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Does democracy cure a resource curse?

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Iikka Korhonen*

Does democracy cure a resource curse?

Abstract

In this paper we utilise a large and reasonably detailed dataset to show that a greater level of democracy in a country's political institutions can alleviate the widely known resource curse. Raw material abundance affects per capita growth negatively, an effect that seems to work through several different channels. Resource-abundant countries have a lower degree of democracy and political rights, and also a lower level of educational attainment. These factors inhibit growth. On the other hand, countries with large extractive industries exhibit high levels of investment. The effects of resource abundance differ for different raw material types, and the largest negative effect on growth appears to come from non-fuel extractive raw materials.

Key words: Economic growth, resource curse, cross-country regression, development, governance, institutions

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Iikka Korhonen

Does democracy cure a resource curse?

Tiivistelmä

Laajan ja yksityiskohtaisen tilastoaineiston avulla tässä työssä osoitetaan, että demokraattinen poliittinen järjestelmä pystyy lieventämään ns. resurssikirouksen vaikutuksia. Maat, joilla on paljon raaka-aineita, ovat yleensä kasvaneet hitaammin kuin muut maat. Resurssikirous näyttää vaikuttavan monin tavoin talouskasvuun. Se heikentää demokraattisia instituutioita ja poliittisia oikeuksia. Lisäksi koulutustaso on keskimäärin huonompi niissä maissa, joissa on runsaasti raaka-aineita. Nämä tekijät heikentävät talouskasvua. Toisaalta maissa, joissa on paljon kaivannaisia, investoidaan voimakkaasti. Raaka-aineiden vaikutukset riippuvat myös siitä, millaisia raaka-aineita maassa on. Kaikkein eniten kasvua näyttävät heikentävät muut kuin energiaan liittyvät kaivannaiset.

Asiasanat: talouskasvu, resurssikirous, poikittaisregressio, kehitys, instituutiot

1 Introduction and motivation

There is a large body of literature showing that, as a rule, resource-rich developing countries have grown more slowly than countries less endowed with natural resources (Sachs and Warner, 1997; Gylfason and Zoega, 2001). A few countries blessed with abundant natural resources, however, have grown rapidly, even over the long run. Botswana, known for its diamond riches, is often cited as a developing-country success story. By 1989, diamonds accounted for some 80% of Botswana's exports, yet between 1970 and 2001 Botswana's per capita GDP averaged 6.4% yearly growth. Among OECD countries, Norway's large oil and natural gas wealth has not prevented it from growing quite rapidly. Given its high initial per capita income, Norway's average annual growth rate of per capita GDP of 2.8% between 1970 and 2001 is also quite impressive. Apparently, a large resource endowment does not automatically condemn a country to sub-par growth performance.

In this paper, we examine a large dataset to determine the robustness of previous results that correlate growth and natural endowments. Specifically, we want to see whether certain political conditions (e.g. societies with extensive political rights and civil liberties) are conducive to growth, especially in the case of resource-dependent countries. This issue extend beyond simple academic interest in that it has large policy implications.

We contribute to the literature in several ways. First, we utilise a larger dataset than most previous studies, covering over 100 countries for a period longer than 30 years. Second, we use a large array of institutional and political variables in explaining long-term growth. Extensive political rights and a high level of democracy in general seem to be positively associated with growth. Moreover, political fragmentation, at least in democracies, seems to be beneficial for growth. Such fragmentation may be an indicator of tolerance for dissent in an economy, which in turn may be beneficial for innovation and long-term growth. We also distinguish among types of raw-material resources and find, perhaps surprisingly, that non-fuel extractive industries have the largest negative effect on growth. This contrasts strongly with the widely held perception that dependence on oil exports is detrimental to long-term growth. On the other hand, we also find that fuel exports are negatively correlated with level of democracy and civil liberties.

The second section of the paper starts with a brief literature survey of growth and resource dependency. We then discuss a political economy model of resource booms and growth developed by Robinson et al. (2002). The third section presents the data. As men-

tioned before, we utilise several variables not previously included in this type of analysis. Section four presents the main empirical findings along with several robustness checks. The fifth section provides concluding discussion of the results.

2 Literature survey and sketch of a model

2.1 Literature survey

Recent years have witnessed an explosion of empirical cross-country growth studies. Most studies find evidence for conditional convergence among countries, i.e. poorer countries tend to grow faster than rich countries conditional on some set of explanatory variables (usually related to accumulation of capital, either physical or human). One class of assets often seems to contribute negatively to economic growth – natural resources. In particular, countries where a large share of their total economic activity involves mineral raw material extraction exhibit very low, or even negative, growth rates. One explanation suggested is that relatively easy extraction of mineral raw materials or fuels provokes extreme rent-seeking behaviour. Competition for rents is more profitable than investing in productive assets in other parts of the economy, which lowers the overall growth rate. Another view is that resource-dependent economies are susceptible to Dutch disease. The success of the natural-resource sector crowds out exports from the manufacturing sector by increasing demand for non-tradables within the economy. If the non-tradable sector has lower productivity growth than manufacturing, it leads to lower overall economic growth.

We begin this section with a brief literature survey of the discussion as it has evolved in recent years. Next, we present relevant features of a model developed by Robinson et al. (2002). The model suggests that the consequences of a resource boom are crucially governed by the quality of institutions, particularly the constraints they place on politicians to prevent them from redistributing resource boom gains in an inefficient manner. We argue that democratic political systems, i.e. those where people enjoy greater freedom of speech and other freedoms, are more likely to have such constraints in place.

Sachs and Warner (1995 and the paper's revised version in 1997) present evidence on the effects of natural resource abundance on economic growth between 1971 and 1989. They employ the ratio of primary exports to GDP as their main indicator of natural re-

source abundance. Their preliminary findings are that conditional convergence has occurred among the countries studied, and that high dependence on primary exports is associated with slower growth. The robustness of this result is checked with various indicators of resource dependency. Sachs and Warner next investigate the potential channels through which resource abundance might affect growth. They find that primary resources do not seem to affect the quality of bureaucracy and that the quality of bureaucracy itself does not seem to affect the level of investment. Instead, resource abundance seems to affect growth more through protective measures that render the economy less open than it would be otherwise. Sachs and Warner postulate that such protective measures are utilised to counter the effects of Dutch disease. Unfortunately, when capital markets operate with less-than-perfectly efficiency, the direct negative effect from resource dependence typically dominates other potential avenues of influence.

Other studies extend the analysis in other directions. Gylfason and Zoega (2001) look at the effects of natural resources on physical investment in detail. They find that natural resources lead to lower investment and a smaller financial sector. Also, the level of education is lower in resource-rich countries. As education contributes positively to growth, raw material abundance is associated with lower growth. Expected rents from the natural resource sector decrease the incentive to gain human capital, i.e. invest in education. Asea and Lahiri (1999) develop a two-sector model in which natural resources increase rewards to non-skilled labour. This slows investment in human capital and ultimately economic growth. They also present tentative empirical evidence in favour of this transmission channel.

Gylfason and Zoega (2002) show that natural resource abundance is associated with higher inequality, which can be harmful for economic growth through its detrimental effect on educational attainment. Mehlum et al. (2002) find that an index of institutional quality is statistically significant in explaining growth when resource abundance is taken into account.[1] Their multiplicative interaction term between resource abundance and institutional quality is positive for explaining growth, i.e. raw material abundance is *good* for growth as long as the country has business-friendly institutions. On the other hand, the index of institutional quality only goes back to 1982; the quality of institutions may have been quite different before that. With a reasonably small sample, Papyrakis and Gerlagh (2004) investi-

gate the relative importance of various transmission channels from resource abundance to economic growth. They find that the largest negative contribution comes through lower investment. Resource-abundant economies are more prone to terms-of-trade shocks, which, in turn, produces more violent boom-and-bust cycles. Such uncertainty depresses investment. Gylfason and Zoega (2001) find that the maturity of the financial system is inversely related to the degree of resource abundance. The lack of a developed financial system is likely to depress investments further. Papyrakis and Gerlagh find that resource abundance affects growth by increasing corruption and decreasing the level of education and international openness of an economy.

Perälä (2003) deepens the analysis by examining different types of raw materials. In her analysis, countries that predominantly export fuels and minerals (point-source economies) are likely to grow more slowly than countries that export a variety of raw materials (diffuse economies). This effect is stronger in countries lacking political cohesion. Perälä uses a binary variable (from Auty, 2001) to classify point-source economies and diffuse economies. A country is a point-source natural resource economy if it is based largely on extraction of minerals or oil, and exports of such products exceed 40% of total exports. We reject this definition and use instead a continuous variable to depict resource dependence. We also make finer distinctions among natural resource categories.

However, some studies at least partially dispute the result that natural resource abundance leads to lower growth. Manzano and Rigobon (2001) attribute the apparent natural resource curse to developing countries' debt problems. When prices of raw materials were high in the 1970s, many developing countries were able to borrow from international capital markets. When prices of raw materials decreased, these countries had difficulties servicing their debt. The result was lower growth in the 1980s and beyond. Lederman and Maloney (2003) argue that natural resources are generally not correlated with growth once structure (concentration) of exports is taken into account. However, in some of their specifications natural resource abundance is *positively* correlated with growth. Export concentration itself is negatively associated with growth, while intra-industry trade contributes positively to growth. Both Manzano and Rigobon, and Lederman and Maloney employ cross-section and panel estimations in their studies. It is worthwhile to note that results of Sachs and Warner do not survive in the panel setting.

[1] They use an unweighted average of five indexes based on data from Political Risk Services: rule of law, bureaucratic quality, corruption, risk of expropriation and government repudiation of contracts. Their data

2.2 Modelling resource booms, economic growth and rent-granting

Robinson et al. (2002) develop a two-period model with two parties.[2] In the first period, the politician A is in power, but at the end of the first period the person (or party) in power may be turned over through elections to B. Two groups of people, A and B, vote in elections. The groups are of equal size. Each politician cares about her own utility and that of her own group (clan, political party or similar grouping). The economy has a stock of natural resources, and prices of natural resources are determined in the world markets in both periods. In the first period, the physical amount of resources extracted is e, and in the second period R(e), with R'<0 and R"<0. The incumbent politician decides e, and how the resource rents are allocated between her own consumption, transfers to all citizens and employment in the public sector. Before the elections, politicians make promises concerning these variables in the second period, but in fact they are unable to commit to any specific set of policies. After the elections, the politician in power thus consumes the remaining resource rents. Voters derive utility (U) only from their own income (Z), $U(Z_t)=Z_t$. Income consists of wage income (ω_t) and transfers (T_t), minus taxes (τ_t), i.e. $Z_t=\omega_t+T_t-\tau_t$. Politicians derive utility from their own income (which they receive if they are in power), and the incomes of their own group. Utility of politician i=A,B in period t is given by:

$$V_t^i = X_t^t + \alpha \int_0^1 Z_t^1 di$$

Here X_t is the income of the politician in period t, and $0<\alpha<1$ is the weight given to other members of the politician's group. Voters can be employed either in the public sector or in the private sector. Productivity is assumed to be higher in the private sector, while wages in the private sector equal the productivity of private-sector labour, H. Public sector wage is W, and the number of people employed in the public sector in period t is G_t. Employment in the public sector is the way in which politicians in this model distribute resource rents to their constituencies. If a voter is employed by the public sector in the first period, he can be fired in the second period with a cost of F. Since politicians care about their own income more than voters' incomes, promises of transfers in the second period are not

sample is somewhat shorter than ours (1965-1990).

[2] We present only the very basic structure of the model, leaving out many features inessential to our argument.

credible. Similarly, no new public sector employees are hired in the second period, because their wages are higher than their productivity (normalised to zero).

Robinson et al. employ a probabilistic voting model, where each voter i has an ideological stance[3] towards the incumbent politician A, σ_i. The voter supports the incumbent if his utility under her rule is higher than in the alternative arrangement, i.e. $Z_t(A)+\sigma > Z_t(B)$. In the first period, the incumbent chooses public sector wages and employment, resource extraction and taxes. In the election, the voters compare their expected utility under the two possible regimes and choose the one that maximises their welfare. The politician in power in the second period chooses optimal policies (for her) and implements them. Especially, public sector wages can be renegotiated and public sector employees from the first period fired. As no new employees will be hired in the second period, the incumbent can credibly promise public sector employment only by hiring public sector employees in the first period, and these workers are recruited from the incumbent's own group. Robinson et al. show that it is optimal for the incumbent to employ the same number of people in the public sector with the same wage also in the second period, provided she stays in the office.

For the purposes of this discussion, we concentrate on proposition 4, which states that resource booms (i.e. either a permanent or temporary increase in raw material prices) may increase or decrease total income. Net present value of the total income Y can be written as follows:

$$Y = 2(1-G_t)H + p_1 e + p_2 R(e)$$

Productivity of public sector workers has been normalised to zero. Total income therefore depends on the production of the private sector (where $1-G_t$ are employed) in both periods and resource rents. The effects of the resource price increase on income can be found by differentiating Y with respect to p. The resource boom has three effects on income. First, there is the direct positive effect on income through higher prices, since they increase resource rents. Second, the boom increases efficiency by moving the extraction path closer to the socially optimal path. Incumbent politicians over-extract in the first period because there is a positive probability that they are not in the office in the second period. Third, re-

[3] Uniformly distributed.

source boom shifts workers away from the private, productive sector to the public sector. This decreases income. It is not possible to unambiguously determine the net effect of resource boom on income, but some observations can be made. Income is more likely to decrease the more the incumbent can affect her re-election probability by increasing public sector employment in the first period. In our opinion, this captures an important aspect of resource curse in many countries; politicians can distribute the rents extracted from the resource sector. Competition for these rents can divert resources from more productive uses.

If a country has institutions in place constraining the actions of politicians and preventing them from distributing the resource rents inefficiently, it has a better chance of benefiting from the resource boom. A wide variety of institutional arrangements can be suitable for limiting the power of politicians to grant rents. Robinson et al. (2002) mention that institutional quality index of Political Risk Services could provide a good overall proxy for such arrangements. However, all such qualities of institutions are highly correlated with the level of democracy in a country. In fact, liberal democracy allows for outside checks (such as free press and non-governmental organisations) on the power of politician and civil servants. In the long run, such checks may matter more for preventing corruption and rent-granting than e.g. the quality of civil servants. We return to this discussion in the empirical part of this paper.

3 Data

We now briefly discuss the data and their sources. The data can be divided broadly into three categories. *Economic* variables depict economic phenomena, including our central variable of interest, growth of per capita GDP. We also employ data on the structure of foreign trade (e.g. share of different goods in total exports in GDP), fixed investments and per capita GDP at the beginning of the sample period. *Social* variables describe social conditions in the countries. These include school enrolment ratios. *Political* variables are related to the political institutions and outcomes. They include fragmentation of the legislature, degree of democracy, and political freedoms enjoyed by the population.

For the economic variables, the main source is the 2003 edition of World Bank's World Development Indicators (World Bank, 2003), or WDI for short. Our main variable to be explained is the average growth of per capita GDP (PGDPLCU) between 1970 and 2001. Average growth rate is calculated from per capita GDP in local currency constant prices with the formula $PGDPLCU = \frac{1}{T}\log(\frac{Y_T}{Y_0})$, where Y_T is the per capita GDP at the end of the sample (for most countries in 2001) and Y_0 at the beginning of the sample (for most countries 1970).[4] T is then merely the length of time in years. The WDI database also provides most of the other economic variables used. Several different measures of raw material dependency are utilised in the analysis. The average share of primary good exports in GDP (PRIMGDPAVE) is often used in analysis, and here it is supplemented with the share of food (FOODGDPAVE) and fuel (FUELGDPAVE) exports in GDP. In Sachs and Warner (1997), the share of primary exports in the beginning of the sample is used. However, we prefer to use the whole period; resource dependency may vary substantially over the years and using a single observation in time may give misleading results.[5] Several potential political and institutional variables could be used in the analysis. For example, one might plausibly claim that political and civil liberties influence long-term growth. Civil liberties are also often correlated with economic freedoms. In the absence of such freedoms, innovation is stifled and growth impaired. Civil liberties and political freedom may themselves be conducive to growth, as well as good indicators of the general rule

[4] If per capita GDP for 1970 is unavailable, the first year when per capita GDP is available is used. If per capita GDP is unavailable for any year before 1980, observation is dropped. We are interested in the determinants of medium to long-term growth, so a too-short sample period is unacceptable.
[5] Correlation between the initial and average primary export shares in our sample is 0.47.

of law. On the other hand, political freedoms can lead to higher demand for redistributive policies. Higher transfers require higher taxation, which may cause inefficiencies in the economy, lowering its long-term growth potential. Freedom House has calculated and published since 1972 indices of civil liberties (CL) and political rights (PR) for a large number of countries (Freedom House, 2003). We use these indicators in the empirical exercise.[6] In addition, Marshall and Jaggers (2003) have constructed a very large database of political indicators, POLITY IV. From this database, we utilise the variable POLITY relating to the nature of democracy in various countries.[7]

There are a number of other political variables spanning our data sample. Further political variables are due to Beck et al. (2001). They have collected a very large comparative database on political institutions, covering 177 countries from 1975 to 1997. Although the years do not exactly correspond to our data sample, the overlap is surely large enough. The variables describe different aspects of elections, electoral rules, types of political system, party composition of the government and opposition coalitions, and the extent of military influence on government. There are also a number of measures of various checks and balances, and political stability. Unlike many other datasets of political indicators, DPI variables are not subjective. Also, the DPI database has several variables relating to the fragmentation of the political field. As the theory does not make clear a priori which variable best describes polarisation of political opinions or the political field, we include several variables in our initial estimations. FRAC is the probability that two deputies picked at random from the legislature will be from different parties. At one extreme FRAC=0, and there is no polarisation of political opinions (except within the one party represented in the legislature). At the other extreme FRAC=1, and all the deputies come from different parties. Presumably, such a legislature would be very divided and uncertainty concerning future policies could be high. On the other hand, some fragmentation of political arena may

[6] More specifically, we will utilise the first principal component of the indicators. Correlation of civil liberties and political rights is very high (0.97), so including the individual variables is a bad idea. The first principal component (PC1) explains 98.45% of the variation in the indices. In the construction of PC1, the index of political rights is weighted by 0.37 and civil liberties by 0.41. Indices of political freedom and civil liberties run from 1 to 7 with 1 indicating the highest level of freedom. To illustrate, in 2003 Australia scored 1 on both accounts, while Azerbaijan had a 6 in political freedom and a 5 in civil liberties. Australia was classified as free; Azerbaijan as not free.

[7] POLITY ranges from +10 (strongly democratic) to -10 (strongly autocratic). POLITY is constructed from sub-indices relating to the competitiveness and openness of executive recruitment, constraints on chief executive and competitiveness of political participation.

be beneficial, as it can reflect liberties more generally.[8] Fragmentation of political life may also have different effects in different political systems. Therefore, we also experiment with an interaction term, multiplying POLITY by FRAC.

4 Estimation results

We report our main empirical findings in this section. We start with simple conditional growth models and then increase their complexity by adding indicators of resource dependency and political system. We pay close attention to the robustness of the results.

4.1 Baseline regressions

We first estimate a very basic conditional convergence regression, where growth of per capita GDP is explained by initial per capita GDP, average investment ratio and average enrolment at the secondary school level (it would not matter much if primary school enrolment is used, correlation between the two variables is 0.92). A planned economy dummy (PLANDUMMY) is used for countries that had command economies in the 1970s and 1980s.[9] In the first regression, all variables have the expected signs and are strongly statistically significant (Table 1, column I). For example, in a sample of 106 countries, we can detect conditional convergence of per capita GDP between 1970 and 2001. In the regressions of Table 1, the coefficient on initial income varies from -0.77 to -0.92. They are somewhat smaller in absolute value than e.g. the coefficients obtained by Sachs and Warner (1995).

Next, we turn to the issue of resource dependence. As explained before, there are several potential indicators of raw material dependence. In our first stab at the data, we use

[8] A similar index, GOVFRAC, can be constructed for the government coalition. The variable HERFTOT is calculated in the same manner as the ordinary Herfindahl index for the total legislature. HERFTOT is the sum of squared shares of all parties in the legislature. With HERFTOT, a smaller value is associated with more fragmented legislature. The DPI database contains Herfindahl indices for the government coalition (and opposition). The corresponding Herfindahl index for government coalition is HERFGOV. Adding these variables to the regressions does not add anything beyond FRAC, and consequently these results are not reported.

[9] Without the dummy, some of these countries would be fairly large outliers. There are two economic reasons for including this dummy: Having a socialist system most probably retarded growth, but this explanation is not within the current growth theoretic framework. Moreover, when the formerly socialist economies started their transition towards a market economy, almost all experienced large reductions in recorded output (some-

the share of primary sector exports in GDP as an indicator of resource dependence. In effect, this regression replicated the initial results of Sachs and Warner, but with twelve more years and a few more countries.[10] Also, we use the average share of primary sector exports in GDP for the sample period. As noted, resource dependency seems to fluctuate considerably for many countries from year to year (partly because of volatility of the raw material prices), so using the initial value is not appropriate. Share of primary sector exports is negatively associated with long-term growth in our sample of 106 countries. Variables in column II of Table 1 seem to explain 0.53 of the variation in per capita GDP growth rates. Residuals of the regression are normally distributed, and there are no large outliers.

Now we turn our attention to the effects of our political and institutional variables on long-term growth. Sachs and Warner used an index measuring the quality of the bureaucracy between 1980 and 1983, taken from Mauro (1995), as an indicator of institutional quality. If institutional quality changes little over the years, using data from one point in time is quite acceptable. Over three decades, however, political systems inevitably change, and these changes obviously affect e.g. the quality of bureaucracy. The transition of previously socialist countries to market-based systems in the early 1990s is an obvious example. Another example is South Korea, which was a largely autocratic country with severely limited civil and economic liberties at the beginning of the 1970s. In 1972, Freedom House classified South Korea as "not free." By 1987, Korea's classification had moved via "partially free" to "free." By 2003, South Korea's political freedoms and civil liberties were approaching the level of most other OECD countries. Several countries have undergone comparable changes in their political systems. Such changes need to be taken into account when devising the institutional and political proxies. Therefore, we use averages over the three decades when constructing our political and institutional variables.

Just adding POLITY to the regression in column III seems to indicate that, ceteris paribus, more democratic systems grow faster. The coefficient of POLITY is positive and significant at the 10% level. To illustrate the significance of this indicator of democracy for per capita growth, we note that its standard deviation is 6.63. Therefore, increasing democracy by one standard deviation of the sample would increase average per capita GDP growth by 0.34 percentage points. However, adding POLITY to the baseline regression

times 30% or even 40%) of pre-reform levels. Also this "transformational recession" is outside the framework of the current exercise.

[10] In later specifications, the number of countries in Sachs and Warner drops quite drastically. This is not the case in our exercise.

causes the coefficient of primary goods' export share to lose its statistical significance (t-value is now 1.52), although it remains negative. We also experimented with adding the variable POLITY as squared, but it did not come in as significant.

When we replace POLITY with the first principal component of Freedom House indices of political rights and civil liberties indices (PC1), it appears that they are positively correlated with growth.[11] This is an interesting result. Some previous studies find that expanding political rights are associated with slower growth, the intuition being that in more democratic states electorate will demand higher level of budget transfers, which leads to higher level of taxation. High taxation, in turn, depresses growth. In our exercise, however, political rights enhance growth. They may be correlated with broader economic freedoms and stable rule of law, which should encourage investment. Unlike with POLITY, including these institutional variables does not cause the coefficient on primary good exports to lose its statistical significance and it remains negative. All other variables remain statistically significant and have the same signs as before.

We next address the effect of political fragmentation on economic growth. It turns out that by itself FRAC has a positive coefficient in growth regression of column V, but it is not statistically significant. Coefficients on our basic growth determinants (initial per capita GDP, investment ratio, secondary school enrolment and planned economy dummy) retain their signs and remain statistically significant, as does the coefficient on primary good exports. However, multiplicative interaction term between POLICY and FRAC is marginally significant, and appears to contribute positively to growth. Again, our basic set of growth determinants retains its significance, while the coefficient on primary good exports, although negative, loses its statistical significance. It may be that the effect of this interaction term is due more to the effect of democracy variable than political fragmentation itself. If POLITY, FRAC and their interaction term are all added to the regression at the same time, none is statistically significant.

Because inclusion of several political and institutional variables seems to decrease the statistical significance of the primary good export variable, it may be that the negative growth effect of resource dependency works mainly through political system. The coefficient on education also decreases sharply when primary goods variables are included. These results could suggest that the effect of resource dependency on growth has two

[11] Again, the Freedom House indices run from 1 to 7. The higher the value, the less rights and liberties people in that country enjoy.

channels of influence: the political system and education. For the effect on political system, the hypothesis that rent-seeking is intensified may be appropriate. For education, higher raw material wealth may depress the relative returns on education and innovation when high-paying jobs are available in the raw material sectors. This issue is taken up in subsection 4.3.

Table 1. Baseline growth regressions, resource variable share of primary good exports in GDP

	I	*II*	*III*	*IV*	*V*	*VI*
CONSTANT	3.31956* (1.944)	2.56882 (1.933)	2.79206 (1.967)	3.93901** (1.984)	2.83567 (1.943)	3.16551 (1.959)
LGDP70	-0.8887*** (0.2554)	-0.768169*** (0.2593)	-0.857897*** (0.2665)	-0.918596*** (0.2622)	-0.831903*** (0.2608)	-0.895634*** (0.2660)
INVAVE	0.162964*** (0.025)	0.187904*** (0.02821)	0.192916*** (0.03030)	0.188088*** (0.02821)	0.179689*** (0.02893)	0.191636*** (0.02993)
ENROLSE-CAVE	0.0338129*** (0.007598)	0.0274256*** (0.007809)	0.0208198** (0.009178)	0.0214677** (0.008568)	0.027498*** (0.008168)	0.0202092** (0.009336)
PLAN-DUMMY	-2.62298*** (0.9922)	-2.72988*** (0.9501)	-2.37306** (0.9568)	--2.38067** (0.9480)	-2.47304** (0.9688)	-2.10372** (0.9780)
PRIMGDP		-0.0250932** (0.009989)	-0.0164285 (0.01084)	-- 0.0198427** (0.01005)	-0.0188344* (0.01037)	-0.0125622 (0.01102)
POLITY			0.0510341* (0.03081)			
PC1				-0.288148* (0.1490)		
FRAC					0.607372 (0.5796)	
FRAC*POLITY						0.0784625* (0.04172)
N	106	106	96	105	103	95
R^2	0.55	0.53	0.53	0.54	0.53	0.54
Log-likelihood	-168.655	-171.956	-153.6	-167.79	-166.02	-151.268
Normality test, Chi^2, p-value	0.6970	0.5029	0.5797	0.9037	0.8090	0.7212

Standard deviations in parenthesis. ***, ** and * indicate 1%, 5% and 10% statistical significance, respectively.

However, it may be that different raw material endowments have different effects on growth. For example, it has sometimes been argued that economies based on mineral resources are more prone to rent-seeking behaviour (Perälä, 2003). Prevalence of rent-seeking behaviour may distort incentives in other parts of the economy, leading to lower investment in physical and human capital, and consequently to lower growth. Therefore,

we try to differentiate among natural resources. The WDI database provides information on food and fuel exports, which allows us to examine separately the effects of these primary goods on growth. We construct two new variables NONFUEL and NONFOOD, which denote the share of primary good exports other than fuel and food in GDP. Table 2 report results from this exercise.

Reassuringly, portioning primary good exports into different components barely affects the estimated coefficients of other variables. Their statistical significance levels are also unaffected. However, the effects of raw material endowments on growth do seem to vary. First, portioning primary goods into fuel and non-fuel component suggests that the non-fuel component contributes more to negative growth. Moreover, its coefficient is statistically significant in all the regressions involving political variables (which is not the case with overall primary goods).[12] The same applies when primary goods are portioned into food and non-food categories. These results suggest that the growth-retarding effect of natural resources may be due to other categories besides food or fuel. When looking at our World Bank data in more detail, it seems that lower growth is associated with large relative export shares of metalliferous ores, non-ferrous metals, wood, pulp and a number of smaller items.[13] This would be in line with the reasoning that at least some extractive industries succumb more readily to rent-seeking behaviour, which in turn is detrimental to long-term growth.

The political variables are statistically significant when primary goods are divided into fuel and non-fuel components. Higher level of democracy is clearly associated with faster growth, regardless whether we use POLITY or PC1 as the variable. However, when primary goods are divided differently, i.e. into food and non-food, the political variables lose their statistical significance, although the estimated coefficients retain their signs.

[12] Regressions involving FRAC and FRAC*POLITY are not reported to save space, but statistical significance survives in those regressions as well.
[13] Primary good exports have been constructed by subtracting manufacturing exports (SITC classes 5-8, with the exception of SITC class 68, non-ferrous metals) from total exports. Fuel exports consist of SITC class 3, while food exports are defined as SITC classes 0, 1, 4, as well as 22 (oil seeds and oleaginous fruits).

Table 2. Baseline growth regressions, resource variables differentiating between food and fuel exports

	I	*II*	*III*	*IV*	*V*	*VI*
CONSTANT	2.72605	4.28740*	5.81734**	1.14875	1.82842	2.62044
	(2.173)	(2.294)	(2.414)	(2.028)	(2.135)	(2.302)
LGDP70	-0.786505***	-1.05372***	-1.13387***	-0.611832**	-0.727670**	-0.774583***
	(0.2843)	(0.3081)	(0.3057)	(0.2668)	(0.2892)	(0.2915)
INVAVE	0.186583***	0.183672***	0.17780***	0.202964***	0.199041***	0.195776***
	(0.02950)	(0.03109)	(0.02910)	(0.02875)	(0.03071)	(0.02898)
ENROLSE-CAVE	0.0279130***	0.0229819**	0.023351***	0.022924***	0.0206656**	0.0211442**
	(0.008409)	(0.009310)	(0.008645)	(0.008005)	(0.009163)	(0.008561)
PLAN-DUMMY	-2.74574***	-2.41704**	-2.40135**	-2.60212***	-2.40637**	-2.41985**
	(0.9598)	(0.9543)	(0.9441)	(0.9378)	(0.9555)	(0.9292)
NONFU-ELGDP	-0.0259222**	-0.0227795*	-0.0262975**			
	(0.01128)	(0.01193)	(0.01108)			
FUELGDP	-0.0231839	0.00212230	-0.000769746			
	(0.01553)	(0.01831)	(0.01728)			
NON-FOODGDP				-0.03944***	-0.0274854**	-0.0303964**
				(0.01212)	(0.01447)	(0.01373)
FOODGDP				-0.00371896	-0.00273392	-0.00700048
				(0.01442)	(0.01609)	(0.01520)
POLITY		0.0695100**			0.0297950	
		(0.03405)			(0.03587)	
PC1			-0.397736**			-0.181794
			(0.1690)			(0.1763)
N	106	96	105	106	96	105
R^2	0.53	0.54	0.55	0.55	0.54	0.55
Log-likelihood	-171.942	-152.748	-166.807	-169.803	-152.884	-167.109
Normality test, Chi^2, p-value	0.5149	0.7146	0.9773	0.4839	0.5028	0.7727

Standard deviations in parenthesis. ***, ** and * indicate 1%, 5% and 10% statistical significance, respectively.

4.2 Alternative specifications

In this subsection we examine the robustness of the results derived in section 4.1, utilising other indicators of resource dependence. We also again check that the results do not depend on a small number of outlier countries.[14]

A World Bank project attempts to assess the total wealth of some hundred countries in terms of human capital, produced assets and resource wealth. For more details about the way the data are collected and wealth estimated, see Kunte et al. (1998). The data for various forms of wealth refer to 1994, which is slightly problematic.[15] Use of the data in cross-country analysis is warranted where we can establish that the relative share of various forms of wealth has not changed drastically between 1971 and 2001 in the countries we study. First, we use the share of natural capital in total capital. The maximum value of the ratio NATW is 0.79 in Niger. In many Western European countries NATW is close to zero, as the produced assets and human resources figure predominantly in their total national wealth. Kunte et al. also provide estimates for values of various raw material stocks, including oil, metals and coal.

To check the robustness of our results, we replicate the growth regressions from columns II-VI of Table 1, replacing the share of primary good exports in GDP with NATW. For starters, the dummy for planned economy must be dropped, as it cannot be estimated precisely when NATW is included. Results of the regressions are reported in Table 3. By and large, results reported in Table 1 are confirmed when another indicator of resource dependence is used. As before, we observe conditional convergence among the countries. Growth is positively associated with investment in physical assets and human capital. Higher initial per capita GDP lowers subsequent growth. When NATW is included in the baseline growth regression alone or with POLITY, its coefficient is negative and statistically significant. To offer an illustration about the effects of natural resource wealth on growth, we can note that the average share of resource wealth in total wealth in our sample is 0.26, and its standard deviation is 0.21. Increasing the share of resource wealth by one standard deviation would lower a country's expected per capita growth rate by 0.355 percentage points. The coefficient of POLITY is positive and statistically significant. Again, the first principal component of Freedom House's political rights and civil liberties indices

[14] Statistical tests in subsection 4.1 already indicated that outliers were not a problem.

is negatively correlated with growth, meaning a higher level of political rights is beneficial for growth, although the coefficient of NATW is not statistically significant. These robustness checks indicate that our earlier results do not depend on the exact indicator of resource dependence.

We next replace NATW with various other natural wealth indicators, i.e. oil, metal and natural gas wealth. By themselves, none of these comes in significant. The most likely reason is that there are only a handful of countries where the share of, say, oil wealth is significantly different from zero. Nevertheless, differentiating between non-oil and oil wealth does change the results a bit. For example, when we replace NATW with a variable that takes out the oil wealth from resource wealth, NONOILW, PC1 remains negative and statistically significant. POLITY remains positive. Although oil wealth is not statistically significant when included in the regression reported in columns VI and VII of Table 3, results would suggest that having non-oil resource wealth is detrimental to growth, but oil resources, ceteris paribus, do enhance growth prospects (at least relative to other types of natural resources). Again, this is in line with the results of previous subsection.

Table 3. Robustness check, share of resource wealth in total wealth

	I	*II*	*III*	*IV*	*V*	*VI*	*VII*
CONSTANT	5.6855** (2.280)	5.8976** (2.293)	7.3887*** (2.440)	5.4966** (2.287)	6.09077** (2.330)	6.9411*** (2.455)	8.5850*** (2.620)
LGDP70	-1.084*** (0.2709)	-1.1828*** (0.2810)	-1.2758*** (0.2878)	-1.1115*** (0.2751)	-1.19981*** (0.2832)	-1.295*** (0.2873)	-1.390*** (0.2940)
INVAVE	0.1616*** (0.02986)	0.1707*** (0.0298)	0.1587*** (0.02951)	0.16450*** (0.0300)	0.173114*** (0.02975)	0.1637*** (0.0303)	0.1506*** (0.03021)
ENROLSECAVE	0.0279*** (0.008660)	0.02250** (0.00912)	0.0238*** (0.00885)	0.028892*** (0.00873)	0.0227917** (0.009352)	0.02297** (0.00885)	0.0236*** (0.00859)
NATW	-1.79142* (1.059)	-1.71310* (1.046)	-1.55889 (1.053)	-1.39639 (1.112)	-1.53767 (1.055)		
NONOILW						-2.0959** (1.079)	-2.00239* (1.084)

[15] In their empirical analysis, Gylfason and Zoega (2001, 2002) use the share of national wealth in the total national wealth.

POLITY		0.057284* (0.03325)				0.06381** (0.0328)	
PC1			-0.3129* (0.1738)				-0.3513** (0.1713)
FRAC				0.401801 (0.6632)			
FRAC *POLITY					0.0766378* (0.04569)		
N	87	84	87	86	83	84	87
R^2	0.59	0.62	0.60	0.60	0.63	0.63	0.61
Log-likelihood	-136.837	-129.626	-135.13	-134.738	-127.796	-129.06	-134.496
Normality test, Chi^2, p-value	0.3322	0.3093	0.6910	0.3566	0.3362	0.2502	0.6042

Standard deviations in parenthesis. ***, ** and * indicate 1%, 5% and 10% statistical significance, respectively.

Our next robustness check concerns the potential engoneneity of political variables. It may be that the level of democracy a country achieves is affected by the growth rate of the economy. For example, a country with a very low growth rate may be more prone to political unrest, which may lead to curtailment of political rights. To take into account the possibility of endogeneity of level of democracy, we also run our regressions with the initial values of Freedom House's indicators (or, more precisely, the first principal component of the initial values of PR and CL, PC1INI).[16] The results are reported below in Table 4. Although the initial level of political and civil rights (proxied by PC1INI) is positively correlated with subsequent growth, it is statistically significant only in the specification where natural resources are divided into fuel and non-fuel components. As the level of democracy and political rights change substantially in many countries of our sample, the initial level of PC1 probably has little value in explaining economic growth for all subsequent years.

All the other variables retain their expected signs. Moreover, share of primary good exports in GDP is statistically significant. When raw material exports are assessed in greater detail, non-fuel and non-food exports are again negative and statistically significant in explaining growth. Therefore, we can consider this result quite robust.

Table 4. Robustness check, initial political conditions

	I	*II*	*III*
CONSTANT	3.27256*	4.36199*	1.82309
	(1.970)	(2.336)	(2.174)
LGDP70	-0.85114***	-0.97840***	-0.68934**
	(0.2628)	(0.3010)	(0.2816)
INVAVE	0.19508***	0.18913***	0.20453***
	(0.02837)	(0.02922)	(0.02885)
ENROLSECAVE	0.02371***	0.025645***	0.021519**
	(0.008104)	(0.008414)	(0.008176)
PLANDUMMY	-2.40955**	-2.42389**	-2.43426**
	(0.9649)	(0.9662)	(0.9586)
PRIMGDPAVE	-0.025454**		
	(0.009919)		
PC1INI	0.189402	0.235662*	0.112820
	(0.1205)	(0.1318)	(0.1297)
NONFUELGDP		-0.03038***	
		(0.01143)	
FUELGDP		-0.0144010	
		(0.01612)	
NONFOODGDP			-0.037078***
			(0.01244)
FOODGDP			-0.00777441
			(0.01518)
N	106	106	106
R^2	0.54	0.54	0.55
Log-likelihood	-170.649	-170.241	-169.395
Normality test, Chi^2, p-value	0.5746	0.6324	0.5022

Standard deviations in parenthesis. ***, ** and * indicate 1%, 5% and 10% statistical significance, respectively.

Our final robustness check concerns the data sample itself. Although no large outliers could be detected in the regression reported in Table 1, it is possible that our results are unduly influenced by a handful of countries with special characteristics. Several countries in our sample have very high resource dependency when measured by share of primary good exports in GDP. Quite predictably, highly developed economies score low on this

[16] The first principal component accounts for 93% of variation in the two variables.

indicator. To assess whether our results are due e.g. to a handful of countries with very high degrees of resource dependence, we drop the countries with highest GDP shares from our sample. Any cut-off point is bound to be arbitrary, but we choose to leave out countries where the share of primary good exports in GDP is higher than 44% (Libya's level). Thus, almost all the oil-producing countries around the Persian Gulf are excluded, as well as small countries like the Seychelles and the Bahamas. In Table 5, we report results from this exercise.

In most regressions the sample does not change very much. Many of the smaller countries have missing observations for a large number of variables, and therefore they do not influence the results of subsection 4.1 in any case. It turns out that omitting the OPEC countries hardly affects the results. This is quite reassuring when assessing the robustness of our results.

Table 5. Robustness check, sample where the countries most dependent on resources have been dropped

	I	*II*	*III*	*IV*	*V*	*VI*
CONSTANT	4.00994*	3.66564*	4.87811**	6.73014***	4.39542**	5.10201**
	(2.096)	(2.067)	(2.120)	(2.222)	(2.064)	(2.120)
LGDP70	-1.01614***	-0.925155***	-1.17106***	-1.26742***	-1.05946***	-1.16962***
	(0.2778)	(0.2766)	(0.2921)	(0.2878)	(0.2790)	(0.2875)
INVAVE	0.17681***	0.189673***	0.197492***	0.187946***	0.178279***	0.193242***
	(0.02941)	(0.02957)	(0.03108)	(0.02879)	(0.03006)	(0.03064)
ENROLSE-CAVE	0.03506***	0.0306995***	0.0243734***	0.0241908***	0.0309460***	0.0239117**
	(0.00807)	(0.008206)	(0.009144)	(0.008450)	(0.008328)	(0.009360)
PLAN-DUMMY	-2.79345***	-2.89900***	-2.57978***	-2.51136***	-2.56083***	-2.24293***
	(0.9557)	(0.9409)	(0.9268)	(0.9129)	(0.9460)	(0.9492)
PRIMGDPAVE		-0.0270242**	-0.0229572*	-0.026005**	-0.0214534*	-0.0175237
		(0.01308)	(0.01409)	(0.01271)	(0.01323)	(0.01418)
POLITY			0.0752182**			
			(0.03373)			
PC1				-0.444625***		
				(0.1613)		
FRAC					0.998292*	
					(0.6081)	
FRAC *POLITY						0.100442**
						(0.04338)
N	99	99	90	98	96	89
R^2	0.52	0.54	0.57	0.57	0.55	0.58
Log-likelihood	-160.857	-158.635	-140.581	-152.42	-151.787	-138.415
Normality test, Chi^2, p-value	0.5321	0.5393	0.7219	0.9596	0.8422	0.8575

Standard deviations in parenthesis. ***, ** and * indicate 1%, 5% and 10% statistical significance, respectively.

4.3 Channels of influence

In this subsection, we discuss the channels through which natural resource abundance may have affected growth. Based on results of subsection 4.1, education and political system appear to be the two main channels. Therefore, we assess the impact of resource dependence on the secondary school enrolment ratio and our political variables by estimating simple cross-section regressions. We then regress the average investment on resource dependency. Results from these regressions are reported in Table 6a. Finally, we again attempt to differentiate among types of natural resources. We duplicate the regressions with fuel and non-fuel export shares, as well as with food and non-food shares. These regressions are reported in Table 6b.

First, resource dependency appears to lower a country's chances of being democratic (regressions where POLITY and PC1 are dependent variables).[17] Resource abundance also lowers educational attainment, although this result is not statistically significant. On the other hand, investments seem to benefit from higher level of primary good exports in GDP.[18] These results lend support to the hypothesis that natural resource dependence leads to rent-seeking as producers try to influence political decision-making. Education also seems to suffer from the resource curse. However, these simple regressions are not entirely convincing from a statistical standpoint. The R^2s remain low and the error terms are not normally distributed.

[17] Please keep in mind that a higher POLITY score means a higher level of democracy, while higher PC1 score means less political and civil rights.
[18] We also experimented with adding PRIMGDPAVE squared. It was not statistically significant.

Table 6a. Channels of influence from resource dependency to growth

Dependent variable	ENROLSE-CAVE	INVAVE	POLITY	PC1
CONSTANT	36.0881***	20.0183***	12.9744***	-0.339025*
	(4.118)	(0.113946)	(0.9906)	(0.2000)
PRIMGDPAVE	-0.18634	0.11395***	-0.14036***	0.0151455**
	(0.1633)	(0.03216)	(0.04178)	(0.007448)
N	122	142	117	141
R^2	0.01	0.08	0.09	0.03
Log-likelihood	-575.386	-455.578	-380.069	-245.579
Normality test, Chi^2, p-value	0.0000	0.1269	0.0000	0.0002

Standard deviations in parenthesis. ***, ** and * indicate 1%, 5% and 10% statistical significance, respectively.

A more nuanced picture emerges when the type of resource endowment is taken into account. It seems that share of non-fuel primary good exports in GDP is negatively associated with educational attainment. This has an indirect negative effect on growth. On the other hand, where POLITY and PC1 are the dependent variables, the results suggest that dependence on fuel resources is definitely detrimental for democracy, political rights and civil liberties. This negative effect on democracy and political rights has an indirect detrimental influence on growth. The same is true if non-food primary good exports are used. However, this negative effect is mitigated by the fact that higher fuel endowment is associated with higher investment ratio. The results remind us that a natural resource endowment may have indirect effects on growth in addition to the direct effects estimated in the subsection 4.1. To get an idea of the size of these indirect effects, we calculate the effect of fuel export share on growth via POLITY and INVAVE using the baseline regression III from Table 1 and all the relevant regressions in Table 6b, where FUELGDP is included. The standard deviation of FUELGDP in our sample is 13.34. Increasing fuel dependency by one standard deviation would lower POLITY score on average by 2.759 (=13.34*(-0.2068)), and increase investment ratio by 1.60 percentage points (=13.34 * 0.11972). Taking coefficient values from regression III in Table 1, this would eventually increase per capita GDP growth rate by 0.17 % [=(-2.759 * 0.05103) + (1.60 * 0.19292)]. Obviously,

this calculation is highly tentative. Regressions in Table 6b have low R^2s, and a number of them have large outliers.

Table 6b Channels of influence from resource dependency to growth, different resources

Dependent variable	ENROL-SECAVE	ENROL-SECAVE	POLITY	POLITY	INVAVE	INVAVE	PC1	PC1
CON-STANT	59.74*** (4.960)	57.78*** (4.856)	12.39*** (1.022)	12.30*** (0.9907)	20.36*** (0.9044)	20.07*** (0.8826)	-0.2481 (0.2109)	-0.2314 (0.2004)
NON-FUELGDP	-0.4300* (0.2421)		-0.05901 (0.05462)		0.08285* (0.0438)		0.004163 (0.01016)	
FUELGDP	0.183908 (0.2177)		-0.207*** (0.05138)		0.1197*** (0.0387)		0.0221** (0.00897)	
NON-FOODGDP		0.02666 (0.1961)		-0.193*** (0.04459)		0.1184*** (0.0362)		0.0247*** (0.00817)
FOODGDP		-0.4287 (0.2985)		0.01684 (0.06871)		0.1036*** (0.0502)		-0.007296 (0.01134)
N	135	137	115	117	140	142	139	141
R^2	0.04	0.02	0.13	0.15	0.08	0.08	0.04	0.07
Log-likelihood	-658.96	-669.67	-371.009	-376.085	-446.624	-455.541	-239.973	-242.246
Normality test, Chi^2, p-value	0.0018	0.0018	0.0000	0.0001	0.1032	0.1369	0.0004	0.0013

Standard deviations in parenthesis. ***, ** and * indicate 1%, 5% and 10% statistical significance, respectively.

5 Concluding remarks

In this paper, we examined the effect of natural resource dependency on growth in the presence of different political systems and freedoms. With our large dataset of more than 100 countries, we confirmed the finding of many previous studies that higher natural resource dependency is associated with lower economic growth. On the other hand, we also established that a higher level of democracy contributes positively to economic growth in the presence of resource dependency. The results did not depend on the exact nature of the indicator for resource dependency used or on observations of a few outlier countries. We

also were able to delve into the issue of resource dependency using more detailed trade data. The data suggested that food and fuel exports had no direct negative effect on economic growth, but rather that the presence of fuel wealth negatively affects democracy, as well as political and civil liberties.

Moreover, education levels tended to be lower in countries with high fuel exports. On the other hand, fuel-dependent countries also had higher investment ratios, which compensated for the lower level of democracy and education. Dependence on metal ores, in particular, seemed to have a direct negative effect on growth, but this effect could be alleviated with more democratic political systems and a greater political freedom.

Our results indicate that countries with large natural wealth endowments are not necessarily condemned to sub-par economic growth. Indeed, certain types of natural resources may even contribute positively to growth. Three policy conclusions deserve mention:

- Negative growth effects of certain natural resource types can be counteracted with institutional and political reforms.
- Allowing greater political freedom and moving towards a more democratic political system improves a country's long-term growth potential.
- Fostering education can partly counteract negative growth effects.

Obviously, implementing large-scale (or even incremental) political changes is a difficult process. In resource-dependent countries such reforms can be especially difficult, because limited political freedoms are a fairly common feature of fuel-intense economies. Nevertheless, several countries have succeeded in dealing with ample natural resource wealth and gone on to build functioning democracies. These states should provide a useful benchmark for other resource-rich countries.

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