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Abstract: We critically evaluate the empirical basis for the so-called resource curse and find that, despite the topic's popularity in economics and political science research, this apparent paradox is a red herring. The most commonly used measure of 'resource abundance' can be more usefully interpreted as a proxy for 'resource dependence'—endogenous to underlying institutional factors. In multiple estimations that combine resource abundance and dependence, institutional and constitutional variables, we find that (i) resource abundance, constitutions and institutions determine resource dependence, (ii) resource dependence does not affect growth, and (iii) resource abundance positively affects growth and institutional quality.

JEL Codes: O11, O13, Q0

Keywords: Natural resource curse, economic growth, growth regressions, political regimes, institutions, constitutions

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1. Introduction

Inspired by work of Sachs and Warner (1995), a new literature is developing that focuses on the so-called "resource curse"—the puzzling paradox suggesting that resource-rich countries tend to grow more slowly than resource-poor ones. Like most people, economists are fond of paradoxes. It is therefore not surprising that the curse has inspired many economists to consider its origins or test its robustness. Among the popular early explanations for the curse are 'structuralist' theories with roots in the 1950s (e.g. Prebisch 1950), rent-seeking analyses (e.g., Tornell and Lane 1999, Baland and Francois 2000, Torvik 2002), and stories based on Dutch-disease type of arguments, where the non-resource sector is the long-run engine of growth due to increasing returns at the sector level but becomes "crowded out" by the resource sector (Matsuyama 1992, Sachs and Warner 1999).[1]

The rough contours of a consensus view now seem to be gaining shape. In the words of a recent World Bank publication (Harford and Klein 2005):

> "*[Natural resource exports] can damage institutions (including governance and the legal system) indirectly—by removing incentives to reform, improve infrastructure, or even establish a well-functioning tax bureaucracy—as well as directly—by provoking a fight to control resource rents. … There is growing evidence that [this] effect is the most problematic.*"

Empirical support for this view is provided by various authors, including Ross (1999, 2001a), Leite and Weidmann (2002), Sala-i-Martin and Subramanian (2004), Isham *et al*. (2005), Bulte *et al*. (2005) and Hodler (2006).[2] While resource abundance can be a blessing for countries with good institutions and a curse for countries with bad institutions (as demonstrated by Mehlum *et al*. 2006), the new consensus view goes one step further. It argues that the institutional context itself is endogenous and not invariant with respect to resource endowments (see also Sokoloff and

[1] See also Wright and Czelusta (2002) for a critical assessment of the claim that the resource sector is unlikely to yield spillover benefits, and Matsen and Torvik (2005) for a normative analysis of resource management and the Dutch disease.
[2] This is not to argue that there are no "dissident" views: Manzano and Rigobon (2001) focus their analysis on debt overhang, Papyrakis and Gerlagh (2004) focus on the role of investments, Gylfason (2001) and Bravo-Ortega and De Gregorio (2005) on the role of human capital, and Hausmann and Rigobon (2002) on having a diversified export structure.

Engerman 2000, Ross 2001b, Jensen and Wantchekon 2004, Robinson *et al*. 2006).[3] While the exact definition of "institutional quality" is open to debate, most economists agree that it refers to the rules of the game, and that it is an important driver of economic development and growth (e.g. Easterly and Levine 2003, Rodrik *et al*. 2004).

In this paper we challenge the consensus view, and dispute that abundant resources lead to bad institutions or slow growth. Instead, the chain of causality appears opposite to current wisdom: bad institutions are associated with high scores on the resource abundance indicator popularized by Sachs and Warner. To appreciate our argument, it is important to understand that the common proxy for resource abundance in the literature on the curse is rather peculiar. It is defined as the ratio of resource exports to GDP, generally based on the information for a single year at the beginning of the observation period.[4] This ratio is more appropriately thought of as a measure of dependence (or intensity) than as a measure of abundance. The denominator explicitly measures the magnitude of other activities in the economy. Consequently, the scaling exercise—dividing by the size of the economy—implies that the ratio variable is not independent of economic policies and the institutions that produce them. Moreover, not only the scale of economic activity, but also the comparative advantage in non-resource sectors is to a large extent determined by government choices (Clarida and Findlay 1992). Hence, the resource dependence ratio potentially suffers from endogeneity problems, and perhaps should not be treated as an exogenous explanatory variable at all in growth regressions. Rather, it is the outcome of specific institutional settings.

Following Williamson (2000), we distinguish between two different perspectives on institutions. Some analysts interpret institutions as "deep and durable" characteristics of societies (e.g., Glaeser *et al*. 2004), whereas others view them as the reflection of policy outcomes that are in a state of flux (e.g., Knack and Keefer 1995, Rodrik *et al*. 2004). The former interpretation is

[3] In a model by Hodler (2006), the link from resources to institutional deterioration is via conflict. For other work on the link between resources and conflict, refer to Collier and Hoeffler (1998) and others.

[4] Several authors have used alternative measures of resource abundance, casting some doubts on the consistency and robustness of the curse. Results of Gylfason (2001), Atkinson and Hamilton (2003), and Boyce and Emery (2006) suggest that the overall growth curse remains, although Boschini et al. (2004) confine it to countries with bad institutions. Brunnschweiler (2006) finds no curse evidence using World Bank resource data, while Stijns (2002) considers physical reserves and finds that the curse disappears for resources other than land; a result which in turn is challenged by Norman (2005).

consistent with the idea of institutions as persistent constitutional variables—think of presidential systems versus parliamentary ones, or the specification of electoral rules. Within the framework of constitutional design, policy makers formulate specific short-term "governance" policies to fight corruption, uphold the rule of law, invest in human capital for public servants, etc. Constitutional design therefore determines a range of policy outcomes—institutional proxies and otherwise (Persson and Tabellini, 2003, 2004, Persson 2005). Evidently, the interpretation of institutions as policy outcomes is more likely to suffer from endogeneity problems in the context of growth regressions.

Both the "durable constraints" and the "changeable policy outcome" interpretations of institutions are potentially relevant for the resource curse. Persson and Tabellini (hereafter PT, 2003, 2004) have pioneered the notion that constitutional designs have observable consequences on economic policies. Key concepts in their analysis are accountability and representativeness of a country's executive body. They find that both presidential regimes and majoritarian electoral rules (as opposed to parliamentarian systems and proportional representation) tend to be associated with more spending for special interests, at the expense of public goods that benefit a wider swathe of voters (and that could enhance economic growth). The reason is that presidential regimes and majoritarian rules imply that the incumbent decision maker is not dependent on a stable majority among the legislators, and is therefore more likely to cater to the interests of powerful minorities (for more information, refer to Persson *et al*. 2000, PT 2003). In the context of the resource curse, one may therefore expect that sectoral lobbying for preferential treatment is more successful in presidential than in parliamentary systems. Basing their analysis on the Sachs-Warner ratio of resource exports as a share of GDP, Andersen and Aslaksen (2006) indeed provide evidence that the "curse" is more likely to materialize in presidential regimes (and in non-democracies).

The objectives of this paper are threefold. First, we explore the underlying factors that determine resource dependence and institutional quality, and properly account for them in 2SLS and 3SLS regression analyses of economic growth. Second, we explore the impact of an alternative and exogenous measure of resource abundance (based on the value of resource stocks—see section 2) on economic growth and institutional quality. And third, we aim to dig deeper into the institutional dimensions of policy making by distinguishing between "durable" and "changeable" interpretations of institutions—i.e., how constitutional variables and institutional outcomes interact to give rise to virtuous or vicious circles of development.

Our main results turn received wisdom upside down. First, resource dependence, based on the conventional Sachs-Warner 'resource' measure in regression analyses, is influenced both by durable and changeable institutions, even if we control for physical resource abundance. Treating resource dependence as endogenous, we reverse the causality implied in earlier work. That is: contrary to the paradoxical result that resource "abundant" countries tend to invite rent seeking and therefore suffer from worse institutions, we find that countries with certain institutional designs fail to industrialize—and failing to develop significant non-resource sectors makes them dependent on primary sector extraction. Second, within the set of constitutional variables, we find that the form of government (presidential versus parliamentary system) is more relevant than the form of the electoral system. We interpret this as evidence that sectoral lobbying pressure from resource firms is more relevant for policy design than electoral pressure through geographically defined constituencies. We present corroborative evidence for this interpretation by distinguishing between different types of resources—clustered ones versus diffuse ones. Third, and perhaps most importantly, we find that the resource curse is a red herring. Properly accounting for resource wealth implies that resources are a blessing for both institutional and economic development—not a curse. Moreover, instrumenting for resource dependence implies that this variable is no longer significant in growth regressions. Finally, all these results are robust when we restrict the sample to democracies only.

The paper is organized as follows. In section 2 we introduce and explain the data, and outline our regression strategy. In section 3 we present OLS regressions of resource dependence and institutional quality, and 2SLS and 3SLS regressions of economic growth and income levels. Section 4 concludes.

2. Estimation strategy and data

In this section, we outline our empirical procedure and present the most important data. Our aim is to explore the underlying factors that determine the degree to which economies depend on exports of natural resources, and analyze the impacts of resource abundance and dependence on economic performance and institutional quality. Resource abundance may directly affect economic growth, but the influence may also be indirect. Our empirical approach allows us to examine both direct and indirect links.

We run three different regression equations. Following earlier work (Leite and Weidmann 2002, Isham et al. 2004, Bulte *et al*. 2005), we first perform a series of estimations to analyze whether resource abundance (*RA*) does in fact have the commonly reported negative effect on institutional quality (*I*). Specifically, we try to unravel the determinants of institutional quality as follows:

(1) $I = b_0 + b_1 * conditioning\ variables + b_2 * RA + e.$

Our main conditioning variables include latitude measured in absolute terms—a common instrument for institutions[5]—and regional dummy variables, as well as resource dependence (*RD*) in some specifications to check for a curse on institutions in a more conventional form. In light of earlier evidence, we distinguish between different "types" of resources: point resources, which are geographically clustered in space and relatively easy to monitor and control, versus diffuse resources spread across space. If resources are a curse for institutional quality, as has been argued in the past based on studies regressing *I* on *RD* as opposed to *RA*, then $b_2<0$. But if resource abundance is positively associated with institutions—due to an income effect, say—then $b_2 > 0$. The term "resource curse" would be inappropriate then.

In a second step, we study the association between *RD* on the one hand, and *RA* as well as "durable" and "changeable" institutional factors on the other. As outlined above, we distinguish between the "durable" constitutional dummy-variables for regime type and electoral rules (*CV*),

[5] All relevant estimations were also run with other frequent instruments for institutions, including the log of settler mortality and the fractions of the population speaking English or another Western European language. Latitude proved the strongest instrument for a large sample of countries, followed by the log of settler mortality (for the much smaller sample of ex-colonies only). We focus on the results using latitude; results using the other instruments are very similar and can be requested from the authors.

and the “changeable” indicators for institutions or institutional quality (*I*). In other words, we explore whether *RD* is an exogenous variable, as implicitly assumed in earlier work, or not. Our reduced-form ‘dependence equation’ is specified as follows:

(2) $RD = a_0 + a_1 * conditioning\ variables + a_2 * RA + a_3 * CV + a_4 * I + e,$

where our main conditioning variables are historic openness averaged over 1950-1969, and regional dummies. There are several reasons why we believe *RD* may be best treated as an endogenous variable. Obviously, it is likely to be positively influenced by resource abundance due to comparative advantage arguments (which is also why most conventional regression analyses treat the former as a proxy for the latter). But institutions may also matter, because they influence policy-making and (indirectly) affect incentives to invest and develop industrial or formal services sectors and thereby reduce the dependence on resources. Therefore, we expect $a_2>0$ and a_3, $a_4<0$.[6] In an additional step, we integrate the findings from equation (1) by endogenizing the changeable indicators for institutional quality *I* in a 2SLS procedure.

Finally, we test for the presence of a direct effect of *RA* on economic growth (*G*), i.e., effects not transmitted through either *I* or *RD*:

(3) $G = c_0 + c_1 * RD + c_2 * I + c_3 * RA + c_4 * conditioning\ variables + e,$

where *RD* and *I* are estimated using (1) and (2). Equation (3) reflects that resource abundance may potentially have an impact on economic performance measures through three channels: indirectly via resource dependence or institutional quality, and directly as an asset that may be traded. It will be interesting to see if resource dependence, i.e. the conventional resource variable in resource curse papers, is still significant if we treat it as endogenous.

Next, we introduce the various data and their sources that we will use to estimate equations (1) – (3). Table 1 shows the descriptive statistics of the main dependent variables and instruments for resource dependence. The first column covers our base sample of some 60 countries from five regions (Europe, North America, Central and South America, Africa and the Middle East, Asia and Oceania) for which we have data on mineral resource abundance and export

[6] The two dummy variables for constitutional design, *CV*, assign values of one to countries which have a presidential regime vs. a parliamentary one, and to those which have majoritarian vs. proportional electoral rules.

shares.[7] Given the particular importance of point-source resources for institutional and economic development found in the literature, this will constitute our preferred sample. The second column depicts the descriptive statistics for the larger sample, covering total resource abundance and export shares in over 80 countries. In general, our variables show little variation between the two samples.

The first row depicts the log of average growth of per capita GDP (PPP adjusted) between 1970-2000 (*g7000*). Korea was the growth leader during this period in both samples, while Zambia was at the very bottom of the growth ladder.

Our main resource dependence variables, the GDP shares of total natural resource and mineral resource exports—based on the Sachs and Warner "resource abundance" variable—are described in rows 3-4. They are compiled on the basis of information from the World Development Indicators and aggregate the export share of total natural resources (natxp), i.e. the sum of mineral and agricultural raw material exports over GDP, and the export shares of mineral ores, metals and fuels (minxp), respectively.[8] We average the shares over the period 1970-1989 because on the one hand, choosing a single year could lead to spurious links and false conclusions since exports are inevitably influenced by market conditions (see e.g. Ledermann and Maloney 2003). In addition, the 1970s saw unusually large turbulence in many resource prices due to external shocks, which suggests using a longer time span.[9] Total natural resource dependence in our base sample and larger sample varies from GDP shares of practically zero for Japan and Mauritius to over 0.4 in the cases of Trinidad and Tobago and Zambia. Similarly, Nepal and Burkina Faso have exported next to no mineral resources relative to their GDP, while Trinidad and Tobago and Zambia again top the list with a GDP share of over 0.4. In Figure 1 we plot economic growth against resource dependence for a simple regression fit—controlling only for initial income

[7] Former Soviet and most Middle Eastern countries are excluded due to data unavailability. The mineral resource abundance and the electoral rule dummy proved the main constraining variables for the sample size.
[8] We also collected data on the disaggregated period average GDP shares of agricultural raw materials exports (agrixp). Details on these and all other variables employed can be found in Appendix B.
[9] We performed all estimations with alternative period averages for resource dependence (1970s and 1970-2000) with qualitatively unchanged results.

and the change in terms of trade—confirming that the "curse" also materializes for our dataset (detailed results given in Table 5, column (1)).[10]

The next two rows show our preferred natural resource abundance measures, the logs of total natural capital and mineral resource assets in USD per capita. The data is taken from a World Bank (1997) study on countries' natural resource wealth and is estimated for the year 1994. The measure for total natural capital aggregates the estimates for subsoil assets, cropland, pastureland, timber and non-timber forest resources, and protected areas; the subsoil wealth measure values the principal fuel and non-fuel mineral stocks present in a country. All estimates are based on valuations of the net present value of benefits over a time horizon of 20-25 years (see World Bank 1997 for further details). The richest countries in terms of overall resources turn out to be Australia, Canada, New Zealand and Norway, while Venezuela and Norway have the most subsoil assets relative to their population. Jordan and Malawi have the least total natural resources; and Belgium, Benin, Ghana, and Nepal share the bottom of the scale as regards subsoil wealth. Similarly to Gylfason (2001), when we use data for the 1990s we implicitly assume that cumulative resource extraction since the 1970s has not significantly altered countries' relative resource abundance two decades later. This is supported by a high positive correlation with resource production data for the early 1970s: the countries which produced the most at the beginning of our observation period still had the richest resource stocks in the 1990s (Brunnschweiler 2006, see also Stijns 2002).[11]

A second issue concerns the exogeneity of our resource wealth measures. We challenge prior work by arguing that the commonly used resource variable of Sachs and Warner is endogenous; but to what extent do our variables offer an improvement? The accuracy and reliability of the country data were important concerns for the authors of the World Bank (1997) study; nevertheless, one could object that basic data availability is already subject to a country's

[10] The curse result is even stronger when we omit the outliers on the far right (t-ratio becomes -2.79, significant at the one-percent level).

[11] In Appendix A, Table A we show how various "abundance" measures discussed in this paper are correlated. For example, the correlation between our abundance variables and the 1970 primary exports to GNP ratio from Sachs and Warner (1997) is 0.18 for subsoil assets and practically zero for total natural resource wealth.

technological level.[12] We argue however that the data on natural resource wealth are likely to be independent of local issues, and therefore truly exogenous for our purpose. In particular, we contend that the (fuel and non-fuel) mineral deposits which determine our core sample have been well explored and estimated due to their substantial economic potential, and thanks also to the involvement of large multinational firms who use similar technical approaches to gather their information, and do so regardless of the local political or technological conditions.[13] We are not suggesting that our resource abundance data are beyond criticism: rather, they are less prone to the policy endogeneity which plagues export-based measures; less subject to technology standards which influence production levels; and only reasonably affected by price fluctuations (and market conditions), which must be an issue for any measure that attempts to assign a "true" (i.e. monetary) value to natural resource wealth.

As described above, we use two variables for the constitutional design, i.e. the fundamental and durable institutional characteristics, at the beginning of the period, depicted in rows 7-8. They are based on the classification of the *Database of Political Institutions* (DPI) compiled by Beck et al. (2005), and supplemented with data from PT (2004). As not all countries are coded starting in 1970, we use the first available entry for the 1970s.[14] The DPI codes a country's form of government as "presidential" (*pres70s*=1) when the chief executive is largely independent of the legislature. This is true both when the president is directly elected by popular vote (as in the "classical" presidential model); or when the chief executive is elected by the assembly, but cannot easily be recalled once in office and therefore is mostly independent *vis-à-vis*

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[12] In fact, the correlation between average years of schooling of the population—a common proxy for the level of technology—in 1970 and our main measure of resource abundance, subsoil wealth, is a very modest 0.28, and 0.56 for total natural resource wealth.

[13] Around 90% of known oil and gas stocks are controlled by national companies, but "…because of the enormous capital and technological resources necessary to exploit minerals, foreign oil companies became the dominant internal actors in all oil exporters […] The complexities of the international market, the continued need for foreign investment and technology, and their links to other powerful actors mean that these companies still retain significant power even after nationalization." (Karl 1997: p.55) Moreover, foreign mineral companies have been willing to get involved in production even if local political and regulatory conditions were unstable or deteriorated to the point of open conflict. A telling example is Shell's long-standing involvement in oil production in Nigeria despite violent conflict, and its willingness even to enter into arrangements with both warring parties to ensure production continuity (see e.g. Zalik 2004).

[14] In a few cases, the form of government changed during the decade; we use the later classification, as it is more likely to be important for development until 2000.

the other branches of the political system. The alternative is a strictly parliamentary form of government (*pres70s*=0). This definition corresponds to that of PT (2003, 2004); nevertheless, the classifications for the relevant years differ for three countries in our sample, namely Greece, Nepal, and Portugal. In these cases, we preferred the DPI coding, as it is more careful in indicating the true balance of power in the executive.

Regarding the electoral rule, a country is considered "majoritarian" (*maj70s* =1) when all or the majority of the house seats are elected by plurality rule, the alternative being (mostly) proportional rule (*maj70s*=0). This DPI definition differs slightly from that of PT (2003, 2004), who consider a country's electoral rule to be majoritarian only if *all* house seats are elected by plurality, adding a third, "mixed" possibility to the classification. The country coding accordingly diverges for two countries in our sample, Japan and Mexico. Again, we follow the definition of the DPI in conflicting cases. Looking at the data, we see that the samples are divided roughly according to the global prevalence of presidential over parliamentary political regimes, and the closer balance between majoritarian and proportional electoral formulas. We can consequently avoid a possible sample bias in our estimations.

The next two rows in Table 1 describe our main measures of “changeable” institutional quality. They were compiled by Kaufmann et al. (2005) for the World Bank and measure the rule of law (*rule*), i.e. the quality of contract enforcement, police, and courts, as well as the likelihood of crime and violence; and what we dub government effectiveness (*goveffect*), i.e. the quality of the bureaucracy and public services. Both are recalibrated to assume values between 0 (weakest institutions) and 5 (strongest). The World Bank data have the advantages of a very wide country coverage and relative objectiveness thanks to a large survey base, which makes them particularly attractive for econometric analysis.[15] The differences between the samples are only slight, while

[15] We performed robustness checks using several alternative institutional quality measures, including the remaining Kaufmann et al (2005) variables (e.g. corruption control, voice and accountability). As these data begin in 1996, we also compared results using measures for earlier time periods, namely the measure of the quality of the legal system and property rights enforcement for the 1970s from the Fraser Institute’s *Freedom of the World* database, and the measure of rule of law for 1982 compiled by Political Risk Services, taken from Sachs and Warner (1997). Correlations between the four measures were very high (0.8 and more), suggesting that institutions in our country sample have undergone only limited qualitative change

the variation within the samples (the standard deviation is just above unity) shows that there are considerable differences in institutional quality among the countries in our survey. The Republic of Congo has the weakest and Norway the strongest institutions in our base sample, while Haiti exhibits the weakest institutions and Switzerland the strongest in the larger sample.

Finally, the last row describes our historic openness indicator for the two decades preceding our observation period, which serves as another principal instrument for explaining resource dependence in our estimations. It is calculated as the average ratio of imports plus exports to GDP between 1950-1969 to avoid endogeneity problems.[16] The data shows that there is wide variation in openness to trade in our samples, with a standard deviation of around 0.24.

3. Empirical results

We first analyze the determinants of institutions according to equation (1). In the most parsimonious specification, we use latitude as the main instrument for institutional quality and add natural resource abundance to explore whether resource wealth erodes institutional quality, be it through rent-seeking, conflict, or otherwise. The results, controlling for region-specific effects (Europe is the omitted region), are reported in Table 2, columns (1)-(4). They show that, quite contrary to earlier work on the resource curse – which argues that resources undermine economic performance through weakening of institutional structures – there is a *positive* correlation between resource *abundance* and institutional quality. Possibly this reflects the income effects of resource booms and discoveries, enabling countries to introduce superior institutions, while at the same time increasing the demand for such improvements.[17]

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over the last three decades. The estimation results with alternative institutional measures further confirm our main observations on the effects of natural resource abundance and dependence.

[16] Nevertheless, the possible endogeneity of the openness measure was considered in separate estimations by using the predicted trade shares developed by Frankel and Romer (1999) as an instrument. Results were not affected (available upon request).

[17] There are several plausible mechanisms linking higher incomes to better economic and political institutions. Glaeser et al (2004) argue that institutional quality as conventionally measured in economic studies is not really a "deep" variable but a policy choice (affected by human capital and income). Moreover, income shocks affecting real wages of civil servants may affect the willingness to accept bribes (e.g., Chand and Moene 1999, Mookherjee 1997) or have an impact on morale—both corruption and quality of the bureaucracy are conventional measures of institutional quality. Miguel et al. (2004) document that adverse

To check if resource *dependence* has an impact on institutional quality, as postulated by advocates of the resource curse consensus, we also add the aggregate resource and mineral resource dependence variables to the analysis in columns (5)-(8). Although it mostly enters with a negative sign, resource dependence proves insignificant once we control for actual resource abundance. We interpret this as evidence that the consensus view on the chain of causality linking resources to institutions should be reversed.

We now consider whether the ratio of resource exports to GDP is a proper explanatory variable in growth regressions. Since the denominator of this dependence measure is the size of the economy, it seems reasonable to expect that the variable is endogenous with respect to various variables that determine economic performance. We "explain" resource dependence with our indicators for institutions and add the two constitutional variables. Insofar as institutional quality and certain constitutional designs are associated with high incomes and growth-enhancing economic policies, we expect them to be negatively correlated with resource dependence.

In Table 3 we present the results of equation (2) and explore whether our prior expectation is correct, controlling for resource abundance and several other variables. In the various columns we distinguish between different types of resource dependence. Earlier work by Leite and Weidmann (2002), Isham et al (2005), and Bulte et al (2005) suggests that "point resources" have a different impact on the economy than "diffuse resources". Columns (1) and (2) interpret resource dependence quite broadly so that it encompasses all types of primary exports; columns (3) and (4) focus on agricultural exports; and columns (5) - (8) present results for the narrower category of mineral resources. Consistent with earlier results, we find significant differences between mineral and agricultural exports, which in turn determine the findings for aggregate resource exports. The results are especially strong for the dependence on mineral resources, as is evident from the values for R-square and the highly significant F-statistics; they clearly indicate that resource dependence is greatly influenced by many "deep" variables of economies. This suggests that using resource

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income shocks increase the risk of civil conflict, which in turn affects institutional quality. The model by Findlay and Lundahl (2001) is not explicitly about institutional development, but could be interpreted that way. For information on the relation between income and political institutions, refer to Barro (1996, 1999), Durham (1999) and Acemoglu et al. (2005).

dependence as an exogenous variable could produce misleading or biased outcomes, and makes an IV approach more suitable.[18]

First consider mineral resource dependence, as presented in columns (5) – (8), for which we find significant and robust results. Consistent with our expectations, we find that the presidential regime dummy is positively correlated with mineral resource dependence, and remains significant at least at the 5%-level even when we control for regions and institutional quality. The results suggest that having a presidential instead of a parliamentary system would have increased mineral resource dependence during this period by up to six percentage points (all other things equal). On the other hand, there is practically never any significant correlation between electoral rules and dependence, and in column (6) we see that omitting the majoritarian dummy does not affect results for our other explanatory variables.[19] Since both majority rule and presidential systems are associated with a tendency to cater to interest groups and minorities (PT 2004), our findings suggest that sectoral lobbies (from resource industries) tend to be more successful in pursuing distorting policies than geographic lobbies (working through constituencies). This is not unexpected. Also, it is unsurprising that openness and resource abundance are positively correlated with resource dependence. Openness affects both the numerator and denominator of the resource dependence variable; but the former effect dominates, as later results from 2SLS will show where openness turns out to have no direct effect on economic development. The abundance result reflects that some countries have a comparative advantage in primary industries, which is a relevant consideration regardless of institutions and constitutions—think of Norway, Canada and Australia.

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[18] Ding and Field (2005) also consider the endogeneity of resource dependence. However, their dependence measure is based on the share of natural capital in total capital, which less closely resembles the commonly used exports measures, and furthermore focus on the role of human capital for resource dependence and economic growth.

[19] All regressions were performed both with and without the weak majoritarian instrument, with the main change lying in the magnitude of the F-statistics. We also used a finer breakdown of the constitutional variables, which confirms that the governmental system—and especially a presidential one—is more important in determining the level of resource dependence than the electoral rules. However, having both a presidential system and majoritarian electoral rules appears to increase resource dependence by 7.4 percentage points relative to where a parliamentary system is combined with proportional electoral rules. The combination of a presidential system with proportional electoral rules, on the other hand, lead to an average 5.4 percentage point increase in resource dependence, while parliamentary systems with majoritarian rules showed a significant difference only in democracies. See Appendix A, Table C for detailed results.

In columns (7) and (8) we introduce two important institutional variables—rule of law and government effectiveness. These will constitute our basic specifications for later estimations. Not only are the earlier results robust; equally interesting, we find that the institutions variables enter with a significant negative sign (at the 2%-level). This suggests that better-quality institutions lead to less resource dependence (as opposed to the other way around). This statement is supported even when we instrument for institutional quality, to account for the probable endogeneity of this variable; in the results reported in columns (9) - (12), we find that the negative relation persists. This is a finding of interest, and one that we can possibly explain by the impact of the quality of institutions—proxied by "rule of law" and "government effectiveness"—on incentives to invest in other sectors of the economy—affecting GDP, the denominator of the dependence variable.[20]

Columns (3) and (4) indicate that dependence on agriculture is not adequately explained by the same variables. The goodness of fit of these regressions is much worse, and our presidential dummy is no longer significant. We believe this is due to the "diffuse nature" of agriculture, making it harder for farmers in developing countries to organize themselves into lobby groups and successfully appeal for special favors. The institutional quality variables also (narrowly) miss conventional levels of significance (as shown in column (3)), although the sign is consistently negative. Not surprisingly, we find that natural capital—which also captures soil quality—is significantly associated with exports of agricultural products. However, in separate estimations we find that sheer country size is in fact more important than the value of the land in explaining the dependence on agricultural exports.

When the separate effects of point-source mineral resource and diffuse agricultural resource dependence are aggregated, we are able to account for a large part of total natural resource dependence using some common explanatory variables (columns (1)-(2)). But we note from the results in column (2) that the strength of our explanation for total resource dependence is due in large part to the importance of minerals in overall exports: the values for R-square and the

[20] All our main results are robust with respect to including alternative regressors: ethnic fractionalization, foreign direct investment, the average GDP shares of investment and government consumption, initial income, average schooling levels, distance to navigable port, and country size. Introducing colonial origins is slightly more complicated because of the multicollinearity that emerges when controlling for both colonial history and constitutional design.

F-statistic jump upward when we use subsoil wealth as the resource abundance proxy. However, the differing factors which explain the extent of mineral and non-mineral resource dependence weaken each other's effect on total resource dependence, and the results are no longer robust to regional controls, nor is institutional quality robustly linked to resource dependence (not shown).

Taken together, Tables 2 and 3 enable us to discuss the net effect of resource abundance on resource dependence. On the one hand there is a direct effect based on the comparative advantage argument (captured in Table 3). On the other, resource abundance also enhances institutional quality (Table 2), which in turn translates into reduced dependence on primary exports (of the mineral kind, see Table 3). However, our estimations show that the comparative-advantage effect dominates the indirect institutions effect. For example, a one-standard-deviation increase in a country's per-capita subsoil wealth would lead to an expected average increase in (mineral) resource dependence of 0.032, i.e. over three percentage points or one-third of a standard deviation.[21] The less-than-proportional impact of resource abundance on the degree of resource dependence would further confirm our hypothesis that the traditional resource dependence variable is only a weak proxy for true resource abundance.

Of course, the assumption is that all other factors are held constant, which complicates real-life thought experiments. One possible objection could be that the results so far are mainly due to the circumstances in non-democratic and authoritarian developing countries (which are also considered presidential in the dummy classification). Such countries may also have weaker economic performance and worse policies *per se*, and therefore bias the results in favor of our hypotheses.[22] We examine this possibility by restricting our sample to democratic countries only, i.e. countries which scored "5" or lower on the 1972 Gastil index compiled by Freedom House.[23]

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[21] For this example, we use the results from Table 3, column (7), and Table 2, column (2): 1.857*(0.109*(-0.035)+0.021)=0.032. The corresponding beta coefficient is 0.032/0.093=0.344, which gives the effect of mineral abundance on dependence in terms of standard deviations. Estimates from 2SLS with endogenous institutions deliver practically identical results.

[22] For a discussion of these issues, refer to Przeworski and Limongi (1993), Barro (1996, 1999), and Acemoglu et al. (2005).

[23] 1972 represents the first year for which Freedom House compiled its index. A more stringent classification of democracies calls for a Gastil score of "3.5" or less. Basic results do not change, but the sample becomes too limited for useful statistical inference. Another alternative is to restrict the sample to countries with a positive or—more stringent—to a polity index score above 8 (from the Polity IV project); estimation results for these samples also do not falsify our conclusions and are available upon request.

The results reported in Table 4 show that our earlier conclusions are largely unaffected. Specifically, democratic countries with presidential regimes or low institutional quality are more resource dependent, although the influence of one type of political regime over the other is less clearcut. We also find that resource abundance still has a positive impact on resource dependence and institutional quality. However, the indirect effect of resource abundance on dependence via institutions (columns (3)-(4)) is strengthened relative to the direct, comparative-advantage effect. Although comparative advantage prevails and the net effect remains positive, the impact is weaker.[24] One interpretation is that in countries with better-developed institutions—which is typically the case in democracies—the structure of the economy will be less biased towards lower-growth sectors such as natural resource extraction and export even if there does happen to be a relative resource abundance.

We now turn to our main results. In the first column of Table 5, we show OLS results for a growth regression of the type popular in the resource curse literature (corresponding to the regression fit in Figure 1), in order to test whether our findings depend merely on our narrower sample. We still find a significant curse result for our dependence measure, even when using a less parsimonious specification (not shown). We can therefore concentrate on the outcomes of the 2SLS regressions reported in the following columns, where we regress per capita income growth between 1970-2000 on the endogenous variables resource dependence and institutional quality. Only second-stage coefficients are shown.

In columns (2)–(5) we provide the basic estimation results when instrumenting for resource dependence to correct for omitted variables, measurement errors and reverse causality. Columns (2) and (3) consider the full set of countries, and in columns (4) and (5) we restrict the analysis to democracies only. The first noteworthy result is that there is no significant association between resource dependence and income growth—although the sign is negative, the conventional "curse" ceases to exist. But our analysis redeems resources to an even greater extent: the resource

[24] As before, the result is reached by adding the effects, this time using the standard deviations for the reduced, democratic sample: 1.807*(0.165*(-0.029)+0.015)=0.018, which corresponds to a beta coefficient of 0.018/0.11=0.168. In additional estimations shown in Appendix A, Table B, we also found that countries with a presidential regime tended to have worse-quality institutions, an effect which persisted in the democracies-only sample.

abundance variable enters positively and significantly in the second stage estimations, and the cumulative net effect on average growth turns out to be positive.[25] Moreover, the political and economic mechanisms linking resources to economic performance are not driven by idiosyncracies of dictatorships. We believe these results lend credibility to earlier ideas advanced by Davis (1995, 1998)—ideas that got snowed under in recent years by the emphasis on the detrimental effects of resources on growth and peace. Interestingly, the Hansen J statistics imply that constitutional design and openness to trade have no significant direct effect on economic development, but only influence it via their impact on the degree of resource dependence.

After having established that institutional quality is not invariant with respect to some of the deep economic and political variables, we also instrument for our two institutional proxies: *Government Effectiveness* and *Rule of Law*. The 2SLS results are provided in columns (6)–(9). Consistent with previous results, we find that that the resource dependence variable does not enter significantly, and even becomes positive when considering the quality of the bureaucracy (column (7)). Institutions enter positively and sometimes significantly in the large sample; but the results of the estimations in the democracy sample in particular suffer from multicollinearity problems, which weigh heavily in the small sample. Resource abundance still positively affects institutions in the first stage of the IV analysis; however, we now find only weak evidence of a direct effect on income growth. This suggests that the indirect institutional effect of resource abundance as shown in Table 3 is perhaps the main link from resources to economic performance. Nevertheless, the consistently positive signs show that natural resources have the potential to be a "double blessing" for economic growth rather than a curse.

We now take the final step and estimate the full system of equations (1)-(3) described in Section 2, simultaneously instrumenting for both resource dependence and institutions. Since we have two endogenous variables in our system, we expect not only the disturbance in equation (3) to be correlated with the endogenous variables, but also the disturbances among the three

[25] For example, we can get an idea of the *ceteris paribus* average resource effect on growth by summing up the effects at the two stages (note that the insignificant dependence coefficient makes this only a very rough estimate): 0.015*(-2.003)+0.153=0.123, and a beta coefficient of (0.123*1.857)/0.813=0.281.

equations to be correlated. This suggests using a 3SLS approach.[26] In this analysis we aim to trace back the chain of causal relationships all the way to exogenous variables (resource abundance, constitutional variables, and latitude), but it is evident that this comes at a cost. The first and second-stage F-statistic is a useful summary statistic for assessing the potential bias in the second stage (the inverse of the F-statistic is proportional to the bias in the second stage). From the earlier tables it is evident that in particular instrumenting for resource dependence may introduce some bias, and the 3SLS analysis shown in Table 6 compounds that bias by regressing dependence on the predicted institutions variable. The main culprit for what must be a cautious statistical inference at this stage appears to be our small sample size, which in turn is due to the limited number of countries for which we have resource abundance data.

Notwithstanding these qualifications and caveats, the results in Table 6 support the earlier findings. All signs are as expected, and the magnitude and significance of the main coefficients of interest are generally consistent with our previous findings. In no regression do we find that resource dependence significantly impacts the average growth rate. Moreover, mineral resource abundance seems to have a positive overall effect on economic performance which is significantly different from zero (*p*-values for the Wald test of 0.000 or below in all specifications), confirming our view that there is no real evidence of a curse. Again, we limit our sample to democracies only in columns (3)-(4) to check if the results are driven by countries with weaker institutional frameworks, and find substantially unchanged effects.

4. Conclusions and discussion

The paradoxical finding of a negative relationship between a sizable resource sector and economic growth has attracted widespread attention from academics, policy makers and international organizations.[27] The main causal mechanism linking resources to poor performance is commonly hypothesized to be "executive discretion over resource rents" (Jensen and Wantchekon 2004).

[26] For more information on 3SLS, see e.g. Greene (2003).

[27] In recent years the curse phenomenon has also been introduced to new domains of "windfall gains". For example, within World Bank circles one now hears people debating whether there might exist a curse of aid (Djankov et al. 2005, Harford and Klein 2005).

According to this view, an abundance of rents allows incumbent politicians to maintain support and consolidate their power base through repression, buying off the opposition, or institutionalized patronage (including massive spending on public service employment). Since such policies are unlikely to promote economic growth, it is no surprise that economic and political performance is not independent. The logic of the story, combined with the fact that it is corroborated with observations of certain countries in the developing world, has undoubtedly added to the appeal of the resource curse hypothesis.

However, our empirical results cast new light on the validity of this emerging consensus. There exists a discrepancy between the theory behind the curse, and the empirical work used to support it. Specifically, *abundant* resource rents, usually referred to as a "windfall gain", are a crucial element in the theory; but the bulk of the empirics is based on a measure of *resource dependence* instead (specifically, on resource exports divided by GDP). It is not obvious that resource dependence is a proper exogenous variable in regression analysis, and our analysis suggests it is not. Treating resource dependence as endogenous, we find that it is no longer significant in growth regressions, and has no effect on institutional quality. In contrast, resource abundance is significantly associated with both growth and institutional quality, but the nature of this association runs contrary to the resource curse hypothesis: greater abundance leads to better institutions and more rapid growth.[28]

The puzzling result that resource wealth appears to impede growth seems to be a red herring, and its origins may be traced back to confusing semantics. In discussing the impact of natural resources on growth, it is useful to distinguish between resource *abundance* (a stock measure of *in situ* resource wealth), resource *rents* (the 'windfall' flow of income derived from the resource stock at some point in time), and resource *dependence* (the degree to which countries do—or do not—have access to alternative sources of income other than resource extraction, again at some point in time). These concepts are possibly correlated—countries with large resource stocks may derive high incomes from extraction, and because of Dutch-disease arguments or

[28] In separate estimations, the positive effects of natural resource abundance were also confirmed for current income levels. However, the level effects are less clearcut and necessitate further investigation, which goes beyond the scope of the present paper.

otherwise, may specialize in primary exports and become dependent on resources. But some resource-abundant countries are not dependent on resources, and some relatively resource-scarce countries are. We find countries should not turn their back on resource wealth to lower resource dependence.

How may we reconcile our finding that resource-abundant countries tend to be better off than resource-poor ones with the existing literature? One possible explanation could be that resources in the ground do not pose the same problem for institutional quality or economic performance as flows of resource rents do. But this begs another question—since resource stocks can be converted into flows of money, why would outcomes for stocks and flows be different? Another possible explanation is more straightforward and fully consistent with our main findings—the curse simply does not exist. The empirically significant relationship between institutional quality and resource dependence reflects that countries with poor institutions are unlikely to develop non-primary production sectors to reduce their dependence on resource exports. If so, the causality would be from institutions to dependence, and not the other way around. It would be inappropriate to talk about the "curse of resources" then. Instead, growth regressions in the resource curse literature may be viewed as a reminder of the important direct and indirect impacts of institutions on economic outcomes.

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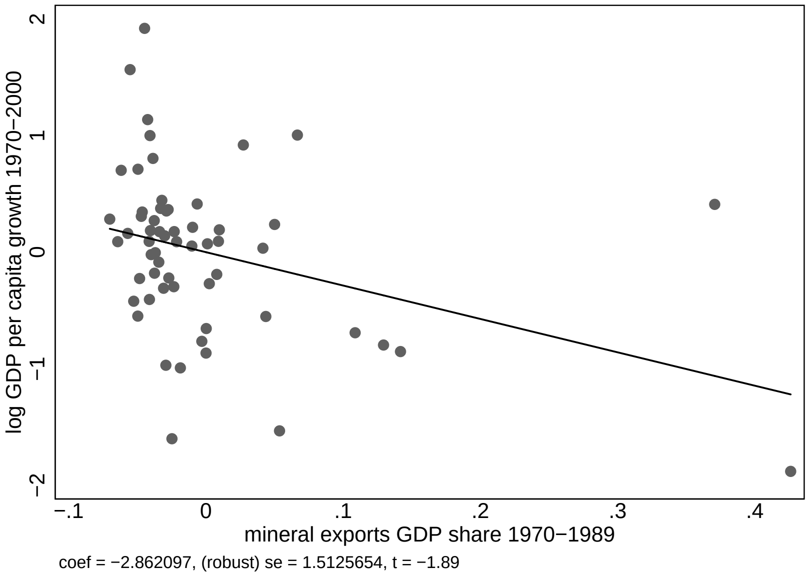

FIGURE 1. GDP SHARE OF MINERAL EXPORTS AND INCOME GROWTH

Notes: Detailed regression results are given in Table 5, column (1).

Table 1. Descriptive statistics of main variables

	Base sample		Large sample	
	Mean	S.D.	Mean	S.D.
Average income growth 1970-2000 ($g7000$)	2.457	0.813	2.398	0.802
Average natural resource exports over GDP 1970-1980 ($natxp$)	0.073	0.095	0.065	0.089
Average mineral resource exports over GDP 1970-1980 ($minxp$)	0.059	0.093	0.05	0.087
Log of total natural capital in USD per capita ($lnatcap$)	8.547	0.860	8.517	0.863
Log of subsoil assets in USD per capita ($lsubsoil$)	5.82	1.857	—	—
Presidential regime dummy for the 1970s ($pres70s$)	0.576	0.498	0.642	0.482
Majoritarian electoral rules dummy for the 1970s ($maj70s$)	0.5	0.505	0.530	0.503
Rule of law ($rule$)	2.81	1.069	2.729	1.026
Government effectiveness ($goveffect$)	2.875	1.07	2.753	1.035
Average openness 1950-1960 ($open5060s$)	0.434	0.237	0.442	0.233

Notes: Base sample for mineral dependence includes: Argentina, Australia, Austria, Bangladesh, Belgium, Benin, Bolivia, Brazil, Cameroon, Canada, China, Colombia, Rep. of Congo, Côte d'Ivoire, Denmark, Dominican Republic, Ecuador, Egypt, Finland, France, Ghana, Greece, Guatemala, Honduras, India, Indonesia, Ireland, Italy, Jamaica, Japan, Jordan, Korea, Malaysia, Mauritania, Mexico, Morocco, Nepal, Netherlands, New Zealand, Norway, Pakistan, Peru, Philippines, Portugal, Senegal, Sierra Leone, South Africa, Spain, Sweden, Thailand, Togo, Trinidad and Tobago, Tunisia, Turkey, United Kingdom, United States, Venezuela, Zambia, Zimbabwe. In addition, the large sample for total natural resources includes: Burkina Faso, Burundi, Central African Republic, Chad, Chile, Costa Rica, El Salvador, The Gambia, Guinea-Bissau, Haiti, Kenya, Madagascar, Malawi, Mali, Mauritius, Nicaragua, Niger, Panama, Paraguay, Sri Lanka, Switzerland, Uruguay. Variable sources and detailed descriptions are given in Appendix B.

Table 2. Institutional quality and natural resources

	(1) rule	(2) rule	(3) goveffect	(4) goveffect	(5) rule	(6) rule	(7) goveffect	(8) goveffect
latitude	2.519***	2.972***	2.706***	2.374***	2.631***	2.887***	2.486***	2.171***
	(0.554)	(0.669)	(0.53)	(0.671)	(0.57)	(0.63)	(0.53)	(0.63)
lnnatcap	0.215***		0.209**		0.194*		0.208**	
	(0.081)		(0.082)		(0.100)		(0.093)	
lnsubsoil		0.109**		0.097**		0.110**		0.132**
		(0.041)		(0.045)		(0.051)		(0.052)
natxp					0.150		−0.098	
					(0.67)		(0.66)	
minxp						−0.194		−1.145
						(0.69)		(0.72)
Observations	89	63	89	63	83	61	83	61
F-stat	58.49***	55.24***	56.16***	43.73***	48.54***	49.04***	44.50***	37.61***
R^2	0.71	0.77	0.76	0.76	0.72	0.78	0.76	0.77

Notes: All regressions are OLS. Regional dummy variables included in all specifications. Robust standard errors in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table 3. Resource dependence, constitutions and institutions

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	natxp	natxp	agrixp	agrixp	minxp	minxp	minxp	minxp	minxp	minxp	minxp	minxp
pres70s	0.043**	0.060***	−0.004	0.004	0.063***	0.059***	0.05**	0.052**	0.051*	0.052**	0.051	0.065**
	(0.020)	(0.020)	0.005	(0.0044)	(0.022)	(0.018)	(0.024)	(0.024)	(0.026)	(0.026)	(0.033)	(0.027)
maj70s	0.024	0.034*	0.005	−0.005	0.027		0.023	0.021	0.023	0.021	−0.022	−0.026
	(0.017)	(0.018)	(0.005)	(0.005)	(0.019)		(0.025)	(0.025)	(0.025)	(0.025)	(0.020)	(0.018)
lsubsoil		0.016***			0.016***	0.016***	0.021***	0.022***	0.021***	0.023***	0.029***	0.031***
		(0.004)			(0.005)	(0.004)	(0.006)	(0.006)	(0.006)	(0.007)	(0.008)	(0.009)
lnatcap	0.038***		0.007*	0.006*								
	(0.01)		(0.004)	(0.0031)								
open5060s	0.205***	0.272***	0.014	0.023	0.247***	0.241***	0.259***	0.257***	0.258***	0.258***	0.306***	0.317***
	(0.064)	(0.057)	(0.015)	(0.018)	(0.067)	(0.059)	(0.070)	(0.068)	(0.072)	(0.067)	(0.088)	(0.083)
rule			−0.004				−0.035**		−0.031		−0.046*	
			(0.003)				(0.014)		(0.023)		(0.024)	
goveffect								−0.038**		−0.040		−0.062**
								(0.016)		(0.029)		(0.031)
Obs	66	52	66	66	52	59	52	52	52	52	29	29
Estimation meth.	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	2SLS	2SLS	2SLS	2SLS
Regional controls	no	no	no	yes	no	no	yes	yes	yes	yes	yes	yes
F-stat	4.16***	9.06***	0.87	0.93	6.66***	9.81***	3.37***	3.48***	38.31***	27.94***	37.11***	48.81***
R^2	0.37	0.59	0.09	0.18	0.53	0.53	0.58	0.58	0.83	0.79	0.83	0.73

Notes: Only second-stage results shown for 2SLS, where F-statistics and R^2 are given for first stage. In columns (9) and (10), institutional quality is instrumented with latitude; in columns (11) and (12), the instrument for institutions is the log of settler mortality (source: Acemoglu et al. 2001). Robust standard errors in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table 4. Mineral dependence and institutions in democracies

	(1) minxp	(2) minxp	(3) rule	(4) goveffect
pres70s	0.055	0.061*		
	(0.036)	(0.033)		
maj70s	0.024	0.022		
	(0.025)	(0.025)		
lsubsoil	0.015***	0.017***	0.165***	0.162***
	(0.005)	(0.005)	(0.051)	(0.051)
rule	−0.029**			
	(0.015)			
goveffect		−0.045***		
		(0.015)		
open5060s	0.292***	0.297***		
	(0.071)	(0.066)		
latitude			3.566***	2.889***
			(0.75)	(0.80)
Obs	40	40	42	42
F-stat	2.72**	3.24***	43.66***	37.08***
R^2	0.62	0.66	0.82	0.80

Notes: All regressions are OLS. Regional dummy variables included in all specifications. Country sample includes democracies only, defined by a 1972 Gastil score between 0 and 5. Robust standard errors in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table 5. Mineral dependence, institutional design, and growth impacts

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
minxp	−2.862**	−2.003	−1.550	−1.718	−1.274	−1.417	0.219	−1.357	−1.779
	(1.460)	(1.72)	(1.72)	(1.57)	(1.56)	(1.56)	(1.74)	(1.78)	(2.61)
lsubsoil		0.153***	0.138**	0.086*	0.077*	0.136**	0.07	0.113*	0.141
		(0.058)	(0.055)	(0.051)	(0.046)	(0.057)	(0.086)	(0.068)	(0.18)
rule		0.671***		0.659***		0.871*		−0.170	
		(0.18)		(0.24)		(0.44)		(0.70)	
goveffect			0.506***		0.497**		1.579		-0.452
			(0.18)		(0.23)		(0.98)		(2.04)
lgdp70	0.055	−0.879***	−0.705***	−0.787***	−0.609**	−1.036***	−1.491**	−0.0846	0.115
	(0.093)	(0.18)	(0.18)	(0.24)	(0.25)	(0.36)	(0.68)	(0.59)	(1.55)
Sample	all	all	all	dems	dems	all	all	dems	dems
Endog. var.		minxp	minxp	minxp	minxp	rule	goveffect	rule	goveffect
Obs	59	58	58	40	40	59	59	41	41
F-stat 1st stage	6.47***	4.00***	4.84***	3.05**	5.22***	108.08***	96.65***	144.6***	89.24***
Excl. F-stat		6.54***	8.16***	6.08***	10.00***				
Hansen J p-value		0.22	0.42	0.79	0.76				
Shea partial R^2		0.43	0.46	0.48	0.56				
R^2 1st stage	0.27	0.61	0.65	0.62	0.7	0.9	0.88	0.93	0.91

Notes: Dependent variable is (log) economic growth 1970-2000. Regression (1) reproduces a simple OLS specification from the curse literature with the additional basic control variable of change in terms of trade 1970-1998 (source: Neumayer 2004). Regressions (2)-(9) are 2SLS with regional dummy variables included in all second-stage specifications. Only second-stage results shown; *pres70s* and *open5060s* are exogenous instruments for mineral resource dependence; *latitude* is instrument for institutions. The p-values of the Hansen J statistic refer to the overidentification test that the instruments in the first-stage regressions do not enter the second-stage economic development equations. Robust standard errors in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table 6. Mineral dependence, constitutions and institutions, and their impact on economic growth (3SLS)

	(1)	(2)	(3)	(4)
Economic growth	*g7000*	*g7000*	*g7000*	*g7000*
minxp	−2.261	−1.652	−1.973	−1.430
	(1.39)	(1.72)	(1.54)	(1.51)
lsubsoil	0.118**	0.057	0.130**	0.110*
	(0.055)	(0.061)	(0.061)	(0.062)
rule	0.559		0.287	
	(0.39)		(0.56)	
goveffect		0.881		0.226
		(0.79)		(0.69)
lgdp70	−0.820**	−0.828	−0.632	−0.513
	(0.34)	(0.64)	(0.49)	(0.56)
R^2	0.59	0.50	0.50	0.50
Mineral dependence	*minxp*	*minxp*	*minxp*	*minxp*
pres70s	0.043*	0.045**	0.058*	0.072**
	(0.024)	(0.023)	(0.035)	(0.032)
maj70s	0.013	0.011	0.02	0.022
	(0.024)	(0.023)	(0.028)	(0.026)
lsubsoil	0.016***	0.014**	0.014**	0.012*
	(0.006)	(0.006)	(0.007)	(0.007)
rule	−0.024		−0.019	
	(0.018)		(0.020)	
goveffect		−0.011		−0.005
		(0.019)		(0.020)
open5060s	0.267***	0.269***	0.292***	0.296***
	(0.045)	(0.043)	(0.050)	(0.047)
R^2	0.59	0.59	0.61	0.60
Institutions	*rule*	*goveffect*	*rule*	*goveffect*
latitude	3.277***	2.357***	3.511***	2.701***
	(0.57)	(0.63)	(0.67)	(0.72)
lsubsoil	0.155***	0.154***	0.160***	0.160***
	(0.037)	(0.042)	(0.043)	(0.047)
R^2	0.82	0.79	0.83	0.80
Sample	all	all	dems	dems
Obs	51	51	40	40
Wald test *lsubsoil*	26.55***	22.81***	20.33***	18.88***

Notes: All regressions are 3SLS. Regional dummy variables included in all specifications. The Wald test statistics refer to the hypothesis that the sum of the effects of *lsubsoil* is insignificantly different from zero. Standard errors in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Appendix A: Additional tables

Table A. Correlations between different proxies for natural resource abundance

	natxp	minxp	sxp	lnatcap
minxp	0.984*			
	(0.886*)			
sxp	−0.209	−0.212		
	(−0.223*)	(−0.259*)		
lnatcap	0.359*	0.332*	−0.005	
	(0.286*)	(0.245*)	(0.028)	
lsubsoil	0.505*	0.509*	0.180	0.707*
	(0.448*)	(0.534*)	(0.008)	(0.654*)

Notes: The table depicts Pearson's correlations and Spearman's rank correlations in parentheses below. * denotes significance at 5 percent level or below. *sxp* denotes the GNP share of total primary resource exports in 1970 used in Sachs and Warner (1997). The other variables are described in Appendix B.

Table B. Institutions, constitutions, and natural resources

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	rule	goveffect	rule	goveffect	rule	goveffect	rule	goveffect
latitude	2.480***	2.130***	3.041***	2.383***	2.519***	2.367***	3.310***	2.982***
	(0.579)	(0.629)	(0.658)	(0.749)	(0.74)	(0.806)	(0.883)	(0.986)
pres70s	−0.338**	−0.26	−0.24	−0.134	−0.366*	−0.118	−0.19	0.09
	(0.164)	(0.167)	(0.176)	(0.169)	(0.191)	(0.211)	(0.245)	(0.241)
maj70s	0.246*	0.132	0.024	−0.02	0.262*	0.198	0.126	0.054
	(0.129)	(0.131)	(0.13)	(0.133)	(0.142)	(0.151)	(0.135)	(0.158)
lnatcap	0.254**	0.290***			0.286**	0.281**		
	(0.097)	(0.105)			(0.107)	(0.116)		
lsubsoil			0.133***	0.149***			0.152**	0.167**
			(0.049)	(0.053)			(0.061)	(0.065)
Sample	All	All	All	All	Dems	Dems	Dems	Dems
Obs	68	68	54	54	53	53	42	42
F-stat	47.54***	36.76***	44.85***	31.52***	41.28***	30.88***	37.82***	26.73***
R^2	0.78	0.78	0.82	0.79	0.79	0.77	0.83	0.8

Notes: All regressions are OLS. Regional dummy variables included in all specifications. Robust standard errors in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table C. Mineral dependence and the finer points of constitutional design

	(1)	(2)	(3)	(4)
	minxp	minxp	minxp	minxp
majpres	0.074**	0.074**	0.090**	0.096***
	(0.035)	(0.036)	(0.040)	(0.036)
propres	0.054*	0.054*	0.108*	0.121**
	(0.029)	(0.031)	(0.055)	(0.051)
majpar	0.027	0.023	0.060**	0.064**
	(0.027)	(0.029)	(0.027)	(0.026)
lnsubsoil	0.021***	0.022***	0.016***	0.018***
	(0.0062)	(0.0059)	(0.0053)	(0.0051)
open5060s	0.260***	0.257***	0.299***	0.305***
	(0.070)	(0.068)	(0.071)	(0.066)
rule	−0.035**		−0.029*	
	(0.014)		(0.015)	
goveffect		−0.038**		−0.047***
		(0.016)		(0.015)
Sample	all	all	dems	dems
Obs	52	52	40	40
F-stat	3.12***	3.23***	2.70**	3.26***
Wald test p-value	0.15	0.16	0.11	0.05
R-squared	0.58	0.58	0.63	0.67

Notes: All regressions are OLS with regional control variables. *majpres* is dummy variable for majoritarian electoral rules and presidential governmental system; *propres* for proportional electoral rules and presidential system; *majpar* for majoritarian electoral rules and parliamentary system; and *propar* is the omitted dummy variable, referring to proportional electoral rules in a parliamentary system. Europe and Central Asia is omitted regional dummy variable. p-values are given for the Wald test of joint significance of the constitutional dummy variables (null hypothesis of joint significance insignificantly different from zero). Robust standard errors in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Appendix B: Variables and sources

Economic development

g7000: Log of growth of real GDP per capita between 1970-2000, defined as $G^i = \big(1/(T-t)\big)ln(Y^i_T/Y^i_t) * 100$. Source: PWT 6.1.

lgdp70: Log of real GDP per capita in 1970. Source: PWT 6.1.

Resource exports and abundance

agrixp: GDP share of yearly agricultural raw materials exports, averaged over 1970-1980. Agricultural raw materials comprise SITC section 2 (crude materials except fuels) excluding divisions 22, 27 (crude fertilizers and minerals excluding coal, petroleum, and precious stones), and 28 (metalliferous ores and scrap). Sources: WDI, and PWT 6.1 for missing GDP data.

lnatcap: Log of total natural capital, estimated in USD per capita for 1994. The measure includes subsoil assets, timber resources, non-timber forest resources, protected areas, cropland, and pastureland. Source: World Bank (1997).

lsubsoil: Log of subsoil assets, estimated in USD per capita for 1994. The measure includes energy resources (oil, natural gas, hard coal, lignite) and other mineral resources (bauxite, copper, gold, iron, lead, nickel, phosphate, silver, tin, zinc). Source: World Bank (1997).

minxp: GDP share of total yearly mineral exports, defined as the sum of mineral fuels, ores and metal exports, averaged over 1970-1980. Fuels comprise SITC section 3 (mineral fuels); ores and metals comprise the commodities in SITC sections 27 (crude fertilizer, minerals not elsewhere specified (n.e.s.)), 28 (metalliferous ores, scrap), and 68 (non-ferrous metals). Sources: WDI, and PWT 6.1 for missing GDP data.

natxp: GDP share of total yearly natural resource exports, defined as the sum of mineral and agricultural raw materials exports, averaged over 1970-1980. Sources: WDI, and PWT 6.1 for missing GDP data.

Constitutions and institutions

goveffect: Measures the quality of the bureaucracy and of public services in 1996. Recalibrated to assume values between zero (worst) and 5 (best). Source: Kaufmann et al. (2005).

maj70s: Binary indicator for majoritarian (plurality) elections of house representatives. Coded 1 when majority or all house members elected by plurality rule. Coded 0 when majority or all members elected by proportional rule. Value for early 1970s. Sources: Beck et al. (2005), Persson & Tabellini (2004).

pres70s: Binary indicator for form of government, coded 1 if the chief executive is directly presidential or a strong president elected by an assembly. Coded 0 if parliamentary. Value for early 1970s. Sources: Beck et al. (2005), Persson & Tabellini (2004).

rule: Measures the quality of contract enforcement, the police and the courts, as well as the likelihood of crime and violence in 1996. Recalibrated to assume values between zero (worst) and 5 (best). Source: Kaufmann et al. (2005).

Other variables

latitude: Absolute value of latitude of a country on a scale of 0 to 1. Source: La Porta et al. (1999).

open5060s: Measure of trade openness (in nominal terms), defined as the sum of imports and exports over GDP. Average between 1950 and 1969. Source: PWT 6.1.

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