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Natural resource dependence and the accumulation of physical and human capital in Latin America

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ABSTRACT

In a simultaneous model of human and physical capital accumulation for 17 Latin American countries from 1975 to 2004, we show that overall resource dependence has no significant direct effect on physical and human capital. When disaggregating the natural resource variable into sub-categories, we find that petroleum export dependence has a significant positive direct effect on physical capital, but a significant negative direct effect on human capital. Agricultural export dependence shows a significant negative direct effect on physical capital. Petroleum exports have a long run positive effect on physical capital but a negative long run effect on human capital. Agricultural exports have a negative long run effect on physical and human capital.

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Introduction

The resource curse, where an abundance of natural wealth ends up being a curse rather than a blessing to a country, is a well-known paradox in the development literature. It is a paradox because resource abundance was once considered a key to economic growth and development. The industrial revolution in England was thought to have been driven by the country's large deposits of coal, while the rise of the U.S. economy was at least partly based on its abundance of natural resources. Modern day examples of the curse abound, however. The Democratic Republic of the Congo, Equatorial Guinea, and Nigeria are just a few developing countries that are rich in sub-soil wealth and poor in almost every other development indicator.

In fact, if we were to construct a matrix of natural resources and wealth, we would find that no box would be empty of examples. While there are plenty of resource-rich countries which grew quickly, there are also countries like Japan, which grew extremely quickly in the post-WWII period with few natural resources. There are also countries like Somalia, which is resource

poor and has had little economic growth. Thus, the anecdotal evidence suggests that the relationship between resources and development is far from clear-cut.

While most of the research on the resource curse has focused on economic growth, there are an increasing number of papers that study the effect of resource dependence on factor accumulation. Since capital is a determinant of economic growth, lower capital accumulation would also mean lower average growth rates. In this paper, we investigate the effect of natural resource dependence on human and physical capital accumulation in a panel of 17 Latin American countries between 1975–2004, a region known for its resource abundance as well as its resource dependence.² Even after more than 50 years of diversification away from primary goods, 68% of Latin America's total merchandise exports in 2000–2004 still consisted of natural resources.³

² The World Bank (2006) classifies Latin America and the Caribbean as having the second highest per-capita natural capital levels in the world, where natural capital is defined as the sum of all sub-soil assets, timber and non-timber resources, pasture and crop land, and protected areas. The region has less natural per-capita natural capital than Europe and Central Asia (\$11,031) but more than the Middle East and North Africa (\$7,989).

³ See Table 1 for a ranking of the countries in our sample by the percentage of primary products exported as a percentage of total merchandise exports. Exports from Ecuador, Nicaragua, and Venezuela are the most resource-intensive in Latin America, with primary products making up almost 90 percent of total exports.

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Our work contributes to the literature on the natural resource curse in five ways. First, we focus on resource dependence (or more specifically, export-dependence on resources) rather than resource abundance.⁴ Some resource-rich countries (like the U.S.) do not rely much on primary commodity exports, while other resource-rich countries (especially oil-exporters) depend heavily on primary commodity exports.

Second, we disaggregate the data on natural resources to determine if different resource types have different effects on capital accumulation.⁵ Mining and petroleum extraction, for example, are often very capital-intensive processes, which means that countries that rely heavily on these activities may have higher than average levels of physical capital. On the other hand, agricultural production tends to be not as capital intensive as other sectors, such as manufacturing.

Third, while much of the literature has either focused on individual countries or large-N cross-sections or panels, we concentrate on a single region. In any empirical estimation, we ideally would like a sample where (1) all the observations come from the same data generating process, and (2) there is sufficient variation in the explanatory variables that we are able to accurately estimate their effects. Limiting the sample to a single region, and one that has shared a common colonial background (or similar background in the case of Brazil) increases the possibility that the observations come from the same data generating process.⁶ While large samples increase the risk of inappropriately pooling data from heterogeneous countries, focusing on a small sample of countries brings its own risks; namely, that there is no interesting variation to investigate. Fortunately, Latin America has enough variability in resource dependence to make the region an appropriate laboratory for our purposes.⁷ Besides overall variation in natural resources, there is also variation in the different types of resources.⁸

Fourth, as noted above, we investigate the relationship between natural resources and physical and human capital accumulation and not on economic growth per se. Growth regressions that include education, investment, and natural resources as right hand side variables imply that resources do not affect growth via human or physical capital accumulation. In these specifications, resource intensity only raises growth through its effect on total factor productivity. There is both theoretical and empirical evidences that resources affect human and physical capital, however, which means that augmented

Solow regressions that include resource dependence as an independent variable are unlikely to fully capture the effect of resources.

Lastly, Grier (2002) shows that there are important spillover effects between human and physical capital accumulation in Latin America. Investigating the effect of resource dependence on human or physical capital by itself will not reveal the true overall effect because we are not controlling for these spillovers. We confirm Grier's (2002) result that human and physical capital are significantly related to one another in Latin America and show that the effect of human capital on physical capital is large and economically important. In our baseline model, an increase in human capital of 1% is associated with an increase of physical capital of 1.8%. The magnitude of the effect of physical capital on human capital is smaller, where a 1% increase on physical capital is associated with an increase in human capital of 0.23%. For this reason, we study resource dependence in a simultaneous model of physical and human capital.

We find little evidence that overall resource dependence has a direct and statistically significant effect on human and physical capital accumulation in the region.⁹ In fact, we find that the long run effect of total primary commodity exports has a positive quantitative effect on the accumulation of both human and physical capital.¹⁰ We go on to disaggregate natural resources into three groups (petroleum, mineral, and agricultural) and find several interesting results. Petroleum exports are associated with higher levels of physical capital and lower levels of human capital. The long run effect of petroleum exports is similar in that they positively affect physical capital and negatively impact human capital. We also show that Latin American countries that export a large percentage of agricultural goods have lower levels of physical capital on average and that mining exports are never significantly related to either physical or human capital accumulation. The long run effect of agricultural exports on physical capital is quantitatively important. A one percent increase in agricultural export intensity is associated with a 0.20% decrease in physical capital.

Natural resources and capital accumulation

Most of the empirical work on natural resources emphasizes the link between resources and economic growth.¹¹ While it is important to study the relationship between resources and overall growth, we still need to identify the channels through which the resource curse works. That is, natural resource dependence can affect growth through its impact on factor

⁴ See Brunnschweiler (2008) and Gylfason (2008) for more on this topic.

⁵ By the term primary commodities, we refer to those commodities that Leamer (1984) argues are particularly resource-intensive, such as petroleum, forest products, animal products, tropical agricultural products, and cereals. In Table 2 we discuss which commodities are considered resource intensive.

⁶ Grier and Tullock (1989) show that countries from Latin America, Asia, Africa, and Western Europe do not share a common set of coefficients in growth regressions.

⁷ For instance, for the years 1975–2004, natural resource exports made up an average of 12% of GDP in the region. Venezuela, Ecuador, Honduras, and Chile, however, exported more than one standard deviation above this average during this time period. Venezuela's natural resource exports were around 23% of GDP, Ecuador's was 21%, and Honduras and Chile followed closely behind with resource exports accounting for approximately 19% of GDP. On the low end of the range were Mexico and Brazil, both of which had natural resource exports equal to around 5–6% of their national income. All of the numbers cited in this paragraph were calculated by the authors using data from the United Nations Commodity Trade Statistics Database and the World Bank's World Development Indicators.

⁸ For instance, while 84% of Venezuela's exports consist of petroleum, most of the region does not export a lot of oil. There are 6 countries in our sample where oil exports make up less than 1% of total exports (Nicaragua, Chile, Costa Rica, Uruguay, Honduras, and Paraguay). Similar variation can be found in the region in agricultural exports as well as non-petroleum mineral exports. Table 1 provides more information on this topic.

⁹ We do find, however, that the coefficient on an alternative measure of resource dependence is weakly significant in the physical capital equation. When using the disaggregated indicators of natural resources, our results are very similar when we use either natural resources as a share of GDP or as a share of total commodity exports.

¹⁰ The long run effect of overall natural resources on physical capital is significant at the 5% level, while the effect on human capital is insignificantly different from zero.

¹¹ There is extensive work on the relationship between resource abundance and economic growth. While some argue that it is possible that resource wealth can stimulate economic growth (Lewis, 1989; Brunnschweiler, 2008), much of the literature emphasizes the drawbacks to resource abundance (Auty, 2001a; Corden, 1984; Gelb, 1988; Neary and van Wijnbergen, 1986; Prebisch, 1950; Sachs and Warner, 1999; Tornell and Lane, 1999; Arezki and van der Ploeg, 2010; Coxhead, 2007; Bulte and Damania, 2008). See Lederman and Maloney (2008) for a good literature review on the impact of resource abundance on growth and Wick and Bulte (2009) for an overview of the literature on the resource curse.

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