, an individual cannot fathom when the "eventual transition" might occur, and so disregards the possibility. Furthermore, there is no incentive to invest earned rents into other types of assets except for self-interest in the *foreseeable future*, such as the individual's lifetime.

Fortunately, for renewable resources, no harm is inflicted by such carelessness. Take, for instance, the effort-yield curve, an inverted U-shaped function, which is often used to

[‡]Field, Barry C. (2001). Natural Resource Economics.

analyze the economics of fisheries. When fish are plenty for the current population of fishers, the thresholds for maximum sustainable yield and stock depletion are well beyond the total amount of effort (i.e. boat-years) that can the population can possibly generate. Thus, exploitation will always be sustainable. It is only the case of *nonrenewable* natural resources that might cause limited future growth.

A second hypothesis stresses the lack of positive externalities resulting from natural resource industries, as opposed to manufacturing industries. We learned in natural resource economics the concept of an externality: the effect caused by a self-interested individual, but incurred by others. There are not many external benefits that result from the extraction of a mineral resource or netting of fish. Meanwhile, the manufacturing of steel from iron-ore, for example, results in many positive externalities. (Most notably, consider the previous example of Japanese and Korean steel manufacturers.)

One related idea uses the "Dutch disease" models to explain industrial shifts. These models demonstrate that the abundance of natural resources cause booms in the natural resources sector. For example, the abundance of fertile soil in a certain region calls for a large agricultural sector. Such booms shift the distribution of employment away from manufacturing sectors and toward the natural resource sectors. This decreases the positive externalities of "learning-by-doing" associated with manufacturing industries; the decrease in such benefits affect the rate of human capital accumulation, and may cause chronic slow growth.* Of course, during the redistribution, other benefits aside from the development of

*Matsuyama (1992).

human capital are lost as well.

An altogether different hypothesis involves natural resource policies and politics. Natural resources, in general, generate high economic rents. Economic rents not only include resource rents, the value of a marginal unit of the resource *in situ*, but also the value of all future uses. Economic rent is analogous in forest economics to the variable S, which represents the present value of all future net benefits when the forest is harvested with the optimal rotation period. It is also analogous in land economics to *land rent*. It has been shown that governments typically earn most of its rents from natural resource exploitation. Due to special-interest groups including governments and the unbalance of power (for example, property rights), innovation may be impeded in resource-rich societies. Some even argue that resource-richness leads to greater corruption and inefficient bureaucracies.[†]

Meanwhile, when the natural resource is open to the public, it suffers open-access externalities. In the classic example with a fishery, we learned how public goods are prone to over-exploitation; individuals act to maximize private net benefits, but end up reducing social net benefits to zero. Taxes on such resources can transfer the lost social benefits to the government, ultimately maximizing social net benefits. Unfortunately, taxation is subject to corrupt incentives, as we discussed.

In between the government and the public, over-exploitation is possible between states, or different factions within the government. It has been found that resource-abundant societies follow state-developed policies,as opposed to national or federal policies. In such cases,

[†]Gelb (1988).

states compete for natural resource rents and inefficiently exhaust social net benefits as a dead-weight loss, instead of acting as a united government (or as Coase might say, a single firm). Furthermore, state-led development has been found to result in lower investment rates and/or lower growth rates directly.

There exists evidence that governments controlling natural resource rents let the rents go to waste. Commodity price forecasts in the 1970's and 1980's were found to be systematically optimistically biased, encouraging larger public investments in projects than there should be, leading to immense inefficiencies and costs when the forecasts turned out to be incorrect. All of this supports that resource-rich economies end up with more wasted capital than economies that are resource-poor.

A final hypothesis is that countries with higher natural resource abundance have higher overall demand, and thus higher relative prices of non-traded goods. Investment goods, which are crucial to economic growth, are then of lower relative value.

We now analyze each of the natural resources covered in our studies from the perspective of economic growth. Mineral resources are nonrenewable and thus of limited supply. When in great abundance, no attempt is made toward sustainable or efficient extraction. Sustainability entails that current consumption does not negatively affect future consumption and the standard of living. We derived equations for intertemporal efficiency as follows. Denoting net discounted benefits at time t by π_t, gross benefits at time t by B_t, and gross costs at time t by C_t, we know that

$$\pi_t = B_t - C_t + \frac{B_{t+1} - C_{t+1}}{1+r} + \frac{B_{t+2} - C_{t+2}}{(1+r)^2} + \cdots \tag{1}$$

For maximization, the derivative of the above expression must be set equal to zero. Thus, denoting consumed quantity by Q and marginal benefits and costs by MB and MC,

$$0 = \frac{\partial \pi}{\partial Q} = MB_t - MC_t + \frac{MB_{t+1} - MC_{t+1}}{1+r} + \frac{MB_{t+2} - MC_{t+2}}{(1+r)^2} + \cdots \tag{2}$$

The sum of the fractional terms (future terms discounted with the interest rate) is known as the "user cost", an important concept in the analysis of intertemporal efficiency. The determination of the interest rate itself is another topic of importance. The interest rate must not only capture the future value of money, but also time preference and other such factors. For example, it has been shown that individuals always prefer to consume quantities at the present rather than the future. The rate of sacrifice is referred to as the *marginal rate of time preference*. Also, a natural resource may be more or less valuable in the future depending on certain conditions. One technique is to derive an implicit rate of interest, or a shadow rate, in order to account for all such preferences.

Thus we have efficiency by adding the constraint,

$$MB_t - MC_t = \frac{MB_{t+1} - MC_{t+1}}{1+r} = \frac{MB_{t+2} - MC_{t+2}}{(1+r)^2} = \cdots \tag{3}$$

(Note that for an energy resource, the interest rate might be high due to risk. Energy prices are volatile and uncertain, and so risk carries a certain cost. The farther into the future we seek, the higher this cost. Thus, the distribution of consumption across every point in time shifts toward the future.)

In a society that is resource-rich, such considerations for future consumption is non-existent, leading to poor conditions for future economic development. Meanwhile, in a society that is resource-poor, such analyses, however basic, is necessary. Additionally, as needed resources are imported from foreign countries, *paying* for the natural resources force more awareness and better accounting of the natural resources being exchanged.

In a society of low iron-ore resources, profit can still be made by importing iron-ore and producing steel. However, since the natural resource is a direct cost of production (not extracted cost), producers are much more aggressive about minimizing costs and maximizing the efficiency of production. This not only results in high efficiency, but also compounded human capital, since technological advances must be made to achieve such efficiency. This is a great positive externality toward social net benefit.

In a society of low water resources, governments and private parties expend more of their time in determining the best form of property rights for water usage. In the United States for example, there is plenty of water, even in the Western states, relative to the middle-eastern countries. Thus, not as many developments have gone underway in the most efficient distribution of rights to water.

After such analyses, it is not terribly surprising that resource-abundant societies have lower growth rates than resource-poor societies. Resembling Darwinism, the societies with higher selective pressure (e.g. resource-poor countries) have evolved and developed more and more efficient ways of extracting and using their natural resources, in some cases, even yielding to sustainable development. Moreover, some of the evolutions result in positive external benefits that further accelerate the welfare of the society. Many concepts of natural resource economics—efficiency, sustainability, rent, the Tragedy of the Commons, and property rights, to name a few—played a key role in assessing the situation of the "resource curse".