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Resource Abundance, Poverty and Development*

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Resource Abundance, Poverty and Development

Abstract: We examine the relationship between resource abundance and several indicators of human welfare. Consistent with the existing literature on the relationship between resource abundance and economic growth, we find that resource-abundant countries tend to suffer low levels of human development. While we find no support for a direct link between resources and welfare, there is an indirect link that operates through institutional quality. There are also significant differences in the effects that resources have on different measures of institutional quality. These results imply that the "resource curse" is a more encompassing phenomenon than previously considered, and that key differences exist between the effects of different resource types on various aspects of governance and human welfare.

Key words : resource curse, human development, resource wealth and scarcity

JEL Classifications: Q00, O10, O13

Resource Abundance, Poverty and Development

1. Introduction

Conventional economic reasoning suggests that increasing a country's stock of assets provides greater opportunities for economic development. Somewhat paradoxically, a substantial body of empirical evidence demonstrates that natural resources tend to hinder, rather than promote economic growth. The seminal and influential studies of Sachs and Warner (1997, 2001) show that after controlling for a wide variety of variables, an increase of one standard deviation in natural resource intensity leads to a reduction of about one percent per year in economic growth. This finding inspired a large volume of subsequent empirical research. The general conclusion that emerged from the first round of empirical studies was that the Sachs-Warner result remains remarkably robust and is unaffected by the inclusion (exclusion) of terms in the set of conditioning variables. This result has been coined the "resource curse".

Economic growth *per se* is a poor indicator of welfare. It is conceivable that even if natural resources are a curse for economic growth narrowly defined, they may lead to improvements in other aspects of welfare – such as the prevalence of poverty, malnutrition, and infant mortality. It is an open question to what extent growth dividends, if any, percolate to other perhaps more vulnerable members of society. The record of growth in recent decades shows that many countries with low per capita growth rates have succeeded in providing food security and meeting basic nutritional needs, while others with higher growth rates have failed (Thomas *et al* 2000). The link between resource abundance and underdevelopment is therefore unknown, *a priori.*

The main objective of this paper is to analyze whether the negative statistical relationship between natural resource abundance and economic growth has a parallel in measures of *economic underdevelopment* and *welfare*. While underdevelopment and welfare clearly are not independent of economic growth, there are important differences between these variables. Underdevelopment and welfare indicators are typically expressed as "levels", whereas economic growth is measured as a change in levels over time.[1] Levels capture differences in economic performance over long time periods, and are directly relevant for welfare as measured by the consumption of goods and services (Hall and Jones 1999). Empirical work by Easterly *et al* (1993) reports relatively low correlation of growth rates across decades, suggesting that differences in growth rates across countries may be transitory and that a focus on 'levels' may be appropriate. Moreover, underdevelopment and welfare indicators capture distributional considerations that are not captured by aggregate growth statistics. For example, some indicators capture the population share for which so-called basic human needs are met. This information complements income growth statistics to provide a more complete picture of the effect of resources on well being in society.

The paper is organized as follows. In section 2 we review the theoretical and empirical literature on the relationship between resource abundance and economic growth. Building on this literature, we develop an empirical model to analyze the impact of resources on underdevelopment and welfare. This model is outlined in section 3. In section 4 we present the empirical results and discuss the main implications for development policies. Section 5 concludes.

2. The resource curse and its explanations

Why might resource-rich countries grow slower than resource-poor ones? In the 1950s several "structuralist" explanations were developed, focusing on declining terms of trade for primary commodities (e.g. Prebisch 1950), sharp fluctuations in the prices of such commodities, or lack of

linkages between resource extraction enclaves and the rest of the economy (Hirschman 1958). None of these explanations have stood the test of closer empirical scrutiny (e.g., Cuddington 1992; Dawe 1996; Behrman 1987; Tan 1983; Moran 1983; Lutz 1994, Fosu 1996).

In more recent times, economists and political scientists have advanced new theories to explain the disappointing growth performance of resource-rich countries, and these theories appear to be converging. In this section we briefly review the main economic explanations for the resource curse: Dutch disease models, rent seeking models and institutional explanations.[2]

One class of hypotheses, of which the Dutch disease is most famous, postulate that a resource boom will divert a country's resources away from activities that are more conducive to long run growth. According to the formal Dutch disease mechanism, a resource boom causes a country's exchange rate to appreciate, which in turn causes a contraction in its manufacturing exports. Others postulate that a booming resource sector may draw capital and labor away from manufacturing, raising manufacturing costs as a result (Neary and van Wijnbergen 1986). The result is to erode a country's ability to compete on world markets, reducing the potential for export-led growth of manufactures in the long run. But this in itself need not induce lower growth rates, since growth in the resource sector could more than offset stagnation in manufacturing. To explain why resource booms may generate lower growth, it is often assumed that the manufacturing sector is the main 'engine of growth,' either because it either generates positive externalities or is subject to increasing returns to scale at the level of the sector (Matsuyama 1992; Sachs and Warner 1999; Torvik 2001).[3] Others believe that a more direct growth-limiting process is at work, that a resource boom can crowd out public and private investments in human capital (Gylfason 2001) or discourage entrepreneurship (Sachs and Warner 2001).

There is little empirical support for the Dutch disease as an explanation for the resource

curse. Perhaps this comes as no surprise. An overview of different case studies in Auty (2001a) demonstrates how complex and diverse the experiences of different resource-rich countries are. There are many exceptions to the resource curse both in the developed and developing world – countries that have used their resources to build modern and successful economies. A satisfactory explanation of the resource curse hypothesis must explain why resource abundance retards growth in some countries, e.g. Nigeria and Venezuela, and promotes development in others, e.g. Australia and Malaysia. The Dutch Disease argument fails to capture this context-dependent complexity. In recent statistical analyses, terms of trade effects typically do not appear as significant determinants of growth rates either (Leite and Weidmann 1999, Sala-i-Martin and Subramanian 2003.)

The second category of explanations revolves around the potentially destructive role of rent seeking in resource-rich countries. Rent-seeking models are built on the assumption that resource rents are easily appropriable, which in turn leads to bribes, distortions in public policies, and a diversion of labor away from productive activities and toward seeking public favors. Torvik's (2002) analysis nicely illustrates how this can cause resource booms to diminish economic growth. In his model the public sector acquires income through resource sales and fixed-rate taxation of manufacturing, and rent-seekers compete to obtain shares of it. Individuals can allocate their efforts either to productive activity or to rent seeking, and arbitrage equalizes the return to both endeavors. A resource boom increases public sector revenue, drawing more entrepreneurial talent into rent-seeking and away from manufacturing. As entrepreneurs switch from modern manufacturing, income and demand fall, as do profits from entrepreneurship. Production in manufacturing falls more than the increase in natural resource income, as a consequence of (assumed) increasing returns to scale in manufacturing. Society as a whole is worse off following the resource boom.

Since, as mentioned above, the available evidence suggests that resources are a curse to development only for some countries and not for others, the basic rent-seeking explanation is too blunt. There have been attempts to enrich rent-seeking models with multiple equilibria, where comparative statics are conditional on the specific equilibrium that prevails. In such systems, the effect of resource abundance on growth becomes context-specific and essentially determined by "initial conditions," e.g. Acemoglu (1995) and Baland and Francois (2000).

Mehlum *et al*. (2002) point out that the growth effects of resource abundance might depend on a country's governance institutions and carry out an institution-specific analysis of the resource curse, regarding institutions as pre-determined or "fixed". Formally, they assume that returns to entrepreneurial activities and rent seeking are determined by the institutional context. In so-called 'grabber-friendly' economies, resource booms trigger a move of labor from production to rent seeking, to the detriment of aggregate growth—the curse materializes. In countries with 'producer-friendly' institutions instead, a resource boom boosts production. To our knowledge there have been no statistical analyses explicitly linking resource booms to rent seeking activity – this stream of literature appears to have developed separately as largely untested theoretical exercises.[4]

The third category of explanations also sees a connection between resources and institutions, but finds that the type of resource matters and regards the form of government as the salient institutional feature. For example, in his examination of transition economies, Auty (2001a,b) argues that resource-rich countries, especially those with so-called 'point resources' like oil fields, tend to be dominated by factional and predatory oligarchic polities, governments that promote narrow sectional interests. Countries well endowed with point resources, then, are expected to have 'bad policies' — policies postponing the transition to competitive industrialization

and diversification of the economy. As a result, the resource sector supports a burgeoning non-tradable sector made up of infant industries and an inflated but unproductive public sector.[5]

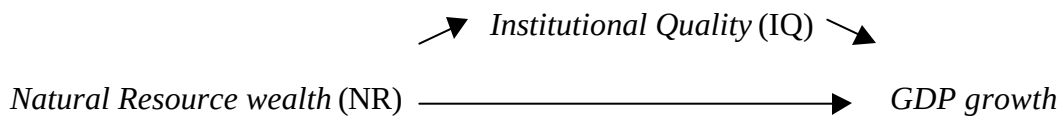
Recent Empirical Evidence

There is now ample empirical support for the key role that political and institutional variables play in economic growth. Beginning with Leite and Weidmann (1999, hereafter LW), it has been shown that resource abundance is a major factor shaping the institutional context within which investment and production take place. LW demonstrated that (*i*) abundant 'point resources' tend to stimulate corruption, and (*ii*) corruption, in turn, retards economic growth. After controlling for the level of corruption, LW find that exports of fuels and ores are no longer significant in economic growth regressions. This suggests that there is no *direct effect* of resource wealth on economic performance, but there is an important *indirect effect*: resources affect the level of corruption, which in turn determines growth. In other words, resource abundance could help shape the "social infrastructure," the importance of which has been demonstrated by Hall and Jones (1999).

This important result has been confirmed and placed in a more general context in two recent papers by Isham et al (2003, hereafter IWPB) and Sala-i-Martin and Subramanian (2003, hereafter SS). IWPB and SS do not only examine corruption, arguably just one dimension of institutional quality, but instead try to find alternative and broader governance indicators. They examine two causal links.

First, if the effect of natural resources (NR) on growth is indirect, as suggested by findings of LW, then, holding institutional quality (IQ) constant, NR should have no separate effect on growth. An alternative explanation, one that accommodates other explanations such as the Dutch

disease, would postulate an extra link in the chain – one that runs directly from NR to GDP growth. These two versions of the chain can be represented as follows:



If the entire effect of resources on growth operates through the effect on institutions, then the top, two-link chain is correct. If, however, resources also affect growth directly, then the link indicated by the bottom-most arrow is also operative. To isolate the causal mechanisms, SS (and IWPB and LW) proceed as follows. They estimate a model with two equations: a growth equation and an institutional quality equation. Their growth equation is specified as follows:

1. $$\text{growth}(1970\text{-}1998) = a_0 + a_1 * \text{conditioning variables} + a_2 * \text{price volatility} + a_3 * \text{overvaluation of exchange rate} + a_4 * IQ + a_5 * NR + e$$

In keeping with the underlying causal story, a current (1998 in SS) measure of IQ is used, while NR is measured at a point in the past (1970 in SS). SS hypothesize that resource abundance might affect growth through volatility of prices, overvaluation of the exchange rate, and institutional quality. They include variables to capture the effects of these factors. If these channels are accounted for, however, then NR should not have any separate effect on growth. They test this last prediction by including NR separately and examining the significance of a_5.

SS assume Institutional Quality is measured with error and estimate equation (1) with instrumental variables for IQ to control for this. Their instruments are the fraction of population

speaking English as first language and the fraction speaking a major European language (English, Spanish, French, German, and Portugese). The conditioning variables in equation (1) include variables macroeconomists often employ to explain growth: income in 1970 (to test the convergence hypothesis), the primary + secondary + tertiary school enrollment in 1960, the relative price of investment goods, the prevalence of malaria in 1966, and population density in coastal areas.[6]

SS find that the conditioning variables are generally significant and of the expected sign.[7] The main conclusion is that *given* a certain level of institutional quality and price volatility, natural resources have no separate effect on growth. IQ does affect growth, however, and so do price volatility and the usual conditioning variables.

The next step is to unravel the determinants of institutional quality, and here SS adopt the following specification:

2. Institutional Quality = $b_0 + b_1$*conditioning variables + b_2*price volatility
+ b_3*overvaluation of exchange rate + b_4*instruments for IQ + b_5*NR + e.

In equation (2) a current (1998) measure of institutional quality is specified to depend on an historic (1970) indicator of natural resource abundance, and on the other variables indicated. The main results from estimating equation (2) are as follows.[8] Fuels and minerals measures of NR, which are point resources, have a strong negative correlation with IQ. However, food and agricultural products measures of NR, which are diffuse resources, are *not* significantly correlated with IQ.[9]

The main conclusion from the institutional equation, therefore, is that 'point' or concentrated NR result in "bad" institutions, but 'diffuse' resources do not.[10] Point resources are

extracted from a narrow geographic or economic base and include oil, minerals and plantations. The fact that these resources are concentrated implies that they can be protected and controlled at relatively modest cost. An abundance of these resources is typically associated with inequality in terms of power and the division of the surplus, and often is accompanied by vertical relationships between agents (shareholders, managers, laborers). Diffuse resources, on the other hand, are spread thinly in space, and harvested or utilized by agents characterized by horizontal relationships of rough equality. Formal theories for this phenomenon have yet to be developed, however, IWPB offer a non-technical discussion of possible explanations.[11]

The overall picture that emerges is that the direct effect of resource wealth on economic growth disappears whenever institutional quality is controlled for, however an important indirect effect exists. Resource wealth negatively affects the quality of institutions, and institutional quality in turn is an important determinant of economic growth. We will refer to this as the LW-IWPB-SS approach in what follows, and explore to what extent its implications carry over to indicators of human welfare and development, which represent levels rather than growth rates.

3. Data and Empirical Procedure

Our aim is to explore the impact of natural resources, possibly channeled through institutional quality, on undernourishment, poverty, and other human development indicators (DI). The basic maintained hypothesis is that human development is affected by institutional quality (IQ) and by income. This is consistent with results on public goods provision reported in Deacon (2003). Both IQ and income are, in turn, potentially affected by natural resource wealth, NR. However, holding IQ and income constant, NR is hypothesized to have no separate effect on development indicators DI. To test this view of human development outcomes, we estimate the following model:

3. $DI = d_0 + d_1*IQ + d_2*$ Per Capita GDP $+ d_3*NR + d_4*$conditioning variables + e.

This is a counterpart to the growth models, e.g., equation (1), estimated by other researchers. The hypothesis that natural resource abundance has no direct effect on DI, once IQ is controlled for, is tested by checking the significance of d_3 in equation (3).

Definitions, sources, and summary statistics for the variables used in empirical work are presented in Appendix Tables A1 and A2. The current DI variables we employ are: the percentage of the population that is undernourished (%Undernour.), the UN Human Development Index (HDI_01), the UN Human Poverty Index (HPI_01), the percentage of children that are underweight (%Underwgt.), and life expectancy at birth (LifeExp.)

As IQ variables, we consider current (1998) values of the World Bank's: rule of law indicator (RL), measure of Voice and Accountability in government (VA), and indicator of Government Effectiveness (GE). Rule of law (RL) is an index that measures the extent to which agents abide by the rules of society. It is comprised of indicators for the protection of property rights and the predictability of the judiciary. Government effectiveness (GE) measures the capacity of the government to formulate and enforce policies. It is formed from measures of the quality of the civil service and bureaucratic efficiency. The main focus of this index is on measuring inputs that are deemed necessary for the efficient provision of public services. Finally, Voice and Accountability (VA) is constructed from various indicators that capture the extent to which citizens participate in the selection of government and the freedom of the press. It is often interpreted as a measure of the outcomes of a participatory democracy (Lindert 2003).

Following Isham *et al*, we distinguish between point and diffuse resources. Accordingly, we disaggregate export data into two classes: (*i*) Fuels, Ores, and Minerals, which we regard as point resources, and (*ii*) Agricultural products and Food, which are deemed diffuse resources.[12] In keeping with virtually all of the resource curse empirical literature, we use resource exports as a share of total exports to indicate resource abundance.[13] As conditioning variables we include 1970 income and 1960 school enrollment – variables that have been identified as important in earlier work by others. Summary statistics are reported in the Appendix Table A2.

We take the IWPB-SS results on growth (equation 1) as given: IQ has a positive effect on current income, but holding IQ constant NR has no separate effect on current income. We then proceed to estimate equations for institutions and for human development in a fashion that allows us to unveil the channels through which natural resource abundance and human development are related.

4. Results of regression analyses

We estimate two equations: an institutional quality equation (equation 2 above) and a "development" equation (equation 3 above,) which is our counterpart of the usual growth equation. We examine alternative measures of NR, IQ and DI, hence the total number of regression equations estimated is considerable. Table 1 reports results for the institutional quality regression. In this Table, the columns correspond to three different indicators of institutional quality in 1998, the dependent variables in the regression equations. Our primary interest is in the relationship between 1970 measures of point and diffuse resources and 1998 values of institutional quality.

<Insert Table 1 about here>

Table 1 clearly indicates that countries with abundant point resources end up with "bad institutions," governments that perform poorly along several dimensions, and that countries with abundant diffuse resources show no tendency to follow this pattern. This is consistent with results reported by LW-IWPB-SS. The absolute magnitude of point resources on institutional quality is substantial. The standard deviation of the variable "Point/Export" is 33.9 (see Appendix Table A2). A country whose Point/Export index falls by one standard deviation would increase the RL, VA and GE variables by 0.24, 0.28 and 0.30, respectively. Since the standard deviation of these variables are only 0.99, 0.97 and 0.99 (see Appendix Table A2), these clearly are large effects.

The magnitudes involved are further detailed Table 2, where we report beta coefficients of key explanatory variables. Beta coefficients are computed by multiplying a regression coefficient by the standard deviation of its variable and then dividing the product by the standard deviation of the dependent variable. They indicate the magnitudes of associations between variables in terms of their standard deviations; for example, the -.24 coefficient relating Rule of Law to Point/Export indicates that a 1 standard deviation change in the point resource export variable is associated with a 0.24 standard deviation change in a country's rule of law index. The magnitudes of the effects of point resource abundance on all three measures of institutional quality are strikingly similar. Education also has a large and significant effect on these measures. There are however, noticeable differences in the relative rankings of the explanatory variables in the equations. In the VA equation, point resource exports have a greater impact than does Income, whereas the ordering is reversed for RL and GE.

<Insert Table 2 about here>

Next, we turn to results of the development equation. The initial expectation is that each indicator of development is enhanced by better institutions and by higher income. Table 1

established that point NR abundance is negatively associated with IQ. Thus, a finding that IQ variables are in turn significantly related to development indicators would imply that the resource curse applies to development outcomes indirectly, through the governance channel. We also include NR as a separate regressor in DI models, to determine whether resource abundance also has a *direct* effect, after accounting for other channels. In Tables 3a-c we summarize key results for the three institutional measures introduced earlier: RL, VA and GE.

<Insert Tables 3a-c about here>

A fairly consistent story emerges From Tables 3a-c. First, higher incomes are consistently associated with better development outcomes. Note that a negative coefficient on certain indicators, such as the percentage of the population that is undernourished, corresponds to a positive effect on development. Second, conditional on income, better institutions are often, but not always, associated with improved development. It is interesting to note that some indicators appear more responsive to institutional quality than others – compare the impact of institutions on the HDI indicator versus the impact on the percentage of underweight children. As we note in the concluding section, formal theories of the resource curse are not sufficiently well-developed at this point to shed light on why this results occurs. Third, some measures of institutional quality are significantly associated with specific development indicators, while others are not. For example, Voice and Accountability alone has a significant (negative) association with the human poverty index. Aside from this, however, the results are fairly consistent. For example, there are no instances where better institutions are significantly associated with worse development outcomes. Fourth, and importantly, holding income and institutions constant, point resource abundance has *no significant association* with development indicators in the vast majority (13 of 15) of cases examined.

How important is the impact of natural resources for the various development and welfare indices in a quantitative sense? In Table 4 we show the *indirect impact* of lowering the Point/Export variable by one standard deviation, which affects welfare through the channel of better institutions. In order to interpret the numbers in Table 4, one can compare their magnitudes to the standard deviations for development indicators, which are reported in Appendix Table A2.

<Insert Table 4 about here>

Based on this comparison we conclude that the impact of the resource curse is substantial, but also note that the impact on development is generally smaller than the impact on economic growth. For example, IWPB report that a decrease of one standard deviation in the resource index yields an increase in the annual per capita growth rate of about 0.5. Since the standard deviation of the growth variable is about 2.4, this amounts to a "relative effect" of $0.5/2.4 \approx 20\%$. The impact of a one standard deviation decrease in the resource index on development outcomes is more modest, typically about 10%.

Our results confirm a general conclusion emerging form other policy research: that the "black box" of good institutions in some way improves economic outcomes. However, this generic finding does not by itself provide any firm policy prescriptions, nor does it provide any evidence of causal mechanisms. The somewhat diverse results in Tables 3a-3c are interesting in this light, because they suggest possible causal links. They indicate that even after controlling for initial income and other factors, there are consistent differences between variables that represent the political architecture of the state (VA) and those that represent ownership protections (RL) and the efficiency of public service provision (GE). For instance, RL and GE have no significant association with the human poverty index and the percentage of Underweight Children, while VA (a proxy for democracy) leads to improvements in both measures.

Deacon's (2003) analysis of public good provision provides one possible explanation for these differences. In autocratic regimes a small ruling elite controls the government and public policies consequently tend to be biased in favor of the elite. By contrast, public policies in more democratic regimes tend to reflect the preferences of a much broader segment of the population. The Voice and Accountability governance indicator is largely a measure of democracy, whereas the Rule of Law and Government Effectiveness indicators respectively capture differences in property rights protection and technical efficiency in the supply of public goods.[14] With this interpretation, technical efficiency in the supply of public goods (a high GE index) and security of property rights (a high RL index) apparently are not sufficient to improve all dimensions of human deprivation, particularly those that require representation of the worst-off segments of society. A political system that is responsive to the preferences of society in very broad terms appears to be a necessary adjunct.

Since political variables appear to play a vital role in determining the effect of natural resources on various measures of development, it is prudent to check whether the results are robust to alternative measures of political institutions. This is particularly important in the present instance since the VA index is based largely on subjective perceptions and has been criticized by some for a lack of precision and objectivity. An alternative set of political measures is available from Marshall and Jaggers (2003). They provide a 10-point index of democratic institutions (with higher numbers indicating greater democracy) based on the competitiveness of political participation, the competitiveness of executive recruitment, the openness of executive recruitment and constraints on the chief executive. While the resulting index is ordinal, the authors' intent clearly is to represent underlying components objectively. Marshall and Jaggers (2003) also provide a 10-point index of autocratic attributes (with 10 indicating complete autocracy) that

reflects an absence of political competition, regulation of political participation, a relatively closed system of executive recruitment and a general lack of constraints on the chief executive. These governance indicators were used to check the robustness of our earlier results on equation (2), which examines the effect of resource abundance on institutions.

Table 5 reports these results; the dependent variables are, alternatively, the Marshall and Jaggers (2003) indices of democracy and autocracy and the independent variables are the same as those in Table 1. These results strongly reinforce one of our principal findings: point resources tend to promote autocratic governance and diminish democratic governance. In addition, however, it now appears that diffuse resources seem to systematically promote more democratic forms of governance. This contrasts with the earlier results where diffuse resources were found to have no impact on the three IQ variables examined originally. The general conclusion that emerges from Tables 1 and 5 is that past levels of resource abundance are strongly associated with subsequent political structures and with measures of other (non-political) social institutions.

<Insert Table 5 about here>

We also considered the effects of democracy and autocracy on various development indices, but for brevity have not included tables of results here. Consistent with our earlier results, democracy leads to improvements in all measured dimensions of welfare. Overall, these results confirm Amartya Sen's (1999) dictum that democracy creates political incentives for rulers to provide basic needs, and his related observation that famines seldom afflict democratic regimes. Our empirical analysis also reveals that, holding income and political attributes constant, natural resource abundance has no direct effect on development indicators.[15]

5. Conclusions and discussion

We have examined whether the paradoxical result that resource-rich countries tend to grow slower than their resource-poor counterparts also applies to the relationship between resource wealth and several measures of human development. In other words, we extend the literature on the resource curse by considering a broader set of welfare and development criteria.

Our main findings are consistent with the consensus that appears to be emerging in the resource curse and growth literature. After examining several alternative models and measures of institutional quality and human development, we find that *point resources* are typically associated with less democratic regimes and with unproductive social institutions. Interestingly, point resources are assets that can be easily controlled by relatively small groups in society, often resulting in a highly skewed distribution of income. Isham *et al* discuss why point resources might trigger bad scores on such governance indicators. One potential explanation is that elites in control of point resources resist industrialization, which would dilute their power base. The result is delayed modernization and low levels of development. Another explanation is that export composition affects social structure – think of horizontal relationships between agents based on equality and cooperation versus systems geared by clientelism and distrust (see also Ross 1999). We conclude that formal modeling of the linkages between resource endowments and institutional structure should be a high priority for those who seek to understand the how the resource curse works.

Our second result is that countries with unproductive institutions and elitist governance tend to score lower on various development indicators. This implies that the resource-curse is a phenomenon that occurs at a broader scale than just economic growth – countries that rely on point resources tend to perform worse across a spectrum of criteria. This reinforces a conclusion that

others have reached: institutional reform may well be a necessary condition for countries to develop. Finally, if the effects of income and governance are accounted for, both point and diffuse resource abundance typically have no significant impact on development. In other words, the impact of resources on development is indirect and occurs only through channels of institutional quality.

Future research arguably should be based on other measures of resource abundance. Following Sachs and Warner (1997), most studies measure resource abundance by the share of natural resource exports in GDP (or total exports). This is of course a direct measure of country's resource export dependence, and as a flow measure it is at best only an imperfect proxy for a country's actual resource stock. Export shares will not be an accurate measure of resource abundance unless there is a consistent and invariant mapping between *in situ* resource stocks and annual exports of these stocks.[16] A skeptic could argue that the generic SW regression merely demonstrates that primary export intensity hampers growth, and dismiss the more far-reaching proposition that resource abundance impedes growth. To demonstrate convincingly that resource abundance is indeed a curse, and that the results now so prominent in the literature are not spurious, future empirical analysis needs to be based on measures of resource stocks (see Stijns 2002).

References

Acemoglu, D., 1995. Reward Structures and the Allocation of Talent, *European Economic Review* 39: 17-33.

Acemoglu, D., S. Johnson and J.A. Robinson, 2001. The Colonial Origins of Comparative Development: An Empirical Investigation, *American Economic Review* 91: 1369-1401.

Auty, R.M., 2001a. *Resource Abundance and Economic Development*, Oxford: Oxford University Press.

Auty, R.M., 2001b. The Political Economy of Resource-driven Growth, *European Economic Review* 45: 839-846.

Baland J.M. and Francois, P., 2000. Rent Seeking and Resource Booms. *Journal of Development Economics* 61: 527-42.

Behrman, J. 1987, Commodity Price Instability and Economic Goal Attainment in Developing Countries, *World Development* 15: 559-573

Collier, P. and A. Hoeffler, 1998. On Economic causes of Civil War, *Oxford Economics Papers* 50: 563-573.

Cuddington, J.T., 1992. Long Run Trends in 26 Primary Commodity Prices, *Journal of Development Economics* 39: 207-227

Damania, R and E. Bulte, 2003. Resources for Sale: Corruption, Democracy and the Natural Resource Curse, School of Economics, University of Adelaide, July 2003.

Dawe, D., 1996. A New Look at the Growth in Developing Countries, *World Development* 24: 1905-1914

Deacon, R., 2003. 'Dictatorship, democracy, and the provision of public goods", Working paper, Department of Economics, University of California, Santa Barbara, June 2003.

Easterly, W., M. Kremer, L. Pritchett and L Summers, 1993. Good Policy or Good Luck? Country Growth Performance and Temporary Shocks, *Journal of Monetary Economics* 32: 459-483

Fosu,A.K., 1996. Primary Exports and Economic Growth in Developing Countries, *World Economy* 19: 465-475.

Gylfason, T., 2001. Natural Resources, Education and Economic Development, *European Economic Review* 45: 847-859.

Hall, R and C. Jones. 1999. Why do some Countries Produce so Much More output than Others? *Quarterly Journal of Economics* 114, 83-116.

Hausman, R and R. Rigabon, 2002. *An Alternative Interpretation of the 'Resource Curse': Theory and Policy Implications*, NBER Working Paper Series, WP 9424, Cambridge: National Bureau of Economic Research.

Hirschman, A.O., 1958. *The Strategy of Economic Development*, New Haven: Yale University Press.

Isham, J., M. Woodcock, L. Pritchett and G. Busby, 2003. The Varieties of Resource Experience: How Natural Resource Export Structures Affect the Political Economy of Economic

Growth, Middlebury College Economics Discussion Paper 03-08, Vermont: Middlebury College.

Karl, Terry Lynn, 1997. *The Paradox of Plenty: Oil Booms and Petro-States*. Berkeley: University of California Press.

Kaufmann, Daniel, Aart Kraay, and H. Mastruzzi, *Governance Matters III: Governance Indicators for 1996-2002*, World Bank, June 30, 2003.

Leite, C and J. Weidmann, 1999. *Does Mother Nature Corrupt? Natural Resources, Corruption and Economic Growth*, Working Paper of the International Monetary Fund, IMF Working Paper WP/99/85.

Lindert P., 2003. Voice and Growth: Was Churchill Right? *Journal of Economic History* 63: 315-350.

Lutz, M., 1994. The Effects of Volatility in the Terms of Trade on Output Growth: New Evidence, *World Development* 22: 1959-1975

Matsuyama, K., 1992. Agricultural Productivity, Comparative Advantage and Economic Growth, *Journal of Economic Theory* 58: 317-334.

Marshall, Monty G., and Keith Jaggers, 2000. *Polity IV Project: Political Regime Characteristics and Transitions, 1800-1999* [computer file]. Center for International Development and Conflict Management, University of Maryland, College Park, MD.

Mehlum, H., K. Moene and R. Torvik, 2002. *Institutions and the Resource Curse*, University of Oslo, Department of Economics, Mimeo.

Moran, C., 1983. Export Fluctuations and Economic Growth, *Journal of Development Economics* 12: 195-218

Murphy, K., A. Shleifer and R. Vishny, 1989. Industrialization and the Big Push, *Journal of Political Economy* 97: 1003-1026.

Neary, P and S. van Wijnbergen, 1986. *Natural Resources and the Macroeconomy*, Cambridge: MIT Press.

Prebisch, R., 1950. *The Economic Development of Latin America and its Principal Problems*, Lane Success, NY: United Nations.

Repetto, R. and M. Gillis, 1988. *Public Policies and the Misuse of Forest Resources*, Cambridge: Cambridge University Press.

Robinson, J.A., R. Torvik and T. Verdier, 2002. *Political Foundations of the Resource Curse*, CEPR DP Series No 3422, London: Centre for Economic Policy Research.

Ross, Michael L., 1999. The Political Economy of the Resource Curse, *World Politics* 51: 297-322.

Ross, Michael L., 2001. *Timber Booms and Institutional Breakdown in Southeast Asia*. Cambridge University Press.

Sachs, J.D and A.M. Warner, 1997. *Natural Resource Abundance and Economic Growth*, NBER Working Paper Series, WP 5398, Cambridge: National Bureau of Economic Research.

Sachs, J.D and A.M. Warner, 2001. The Curse of Natural Resources, *European Economic Review* 45: 827-838.

Sachs, J.D and A.M. Warner, 1999. The Big Push, Natural Resource Booms and Growth, *Journal of Development Economics* 59: 43-76.

Sala-I-Martin, X. and A. Subramanian, 2003. *Addressing the Natural Resource Curse: An Illustration from Nigeria*, Working Paper 9804, Cambridge, MA: National Bureau of Economic Research.

Sen, A.K., 1999. *Development as Freedom*, New York, Alfred Knopf.

Stijns, J., 2002. *Natural Resource Abundance and Economic Growth Revisited*, UC Berkeley, Department of Economics, Mimeo.

Tan, G., 1983. Export Instability, Export Growth and GDP Growth, *Journal of Development Economics* 12: 219-227.

Thomas, V. M. Daclam, A. Dhareshwar, D. Kaufman and R. Lopez, 2000 *The Quality of Growth* Oxford, Oxford University Press.

Tanzi, V., 1998. Corruption around the World: Consequences, Scope and Cures, *IMF Staff Papers* 45: 559-594.

Torvik, R., 2001. Learning by Doing and the Dutch Disease, *European Economic Review* 45: 285-306.

Torvik, R., 2002. Natural Resources Rent Seeking and Welfare, *Journal of Development Economics* 67: 455-70.

Tornell, A. and P. Lane, 1999. The Voracity Effect, *American Economic Review* 89: 22-46.

Appendix: Data sources and summary statistics

Table A1. Data sources and definitions

Variable	Source	Definition
%Undernour.	FAO	Percentage of people in the population that is undernourished in 1998-2000.
HDI_01	HDR	Human Development Index in 2001.
HPI_01	HDR	Human Poverty Index in 2001.
% Underwght.	HDR	% underweight children.
LifeExp.	HDR	Life Expectancy.
VA	KKM	Voice and accountability in 1998.
GE	KKM	Government Effectiveness in 1998.
RL	KKM	Rule of Law in 1998.
Democracy	Polity	Index of democratic attributes of political regime in 1990.
Autocracy	Polity	Index of autocratic attributes of political regime in 1990
DifExp_70	WDI	Diffuse resource exports (food and agricultural exports) as a share of total exports, 1970.
PointExp_70	WDI	Point resource exports (fuels and minerals) as a share of total exports, 1970.
EnglFr.	H&J	Fraction of the population speaking English as first language.
EurFr.	H&J	Fraction of the population speaking a major European language as first language (English, German, French, Spanish or Portuguese.)
Income	S&W	Log of GDP per member of economically active population (ages 15-64) in 1970.
Education	S&W	Enrollment rate in secondary education in 1960.

Sources: FAO, U.N. Food and Agriculture Organization.
HDR, U.N. Development Programme, *Human Development Report* online;
WDI World Bank, *World Development Indicators* online;
KKM, Kaufmann, Daniel, Aart Kraay, and Mastruzzi (cited in references;)
Polity, Marshall, Monty G., and Keith Jaggers, 2000 (cited in references;)
H&J, Hall, R and C. Jones, 1999 (cited in references;)
S&W, Sachs, J.D and A.M. Warner, 1997 (cited in references.)

Table A2. Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
%Undernour.	118	20.237	18.043	0	73
HDI_01	149	.684	.184	.275	.944
HPI_01	87	29.4	15.8	4.1	61.8
% Underwght.	97	16.68	12.57	1	48
LifeExp.	148	64.364	12.972	33.400	81.312
VA	179	-.029	.965	-1.93	1.55
GE	177	-.007	.992	-2.14	2.59
RL	179	-.0001	.994	-1.97	2.36
Democracy	126	3.65	4.30	0	10
Autocracy	126	4.26	3.88	0	10
DifExp_70	138	50.848	34.872	0	99.9561
PointExp_70	112	28.332	33.888	.0003	99.9998
EnglFr.	138	.103	.278	0	1
EurFr.	138	.264	.401	0	1.064
Income	117	8.995	.980	6.32	9.89
Education	110	97.130	21.043	17	114

*Table 1. Natural Resource Abundance and the Quality of Institutions**

	RL	RL	GE	GE	VA	VA
Initial GDP	0.41**	0.52**	0.35**	0.49**	0.13	0.18
	(3.01)	(3.78)	(2.22)	(3.07)	(0.94)	(1.29)
Enrollment	0.03**	0.02**	0.03**	0.02**	0.03**	0.02**
	(5.17)	(3.03)	(4.57)	(2.67)	(5.10)	(3.44)
Investment	-0.25	-0.36**	-0.20	-0.27	-0.14	-0.14
	(-1.68)	(-2.31)	(-1.14)	(-1.49)	(-0.92)	(-0.90)
English fraction	-0.07	0.19	-0.20	0.05	-0.02	0.03
	(-0.23)	(0.56)	(-0.52)	(0.13)	(-0.55)	(0.08)
European fraction	-0.15	-0.30	0.02	-0.12	0.51**	0.44
	(-0.68)	(-1.34)	(0.09)	(-0.45)	(2.31)	(0.05)
Diffuse resources	-0.022		0.03		0.003	
	(0.90)		(0.99)		(1.40)	
Point resources		-0.007**		-0.009**		-0.01**
		(-2.68)		(-2.87)		(-3.10)

*RL = Rule of Law, GE = Government Effectiveness, VA = Voice and Accountability.
** Significant at 5% or better.

Table 2. Relative magnitudes of natural resource effects on institutions

Variables	Rule of Law	Voice and Accountability	Government Effectiveness
Point/Export	-0.24	-0.27	-0.30
English language	0.05	0.01	0.01
European language	-0.12	0.18	-0.05
Income	0.48	0.17	0.45
Education	0.42	0.43	0.42
Investment	-0.18	-0.07	-0.14

Table 3a. Explaining Development. The effect of Resources, Institutions and Income: Rule of Law

	HDI	HPI	Undernourished population	Underweight children	Life expectancy
Diffuse resources					
GDP	9.8×10^{-6}**	-2.6×10^{-3}**	-1.4×10^{-3}**	-1.1×10^{-3}**	3.7×10^{-4}*
	(3.64)	(-4.35)	(-2.58)	(-2.61)	(1.71)
Diffuse	-3.3×10^{-4}	0.012	-0.012	0.026	-0.012
	(-0.88)	(0.25)	(-0.25)	(0.66)	(-0.41)
RL	0.66**	-0.08	-8.95**	-0.31	5.92**
	(2.86)	(-0.03)	(-2.81)	(-0.12)	(3.15)
Point resources					
GDP	1.0×10^{-5}**	-2.6×10^{-3}**	-1.4×10^{-3}**	-1.0×10^{-3}**	3.9×10^{-4}*
	(3.87)	(-3.93)	(-2.30)	(-2.26)	(1.81)
Point	5.3×10^{-4}	-0.014	0.004	-0.02	0.03
	(1.50)	(-0.28)	(0.68)	(-0.49)	(1.04)
RL	0.06**	0.06	-9.18**	-0.73	5.76**
	(2.61)	(0.02)	(-2.60)	(-0.26)	(2.94)

** Significant at 5% or better. * Significant at 10* or better.

Table 3b. Explaining Development. The effect of Resources, Institutions and Income: Voice and Accountability

	HDI	HPI	Undernourished population	Underweight children	Life expectancy
Diffuse resources					
GDP	1.3×10^{-5}**	-2.4×10^{-3}**	-2.5×10^{-3}**	-1.0×10^{-3}**	8.1×10^{-4}**
	(7.31)	(-5.76)	(-5.81)	(-3.81)	(5.30)
Diffuse	-5.2×10^{-4}	0.029	-0.029	0.044	-0.022
	(-1.36)	(0.61)	(-0.55)	(1.11)	(-0.68)
VA	0.04**	-3.81**	-1.18	-3.01*	2.08
	(2.39)	(-1.94)	(-0.55)	(-1.88)	(1.56)
Point resources					
GDP	1.3×10^{-5}**	-2.3×10^{-3}**	-2.4×10^{-3}**	-1.0×10^{-3}**	7.9×10^{-4}**
	(3.11)	(-5.28)	(-5.37)	(-3.56)	(5.75)
Point	1.0×10^{-3}**	-0.039	0.017	-0.04	0.055
	(2.64)	(-0.79)	(0.30)	(-0.97)	(1.70)
VA	0.05**	-4.35**	-1.39	-3.18*	2.73*
	(3.00)	(-1.98)	(-0.58)	(-1.80)	(1.88)

** Significant at 5% or better. * Significant at 10% or better.

Table 3c. Explaining Development. The effect of Resources, Institutions and Income: Government Effectiveness

	HDI	HPI	Undernourished population	Underweight children	Life expectancy
Diffuse resources					
GDP	1.3×10^{-5}**	-2.8×10^{-5}**	-2.0×10^{-3}**	-1.1×10^{-3}**	7.5×10^{-4}**
	(5.81)	(-5.60)	(-4.56)	(-3.37)	(3.90)
Diffuse	-3.7×10^{-4}	0.008	-0.014	0.027	-0.016
	(-0.98)	(1.61)	(-0.29)	(0.68)	(-0.50)
GE	0.03	1.75	-7.69**	-0.49	2.31
	(1.46)	(0.67)	(-2.96)	(-0.24)	(1.42)
Point resources					
GDP	1.3×10^{-5}**	-2.7×10^{-3}**	-1.9×10^{-3}**	-1.0×10^{-3}**	7.0×10^{-4}**
	(5.93)	(-4.79)	(-4.03)	(-2.80)	(3.81)
Point	6.8×10^{-4}*	-0.01	0.075	-0.025	0.041
	(1.87)	(-0.19)	(0.14)	(-0.59)	(0.40)
GE	0.04*	1.17	-7.49**	-1.25	3.02*
	(1.90)	(0.41)	(-2.60)	(-0.56)	(1.82)

** Significant at 5% or better. * Significant at 10% or better.

Table 4. The Quantitative Impact of Natural Resources on Welfare

	Rule of Law	Voice and Accountability	Government Effectiveness
Human Development Index	0.015	0.015	0.012
Undernourished Population	-2.21	-	-2.25
Human Poverty Index	-	-1.22	-
% Underweight Children	-	-0.89	-
Life Expectancy	1.38	0.76	0.91

Table 5. Natural resource exports and Democracy

	Democracy	Democracy	Autocracy	Autocracy
Initial GDP	1.89**	1.61**	-1.19**	-0.99*
	(3.10)	(2.71)	(-2.23)	(-1.91)
Enrollment	0.08**	0.06**	-0.06**	-0.03
	(3.45)	(2.17)	(-2.80)	(-1.40)
Investment	-1.11*	-1.57**	0.90	1.38**
	(-1.70)	(-2.35)	(1.58)	(2.37)
English fraction	-1.82	-1.21	2.60**	1.98
	(-1.28)	(-0.85)	(2.09)	(1.60)
European fraction	2.39**	2.52**	-2.97**	-2.99*
	(2.44)	(2.61)	(-3.47)	(-3.57)
Diffuse resources	0.03**		-0.028**	
	(3.06)		(-2.97)	
Point resources		-0.027**		0.025**
		(-2.33)		(2.50)

** Significant at 5% or better. * Significant at 10% or better.

Endnotes

[1] While the focus of the resource curse literature is to explain *income growth* over a given period, empirical models nearly always include the initial income level as a regressor. Accordingly, the resulting specification can be regarded as a model that explains the link between the historic level of resource abundance and current income (conditional on a past income level.) The human development models we estimate in Section 3 follow a parallel specification. We estimate the relationship between historic resource abundance and current human development, conditional on past income.

[2] Ross (1999) provides a discussion and critique of the political explanations – closely linked to our third category of economic explanations. In addition to these explanations there exists a rather disparate set of alternative theories and findings that might fit in the puzzle as well. For example, Collier and Hoffler (1998) demonstrate that increased endowments of natural resources raise the probability of civil war, with detrimental consequences for investment and growth.

[3] Some commentators argue that there is little evidence to suggest that a dependence on natural resources is intrinsically growth retarding. In a historical study of the mining sector, Wright (2002) asserts that mining is a technically advanced and knowledge intensive industry with as much capacity to generate positive spillovers – as (say) manufacturing. Similarly, productivity gains in agriculture and forestry have been fuelled by high-tech innovations with both forward and backward linkages to other sectors in the economy (an example being the Green Revolution).

[4] Exceptions include Mehlum *et al* and Damania and Bulte, but their empirical work focuses on the importance of the (exogenous) institutional and political context more than on the link between resources and institutions.

[5] There is an extensive case study literature from political science indicating that natural resource abundance and autocratic, elite-dominated governance tend to go hand in hand. See, for example, Karl (1997) and Ross (2001).

[6] For discussions of the rationales for including indicators for malaria and coastal population density, see Acemoglu et al (2001) and Hall and Jones (1999).

[7] Price volatility is sometimes significant, but not consistently so. Exchange rate overvaluation, included to test the Dutch disease argument, is never significant. IQ is significant and of expected sign – better institutions foster growth. Finally, NR is not significant and the sign is generally not consistent.

[8] GDP in 1970 has a significant, positive correlation with current IQ. However other conditioning variables from the conventional growth equation (estimated by Sachs and Warner, 1997) are not significantly correlated with IQ. The instruments for IQ are, as expected, correlated with IQ

[9] SS find that their NR export variable has a stronger correlation with IQ when measured as a share of total exports than as a share of GDP.

[10] Isham et al (2003) have shown that the resource curse result spills over to some agricultural products, or more correctly, modes of agricultural production associated with certain crops, but not to others. Countries that heavily depend on plantation crops like coffee, cocoa and bananas, appear to suffer from effects similar to those dependent on minerals and fuels.

[11] While there is presently no formal model of the link between point resources and institutions, Isham *et al* discuss mechanisms through which resource abundance may translate into bad institutions and policies. In addition to delayed modernization, abundant point resources may give rise to so-called *rentier effects*, particularly a reduced incentive for government and citizens to invest in mechanisms of accountability that form the basis of a civil society. Resource wealth may also mean that governments can finance repression against dissenters in society, with adverse effects on investment and growth. See also Ross (1999).

[12] Since some agricultural output will be produced on plantations, the "diffuse resource" class is broad and possibly not homogenous. However, we are mainly interested in the impact of point resources.

[13] We also examined two different measures of scale, total exports and total GDP, which gave rise to four different NR abundance measures: Point/total GDP, Point/total exports, Diffuse/total GDP, and Diffuse/total export. Using total exports vs. total GDP as the denominator of resource abundance measures made little difference to the estimates, though the results were slightly stronger with the former. For the sake of simplicity, we only present results for the resource abundance measure based on shares of total exports.

[14] Using data for 1998, the simple correlation between VA and the Marshall and Jaggers index of democracy, described momentarily, is 0.9, whereas the correlations between RL and GE and the same index of democracy are only about .54.

[15] Since policy makers shape institutional structures, it seems reasonable to postulate that a nation's political regime, e.g. democracy or autocracy, may influence the type of non-political institutions that develop. This in turn may be reflected in the RL and GE indicators. We examined this possibility by regressing RL and GE indicators in 1998 against *past* levels of democracy and autocracy. As controls we used all the variables in equation (2). We found that democracy (autocracy) has no impact on the GE indicator. Democracy does, however, lead to improvements in RL in countries with diffuse exports, but not in regimes dependent upon point exports. This suggests that the interactions between resource endowments, political regimes and institutional structures are far from simple. The finding that a history of democratic governance may not give rise to property rights protection (RL) in countries with abundant point resources may indicate that point resource owners can effectively capture political processes even in seemingly democratic countries, and impede institutional reforms. That is, point resources may erode the institutional outcomes typically associated with democratic governance.

[16] The Sachs-Warner proxy may even be inaccurate as a measure of export intensity. For instance, when using the share of natural resource exports in GDP, Singapore, with its very high proportion of processed re-exports of natural resources, is classified as highly resource abundant. To correct for this anomaly, Sachs and Warner adjust Singapore's resource endowments by using net resource exports as a proportion of GDP as a proxy for Singapore's resource endowments. But it is evident that the gross measure of exports used for all other countries will overestimate the true level of resource exports for any country involved in the re-export of primary products.