The Elusive Curse of Oil

by

Michael Alexeev*

and

Robert Conrad**

February 2008

* Department of Economics, Indiana University, Bloomington, IN 47408; e-mail: malexeev@indiana.edu

** Terry Sanford Institute of Public Policy and Department of Economics, Duke University, Durham, NC 27709, e-mail: rconrad@duke.edu

We are grateful to Omar Al-Ubaydli, Graham Davis, Gerhard Glomm, Michael Kaganovich, Jim Leitzel, Andrei Levchenko, Michael Ross, Mark Schaffer, Andrei Shleifer, Kevin Tsui, Konstantin Tyurin, two referees, and the workshop participants at the University of Chicago and Indiana University for insightful comments. We would like to thank Anca Grozav for her invaluable assistance with data search and processing. Financial support from the United States Agency for International Development via a grant to the Institute for the Economy in Transition is also gratefully acknowledged. All remaining errors and omissions are our own.

Abstract

Our goal is to show that contrary to the claims made in several recent papers, the effect of a large endowment of oil and other mineral resources on long-term economic growth of countries has been on balance positive. Moreover, the claims of a negative effect of oil and mineral wealth on the countries' institutions as well as on some other factors potentially affecting economic growth are called into question.

JEL Classification: O43, O13, Q32

Keywords: Natural resources, economic growth, economic development, oil, institutions

The Elusive Curse of Oil

1. Introduction

Our goal is to show that, contrary to the claims made in several recent papers, the effect of a large endowment of oil and other mineral resources on long-term economic growth of countries has been on balance positive. Moreover, the claims of a negative effect of oil and mineral wealth on the countries' institutions do not appear to be valid.

Over the last decade, a large literature has developed to analyze the link between countries' natural resource endowment, particularly oil, and economic growth. Sachs and Warner (1995) who started this literature, showed "a statistically significant, inverse, and robust association between natural resource intensity and growth over the past twenty years." A number of other papers confirm this relationship, allowing Sachs and Warner (2001) to conclude that "[e]mpirical support for the curse of natural resources is not bulletproof, but it is quite strong" and that "[t]he finding in repeated regressions using growth data from the post-war period is that high resource intensity tends to correlate with slow growth."[1]

By now, much of the literature has been taking the negative impact of natural resources on growth at least in developing economies almost for granted, focusing instead on the transmission mechanisms for this negative impact. Some mechanisms were investigated in Sachs and Warner (1995) and several others were discussed in papers cited below. It is usually suggested that a large natural resource endowment leads to phenomenon X that in turn causes slower growth. The role of X has been played by the Dutch Decease, civil conflict, rent-seeking, neglect of human capital development, decline in saving and investment, increase in income inequality, and so on.[2] Recently, deterioration of institutions appears to have emerged as the most popular interpretation of phenomenon X. For example, Sala-i-Martin and Subramanian (2003) claim to show that "[s]ome natural resources – oil and minerals in particular – exert a negative and non-linear impact on growth via their deleterious impact on institutional quality" although they also conclude that "[o]nce institutions are controlled for, there is either very little effect of natural resources on growth or even a positive effect." Leite and Weidmann

(1999) blame natural resources for increasing corruption in the affected countries and Ross (2001) argues that natural resources undermine democracy.

In this paper, we argue that both major claims of the natural resource curse literature described above are due mostly to misinterpretation of the available data. First, we will demonstrate that so far oil and mineral resources have enhanced rather than inhibited long-term growth. Second, we will show that oil and minerals are largely neutral with respect to the quality of the countries' institutions. To demonstrate the first point, we follow the approach of Hall and Jones (1999), Easterly and Levine (2003) and Rodrik et al. (2004) and measure long-term growth via GDP per capita levels rather than by calculating growth rates over a given period of time. The direct determination of the impact of mineral resources on the rates of growth is hindered by the relative shortness of the time period for which more or less reliable data are available. Usually, growth rates are measured as an average rate for a 25-30 year period starting in 1965 or in 1970. While it is plausible that the oil and other mineral resource producers had had slower growth rates during this time, the main issue is presumably the effect of mineral resource endowment on the economic growth over the entire period of discovery and commercial use of the resource and beyond. For example, most of the major oil exporters began commercial exploitation of their oil wealth well before 1950 (See Table 1). Therefore, even if the existing empirical literature is correct, it is possible that a large oil endowment results in high growth rates in the early stages of extraction and slower rates when the oil deposits mature. In fact, Boyce and Emery (2005) demonstrate in their dynamic general equilibrium framework that such growth pattern may be optimal.[3]

To address our second point about the impact of natural resources on the quality of institutions we argue that the existing literature arrives at misleading results because it does not adequately account for a positive relationship between natural resource endowment and GDP that we referred to above. The main problem in this regard was pointed out by Rodrik (as cited by Sala-i-Martin and Subramanian, 2003, footnote 10). Most of the regressions that estimate the impact of natural resource endowment on growth, institutions, investment, etc., control for "initial" per capita GDP. If, however, natural resources are "manna from heaven" then this "manna" increases per capita GDP, whether "initial" or "current," without affecting other important variables at least in short and medium terms. Such variables might then look worse in the countries where income has been increased by natural resources relative to other countries with similar income levels. Sala-i-Martin and Subramanian claim to address this issue by using per capita GDP for 1960 because “many of the oil discoveries were made after 1960.” While it is true that “many” discoveries were made after 1960, the club of major oil producers has not changed much since the 1940’s. Therefore, the use of 1960 income levels does not necessarily solve this problem.

To overcome this difficulty, we use exogenous geographical factors to estimate the countries’ per capita GDP in the absence of atypical oil or mineral wealth. Then we use this estimated GDP as a control variable in the regressions of institutional quality on natural resource endowment measures. We demonstrate that our adjustment eliminates the negative link between natural resources and institutions. In a way, our results provide new evidence that in the relationship between institutions and economic growth, the main causality is likely to be from the former to the latter. We demonstrate that “manna from heaven” wealth that causes an increase in GDP (i.e., “exogenous” growth) does not lead to better institutions, although it does not undermine the quality of the existing institutions either. Assuming that institutions are indeed important for growth, this suggests that countries that are rich only because of their natural resource wealth are likely to grow relatively slowly after that wealth has been depleted. But they will, on average, remain wealthier than they would have been without natural resource wealth. In this sense, we reject the claim that natural resource wealth is a “curse” that makes countries worse off in any significant way. It may be the case, however, that natural resource-induced growth is less beneficial over the long term than growth generated by industry, exports, or education, for example.

Some of the papers that are mentioned below and whose results we question may have additional econometric problems, particularly issues related to potential endogeneities that the authors do not address. We stress, however, that our focus is not to analyze all questionable aspects of these regressions. Instead, we concentrate on the effect of the use of the initial per capita GDP as a control variable.

In the next section we clarify the concept of the natural resource curse, and argue that the use of GDP levels is more appropriate for the issue at hand than the use of average GDP growth rates for a relatively limited period of time. In Section 3 we describe our data and present regression results for the effect of oil and mineral wealth on long-term growth. Section 4 addresses the impact of natural resources on institutions. Our conclusions are presented in Section 5.

Throughout the rest of the paper, we will often refer to oil as a shorthand for various “point-source” resources.

2. Oil and Mineral Wealth and Long-term Growth

According to the common notion of the curse of oil, a large endowment of oil slows down the country’s long term growth rates. Empirical tests of the curse, however, usually involve comparisons of growth rates across countries over a specific period of time, and so implications of these comparisons for truly long-term growth are not always clear. Several interpretations of the curse are possible. We use the following stylized framework to clarify the concept of the oil curse.

Consider an economy with a constant population and a per capita GDP of $G(t)$, where $t \geq 0$ is a time index. Denote the economy’s growth rate in the absence of oil endowment by $g(t)$. Suppose now that at time $t = a > 0$, significant oil deposits are discovered and their extraction proceeds until time $t = b > a$, after which time the extraction stops because the deposits have been depleted. Let $h^*(t)$ and $H^*(t)$ denote, respectively, the growth rate and the level of GDP at time $t \geq a$ in the absence of the oil curse. That is, $h^*(t)$ growth rate corresponds to the socially optimal pattern of extraction and use of oil. Presumably, it is possible that $h^*(t) < g(t)$ for $t \in [a+c,b]$, for some c, $0 < c \leq b-a$, while $H^*(t) > G(t)$ for all $t > a$. That is, the optimal growth rate of the oil producer starting at some point after the beginning of extraction and up to its end may be lower than the growth rate of the otherwise identical non-oil-based economy (see, for example, the analysis in Boyce and Emery, 2005). Intuitively, this happens because during the initial period of extraction, the oil producer’s growth accelerates above its long-run growth rate due to the relatively high productivity in the oil sector. As oil endowment is being depleted and fewer amounts of factors are able to take advantage of the oil sector’s high productivity, the economy returns to its long-run growth path albeit at a higher level of GDP. According to the oil curse literature, however, oil producers usually would not use their oil wealth optimally and, therefore, would not grow at rate $h^*(t)$. Let $h(t)$ be the actual growth rate of the oil producer and let $H(t)$ be the corresponding per capita GDP. Using this notation we can define the following two versions of the oil curse:

The strong version. At time $t = a$, $h(t)$ falls below $g(t)$ resulting in $H(t) < G(t)$ for all $t > a$. This version can be modified by assuming that $h(t) < g(t)$ only starting at $t = a+\varepsilon$, where $\varepsilon > 0$ is relatively small, with $H(t) < G(t)$ shortly thereafter. That is, the strong version of the curse implies that growth rates decline soon after the commercial extraction of oil begins and, as a result, the oil producer's GDP relatively quickly falls below what it would have been without the discovery of oil.

The weak version. The discovery of oil may initially lead to a significant expansion of the economy, i.e., $h(t) > g(t)$ for $t \in [a,a+s]$, $s > 0$, but eventually growth slows, resulting in $h(t) < g(t)$ for all $t > a+s$, where $a+s$ may or may not be greater than b. After a sufficient period of time, this leads to $H(t) < G(t)$. Under this version of the curse, the growth rate declines later than under the strong version. Nonetheless, GDP of the oil producer eventually falls below that of the similar but non-oil-producing economy.

It is also possible that while $H(t) > G(t)$ for all $t \geq a$, $h(t) < h^*(t)$ and $H(t) < H^*(t)$ for some $t \geq a$. That is, due to some negative effects of oil endowment on the country's institutions or due to some other negative externalities associated with oil extraction, the economy would grow at below optimal rates, although its GDP will always remain greater than it would have been without the discovery of oil. This outcome, however, hardly qualifies to be called a curse.

The usual approach to testing the presence of the curse of oil consists in regressing GDP growth rates over a period of time on various factors that are thought to affect growth and on a measure of the economy's reliance on oil. The more or less reliable GDP data for a sufficient number of developing countries are available only starting around 1970. Accordingly, growth rates are usually calculated for the period after that year. Most major oil producers started commercial extraction of oil much earlier than 1970, however. Table 1 presents the relevant information for members of OPEC and for the major non-OPEC producers with more than 2 million barrels of oil per day in 2002.[4] Out of 16 oil producers in the table, 15 began commercial oil extraction well before 1970, with 12 beginning extraction prior to 1960. We also include the 1960 per capita purchasing power parity (PPP) GDP for these countries as presented in Maddison (2006). Note that both the mean ($9,575) and the median ($6,182) for the countries where oil was discovered prior to 1960 are considerably greater than the world average 1960 per capita PPP GDP of $2,777. As we mentioned earlier, it is possible that an oil producer would grow fast during the early stages of development of its oil reserves and reduce its growth significantly as its reserves are depleted, and this does not necessarily serve as evidence of the oil curse but may be part of an optimal growth pattern.

Obviously, real world dynamics of oil extraction in any given country may not be socially optimal even without the oil curse. It is clear, however, that the rate at which the output of oil extraction in a given country can grow over a sufficiently long period of time is limited relative to the growth of the rest of the economy. Also, growth of the oil component of GDP depends on the relative prices of oil and other goods, and growth of the rest of the economy during the period of oil extraction depends on how the country invests its net oil revenues and what aggregate consumption pattern the country chooses. All these factors can work in different directions, with oil prices being a particularly volatile component. In the end, however, an oil producer can have relatively slow growth over a period of time simply due to slow growth (or even decline) of oil output rather than for any institutional reasons. For example, consider a simple economy with an oil sector and a manufacturing sector with output linear in capital and assume that extracting oil does not require any investment. Then the economy's output is $Y=\alpha Ke^{gt}+R$, where R is output of the oil sector, K is the stock of capital, and g is the exogenous rate of technical progress. Let this economy invest a constant share b of its output, i.e., $\dot{K}=bY$, where $\dot{K}=\partial K/\partial t$. This economy grows at rate $\dot{Y}/Y=\alpha be^{gt}+g+(\dot{R}-gR)/Y$. Relative to an otherwise identical economy, but with R=0 and $\dot{R}=0$, the oil producer would grow faster if and only if $\dot{R}/R>g$, which is obviously not sustainable in the long run unless relative world prices of oil grow sufficiently fast.

Therefore, unless the period over which the growth rates are measured is sufficiently long, the direct use of GDP growth rates runs a risk of reflecting a relatively slow growth of oil producers that have partly depleted their resources rather than the true impact of oil endowment on overall growth. One simple way to overcome this difficulty would be to use the approach to measuring long-term growth of Hall and Jones (1999), Easterly and Levine (2003) and Rodrik et al. (2004) and look at the levels of GDP per capita.[5] After all, countries with high per capita GDP must have been growing fast at some point in time. If oil endowments are associated with high per capita GDP levels, then the strong version of the oil curse can be rejected. The weak version, however, may still be maintained even in the presence of positive relationship between GDP and oil endowment, although such a positive relationship would certainly undermine any evidence based on the examination of growth rates over a limited period of time. Using our notation, even the weak version cannot be established until it is shown that $H(t) < G(t)$.[6]

2. The data and results of income level regressions

We begin by testing whether oil endowments are associated with high levels of GDP per capita. To this end, we run the following regression:

$$Y_{i,2000} = \beta_0 + \Sigma\beta_i X_i + \gamma N_i + \varepsilon_i \,, \qquad (1)$$

where $Y_{i,T}$ represents per capita GDP in year T in country i adjusted for purchasing power parity, N_i denotes a measure of oil endowment and X_i's stand for control variables.

In order to estimate equation (1) we use several different measures of oil and mineral resource endowment, and different control variables. One measure of oil endowment is the logarithm of 1993 hydrocarbon deposits per capita from Sala-i-Martin et al. (2004). Another measure is the logarithm of one plus the country's per capita production of oil in 2000 at world market prices. Unlike much of the literature, we prefer to use measures of natural resources that are not expressed as shares of GDP, because we are interested precisely in the effect of natural resources on GDP. If, for example, the share of oil output in GDP is used as an indicator of oil dependency, then, given some output of oil, a country that for whatever reason has low growth rates and low GDP would have a higher oil/GDP ratio. This would bias the results, artificially creating a negative effect of oil on GDP. We are even more skeptical about using the share of natural resource exports in GDP or in total exports. The use of export-related measures of oil dependence has a bias similar in nature to measures expressed in shares of GDP. In fact, the bias in the export-related measures is probably larger numerically, because a more developed country may consume much of its natural resources domestically and export a smaller share of its endowment, holding initial total reserves constant. Therefore, an oil-producing country that has a relatively small GDP for reasons unrelated to oil would have a large ratio of oil exports to GDP, thus biasing the results toward the negative effect of oil on both GDP and growth. The same argument holds for other mineral resources. The regressions that use export shares probably reveal the effect of low GDP and growth on the structure of exports rather than the other way around. It is not surprising, therefore, that some of our results do not hold for measures based on the share of natural resource exports in GDP. In addition, we do not think that the "natural capital" measure developed in World Bank (1997) is appropriate for our purposes, largely because it includes the value of arable land and, therefore, goes against most existing theoretical explanations of the natural resource curse. Instead, we concentrate on the "point-source" resources (Isham et al, 2003) or "lootable" resources in Mehlum et al's (2006) terminology.[7]

While we believe that the best measures of the role of natural resources in long-term growth are per capita measures, Sachs and Warner (2001) contend that GDP should be in the denominator of the natural resource dependence measures, because the goal is to "measure the importance of natural resources in the economy, not just per capita." (p. 830, footnote 1) The problem with this statement, as we have just argued, is that the "importance of natural resources in the economy" may be caused by factors unrelated to natural resources and this consideration biases the estimates in favor of "the curse." Nonetheless, to accommodate Sachs and Warner's point, we use logarithm of one plus the ratio of the average value of oil output in 2000 to PPP GDP to show that our results are generally robust to using GDP shares.[8] We use per capita PPP GDP data from Maddison (2006) that provides for a wider coverage, particularly of oil producers and less developed countries than the Penn World Tables often used in the literature. This is particularly true for 1970 PPP GDP data that are needed in order to make our results comparable to other work on the natural resource curse.

With respect to control variables, we use two different approaches. One set of controls is highly parsimonious and includes only the geographic variables of absolute value of latitude, and dummy variables for European population and Latin American and East Asian countries. These independent variables are clearly exogenous. The other set of estimates includes institutional quality and the degree of ethnic fractionalization as additional regressors.

In addition to the results described in this section, we tried a wide range of other control variables and our result remained extremely robust. We would like to emphasize, however, that our goal is not to find the factors that explain most variance in income levels as measured by per capita GDP in a country, but simply to examine whether oil and other point-source natural resources raise or reduce these levels. From this point of view, the inclusion of the variables measuring institutional quality on the right hand side, as is commonly done in the growth literature, is not crucial to the validity of our results. While good institutions may be important for raising per capita GDP, as Hall and Jones (1999), Acemoglu et al. (2001), Rodrik et al. (2004) and others have argued, their inclusion as one of the regressors raises a problem of finding appropriate instruments.[9] On the other hand, the exclusion of institutions may cause an omitted variable bias, but unless institutions positively affect measures of natural resource dependency, their exclusion should not undermine our argument.[10] We will examine the relationship between natural resources and institutions in a different context in the next section.

We run our regressions both with and without an instrumented measure of institutional quality. To measure institutional quality, we use mainly the rule of law index from World Bank Governance (2005), but also checked the robustness of our results using control of corruption and government effectiveness measures from the same source. In one set of regressions we instrument the institutional quality variable by the fraction of English-speaking population, the fraction of population speaking a major West European language, and absolute latitude of a country. These are the instruments argued for and used by Hall and Jones (1999) and several other papers, including Sala-i-Martin and Subramanian (2003) and Isham et. al. (2003).[11] Some recent papers have used settler mortality as one of the instruments (e.g., Acemoglu, et al, 2001, Rodrik et al., 2004).[12] A shortcoming of this instrument is that it is unavailable for many countries, some major oil producers in particular.[13] Our results, however, hold just as strongly even when we use settler mortality and absolute latitude, i.e., the main instruments used by Acemoglu et al. (2001).[14] All variables and sources for them are described in the Appendix.

The results of the regressions for oil-related measures are presented in Table 2A. In all but one equation, the measures of oil endowment are positive and statistically significant at 1% level and in one equation the ratio of the value of oil output and GDP is significant at 5% level. In all instrumental equations the coefficients of oil wealth are significant at 1% level. In the equation with geographic controls only, the elasticity of per capita GDP in year 2000 with respect to per capita oil output for oil producers is almost 0.1. The elasticity with respect to the share of oil output in GDP evaluated at the median share for the oil producers (0.06) is about 0.085. The same elasticity evaluated at the mean share for oil producers (this share is 0.26) is 0.31. These results strongly suggest that the curse of oil is unlikely to exist. The countries endowed with oil resources tend to have relatively high levels of GDP.

We also use similar regressions to investigate the impact of overall mineral wealth on per capita GDP levels. We employ two different measures of mineral wealth that are analogous to our measures of oil wealth: the logarithm of one plus per capita mining output in a country and the logarithm of one plus the share of mining in the country's GDP. Both of these variables have positive and statistically significant (usually at 1% level) coefficients (see Table 2B). In the equation with geographic controls, the elasticity of per capita GDP in 2000 with respect to the share of mining output in the country's GDP evaluated at the mean of this variable (0.058) is approximately 0.14.

Some recent papers have argued that the effect of natural resources on economic growth depends on the quality of institutions. The countries with good institutions are supposed to benefit from the abundance of natural resources while the countries with bad institutions fall victim of the natural resource curse.[15] In order to test this proposition, the usual approach is to include an interactive term between the quality of institutions and natural resource endowment in the regression. We again use the rule of law index as an indicator of institutional quality. Due to potential endogeneity between institutions and per capita GDP, we use the values of the rule of law index predicted from the first stage of the appropriate 2SLS regressions we used to estimate (1) above.

The results presented in Table 2C show some evidence of the importance of the interaction between institutions and natural resources although this evidence points to countries with weaker institutions benefiting more from natural resources. The coefficients of the interactive terms are negative but they are not statistically significant in two out of five regressions. Moreover, the economic significance of these coefficients is small relative to the positive effect of natural resource wealth, because the coefficients of the interactive terms are always smaller in absolute value than the coefficients of the direct terms, and because the rule of law index is centered around zero, making the average value of the interactive term small in all but one equation. In the corresponding regressions based on Acemoglu et al. (2001) sample the coefficients of the interactive terms are also always negative, but statistical significance obtains only in one specification and only at 10% level. These results are available upon request.

We do not claim, of course, that good institutions hurt long-term growth. Instead, we conclude that countries with good institutions that would have been rich anyway, tend to benefit less from the positive effect of natural resources while countries with weak institutions that would have been poor in the absence of substantial natural endowment reap relatively large benefits from their natural resource wealth. In other words, Norway would have done well with or without oil, but Kuwait without oil would have been poor. This result contradicts the findings of Mehlum et al. (2006). In their work that used average growth rates of GDP between 1965 and 1990, the effect of the interactive term on economic growth was positive while the direct effect of natural resource abundance was negative. We will address another aspect of the interaction between institutions and natural resources in the next section.

The above results hold almost as strongly, both for oil and for other minerals, when we use per capita GDP for 1970 as a dependent variable and measures of oil importance for 1970 instead of the corresponding variables for year 2000.[16] This fact confirms our earlier statement that oil and other mineral resources have had a significant effect on the countries' income for a long time. Our results also hold just as strongly for the alternative measures of institutional quality such as control of corruption and government effectiveness.

3. Mineral Wealth and Institutions

In the previous section, we demonstrated that high endowments of oil and other minerals have a positive impact on per capita GDP and, therefore, we concluded that natural resource endowments positively affect long-term growth rates of countries. This result contradicts most but not all of the empirical literature on the "resource curse." As we mentioned earlier, Sala-i-Martin and Subramanian (2003), hereafter, S&S, found the possibility of a positive effect of natural resources on growth after controlling for institutions. The "resource curse" literature, however, not only investigates the relationship between growth rates and mineral wealth, but also seeks to determine the mechanism, through which natural resources, oil in particular, might lead to low growth rates of GDP. Various authors have claimed that either oil or mineral wealth in general exert a negative influence on the quality of institutions, income inequality, investment rate, and so on. While some of these links may indeed be present, we think that all of these studies are flawed due to the relationship between oil wealth and per capita GDP that we established earlier.

Here we focus on the relationship between oil and the quality of institutions.[17] In one of the most sophisticated examples of this literature S&S use a 2SLS estimation of the growth equation, instrumenting for the institutional quality. Their first-stage results suggest that oil wealth negatively affects the quality of institutions in a country, and the second stage implies that institutions negatively affect growth rates. Using similar regressions, several other recent papers arrive at similar conclusions with respect to the effect of "point-source" resources on institutions (Isham et. al., 2003; Leite and Weidmann, 1999; Bulte et. al, 2005). The implication is that even if the oil endowment does not result in lower GDP within the time period for which data are available, the curse of oil might exist in the longer run if the oil wealth causes deterioration of the country's institutions. We argue, however, that this interpretation of the curse is not supported by the data. In a nutshell, S&S and others obtain a negative link between natural resources and institutions largely because they use per capita GDP as one of the control variables. Given the positive relationship between oil and GDP and between institutional quality and GDP, the inclusion of GDP as a control variable in the institutional quality regression drives the coefficient on the measure of oil wealth down.

This happens because oil output raises GDP, but does not seem to improve institutions, at least not in the medium term. Therefore, in terms of GDP, oil producers belong to the club of nations with relatively good institutions, but in terms of the institutions themselves, these countries remain with the otherwise similar but relatively poor non-oil producing countries.

As we discussed in the introductory section, S&S tried to disentangle the effect of oil on institutions from its effect on GDP by using the "initial," usually 1970, GDP numbers. Instead of using the initial GDP as a control variable, we employ the following procedure. First, we generate the values of per capita GDP that the oil countries can be predicted to have if they did not have their oil endowments. We do this by regressing logarithm of per capita GDP on the "strongly" exogenous variables.[18] In other words, we obtain the fitted values of per capita GDP generated by the following regression:

$$Y_{i,1970} = \beta_0 + \Sigma\beta_i X_i + u_i \,, \qquad (2)$$

where independent variables are absolute value of latitude and the dummies for European population, Latin America, and East Asia. The resulting estimates are as follows (robust standard errors are in parentheses):

$$\underset{}{\hat{Y}}_{i,1970} = \underset{(0.12)}{6.8} + \underset{(0.005)}{0.03}\cdot ABSLAT + \underset{(0.23)}{1.17}\cdot EUROPE + \underset{(0.16)}{0.83}\cdot LATAM + \underset{(0.25)}{0.49}\cdot EAST \qquad (3)$$

Adj. R^2 = 0.55; No. obs. = 118

While the coefficients of correlation between logarithm of $Y_{i,1970}$ and our measures of oil endowments are 0.39 for logarithm of per capita oil output, 0.27 for the ratio of oil output to GDP, and 0.35 for logarithm of hydrocarbon deposits, the respective correlations of these variables with the fitted values from regression (3), $\hat{Y}_{i,1970}$, are 0.07, -0.15, and -0.05. Not surprisingly in light of our results in the previous section, the fitted values of per capita GDP are on average significantly lower for the oil producers and for the countries with large mining industries. For the 37 oil producing countries in our dataset, the difference between actual and fitted values of 1970 per capita GDP is on average about $2500 with a median of almost $590. (The average 1970 per capita GDP for all our countries is $4,227.) For the countries with above median share of mining output in their GDP, this difference is $1,662 with a median of $335. The regressions of this difference on our measures of natural resource wealth have positive and statistically significant coefficients.

We then compare the results of the following two institutional quality regressions that use $Y_{i,1970}$ and $\hat{Y}_{i,1970}$:[19]

$$IQ_i = \mu_0 + \Sigma\mu_i X_i + \nu_1 Y_{i,1970} + \nu_2 N_i + v_i \quad (4)$$

$$IQ_i = \mu_0 + \Sigma\mu_i X_i + \nu_1 \hat{Y}_{i,1970} + \nu_2 N_i + v_i \quad (5)$$

where IQ represents the “rule of law” index from World Bank Governance (2005) or other measures of institutional quality. In the above regressions, we use three different sets of control variables X_i and different measures of oil and mineral wealth. In the first control variable set we use only the ethnolinguistic and geographic variables we used in the earlier regressions (excluding continental dummies we used to generate fitted values of 1970 per capita GDP) that is, the fraction of English-speaking population, the fraction of population speaking West European languages, the degree of ethnolinguistic fractionalization, and absolute latitude of a country. In the second set, the ethnic and linguistic variables are replaced with the settlers mortality. That is, the second set of controls consists of the two main determinants of institutions from Acemoglu et al. (1991). The third set is comprised of explanatory variables obtained from S&S. In addition to ehtnolinguistic fractionalization, the fraction of English speakers, and the fraction of population who speak one of major West European languages, this set of variables includes primary school enrollment, the relative price of investment goods, population density in the coastal areas, and malaria prevalence. It is possible that some of these variables, particularly school enrollment, may be correlated with the residuals. We did not instrument any of these variables, however, to keep our results comparable to S&S’s.

Only the results of regressions (4) and (5) for the first two sets of controls described above are presented here (Tables 3A-B).[20] Note that the coefficients of oil wealth measures in equations (4) are always negative and statistically significant, usually at or close to 1% level. In equations (5) on the other hand, none of these coefficients are statistically significant and one of them is positive. In all cases, the point estimates of the oil wealth measures in equation (5) decline in absolute value relative to those in equation (4).

We conclude that the statistically significant negative coefficients of the oil wealth in the institutional quality regressions presented in S&S are largely a consequence of the positive link between GDP and oil, rather than some substantive negative influence of the oil endowment on institutions.

We also run similar regressions using our two mining measures instead of oil-related measures. As Table 4 demonstrates, the results are broadly similar to the regressions in Table 3 (A-B) although not as stark. Mining measures are always negative in regressions (4), but only once in (5). Only mining as a share of GDP when settler mortality is used as a control is statistically significant in equation (4). The direction of change of the coefficients of mining variables between equation (4) and equation (5) is the same as for oil wealth measures, however.[21]

The results for other indicators of institutional quality such as "control of corruption" and "government effectiveness" from World Bank Governance (2005) are qualitatively similar to those for the rule of law measure. The only notable difference is that in both sets of regressions the coefficient of the share of oil in GDP remains statistically significant, at 5% level in the corruption regression and at 10% level in the government effectiveness one, for the Acemoglu et al. (2001) sample. While this may be construed as some weak evidence of the negative effect of oil endowment on institutions, we note that this relatively small sample does not contain some major oil producers and, more important, the share of oil in GDP measure may suffer from the omitted variable bias that we discussed in the introduction. Indeed, when we use fitted 2000 GDP values obtained based on an appropriately modified equation (3) to calculate the share of oil in GDP, the results become similar to the other regressions. Namely, the coefficient of the share of oil in fitted GDP is negative and significant in regressions (4) and negative, but not significant in equation (5). The output of these regressions is available upon request.

Table 5 shows the results of a similar exercise based on one of the regression equations in Leite and Weidmann (1999).[22] Again, when we use the actual 1970 per capita GDP, natural resource wealth tends to increase corruption (reduce "control of corruption") and for two oil wealth measures this effect is highly statistically significant.

When we use fitted 1970 GDP data, however, this significance disappears. In the regressions where the negative effect of natural resource measures is not statistically significant when actual 1970 per capita GDP is used as a control, the corresponding coefficients turn positive when fitted GDP numbers are used.

4. Conclusions

Contrary to the claims of the literature on the curse of natural resources, we believe there is little or no evidence that the large endowments of oil or minerals slow down long term economic growth. In fact, the data available so far suggest that natural resources enhance long term growth. We have demonstrated this result by focusing on the levels of per capita GDP rather than on the rates of growth over any given period of time. Our reasoning is simple. If Country A has a higher per capita GDP than Country B, Country A must have experienced faster growth over the long term than Country B.

In addition, we have shown that the negative effect of large endowments of "point-source" resources on institutions claimed in the literature is mostly due to the use of initial GDP values as control variables. Large natural resource endowments appear to increase per capita GDP without a simultaneous improvement of the country's institutions. Because of this and because institutions in countries with few natural resources are positively correlated with GDP, the use of GDP as a control in a regression of the quality of institutions on oil or mineral wealth biases the results towards a negative effect of natural resources on institutions. According to their GDP, natural resource rich countries should have good institutions. Because their institutions are poor relative to industrialized countries with similar GDP levels (i.e., they are at the level where they would have been if the country had no oil) the regression assigns a negative coefficient to the measure of oil wealth. In this situation, however, it is wrong to say that oil wealth has caused a deterioration of institutions. It simply has not improved them.

The fact that growth based on oil wealth does not improve institutions may and probably should be viewed as a drawback of resource-based growth. In this sense one may perhaps speak of the curse of natural resources. In an indirect way, however, this result supports the view that the main causality goes from institutions to growth rather than the other way around (see Acemoglu et al., 2001, and Rodrik et al., 2004).

Interestingly, the Slavic countries that emerged from the former Soviet Union, while absent from our regressions, provide additional evidence for our claims. Although this evidence is anecdotal, it is hard to dismiss because to a large extent, the experience of Belarus', Russia, and Ukraine can serve as a natural experiment with respect to the influence of oil and mineral resource endowment on growth and institutions. These three countries have had very similar cultural, institutional and structural economic legacies due to the fact that they are predominantly Slavic and for many years were well-integrated parts of the Soviet economic space. A major difference among them is in their natural resource endowment, with Russia having by far the greatest deposits of oil, gas, and minerals, and Belarus having almost none. Ukraine's size of natural resource endowment is in-between those of Russia and Belarus'. If the natural resource curse were to exist, Russia would be expected to have the worst institutions and lowest per capita GDP of the three countries, and Belarus' would have the best indicators. As the numbers below demonstrate, the reality dramatically deviates from this prediction:[23]

	PPP GDP per capita, 2004 US$	Rule of law 2004	Control of corruption 2004	Government effectiveness 2004
BELARUS	6,970	–1.31	–0.91	–0.93
RUSSIA	9,902	–0.70	–0.72	–0.21
UKRAINE	6,394	–0.83	–0.89	–0.67

Obviously, many other factors besides the differences in natural resource endowments have influenced the development patterns of the three countries since the Soviet Union's collapse. Nonetheless, the comparison of Belarus', Russia, and Ukraine is instructive because of its stark divergence from the prediction based on the natural resource curse. We use it simply to supplement our more general cross-sectional results.

We conclude that while mineral wealth might have some negative consequences for a country, the general curse of natural resources as understood in the current literature does not seem to exist.

APPENDIX

Data Descriptions

Variable	Description and Source
Absolute latitude	Source: Sala-i-Martin et al (2004)
Control of corruption	Index of control over corruption in year 2000. Source: World Bank Governance Indicators 1996-2004
East Asia	Dummy variable for East Asian countries
English speakers	Fraction of population speaking English. Source: Sala-i-Martin et al (2004)
Ethnolinguistic fractionalization	Average of five different indices of ethnolinguistic fractionalization which include *inter alia* the probability of two random people in a country not belonging to the same ethnolinguistic group or not speaking the same language. Source: Alesina et al. (2003)
European population	Dummy variable for a European population
Fitted per capita 1970 GDP	Fitted values of logarithm of per capita PPP GDP in year 1970 from regression (3)
European language speakers	Fraction of population speaking one of five primary Western European languages. Source: Sala-i-Martin et al (2004)
GDP 1970, per capita	Logarithm of per capita PPP GDP in year 1970. Calculated from per capita GDP in year 1970. Source: Maddison (2006).
GDP 2000, per capita	Logarithm of per capita PPP GDP in year 2000. Calculated from per capita GDP in year 2000. Source: Maddison(2006).
Hydrocarbon deposits, per capita	Logarithm of hydrocarbon deposits in year 1993. Source: Sala-i-Martin et al (2004)
Latin America	Dummy variable for Latin American countries
Mining output, per capita	Logarithm of one plus mining output per capita. Calculated from Sala-i-Martin et al (2004).
Mining/GDP ratio	Logarithm of one plus the share of mining in the country's GDP in current prices in 1992. Calculated from Sala-i-Martin et al (2004)
Oil/GDP ratio	Logarithm of one plus the value of oil output in 2000 divided by PPP GDP from Maddison (2006). Oil output is from BP Statistical Review (2005)
Rule of law	Rule of law index for 2000. Source: World Bank Governance Indicators 1996-2004
Settler mortality	Logarithm of estimated mortality rate of European settlers. Source: Acemoglu et al. (2001)
Value of oil output, per capita	Logarithm of one plus the value (at world market price) of country's per capita oil output in year 2000. Oil output and world market price are from BP Statistical Review (2005)

REFERENCES

Acemoglu, Daron, Simon Johnson,, and James A. Robinson, 2001. "The Colonial Origins of Comparative Development: An Empirical Investigation," *American Economic Review* 91(5): 1369-401.

Alesina, Alberto, Arnaud Devleeschauwer, William Easterly, Sergio Kurlat, Romain Wacziarg, 2003. "Fractionalization," *Journal of Economic Growth* 8: 155-194.

Alexeev, Michael, and Robert Conrad, 2005. "The Elusive Curse of Oil" The Sanford Institute Working Paper SAN05-07, Duke University, Durham, NC.

Boyce, J., and J. Emery 2005. "A Hotelling Explanation of 'The Curse of Natural Resources," University of Calgary, Department of Economics Discussion Paper 2005-06, April.

BP Statistical Review of World Energy 2005. BP website .

http://www.bp.com/liveassets/bp_internet/globalbp/globalbp_uk_english/publications/energy_reviews_2005/STAGING/local_assets/downloads/spreadsheets/statistical_review_full_report_workbook_2005.xls#'Oil Production – barrels'!A1

Bulte, E.H., R. Damania and R.T. Deacon, 2005. "Resource intensity, institutions and development," *World Development* 33: 1029-1044.

Cerny, A. 2005"Are Natural Resources Innocent of Their Curse?" mimeo, CERGE-EI, Prague, Czech Republic, August, 2005.

Easterly, W., and R. Levine 2003. "Tropics, germs, and crops: how endowments influence economic development," *Journal of Monetary Economics* 50:3-39.

Glaeser, E. L., R. La Porta, F. Lopez-de-Silanes, and A. Shleifer, 2004. "Do Institutions Cause Growth?," *Journal of Economic Growth* 9(3):271-303.

Gylfason, T. 2001. "Natural resources, education, and economic development," *European Economic Review* 45:847-859.

Gylfason, T., and G. Zoega 2002a. "Natural Resource and Economic Growth: The Role of Investment," mimeo.

Gylfason, T., and G. Zoega 2002b. "Inequality and Economic Growth: Do Natural Resources Matter?" CESifo Working Paper No. 712.

Herb, M. 2005. "No Representation without Taxation? Rents, Development and Democracy," *Comparative Politics* 37:297-317.

Hodler, R., 2006. "The curse of natural resources in fractionalized countries," *European Economic Review*, forthcoming.

Human Development Report 2004 Statistics 2004. UNDP website. http://hdr.undp.org/statistics/data/excel/hdr04_table_14.xls

Isham, J., M. Woolcock, L. Pritchett, and G. Busby 2003. "The Variety of Resource Experience: How Natural Resource Export Structures Affect the Political Economy of Economic Growth," Middlebury College Economics Discussion Paper No. 03-08R.

Leite, C., and J. Weidmann, 1999. "Does Mother Nature Corrupt? Natural Resources, Corruption, and Economic Growth," IMF Working paper 99/85, June.

Maddison, A., 2006. "World Population, GDP and Per Capita GDP, 1-2003 AD," online database: http://www.ggdc.net/index.html .

Mehlum, H., K. Moene, and R. Torvik 2006. “Institutions and the resource curse,” *Economic Journal* 116:1-20.
Robinson, J., R. Torvik, and T. Verdier 2006. “Political Foundations of the Resource Curse,” *Journal of Development Economics*, forthcoming..
Rodriguez, F., and J. D. Sachs, 1999. “Why Do Resource-Abundant Economies Grow More Slowly?” *Journal of Economic Growth* 4(3):277-303.
Rodrik, Dani, Arvind Subramanian, and Francesco Trebbi, 2004. “Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development,” *Journal of Economic Growth* 9:131-165.
Ross, M.L. 2001. “Does oil hinder democracy?” *World Politics* 53:325-361.
Sachs, J., and A. Warner 1995. “Natural Resource Abundance and Economic Growth,” Harvard Institute for International Development, Development Discussion Paper No. 517a, October.
Sachs, J., and A. Warner 2001. “The Curse of Natural Resources,” *European Economic Review* 45:827-838.
Sala-i-Martin, X., and A. Subramanian 2003. “Addressing a Natural Resource Curse: An Illustration from Nigeria,” NBER Working Paper No. 9804.
Sala-i-Martin, X., G. Doppelhofer, and R. Miller 2004. “Determinants of Long-Term Growth: A Bayesian Averaging of Classical Estimates (BACE) Approach,” American Economic Review 94(4):813-835.
Stijns, J-P, 2006. “Natural Resource Abundance and Human Capital Accumulation,” *World Development* 34(6):1060-83.
Tornell, A., and P. R. Lane, 1999. “The Voracity Effect,” *American Economic Review* 89: 22-46.
World Bank, 1997. “Expanding the measure of wealth: indicators of environmentally sustainable development,” Environmentally Sustainable Development Studies and Monographs Series No. 17, World Bank, Washington, DC.
World Bank Governance Indicators 1996-2004, 2005. World Bank website. http://www.worldbank.org/wbi/governance/govdata/
WDI Online, 2006. World Development Indicators Online Database. World Bank website. http://www.worldbank.org/data/onlinedatabases/onlinedatabases.html

Table 1. Dates of first commercial extraction of oil for major world producers

Country	Year of first commercial extraction	Per capita PPP GDP in 1960 (1990 International Geary-Khamis dollars)
OPEC		
Algeria	1965	2,088
Indonesia	1883	1,019
Iran	1920	2,154
Iraq	1923	2,735
Kuwait	1938	28,813
Libya	1957	1,830
Nigeria	1960	854
Qatar	1939	33,104
Saudi Arabia	1944	3,719
United Arab Emirates	1965	22,433
Venezuela	1917	9,646
NON-OPEC		
Canada	1920	8,753
Mexico	1901	3,155
Norway	1969	7,204
UK	1918	8,645
US	1859	11,328

Sources:

http://reference.allrefer.com/country-guide-study/indonesia/indonesia108.html
http://www.busman.qmw.ac.uk/abh/archive5.htm
http://reference.allrefer.com/country-guide-study/mexico/mexico72.html
http://www.hydro.com/en/about/history/1946_1977/1969_1.html
http://www.bp.com/genericarticle.do?categoryId=2010597&contentId=2015164
http://www.bp.com/genericarticle.do?categoryId=2010597&contentId=2015164
http://www.absoluteastronomy.com/encyclopedia/p/pe/petroleum.htm
http://www.eia.doe.gov/emeu/cabs/contents.html
PPP GDP data are from Maddison (2006)

Table 2A. The Effect of Oil Wealth on Per Capita GDP
(Dependent variable: Logarithm of per capita PPP GDP in 2000)

	Large sample						Acemoglu et al. sample		
Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Hydrocarbon deposits, per capita	.059*** (.016)			.051*** (.010)			.064*** (.013)		
Value of oil output, per capita		.096*** (.023)			.086*** (.015)			.131*** (.018)	
Oil/GDP ratio			1.51** (.693)			1.26*** (.313)			2.57*** (.712)
Absolute latitude	.037*** (.005)	.038*** (.005)	.038*** (.005)						
Ethnolinguistic fractionalization				-170 (.232)	-.455* (.250)	-.436* (.262)	.107 (.237)	.227 (.224)	.204 (.217)
European population	1.34*** (.202)	1.30*** (.202)	1.43*** (.208)	-.054 (.308)	.097 (.286)	.066 (.322)			
Latin America	1.02*** (.155)	.926*** (.154)	1.06*** (.171)	.814*** (.134)	.662*** (.135)	.774*** (.151)	1.02*** (.126)	1.02*** (.119)	1.15*** (.128)
East Asia	1.70*** (.334)	1.67*** (.290)	1.77*** (.269)	.572*** (.195)	.594*** (.172)	.618*** (.213)	.707*** (.226)	.557** (.244)	.569 (.387)
Rule of law (Instrumented)				1.14*** (.150)	1.02*** (.150)	1.09*** (.165)	1.09*** (.102)	1.14*** (.101)	1.31*** (.095)
No. obs.	111	118	118	111	117	117	68	69	69
P-value for instrument overidentif. test (Hansen J statistic)				.122	.114	.811	.978	.988	.907
Adjusted R-squared	.739	.725	.708	.862	.869	.844	.865	.890	.831

Notes: robust standard errors are in parentheses; constant is not shown;
*** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level.
Instruments for Rule of law: eq. (4)-(6): absolute latitude, English language speakers; European language speakers; eq. (7)-(9): absolute latitude, settler mortality

Table 2B. The Effect of Mineral Wealth on Per Capita GDP

(Dependent variable: Logarithm of per capita PPP GDP in 2000)

	Large sample				Acemoglu et al. sample	
Variable	**1**	**2**	**3**	**4**	**5**	**6**
Mining output, per capita	.094*** (.028)		.062*** (.020)		.082*** (.029)	
Mining/GDP ratio		2.60* (1.111)		1.44* (.846)		4.51*** (1.37)
Absolute latitude	.036*** (.005)	.038*** (.006)				
Ethnolinguistic fractionalization			-.432 (.272)	-.417 (.279)	.288 (.237)	.216 (.241)
European population	1.38*** (.187)	1.49*** (.209)	.081 (.316)	.022 (.357)		
Latin America	.941*** (.161)	1.05*** (.170)	.690*** (.158)	.748*** (.161)	1.06*** (.152)	1.10*** (.159)
East Asia	1.63*** (.333)	1.73*** (.304)	.574*** (.179)	.561** (.223)	.625** (.259)	.467 (.301)
Rule of law (Instrumented)			1.04*** (.173)	1.12*** (.180)	1.19*** (.107)	1.30*** (.101)
No. obs.	117	117	117	117	69	69
P-value for instrument overidentification test (Hansen J statistic)			.222	.494	.533	.404
Adjusted R-squared	.711	.700	.843	.826	.817	.811

Notes: robust standard errors are in parentheses; constant is not shown;

*** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level.

Instruments for Rule of law: eq. (3)-(4): absolute latitude, English language speakers; European language speakers; eq. (5)-(6): absolute latitude, settler mortality

Table 2C. **The Effect of Interaction between Institutions and Natural Resources on Per Capita GDP (large sample)**
(Dependent variable: Logarithm of per capita PPP GDP in 2000)

Variable	1	2	3	4	5
Hydrocarbon deposits,	.056***				
per capita	(.014)				
Value of oil output,		.101***			
per capita		(.021)			
Oil/GDP ratio			1.14*		
			(.678)		
Mining/GDP ratio				1.64	
				(1.14)	
Mining output,					.072**
per capita					(.028)
Rule of law	1.14***	1.08***	1.15***	1.13***	1.19***
(fitted values)	(.189)	(.202)	(.218)	(.238)	(.236)
(Rule of law)*	-.041***	-.065***	-.834	-1.53	-.053***
Natural resources	(.012)	(.017)	(.913)	(2.20)	(.019)
Ethnolinguistic fractionalization	-.179	-.433	-.453	-.420	-.486
	(.287)	(.322)	(.323)	(.347)	(.347)
			(.008)		
European population	.019	.227	-.028	.051	.129
	(.377)	(.353)	(.390)	(.410)	(.408)
Latin America	.763***	.555***	.750***	.702***	.638***
	(.158)	(.168)	(.175)	(.176)	(.182)
East Asia	.530*	.722**	.557*	.744**	.552*
	(.310)	(.283)	(.291)	(.294)	(.303)
No. obs.	111	117	117	117	117
Adj. R-squared	.783	.770	.754	.745	.756

Notes: (1) The interactive term (Rule of law)*(Natural resources) is the product of the fitted value of the Rule of Law index and the natural resource dependence measure that is used in the given regression;
(2) robust standard errors are in parentheses; constant term is not shown; *** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level.

Table 3A. The Effect of Oil Wealth on the Rule of Law (ethnic and linguistic controls only; large sample)

(Dependent variable: Rule of law index for year 2000)

Variable	1	2	3	4	5	6
Hydrocarbon deposits, per capita	-.042** (.017)	-.005 (.017)				
Value of oil output, per capita			-.068** (.026)	-.012 (.027)		
Oil/GDP ratio					-1.33** (.536)	.003 (.666)
GDP 1970, per capita	.570*** (.090)		.552*** (.091)		.569*** (.103)	
GDP 1970, per capita, fitted		.508*** (.173)		.466*** (.169)		.473*** (.160)
Absolute latitude	.027*** (.006)	.029*** (.009)	.026*** (.006)	.029*** (.009)	.026*** (.006)	.029*** (.009)
English speakers	.607** (.244)	.951*** (.277)	.718*** (.248)	.928*** (.282)	..476** (.212)	.934** (.257)
European language speakers	.087 (.155)	.383* (.210)	.204 (.148)	.398** (.195)	.156 (.145)	.371* (.191)
Ethnolinguistic fractionalization	.117 (.242)	.374 (.267)	.157 (.209)	.291 (.241)	.235 (.214)	.274 (.245)
No. obs.	112	112	118	118	118	118
Adj. R-squared	.717	.623	.710	.617	.712	.616

Notes: robust standard errors are in parentheses; constant term is not shown;

*** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level.

Table 3B. The Effect of Oil Wealth on the Rule of Law (settler mortality included as a control variable ; Acemoglu et al. sample)

(Dependent variable: Rule of law index for year 2000)

Variable	1	2	3	4	5	6
Hydrocarbon deposits, per capita	-.042** (.019)	-.020 (.020)				
Value of oil output, per capita			-.076** (.030)	-.018 (.030)		
Oil/GDP ratio					-1.70*** (.402)	-.687 (.515)
GDP 1970, per capita	.496*** (.103)		.521*** (.117)		.482*** (.111)	
GDP 1970, per capita, fitted		.343 (222)		.328 (.229)		.291 (.222)
Settler mortality	-.241*** (.090)	-.340*** (.117)	-.231** (.089)	-.335*** (.113)	-.202** (.086)	-.329*** (.111)
Absolute latitude	.015 (.009)	.012 (.011)	.014 (.009)	.011 (.012)	.011 (.010)	.011 (.011)
No. obs.	69	69	70	70	70	70
Adj. R-squared	.622	.499	.601	.490	.616	.495

Notes: robust standard errors are in parentheses; constant term is not shown;

*** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level.

Table 4. The Effect of Mineral Wealth on the Rule of Law (ethnic and linguistic, and settler mortality controls)

(Dependent variable: Rule of law index)

	Large sample				Acemoglu et al. sample			
Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Mining/GDP ratio	-1.20	.357			-.3.19**	-.797		
	(1.60)	(1.31)			(1.26)	(1.40)		
Mining output,			-.044	.003			-.049	.012
per capita			(.031)	(.030)			(.038)	(.037)
GDP 1970, per capita	.483***		.493***		.485***		.472***	
	(.103)		(.093)		(.117)		(.128)	
GDP 1970, per capita, fitted		.493***		.475***		.306		.281
		(.158)		(.170)		(.223)		(.231)
Settler mortality					-.182**	-.324***	-.219**	-.334***
					(.089)	(.111)	(.087)	(.112)
Absolute latitude	.028***	.028***	.029***	.028***	.014	.012	.016*	.012
	(.006)	(.008)	(.006)	(.009)	(.009)	(.011)	(.009)	(.012)
English speakers	.609***	.912***	.721***	.924***				
	(.200)	(.262)	(.219)	(.284)				
European language speakers	.157	.352*	.176	.366*				
	(.154)	(.195)	(.159)	(.204)				
Ethnolinguistic	.160	.251	.133	.271				
fractionalization	(.247)	(.250)	(.218)	(.241)				
No. obs.	118	118	118	118	70	70	70	70
Adj. R-squared	.690	.617	.693	.617	.604	.489	.583	.487

Notes: robust standard errors are in parentheses; constant term is not shown;

*** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level.

Table 5. The Effect of Oil and Mineral Wealth on Corruption

(Dependent variable: Index of control over corruption, 2000)

Variable	1	2	3	4	5	6	7	8	9	10
Hydrocarbons, per capita	-.014 (.015)	.014 (.013)								
Value of oil output, per capita			-.060** (.023)	-.008 (.019)						
Oil/GDP ratio					-1.12** (.442)	.111 (.363)				
Mining/GDP ratio							-.554 (1.25)	.814 (.829)		
Mining output, per capita									-.022 (.027)	.019 (.025)
GDP 1970, per capita	.498*** (.100)		.578*** (.088)		.579*** (.093)		.517*** (.103)		.528*** (.099)	
GDP 1970, per capita, fitted		.765*** (.167)		.800*** (.153)		.804*** (.154)		.814*** (.155)		.803*** (.157)
Revolutions&coups	-1.02*** (.245)	-1.10*** (.234)	-.967*** (.226)	-1.00*** (.235)	-.933*** (.235)	-1.02*** (.241)	-1.07*** (.254)	-1.03*** (.241)	-1.09*** (.243)	-1.01*** (.242)
Opennes	1.25*** (.253)	1.22*** (.300)	1.10*** (.219)	1.12*** (.273)	1.06*** (.240)	1.12*** (.276)	1.15*** (.262)	1.13*** (.276)	1.14*** (.247)	1.12*** (.277)
Ethnolinguistic fractionalization	-.536* (.272)	-.229 (.253)	-.376 (.239)	-.221 (.256)	-.380 (.240)	-.234 (.256)	-.451* (.258)	-.255 (.255)	-.446* (.247)	-.249 (.257)
Sub Saharan Africa	.274 (.196)	.421** (.204)	.208 (.167)	.387** (.189)	.285* (.164)	.410** (.183)	.284* (.169)	.420** (.183)	.256 (.173)	.441** (.193)
No. obs.	110	110	113	113	113	113	113	113	113	113
Adj. R-sq.	.732	.756	.738	.740	.734	.740	.720	.743	.721	.742

Notes: robust standard errors are in parentheses; constant term is not shown;
*** - significant at 1% level; ** - significant at 2% level; * - significant at 10% level.

ENDNOTES

---

[1] Some authors differentiate between the broad concept of natural resources and the so-called "point-source" resources such as oil and valuable minerals, suggesting that only the latter causes the curse (Isham et. al., 2003).

[2] The literature on the Dutch Decease as a cause of the natural resource curse was briefly surveyed by Sachs and Warner (1995). Civil conflict and rent-seeking are discussed in Tornell and Lane (1999) and Hodler (2006). Human capital, savings and investment, and inequality factors are analyzed in, respectively, Gylfason (2001), Gylfason and Zoega (2002a) and Gylfason and Zoega (2002b).

[3] Rodriguez and Sachs (1999) make a related argument that natural resource rich economies adjust to their steady state growth, in which natural resource tends to zero, from above. This results in negative growth rates during the transition.

[4] We exclude the former Soviet economies from our dataset, because most of the oil curse literature typically does not include these economies in the analysis.

[5] Neither Easterly and Levine (2003) nor Rodrik et al. (2004) focus on the effect of oil or mineral wealth. Easterly and Levine acknowledge more or less in passing that the oil dummy appeared to exert a positive influence on GDP even controlling for institutions, but they dismissed this result because it did not help distinguish between their geography, institutions, and policy hypotheses of economic growth. Rodrik et al. have a similar result in one of their tables but simply note that controlling for being a major oil exporter does not change the effect of institutions and openness on per capita GDP.

[6] Sachs and Warner (2001) also mention that per capita GDP levels can be used to test for the natural resource curse, asserting that "…casual observation suggests that there is virtually no overlap in the set of countries that have large natural resource endowments – and the set of countries that have high levels of GDP." (p. 828) While this observation may or may not be correct, depending on how natural endowments are measured, the issue is not whether natural resources make countries richer than anybody else, but rather whether countries well-endowed with natural resources are richer than they would have been otherwise.

[7] Cerny (2005) demonstrates that the relationship between growth rates and the shares of primary exports in GDP is substantially different from the relationship between growth and measures of primary exports per capita. Stijns (2006) has a comprehensive discussion of various possible measures of natural resource endowment in a country, including those mentioned by us, that is broadly consistent with our views. We do not present our results based on export-related measures or natural capital measures here.

[8] The absolute measures of natural resources have another shortcoming in the regressions where GDP is a dependent variable, because in this case GDP is being regressed on its part. The measures expressed in shares of GDP are not subject to this criticism. We think, however, that this is a relatively minor problem given how our absolute measures are calculated and given that in most economies natural resource output constitutes a relatively small part of GDP.

[9] See, for example, Hall and Jones, 1999, and Glaeser et al, 2004, for a discussion of instruments for institutional quality.

[10] If institutions and natural resources are the only two covariates and are orthogonal, there would be no omitted variable bias. If these variables are negatively correlated while

institutions and GDP are positively correlated, the omission of institutions would bias our estimate of γ in (1) down. Positive correlation between institutions and natural resources would bias the estimate of γ up, but institutions are unlikely to be positively correlated with measures of natural resource wealth. If they are, however, that by itself would undermine much of the current literature on resource curse, because the usual causality investigated in that literature is from natural resources to institutions and the conventional wisdom is that the impact is negative. A negative effect of institutions on some natural resource measures is also possible via the institutions' influence on GDP that is in the denominator of some of these measures. Signing the potential bias is more complicated in the presence of other covariates. We regressed institutional quality and natural resource measures on the other covariates in (1) and found that the residuals of these regressions are virtually uncorrelated (coefficients of correlation were less than 0.01). We conclude that the omitted variable bias is likely to be negligible.

[11] Sala-i-Martin and Subramanian (2003) do not include absolute latitude in their instruments. Our results remain qualitatively the same whether we include absolute latitude in the instrument set or not.

[12] We do not include a dummy for the European population in the regressions that use settler mortality as an instrument for institutional quality, because of rather strong negative correlation between these two variables. The exclusion of this variable, however, does not qualitatively affect the results.

[13] Also, Glaeser et al. (2004) argued that settler mortality was not necessarily a good instrument for institutions.

[14] We use an extended sample of settler mortality that has 82 countries. However, because of the unavailability of some other data, particularly purchasing power parity GDP for year 2000 or the fraction of English-speaking population, we had to exclude Afghanistan, the Bahamas, Belize, Barbados, Myanmar, Djibouti, Fiji, Guyana, Laos, Malta, Papua New Guinea, Suriname, and Vietnam. Our results were similar when we used the original settler mortality sample of 64 countries. These results are available upon request.

[15] See Mehlum et al (2006) and Robinson et al (2006).

[16] For those variables, for which we lacked the data for 1970, e.g., the share of mining output in GDP, we used the same values that we used in the regressions for 2000 GDP.

[17] Similar arguments can be advanced with respect to other potential transmission mechanisms between oil and economic growth such as the alleged negative effect of oil on investments or human capital explored, respectively, in Gylfason and Zoega (2002) and Gylfason (2001).

[18] We use 1970 GDP in order to make our results comparable to S&S and other papers that use "initial values" of per capita GDP as a control variable in their regressions. As we mentioned earlier, however, the correlation between per capita GDP in different years over the last 40 years or so is very high, implying that the year in which GDP is measured makes little difference.

[19] Herb (2005) uses a somewhat similar approach to disentangle the effects of oil endowments and, more generally, "rentierism," on the countries' GDP and on the degree of democracy, although his procedure is somewhat *ad hoc*. Herb calculates what he calls "counterfactual GDP" by averaging the per capita GDP's of the rentier country

neighbors. Our fitted values of GDP are obtained according to a significantly more rigorous procedure. In addition, we ran regressions of institutional quality where instead of the fitted value of 1970 per capita GDP we used the independent variables from (3). The results were not qualitatively different from the results with fitted values of per capita GDP as a control.

[20] The results for controls used by S&S are qualitatively similar and are presented in Alexeev and Conrad (2006).

[21] The regressions using S&S control variables produce similar results (see, Alexeev and Conrad, 2006).

[22] We use a somewhat modified corruption regression from Leite and Weidmann, because of our different focus and because we use different measures of natural resource wealth. Also, unlike Leite and Weidmann, we do not use a measure of the rule of law as an independent variable, because of a high likelihood of reverse causality. We feel, however, that our regressions are sufficient to make our point, particularly because Leite and Weidmann claim that their regressions are robust to various modifications.

[23] PPP GDP per capita data are from WDI Online (2006); governance indicators are from World Bank Governance Indicators 1996-2004 (2005).