Neoclassical growth and the natural resource curse puzzle☆

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ABSTRACT

We advance a novel mechanism that helps to explain the puzzling evidence on the natural resource curse. The new channel arises in a standard dynamic Heckscher–Ohlin model composed of small-open economies that take international output prices as given. Within this framework, a more capital-intensive primary sector implies that natural-resource abundant economies grow more slowly along the adjustment path. This effect might be only temporary because the natural input also affects long-run income, and not necessarily in the same direction as transitional growth. We produce quantitative results that show that the new mechanism can account for a significant fraction of the observed output growth gap between resource rich and resource poor U.S. states.

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1. Introduction

Recent studies such as Sachs and Warner (1997, 1999, 2001) and Gylfason (2001) argue that resource abundant countries grow more slowly and lag, on average, behind countries with less resources. This puzzling phenomenon has been labeled as the natural resource curse. Frankel (2010) and van der Ploeg (2011) summarize the literature, pointing out two main explanations: market mechanisms, and political channels. The former ones state that sectors that are intensive in natural resources could be dead-end activities because of, for example, the high volatility and secular decline of the international prices of these commodities. The dead-end nature can be also a consequence of a crowding out effect on other activities such as manufacturing that potentially contribute more intensively to technological change. The latter channels, in turn, imply that natural riches can offer an easy source of wealth for politicians and powerful elites, leading to the establishment of bad institutions, and frequent wars for their control.

Nevertheless, the evidence is far from being conclusive. For example, while some resource-rich countries do poorly, others like Norway do very well economically. Perhaps more importantly, some evidence that gives support to the curse is difficult to explain with existing theories. Papyrakis and Gerlagh (2007), for instance, find that there is a statistically significant negative relationship between resource abundance and economic growth for 49 U.S. states; it is unlikely that changes in international prices, or institutional and political system differences are behind the result. This justifies the need for other theories that do not rely on those mechanisms.

In this paper, we advance a new explanation based on a simple open-economy two-sector neoclassical growth model. The novel theory explains why higher resource endowments can result in lower growth in the less resource-intensive sector, making the whole economy grow more slowly. The key is the existence of differences in input shares in different production activities. This allows the effect of resources to evolve along with the economy, rather than being a simple fixed total factor productivity effect.

More specifically, we introduce a natural input into a dynamic Heckscher–Ohlin model of international trade and growth. The economy is composed of a large number of small open economies. Each country has the production structure of the two-sector neoclassical growth model with two goods – one primary and the other non-primary – that are traded internationally. The two sectors employ capital and labor as factors of production with different intensities. In addition, a fixed natural resource and the primary product are employed as inputs by the primary and non-primary sectors, respectively. All economies have identical preferences and production technologies, but they may differ regarding the natural endowment. Some countries that we call the developed world have already reached the steady state, while other countries have not.

The main prediction of the model is that, under diversified production equilibrium, in small-open economies, or economies that are price takers in international markets, the natural input negatively affects economic growth through the convergence speed. The reason is that the economy-wide capital weight is affected by the allocation of resources between sectors. In particular, given that primary activities are more physical capital intensive, the economy-wide capital share rises with the natural endowment because of the increasing weight of the primary sector. The implication of this increase in the capital share is that the interest rate falls more slowly towards its long-run value, thus decreasing the investment rate in capital accumulation and, therefore, the rate of economic growth.

We also find that the negative growth effect in the model might be only temporary: a larger stock of natural inputs has a positive effect on long-run income if the primary activity is the less labor intensive activity. As a consequence, the long-run and transitional effects can run in opposite directions. This is an interesting result of the model that has important implications for growth regressions because it can make natural resources show up in the data as a curse for economic growth even when they positively affect steady-state output. Furthermore, this result is consistent with recent work by Alexeev and Conrad (2009) who find that natural riches have a positive effect on income per capita.

We perform a quantitative exercise to assess the theory and show that these effects, although not large, can be significant. In the calibrated economy, when the natural endowment triples, income per capita can increase up to 12%, and the convergence speed falls more than 1.5 percentage points. More importantly, focusing on the sample of U.S. states employed by Papyrakis and Gerlagh (2007), we find that our novel mechanism contributes to generate a resource curse over the time horizon considered by these authors, 1986–2000. In particular, the model can explain most of the observed growth disparities as a consequence of differences in both output distance to the long-run trend and natural endowments. Moreover, differences in the natural endowments are estimated to explain about 11% of the dispersion in growth rates across U.S. states.

The rest of the paper is organized as follows. Section 2 carries out a review of the related literature. The model's economic environment is described in Section 3. Section 4 analyzes the impact of natural inputs on a small-open developing economy. The numerical exploration is in Section 5. Section 6 presents the conclusion.

2. Review of the related literature

Frankel (2010) and van der Ploeg (2011), among others, provide a detailed review of the evidence and theories about the natural resource curse. This section focuses on some articles that offer observational evidence that establishes the puzzle, and reviews the literature that we believe is closest to our research.

Sachs and Warner (1999, 2001) are among the most important works that offer evidence in favor of the natural resource curse. In particular, they show that the share of exports of primary products in GDP displays a negative correlation with posterior growth after controlling

for several variables that include economic, geographical, and climate proxies. Their result is illustrated in Fig. 1. We observe that countries with lower shares of primary-product exports in 1970 generated, on average, faster GDP per-capita growth from 1970 to 1989; this negative correlation is significant at the 5% level.

The result has been found as well by other authors employing a variety of measures of resource abundance. Gylfason (2001) shows that the population's level of education, a variable closely related to the level of economic development, is negatively related to the share of natural capital in national wealth. Isham et al. (2005) obtained evidence that oil, minerals such as copper and diamonds, and plantation crops such as coffee and cocoa are negatively related with institutional quality measures that are, in turn, strongly associated to economic growth.

There exist several theoretical explanations for this puzzle. Among the earliest ones, Bhagwati's (1958) immiserizing growth theory emphasizes the negative effect on a country's income of the change in the terms of trade that follows after the discovery of natural riches. In the same vein – that is, through changes in international prices – Corden and Neary (1982) show that the structural problems that arise from the discovery of a natural resource (the called 'Dutch disease') can be the consequence of appreciations in the exchange rate.

In other models, natural resources discourage the accumulation of capital inputs necessary to foster economic growth. Matsuyama (1992), for example, considers that the manufacturing sector is characterized by a learning by doing mechanism that promotes growth, while the primary sector that uses natural resources is a stagnant activity. Adamopoulos (2008) and Galor et al. (2008) emphasize that land-ownership inequality can delay industrialization through its effects on the import of intermediate goods used in industry and on the implementation of human-capital promoting institutions, respectively. Gaitan and Roe (2012) argue that the phenomenon can be explained by an increase in trade revenues that induces a reduction in capital investment in the resource-abundant country.

On the political economy side, Hodler (2006) and Caselli and Cunningham (2009), among others, offer frameworks in which a natural resource curse can appear via internal struggle for ownership. Finally, a simpler explanation is provided by Rodriguez and Sachs (1999, p. 278): they argue that "resource-rich countries may grow more slowly because they are likely to be living beyond their means".

The natural resource curse literature can be, however, very controversial. In particular, not all authors actually find the existence of a curse. For an example of this see James (2015) who argues that – if you measure things correctly – there is not much of a resource curse after all. Other examples are Mehlum et al. (2006) and Alexeev and Conrad (2009). The former provides evidence that in countries with good (bad) institutions natural inputs are a blessing (curse) for economic growth. The latter paper, in turn, finds that natural inputs have a positive effect on income per capita. Similarly, Brunnschweiler and Bulte (2008) conclude from their statistical analysis that the apparent paradox may be a red herring.[2]

In addition, as explained in the introduction, some articles such as Papyrakis and Gerlagh (2007) provide evidence that gives support to the curse within a context that disagrees with existing theories. Our framework does not rely on the above mechanisms; final-goods prices remain constant, total factor productivity growth can be the same across activities, and political institutions are absent. The focus is on the effects that are a consequence of *Rybczynski-type* mechanisms.

This work is also related to the literature on multi-sector models of international trade and growth that include Ventura (1997),

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[2] Van der Ploeg and Poelhekke (2010), however, argue that this last result suffers from endogeneity problems.