RESOURCE ABUNDANCE, POVERTY AND DEVELOPMENT

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ESA Working Paper No. 04-03

January 2004

Agricultural and Development Economics Division

The Food and Agriculture Organization
of the United Nations

www.fao.org/es/esa

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www.fao.org/es/esa

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Abstract
The negative correlation between resource endowments and GDP growth remains one of the most robust findings in the empirical growth literature, and has been coined the "resource curse hypothesis". The policy consequences of this result are potentially far reaching. If natural resources are an inescapable curse, this may imply that countries richly endowed with natural resources can only develop by turning their backs on their comparative advantage and diversifying into other non-resource based activities. This papers analyzes whether the negative statistical relationship between natural resource abundance and economic growth spills over to other important economic and social indicators. The impact of resource wealth on several proxies of economic underdevelopment and welfare are scrutinized. While underdevelopment and welfare are clearly not independent of economic growth, it is known that there exist important differences between these variables. The research presented in this paper represents a step forward in the understanding of the resource curse, and the channels through which it is manifested.

Key Words: resource abundance, economic growth, developing countries, cross-country analysis.

JEL: Q2 Q3 O13 O47 O57

Research support from the Agricultural and Development Economics Division (ESA) at the United Nations Food and Agricultural Organization is gratefully acknowledged. This research paper is part of ESA's work on Sustainable Natural Resource Management and Poverty Reduction.

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1. Introduction

Conventional economic reasoning suggests that increasing a country's stock of assets provides greater opportunities for economic development. Somewhat paradoxically, a substantial body of empirical evidence demonstrates that natural resources tend to hinder, rather than promote economic growth. The seminal and influential studies of Sachs and Warner (1997, 2001) show that after controlling for a wide variety of variables, an increase of one standard deviation in natural resource intensity leads to a reduction of about 1 percent per year in economic growth.

The negative correlation between resource endowments and GDP growth remains one of the most robust findings in the empirical growth literature, and has been coined the "resource curse hypothesis". The policy consequences of this result are potentially far reaching. If natural resources are an inescapable curse, this may imply that countries richly endowed with natural resources can only develop by turning their backs on their comparative advantage and diversifying into other non-resource based activities.

The main objective of this paper is to analyze whether the negative statistical relationship between natural resource abundance and economic growth spills over to other important economic and social indicators. To be more specific, we scrutinize the impact of resource wealth on several proxies of *economic underdevelopment* and *welfare*. While underdevelopment and welfare are clearly not independent of economic growth, it is well known that there exist important differences between these variables. Here we mention only two such differences. First, our underdevelopment and welfare proxies are typically expressed as "levels", whereas economic growth is measured as a change in levels over time. Second, our underdevelopment and welfare indicators capture distributional considerations overlooked in aggregate growth statistics. For example, some indicators capture the population share able to fulfill so-called basic needs. This information complements income growth statistics to provide a complete picture of the effect of resources on well being in society.

The organization of the paper is as follows. In section 2 we review the theoretical and empirical literature on the relation between resource abundance and economic growth. Building on this literature, we develop an empirical model to analyze the impact of resources on underdevelopment and welfare. This state of the art model is outlined in section 3. In section 4 we present the numerical results and discuss the main implications for development policies. Section 5 concludes and section 6 contains recommendations for follow-up research.

2. Explanations for the resource curse: brief literature review

Why might resource-rich countries grow slower than resource-poor ones? Theoretical explanations for the resource curse now abound, and it is only very recently that a consensus seems to be

emerging. In this section we first briefly discuss the various 'streams' of theoretical explanations competing for recognition. We distinguish between three broad categories of explanations that have been advanced: "Dutch Disease" models in various forms and guises, (usually combined with linkage and spillover models), political economy explanations, and, finally, explanations based on endogenous institutions.[1] In section 2.2 we examine the available evidence and we present the consensus view that seems to be materializing – a story consistent with the bulk of the empirical evidence. This evolves around the key role played by institutions in linking resource wealth to economic growth.

A few words of caution about the existing empirical evidence, to which we are contributing, are in order at this point. The great majority of empirical investigations into the resource curse have used the ratio of primary exports to GDP or total exports (or the *primary export share*) as a proxy for resource wealth. It is evident that this is an imperfect proxy at best. First, it measures *flows* rather than *stocks,* or expected *in-situ* rents. This is inconsistent with most of the discussions of the resource curse, in which phrases like "resource wealth" and "resource abundance" feature prominently. Recent work by Stijns (2002) suggests that this distinction is not unimportant; an issue to which we return below.

Second, primary export shares include output that would usually not be classified as resource endowments, such as agricultural production. Isham et al (2003) have shown that the resource curse result spills over to some agricultural products (or more correctly**,** modes of agricultural production associated with certain crops), but not to others. Countries that heavily depend on plantation crops like coffee, cocoa and bananas, appear to suffer from similar effects as those dependent upon the export of minerals and fuels. This insight has triggered a distinction between so-called *point resources* versus *diffuse resources*. The former are extracted from a narrow geographic or economic base and include oil, minerals and plantations. The fact that these resources are concentrated implies that they can be protected and controlled at relatively modest cost. They are typically associated with some inequality in terms of power and the division of the surplus, and often are characterized by vertical relationships between agents (shareholders, managers, laborers). Diffuse resources, on the other hand, are spread thinly in space, and harvested or utilized by agents characterized by horizontal relationships of equality.

In what follows we focus on point resources as the evidence demonstrates that such resources hold the key to understanding the resource curse – see the discussion below. We therefore distinguish between extraction of fuels and minerals versus food and agricultural production. We now turn to a discussion of existing analyses.

[1] In addition to these categories there exists a rather disparate set of *ad-hoc* explanations. Collier and Hoffler (1998), for example, provide empirical evidence showing that increased endowments of natural resources raise the probability of civil war. Controlling for all other factors, a country that has no resources faces 0.5 probability of civil conflict. But a country with a 25% resource to GDP ratio faces a 23% probability of conflict. Thus the chances of civil strife rise (almost) linearly with the share of resources in GDP. This finding suggests that resource rents may at times have a corrosive effect on the institutions of governance in resource rich developing countries. However, while this is an interesting field of research we believe it is not sufficiently developed to serve as a general theory of the resource curse.

2.1 Different explanations for the resource curse

Dutch Disease Explanations

Following pioneering work by Sachs and Warner, early studies on the resource curse placed great emphasis on declining terms of trade for primary products, and on the failure of resource-abundant countries to develop a competitive manufacturing sector – the so-called *Dutch Disease* hypothesis. According to this view, a resource boom results in an appreciation of the exchange rate followed by a contraction of the tradable manufacturing sector.

Note, however, that if the productivity gains from the resource sector are sufficiently large, a contraction in manufacturing in itself need not induce lower growth rates. To generate lower growth it is necessary to assume that the manufacturing sector is the main 'engine of growth'. This is done by assuming that manufacturing either generates positive externalities, or that it is subject to increasing returns to scale at the level of the sector. Hence, the benefits of manufacturing are to a certain extent external to individual firms and therefore ignored by them – resulting in under-investment in manufacturing (e.g., Matsuyama 1992; Sachs and Warner 1999; Torvik 2001). The assumption, then, is that the resource sector aggravates this problem by drawing away labor or investments from the sector most suitable to achieve long-run growth.[2]

In a related vein, Hausmann and Rigobon (2002) show how the tradable manufacturing sector might suffer from lack of investments because of the interplay between volatile resource returns and endogenous interest rates in imperfect capital markets. A booming resource sector might also crowd out public and private investments in education, or human capital (Gylfason 2001), or discourage entrepreneurship (Sachs and Warner 2001). Thus a country's ability to compete on world markets is eroded, reducing the potential for export-led growth in the long run.

Rent Seeking Models

Rent-seeking models are built on the assumption that resource rents are easily appropriable by an elite. This may trigger bribes and an unproductive allocation of labor, and could also distort policies. Torvik (2002) develops a model in which resource abundance increases the payoffs from unproductive rent seeking behaviour and thus lowers overall growth of the economy. In the model, rent seekers compete for a share of the public sector's income that is acquired through resource sales and fixed-rate taxation of manufacturing. Individuals compare income from production (with increasing returns to scale) to income from rent seeking, and arbitrage away differentials between these occupations by entry and exit decisions. A resource boom tilts the balance in favour of rent seeking. As entrepreneurs switch from modern manufacturing, income and demand falls, as do profits from entrepreneurship. Production in manufacturing falls more than the increase in natural

[2] Some commentators argue that there is little evidence to suggest that a dependence on natural resources is intrinsically growth retarding. In a historical study of the mining sector**,** Wright (2002) asserts that mining is a technically advanced and knowledge intensive industry with as much capacity to generate positive spillovers**–**as (say) manufacturing. Similarly, productivity gains in agriculture and forestry have been fuelled by high-tech innovations with both forward and backward linkages to other sectors in the economy (an example being the Green Revolution). Thus, natural resource based activities can have high productivity growth, technical spillovers and linkages to other sectors of the economy. The question that remains unanswered is why some countries have harnessed these benefits and used resource rents judicously, while others have not.

resource income, a result driven by the assumption of IRS in manufacturing. Society as a whole is worse off.

Since the available evidence suggests that resources are a curse to development only for some countries and not for others, there have been attempts to enrich rent-seeking models with multiple equilibria features, where comparative statics are conditional on the specific equilibrium the system is located in– i.e., the effect of resource abundance on growth becomes context-specific and essentially determined by "initial conditions" (e.g. Acemoglu 1995 and Baland and Francois 2000). Mehlum *et al*. (2002) have added institutions to the analysis, but treat them as pre-determined or "fixed". They assume that returns to entrepreneurial activities and rent seeking are determined by the institutional context. In so-called 'grabber-friendly' economies, resource booms trigger a move of labor from production to rent seeking at the detriment of aggregate growth—the curse materializes. In countries with good institutions ('producer-friendly economies'), instead, a resource boom boosts production. This model provides a natural link between rent seeking models and the class of endogenous institutions models, where resource abundance "shapes" the institutional context, which we discuss next.

Endogenous Institutions and Policies

Auty (2001a,b) distinguishes between different development trajectories, and argues that resource-rich countries (especially those characterized by so-called 'point resources' like oil fields) tend to be dominated by factional and predatory oligarchic policies, promoting narrow sectional interests. This is consistent with recent work by Sala-I-Martin and Subramanian (2003) and Isham et al. (2003), who argue that countries depending on exports of point source resources are more likely to perform worse on various government indicators. Countries well endowed with point resources, then, are expected to have 'bad policies' — policies postponing the transition to competitive industrialization and diversification of the economy. As a result, the resource sector supports a burgeoning non-tradable sector made up of infant industries and an inflated but unproductive public sector. Complementing these theories, Leite and Weidman (1999) demonstrate that the availability of resource rents induces excessive lobbying and corruption which is inimical to growth (see also Damania and Bulte 2003).

While there is no formal modeling of the link between point resources and institutions, Isham *et al* discuss mechanisms through which resource abundance may translate into "bad" institutions and policies. In addition to delayed modernization, abundant point resources may imply so-called *rentier effects*, such as a reduced incentive of government and citizens to "invest" in mechanisms of accountability that form the basis of a civil society as properly understood. Resource wealth may also mean that governments can finance repression against dissenters in society, with adverse effects on investment and growth.

2.2 Examining the evidence – Towards a Consensus

The most widely cited study of the resource curse is based on Sachs and Warner's (1997, 2001) empirical analysis. Sachs and Warner employ a standard econometric growth model of the form:

1. average annual growth from 1970-1990 = $a_0 + a_1$*conditioning variables + a_2*price volatility + a_3*Log Initial GNP + + a_4*Natural resources + e

The dependent variable is the average annual growth rate of the economy from 1970 to 1990. The explanatory variables include the initial level of per capita GDP, which allows for convergence in income, and a set of other conditioning variables. The latter include: proxies for openness to trade, investment and institutional quality. The key variable in the model is the share of primary exports to GDP in 1970, which is used as a measure of resource abundance. The negative and significant correlation between growth and the proxy for natural resource abundance is deemed to provide evidence for the existence of the resource curse.

This finding inspired a vast amount of subsequent empirical research, which has been motivated by the fact that the Sachs-Warner estimates could be biased if there are any missing variables in the regression that are correlated with the resource term. The general conclusion which emerged from the first round of empirical studies was that the resource curse result remains remarkably robust and is unaffected by the inclusion (exclusion) of terms in the set of conditioning variables.[3]

Having accepted the growth-impeding effects of resource wealth as a stylized fact, there have been various attempts to unravel the causal relation between resources and economic growth. The focus of the most recent empirical work is on institutional factors. It now appears that there is little support for the Dutch disease explanation. Perhaps this should come as no surprise. An overview of different case studies in Auty (2001a) demonstrates how complex and diverse the experiences of different countries are. There exist many exceptions to the resource curse both in the developed and developing world – countries that have used their resources to build modern and successful economies. A satisfactory explanation of the resource curse hypothesis must explain why resource abundance retards growth in some countries (e.g. Nigeria and Venezuela) and promotes development in others (e.g. Australia and Malaysia) – the more generic Dutch Disease phenomenon fails to capture this context-dependent complexity. In recent statistical analyses, terms of trade effects typically do not appear as significant variables (Leite and Weidmann 1999, Sala-I-Martin and Subramanian 2003).

To our knowledge there have been no explicit statistical analyses of rent seeking explanations – this stream of literature appears to have developed almost as separate and untested theoretical exercises. Exceptions include Mehlum *et al* and Damania and Bulte, but their empirical work focuses on the

[3] However, some econometric issues may have been overlooked thus far. For example, empirical tests of the resource curse are based on cross country growth regressions with average GDP **growth** on the left hand side ($\Delta Y/t$) and a proxy for resource abundance (R), together with a set of controls (X), on the right hand side: $\Delta Y/t = a+bX+cR+e$. This equation may be re-arranged by multiplying through by t: $\Delta Y = at+bXt+cRt+et$. This latter equation highlights an important implication of using average of growth rates. A linear inflation factor (t) is imposed on all explanatory variables. This is problematic for the resource term in the equation. R is ideally a measure of resource abundance, hence this specification implies that the effect of an initial resource stock on future income increases steadily as the economy moves into the future. This is not obviously sensible. Indeed, one might expect the opposite result, that a discovery of a resource stock might first cause an economic boom when the resource is first exploited, followed by a subsequent economic decline as the stock is used up. Supposing that resource endowments (R) are constant, the new equation reveals that a regression on average growth inflates the true measure of R by a factor t such that the estimated regression coefficient on R will underestimate the true impact of R on GDP growth. Conclusions based on growth regressions are thus likely to be biased and misleading. Our empirical work below, which is not based on averaging the dependent variable, does not suffer from this potential problem.

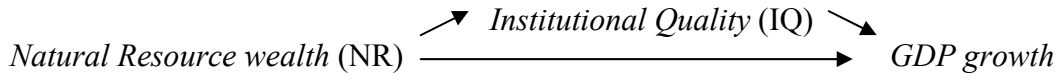
importance of the (exogenous) institutional and political context more than on the link between resources and institutions.

There have, however, been very significant empirical advances in testing the role of endogenous institutions. Beginning with Leite and Weidmann (1999, hereafter LW), it has been shown that resource abundance can be a major factor shaping the institutional context, within which investment and production takes place in the real world. LW demonstrated that (i) point source resources tend to stimulate corruption, and (ii) that corruption in turn negatively impacts on economic growth. When controlling for the level of corruption, LW find that exports of fuels and ores are no longer significant in growth regressions. These findings suggest that there is no *direct effect* of resource wealth on economic performance, but there is an important *indirect effect*: resources affect the level of corruption, which determines growth. This important result has been confirmed and placed in a more general context in two recent papers by Isham et al (2003, hereafter IWPB) and Sala-I-Martin and Subramanian (2003, hereafter SS). IWPB and SS do not just examine corruption (arguably just one proxy of institutional quality), but instead try to find alternative and broader governance indicators.

Consider the SS results in more detail. They examine the following causal chain:

Natural Resource wealth (NR) $\rightarrow$ *Institutional Quality* (IQ) $\rightarrow$ *GDP growth*.

If the effect of NR on growth is indirect (as suggested by findings of LW) then, holding IQ constant, NR should have no separate effect on growth. An alternative explanation, accommodating various other explanations, is that there is an extra link in the chain – one that runs directly from NR to GDP growth. Such a causal chain would look as follows:



To isolate the causal mechanisms, SS (as well as IWPB, and LW) proceed as follows. They estimate a "two equation model" capturing both links of the proposed causal links; a growth equation and an institutional quality equation. Their growth equation is as follows:

2. $\text{growth}(70\text{-}98) = a_0 + a_1 * \text{conditioning variables} + a_2 * \text{price volatility} + a_3 * \text{overvaluation of exchange rate} + a_4 * \text{Institutional Quality} + a_5 * \text{Natural resources} + e$

SS hypothesize that resource abundance might affect growth through volatility of prices, overvaluation of the exchange rate, and institutional quality. They include variables to capture the effects of these factors. However, if these channels are accounted for, then NR should not have any separate effect on growth. They include NR separately to test this last prediction.

They assume Institutional Quality is measured with error and estimate with instrumental variables for IQ to control for this. Their instruments are the fraction of population speaking English as first language and the fraction speaking a major European language (English, Spanish, French, German, and Portugese). The conditioning variables in equation (2) include the usual variables that

macroeconomists employ to explain growth: income in 1970 (convergence hypothesis), primary + secondary + tertiary school enrollment in 1960, relative price of investment goods, prevalence of malaria in 1966, and population density in coastal areas.

The most important findings of SS are that the conditioning variables are generally significant and of the expected sign**,** i.e**.,** consistent with earlier empirical work. Price volatility is sometimes significant, but not consistently so. Exchange rate overvaluation (Dutch disease) is never significant. IQ is significant and of the expected sign – better institutions foster growth. Finally, NR is not significant and the sign is not consistent. The main conclusion, therefore, is that *given* a certain level of institutional quality and price volatility, natural resources have no separate effect on growth. IQ does affect growth, and so does price volatility and the usual conditioning variables. Next, it is necessary to unravel the determinants of institutional quality:

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

The main results from estimating equation (3) are as follows. GDP1970 is highly positively correlated with IQ. Conditioning variables from the growth equation (1) are not significantly correlated with IQ. Instruments are correlated with IQ. NR flow measures are negatively correlated with IQ. NR exports measured as a share of exports has a stronger correlation with IQ than NR exports measured as a share of GDP. Finally, fuels and minerals measures of NR *are* strongly negatively correlated with IQ, but food and agricultural products measures of NR are *not* significantly correlated with IQ.

The main conclusion of the institutional equation, therefore, is that so-called "point" or concentrated NR result in "bad" institutions. This does not hold true for diffuse resources. Formal theories for this phenomenon have yet to be developed, but see IWPB for a non-technical discussion of possible explanations.

The overall picture that emerges is that the direct effect of resource wealth on economic growth disappears whenever institutional quality is controlled for, but that an important indirect effect exists. Resource wealth negatively impacts on the quality of institutions, and institutional quality, in turn, is an important determinant of economic growth. We will refer to this as the LW-IWPB-SS approach in what follows, and we expect that this will become widely accepted once the results have been published in refereed journals.

3. Data and Empirical Procedure

The focus of all existing studies of the curse has been on the effects of natural resources on economic growth. This, however, measures only one dimension of human well-being. It is conceivable that even if natural resources are a curse for growth, they may lead to improvements in other aspects of welfare – such as malnutrition, infant mortality, or poverty. Hence, rather than

analyzing the implications of resource abundance on economic growth, we examine the link between resources and various underdevelopment and welfare indicators.

To investigate this relationship we adopt the LW-IWPB-SS approach discussed above, and explore the impact of natural resources (NR), channeled through institutional quality (IQ), on undernourishment and other development/underdevelopment indicators (DI). The basic maintained hypothesis is that human development is affected by institutional quality and by income. This is consistent with results reported in Deacon (2003). Both IQ and income are, in turn, affected by NR. However, holding IQ and income constant, NR is hypothesized to have no separate effect on DI. This last prediction is tested by including NR in equation 4:

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

The DI variables we employ are the UN Human Development Index (HDI), the UN Human Poverty Index (HPI), the percentage of the population that is undernourished (%Pop), the percentage of children that are underweight (%Child), and life expectancy at birth (LE).

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

Following Isham *et al*, we distinguish between point and diffuse resources. Accordingly the export data are disaggregated into two classes (*i*) Fuels, Ores, and Minerals and (*ii*) Agricultural products and Food.[4] In addition, we relate these exports to GDP and total exports to arrive at 4 different NR measures: Point/GDP, Point/export, Diffuse/GDP, and Diffuse/export. Since the difference between GDP and total exports ratios was minimal, we only present results for the variables based on export shares in this report. As conditioning variables we have included 1970 income and 1960 school enrollment – variables that have been identified as important in earlier work by others. Summary statistics of the variables are reported in the Appendix.

We take the IWPB-SS results on growth (eq. 2) as given. Hence, IQ has a positive effect on current income, but holding IQ constant NR has no separate effect on current income. We then proceed by: (*i*) re-estimating the IQ equations to confirm or refute the claim that NR matters and to check different NR and IQ measures, (*ii*) we then estimate DI equations, and examine the effects of different IQ and NR measures. This allows us to unveil the channels through which natural resources affect development indicators.

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

4. Results of regression analyses

Following LW-IWPB-SS we estimate two equations: an institutional quality equation and a "development" equation (our counterpart of the usual growth equation). Since we combine various NR, IQ and DI measures, the number of regression equations that we have estimated is considerable. Rather than presenting the results of each equation separately, we summarize the main results in the following Tables. The corresponding OLS estimates are in the Appendix. Table 1 summarizes the insights following from the institutional quality regression:

Table 1: Natural Resource Exports and Institutions

Institutional quality proxies	**Point/Export**	**Diffuse/Export**
Rule of Law RL	(–)**	0
Voice and Accountability VA	(–)**	0
Government Effectiveness GE	(–)**	0

** means significant at the 5% level or better.

In Table 1, the three rows correspond with three different proxies of institutional quality in 1998 (the dependent variable in the regression equations). In addition to the various independent variables mentioned above, we have included the shares of point and diffuse resources in total exports in 1970 as explanatory variables. Table 1 clearly indicates that countries with abundant point resources end up with bad institutions and bad governments, and that countries with abundant diffuse resources show no tendency to follow this pattern (the zeros in the last column indicate that there is no statistically significant effect). This finding is consistent with results reported by LW-IWPB-SS.

The absolute magnitude of point resources on institutional quality is substantial. The standard deviation of the variable "Point/Export" is 33.9 (see Appendix 1). A country whose Point/Export index falls by one standard deviation would increase the RL, VA and GE variables by 0.24, 0.28 and 0.30, respectively. Since the standard deviation of these variables is only 0.99, 0.97 and 0.99 (see Appendix 1), it is clear that these are large effects.

This is also evident from table 2, where we report "beta coefficients" of the explanatory variables to assess their relative magnitude. The coefficients are computed by multiplying the coefficient of Point/Export in equation 2 by the standard deviation of this variable and, next, dividing the product by the standard deviation of the dependent variable. There is a striking similarity in the absolute magnitude of point resources on all three measures of institutional quality. Similarly, education too has a large and significant effect on these measures. There are however, noticeable differences in the relative rankings of the explanatory variables in the equations. In the VA equation, point resource exports have a greater impact than does Income. The ordering is reversed for RL and GE. We explore possible reasons for these differences in greater depth later in this paper.

Table 2: Relative magnitude of natural resources on institutions

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

Next, we turn to results of the development equation. The initial expectation is that development indicators are functions of institutional quality (governance quality) and income. Table 1 established that (point) NR affect IQ and thus, if IQ variables are significantly related to development indicators, the resource curse might appear through this indirect channel. We also include NR in the regression models separately to analyze whether resource abundance also has a *direct* effect, after accounting for other channels. In Tables 3a-c we summarize key outcomes for the three different proxies of institutional measures that we have employed (RL, VA and GE).

Table 3a: Explaining Development; the effect of Resources, Rule of Law and Income.

Development Indices	Point/Export	Diffuse/Export	Rule of Law	Income
Human Devel. Index	0	0	(+)**	(+)**
Undernourished (% pop)	0	0	(–)**	(–)**
Human Poverty Index	0	0	0	(–)**
% Underweight Children	0	0	0	(–)**
Life Expectancy	0	0	(+)**	(+)*

** means significant at the 5% level, and * means significant at the 10% level.

Table 3b: Explaining Development; the effect of Resources, Voice and Accountability and Income.

Development Indices	Point/Export	Diffuse/Export	Voice and Acc	Income
Human Devel. Index	(+)**	0	(+)**	(+)**
Undernourished (% pop)	0	0	0	(–)**
Human Poverty Index	0	0	(–)**	(–)**
% Underweight Children	0	0	(–)*	(–)**
Life Expectancy	0	0	(+)*	(+)**

Table 3c: Explaining Development; the effect of Resources, Government Effectiveness and Income.

Development Indices	Point/Export	Diffuse/Export	Government Effectiveness	Income
Human Devel. Index	(+)*	0	(+)*	(+)**
Undernourished (% pop)	0	0	(–)**	(–)**
Human Poverty Index	0	0	0	(–)**
% Underweight Children	0	0	0	(–)**
Life Expectancy	0	0	(+)*	(+)**

From Tables 3a-c a fairly consistent story emerges. First, higher incomes consistently improve development indicators. Note that a negative effect on certain indicators, such as the percentage of people undernourished, must be interpreted as a positive effect on development. Second, accounting for income levels, better institutions or governance often (but not always) improves development indicators. It is interesting to note that some indicators appear more responsive to institutional quality than others – compare the impact of institutions on the HDI indicator versus the impact on the percentage of underweight children. In order to shed light on these issues, formal theories of the resource curse first need to be developed (see recommendations below). Third, there are differences between the three proxies for institutional quality that we employ. Once again differences emerge, in significance levels and signs, between the effects of the Rule of Law (RL) and Government Effectiveness (GE) measures on the one hand, and the Voice and Accountability (VA) proxy on the other hand. In particular, VA alone seems to have a significant (negative) impact on the human poverty index (HPI). Fourth, and importantly, holding income and institutions constant, natural resource abundance typically has no *significant effect* on development indicators.

How important is the impact of natural resources for the various development and welfare indices in a quantitative sense? In Table 4 we show the indirect impact of lowering the Point/Export variable by one standard deviation, which affects welfare through better institutions. In order to interpret the numbers in Table 4, one can compare their magnitude to the relevant standard deviations as reported in Appendix 1.

Table 4: The Quantitative Impact of Natural Resources on Welfare

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

By comparing the impact of a one standard deviation change in the natural resource level to the standard deviation of the various welfare indicators we can assess the quantitative importance of the resource curse for welfare. We conclude that the impact of the resource curse is substantial, but also note that the impact on welfare is smaller than the impact on economic growth. For example,

IWPB report results that a decrease of one standard deviation in the resource index yields an annual increase of per capita growth of about 0.5. Since the standard deviation of the growth variable is about 2.4, this amounts to a "relative effect" of $0.5/2.4 \approx 20\%$. The relative impact of the curse on welfare indicators is more modest, and typically only about 10%. We hope future research will be able to shed further light on this result.

The degree of commonality between our findings and the earlier statistical work by LW-IWPB-SS on the resource curse is striking and encouraging. This is remarkable when we note that economic growth represents a change in level, whereas our dependent development variables are levels themselves.

Our results confirm a general conclusion emerging form other policy research: that the "black box" of good institutions in some way improves economic outcomes. However, this finding does not in itself provide any firm policy prescriptions, nor does it provide any evidence of causal mechanisms. The results in Table 3 are, however, suggestive of possible causal links. They indicate that even after controlling for initial income and other factors, there are consistent differences between variables that represent the political architecture of the state (VA) and those that represent the quality and efficiency of public services provided by the state (RL, GE). For instance, RL and GE, have no significant impact on the human poverty index and the % of Underweight Children, while Voice and Accountability (a proxy for democracy) leads to improvements in both measures. Deacon's (2003) analysis of public good provision provides one possible explanation for this finding. In autocratic regimes, the government is controlled by a small ruling elite. Public policies are thus biased in favour of the elite. On the other hand in democratic regimes, policy decisions (at least partly) reflect the preferences of the entire electorate. The differences between an elite franchise (associated with low values of VA) and a full democratic franchise (with high values of VA), may thus explain these differences. That is efficiency in the supply of public goods (captured by the GE index) and security of property rights (captured by the RL index) are not sufficient conditions to improve all dimensions of poverty and deprivation. A political system that is responsive to citizen preference appears to be a necessary adjunct.

Since political variables appear to play a vital role in determining the effect of resources on various measures of development, it is useful to check whether the results are robust to alternative measures of political attributes. This is perhaps particularly important since the VA index is based largely on subjective perceptions and has therefore been criticized for its lack of precision and objectivity. A more objective measure of political attributes is provided by Marshal and Jaggers (2003) (the Polity Project). Marshall and Jaggers provide measures of the democratic and autocratic attributes of a regime. Democracy is measured by an additive ten-point scale, with a score of ten being given to the most democratic system and zero to the least democratic. The democracy attributes include: the competitiveness of political participation, the competitiveness of executive recruitment, the openness of executive recruitment and constraints on the chief executive. The autocratic attributes are also measured on a ten-point scale, with a score of ten being given to the most autocratic. The autocratic attributes include proxies for: the lack of political competition, the regulation of political participation, lack of openness of executive recruitment and lack of constraints on the chief executive.

Table 5a reports the effects of a regression using these democracy and autocracy indexes as the dependent variable in regression equation 3. The results strongly reinforce our previous findings. Point resources promote (diminish) the autocratic (democratic) attributes of a regime. However **,** in addition, we now find that diffuse resources are associated with more democratic forms of governance. This contrasts with the earlier results where diffuse resources were found to have no impact on IQ variables. The general conclusion that emerges from Table 1 and 5a is that resources influence both institutional structures and political systems.

Table 5a: Natural Resource Exports and Institutions

Institutional quality proxies	**Point/Export**	**Diffuse/Export**
Democracy	(–)**	(+)**
Autocracy	(+)**	(-)**

** significant at the 5% level or better.

Consider next the effects of democracy (autocracy) on the development indices. Consistent with our earlier results, democracy leads to improvements in all measured dimensions of welfare. Overall these results confirm Amartya Sen's observation that democracy creates political incentives for rulers to provide basic needs. Sen (1999) thus concludes that famines seldom afflict democratic regimes. Table 5b also reveals that holding income and political attributes constant, natural resource abundance has no direct effect on development indicators.

Table 5b: Explaining Development; the effect of Resources, Democracy and Income.

Development Indices	**Point/Export**	**Diffuse/Export**	**Democracy**	**Income**
Human Devel. Index	0	0	(+)**	(+)**
Undernourished (% pop)	0	0	(-)**	(–)**
Human Poverty Index	0	0	(–)**	(–)**
% Underweight Children	0	0	(–)*	(–)**
Life Expectancy	0	0	(+)*	(+)**

Since institutional structures are shaped by policy makers, it seems reasonable to postulate that the type of political regime (e.g. democracy or autocracy) may influence the type of institutions that develop. This in turn may be reflected in the RL and GE indicators. Table 5c reports the results of a regression on the RL and GE indicators in 1998, against *past* levels of democracy and autocracy. As controls we use all the variables in equation 3. Note that democracy (autocracy) has no impact on the GE indicator. It does, however, lead to improvements in RL in countries with diffuse exports. But democracy has no effect on RL in regimes dependent upon point exports. This suggests that the interactions between resource endowments, political regimes and institutional structures are extremely complex. The absence of a link between past levels of democracy and institutional efficiency in countries with point resources is indicative of a high degree of political capture by resource owners, which impedes institutional reforms. It would appear that point resources erode the political incentives typically associated with democratic governance. These are, however, issues that extend beyond the remit of this project and warrant further consideration in future work.

Table 5c: Political System and Governance

Institutional quality proxies	Point/Export	Diffuse/Export	Democracy in 1979	Autocracy in 1979
Rule of Law in 1998	~	0	(+)**	(-)**
Rule of Law in 1998	(–)**	~	0	0
Government Effectiveness 1998	(-)**	~	0	0
Government Effectiveness 1998	~	0	0	0

** significant at the 5% level or better. ~ indicates variable not included in the regression.

There has been no formal theoretical research on the links between resources and governance. Hence, reasons for these empirical findings remain a matter of conjecture. However, political economy theories are suggestive of possible causal links. There is a presumption that point resources are more easily captured by a narrow elite, resulting in a highly skewed distribution of resources. This in turn is likely to trigger intense lobbying by resource owners for policies that protect their narrow sectoral interests. Such policies will often be inimical to growth and development. Thus, in the absence of other mitigating factors, a reliance on point resources may generate a "vicious cycle of underdevelopment": point resources are conducive to unrepresentative forms of governance (an elite franchise, see Table 5b) which results in lobbying for both "bad" policies and institutions that favor the resource owning elite. On the other hand, when resource rents are more evenly distributed (diffuse resources), there is less scope for political capture by resource owners, resulting in better institutions and policies that promote economic growth and general social welfare.

5. Conclusions and discussion

In this manuscript we have explored whether the paradoxical resource curse result that resource-rich countries tend to grow slower than their resource poor counterparts also applies to the relationship between resource wealth and development. In other words, while previous analysts have considered the effect of resources on economic growth (measured as the average increment in GDP over some period), we extend the analysis to consider a broader set of welfare and development criteria – and not their rate of change over time.

Our findings are consistent with the consensus view that appears to be emerging in the resource curse literature. We have estimated several equations; institutional quality equations and development equations (our novel counterpart of the conventional economic growth equation in resource curse work). We find that certain types of resources – so-called point resources that can be easily controlled by small groups in society – are typically associated with less democratic regimes and bad institutions that deliver an inadequate quality of governance. Isham *et al* discuss why point resources might trigger bad scores on such governance indicators. One explanation is that elites in control of point resources resist industrialization because this would dilute their power base, causing delayed modernization and low levels of development. Another explanation is that

export composition affects social structure – think of horizontal relationships between agents based on equality and cooperation versus systems geared by clientelism and distrust.

Our second result is that countries with low levels of institutional quality (or quality of governance) tend to score lower on various development indicators. This implies that the resource-curse is a phenomenon that occurs at a broader scale than just economic growth – countries that rely on point resources tend to perform worse across a spectrum of criteria. However, the quantitative impact on welfare indicators is smaller than on economic growth.

Finally, for given income and governance levels we find that both point and diffuse resource abundance typically has no significant impact on development. That is the impact of resources on development is indirect and occurs only through the institutional quality channels.

Policy Implications

Alleviating hunger and poverty is a priority for the international community. Does the resource curse literature in general, and our results in particular, shed any light on these issues? There is an obvious link between the resource curse, food security and poverty levels. It is well established that rapid growth rates, coupled with high levels of investment in human capital, will eventually result in higher living standards. In particular, when growth raises incomes above a threshold level, this provides a buffer against exogenous shocks that would otherwise result in deprivation, hunger or famine. However, as critics have noted, this mechanism relies upon the growth dividend percolating to the most vulnerable members of society – an outcome that is not assured and is likely to be achieved over a long period of time. More importantly, the record of growth in recent decades shows that many countries with low per capita growth rates have succeeded in providing food security and meeting basic nutritional needs, while others with higher growth rates have failed. Our empirical analysis suggests reasons for this anomaly.

The results forcefully indicate that the main effect of resources on human development outcomes is through the institutional variables. Hence, the development benefits from (say) increased crop yields are only realized in an environment with "good" institutions. This suggests that institutional reform may be a necessary condition for countries to develop. However, institutional change is a slow process and is poorly understood. The results here, however, suggest that in determining policies it is necessary to examine not only the visible (and more easily calculable) direct effects of a project (e.g. output, yields, value-added), but also the more subtle and indirect institutional impacts, which may be quantitatively more significant.

Consider, for example, the issue of aquaculture. With declining global catches from traditional wild fisheries, aquaculture projects have been proposed as a way to generate regional growth and provide greater food security in developing countries. Our analysis suggests that the welfare and growth impacts of such developments will depend not only the direct supply side effects (i.e. a greater output of fish), but also the institutional consequences. If aquaculture projects are similar to other point resources, they are likely to erode institutional quality. Hence, the welfare benefits from such projects will be smaller than anticipated. Similarly, support for agricultural activities such as large scale cattle ranching and plantations, with the characteristics of point resources, are likely to have a corrosive effect on institutions which in turn lowers welfare benefits. More

generally, investment projects that are vulnerable to special interest capture are likely to be counterproductive in terms of development outcomes in countries with deficient institutions

Where governance is weak, support for diffuse modes of agriculture would seem to be more appropriate. For instance, enhanced support for small land holders in developing countries would yield not only a direct benefit in the form of higher incomes to poor farmers, but also have a beneficial impact on political institutions by promoting accountability (see Table 5b).

Similar concerns are also of relevance in evaluating the effects of emerging genetic modification (GM) technologies. GM technologies have the potential to contribute greatly to both development and institutional quality if they confer equitable benefits across a wide spectrum of farmers. If, however, the benefits are concentrated and hence easily appropriable by narrow sectoral interests the development consequences may well be counterproductive. Similarly, development assistance, e.g., for better nutrition, will be less effective if it is allocated to countries with bad institutions, as they may be disinclined to pursue the objectives such aid would promote. In short, our results indicate that institutional details matter and that generalizations are therefore hazardous. Projects that are beneficial in countries with well-developed political and institutional structures, may well be detrimental in other circumstances.

6. Future research: Extensions and sensitivity analysis

The research presented in this paper represents a step forward in our understanding of the resource curse, and the channels through which it is manifested. To ensure maximum comparability between our results (linking resources to development) and the usual findings in this literature (focusing on resources and growth), we have adopted a methodology that is consistent with prior work, representing current state of the art. However, we believe the current analysis does not represent the final word about the topic. At least three extensions of the current methodology are proposed, all of which can be addressed in relatively small and inter-related projects.

First, following Sachs and Warner (1997) and as discussed in section 1**,** most studies measure resource abundance by the share of natural resource exports in GDP. This is of course a direct measure of country's resource export dependence, and at best only an indirect proxy for a country's true resource endowment. To accurately measure resource endowments through export shares it is necessary to assume a consistent and invariant mapping between in situ resource stocks and exports of these stocks. But the Sachs-Warner proxy may even be inaccurate as a measure of export intensity. For instance, when using the share of natural resource exports in GDP, Singapore, with its very high proportion of processed re-exports of natural resources, is classified as highly resource abundant. To correct for this anomaly, Sachs and Warner adjust Singapore's resource endowments by using net resource exports as a proportion of GDP as a proxy for Singapore's resource endowments. It is evident that the gross measure of exports used for all other countries will overestimate the true level of resource exports for any country involved in the re-export of primary products. Arguably, the SW regression only demonstrates that primary export intensity hampers growth. It does not establish the more far reaching proposition that resource abundance impedes growth. To show that resource endowments are a curse it is necessary to use more direct measures of resource stocks. Preliminary work by Stijns (2002) on physical resource stocks and economic

growth indicated that the implications can be far-reaching. The implications for development and welfare are as yet unknown, and should be examined to assess the robustness and relevance of the resource curse for growth and development.

Second, LW-SS-IWPB and we have considered the impact of resources on growth and development as channeled through institutions. Our regression analyses suggest that similar results are obtained when using 'political variables' rather than institutional ones. We have included variables that represent the degree of democracy or authoritarianism in society, and find three results that are new in the literature. First, and not surprisingly, there exists strong correlation between institutional and political variables - hence one cannot include both in a single regression due to potential problems of multicollinearity. Second, and consistent with the results on institutional quality, when accounting for political variables and income, there is no residual effect (or only a small effect for some variables) of resources on development criteria. Third, the impact of resources on political variables is similar to its impact on institutions in that point resources are typically associated with lower scores. Interestingly, and unlike the institutional results, we find that diffuse resources also have a significant impact on political variables. But in sharp contrast to point resources we find that a larger share of food and agricultural exports in GDP is associated with more democracy and lower authoritarian scores - agricultural exports appear 'good' for the political context. It is important to consider the interplay between both classes of variables (do political systems cause institutional quality, or does the causation run the other way?) to understand the exact mechanism behind the curse such that sensible policy recommendations can be formulated. This remains an issue in urgent need of further research.

Finally, the resource curse literature that focuses on the institutional channel is mainly empirical. While Isham *et al* present a series of hypotheses that is consistent with the results contained in their paper (and in ours), there is a need for a formal and more rigorous theory, which can then be explicitly tested. Without such advances, for example, it will always be unclear whether institutions or political variables are the relevant channel through which the curse materializes, or why different countries with access to resources fare so differently. This may require building on existing political economy models, but likely also involves innovative modeling.

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Appendix 1: summary statistics and correlations for key variables

Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
unn6971	98	5.709184	22.81477	0	218.3
unn7981	98	6.196939	26.88109	0	261.5
unn9092	98	6.315306	22.36688	0	215.6
unn9800	118	5.850848	22.24046	0	233.3
unp6971	98	27.36735	15.43886	0	64
unp7981	98	23.34694	17.40844	0	68
unp9092	98	23.62245	17.99915	0	69
unp9800	118	20.23729	18.04301	0	73
HDI75	96	.5897812	.1994481	.231	.872
HDI80	107	.623271	.1894759	.26	.884
HDI85	114	.6375789	.1869903	.254	.904
HDI90	127	.6574882	.1850479	.264	.924
HDI95	131	.6672901	.1867065	.27	.929
HDI01	149	.6845839	.1848066	.275	.944
HPI	87	29.395	15.777	4.1	61.8
VA98	179	-.0296648	.965829	-1.93	1.55
GE98	177	-.0075706	.9921105	-2.14	2.59
RL98	179	-.0007263	.9944724	-1.97	2.36
Life Exp	148	.64.364	12.972	33.4	81.312
% Undwght	97	16.6831	12.5704	1	48
Democracy	126	3.65	4.3	0	10
Autocracy	126	4.26	3.885	0	10
DIF/EXP	138	50.84874	34.87263	-3.62e-06	99.95617
POINT/EXP	112	28.33255	33.88893	.000324	99.99987
SERV/EXP	108	26.77359	19.01176	1.80751	95.61398
DIF/GDP	99	11.26728	9.8995	.0188223	46.76212
POINT/GDP	86	8.801234	16.37593	.0089058	73.35529
EnglFr	138	.102971	.2782195	0	1
EurFr	138	.264471	.4010866	0	1.064
Income	117	.8.995	.980282	6.32	9.89
Education	110	.97.13	21.0433	17	114

where: unn = number of under-nourished people (in millions); unp = the percentage of people in the population that is undernourished; HDI = Human Development Index, HPI = Human Poverty Index in 2001, VA98 = Voice and accountability in 1998; GE98 = Government Effectivenes in 1998; RL98= Rule of Law in 1998; Life Exp = Life Expectancy; % Undwght= % underweight children; Democracy = index of democratic attributes of political regime in 1990; Autocracy= index of autocratic attributes of political regime in 1990; DIF/EXP = diffuse resources (food and agricultural exports) as a share of total exports; POINT/EXP = point resources exported as a share of total exports; SERV/EXP = export of services as a percentage of total exports; DIF/GDP = export of diffuse resources as a percentage of GDP; POINT/GDP = export of point resources as a share of GDP; Englfr = fraction of the population speaking English as first language; EurFr = fraction of the population speaking a major European language as first language (English, german, French, Spanish or Portuguese); Income = log of GDP per capita in 1970; Education = Enrolment in secondary education.

Correlation between resource wealth and institutional variables

Export shares

	DIF/EXP	POINT/EXP	VA98	GE98	RL98
DIF/EXP	1.0000				
POINT/EXP	-0.6818	1.0000			
VA98	-0.1350	-0.3495	1.0000		
GE98	-0.3021	-0.1773	0.7659	1.0000	
RL98	-0.4107	-0.0600	0.6999	0.9306	1.0000

Exports relative to income

	DIF/GDP	POINT/GDP	VA98	GE98	RL98
DIF/GDP	1.0000				
POINT/GDP	-0.2907	1.0000			
VA98	-0.1420	-0.2158	1.0000		
GE98	-0.2211	-0.1137	0.8126	1.0000	
RL98	-0.3132	-0.0204	0.7786	0.9326	1.0000

It seems that the percentage exports measures of NR are more strongly correlated with IQ than the percent of GDP measures. In what follows, to simplify, we use the percent of exports measures only. However, the main results are robust with respect to replacing this variable with the one based on export shares relative to income.

Correlation between measures of human development and institutional quality

	VA98	GE98	RL98	HPI_1	U_Weight	LifeExp
VA98	1.0000					
GE98	0.4382	1.0000				
RL98	0.4606	0.7972	1.0000			
HPI_1	-0.2853	-0.3236	-0.3958	1.0000		
U_Weight	-0.2175	-0.2371	-0.3262	0.6859	1.0000	
LifeExp	0.2150	0.3718	0.4283	-0.8812	-0.5041	1.0000

	VA98	GE98	RL98	HDI01
VA98	1.0000			
GE98	0.7374	1.0000		
RL98	0.7312	0.9171	1.0000	
HDI01	0.6051	0.6397	0.7012	1.0000

O.L.S. Regression Results

The table numbers in this Appendix correspond to the table numbers in the main text.

Table 1a

	Initial GDP	Enrolment	Investment	English fraction	European fraction	Agriculture exports
Rule of Law RL	0.41** (3.01)	0.03** (5.17)	-0.25 (-1.68)	-0.07 (-0.23)	-0.15 (-0.68)	-0.022 (0.898)
Government Effectiveness GE	0.35** (2.22)	0.03** (4.57)	-0.20 (-1.14)	-0.20 (-0.52)	0.02 (0.09)	0.003 (0.994)
Voice and Accountability VA	0.13 (0.94)	0.03** (5.10)	-0.14 (-0.92)	-.018 (-0.55)	0.51** (2.31)	0.003 (1.40)

Table 1b

	Initial GDP	Enrolment	Investment	English fraction	European fraction	Fuel and mineral export
Rule of Law RL	0.52** (3.78)	0.02** (3.03)	-0.36** (-2.31)	0.19 (0.56)	-0.30 (-1.34)	-0.007** (-2.676)
Government Effectiveness GE	0.49** (3.07)	0.02** (2.67)	-0.27 (-1.49)	0.05 (0.13)	-0.12 (-0.45)	-0.009** (-2.873)
Voice and Accountability VA	0.18 (1.29)	0.02** (3.44)	-0.14 (-0.90)	0.03 (0.08)	0.44 (0.05)	-0.008** (-3.099)

Table 3a

	Rule of Law	Per capita GDP	Agriculture export
HDI	0.66** (2.86)	9.8×10^{-6}** (3.64)	-3.3×10^{-4} (-0.88)
HPI	-0.08 (-0.03)	-2.6×10^{-3}** (-4.35)	0.012 (0.254)
Undernourished children (mil.)	-8.95** (-2.81)	-1.4×10^{-3}** (-2.58)	-0.012 (-0.25)
Underweight children (%)	-0.31 (-0.12)	-1.1×10^{-3}** (-2.61)	0.026 (0.663)
Life expectancy	5.92** (3.15)	3.7×10^{-4}** (1.71)	-0.012 (-0.408)

	Rule of Law	Per capita GDP	Fuel and mineral export
HDI	0.06** (2.61)	1.0×10^{-5}** (3.87)	5.3×10^{-4} (1.500)
HPI	0.06 (0.02)	-2.6×10^{-3}** (-3.93)	-0.014 (-0.276)
Undernourished children (mil.)	-9.18** (-2.60)	-1.4×10^{-3}** (-2.30)	0.004 (0.68)
Underweight children (%)	-0.73 (-0.26)	-1.0×10^{-3}** (-2.26)	-0.020 (-0.493)
Life expectancy	5.76** (2.94)	3.9×10^{-4}** (1.81)	0.029 (1.043)

Table 3b

	Voice and Accountability	Per capita GDP	Agriculture export
HDI	0.04** (2.39)	1.3×10^{-5}** (7.31)	-5.2×10^{-4} (-1.363)
HPI	-3.81 (-1.94)	2.4×10^{-3}** (-5.76)	0.029 (0.609)
Undernourished children (mil.)	-1.18 (-0.55)	-2.5×10^{-3}** (-5.81)	-0.029 (-0.553)
Underweight children (%)	-3.01 (-1.88)	-1.0×10^{-3}** (-3.81)	0.044 (1.11)
Life expectancy	2.08 (1.56)	8.1×10^{-4}** (5.30)	-0.022 (-0.677)

	Voice and Accountability	Per capita GDP	Fuel and mineral export
HDI	0.05** (3.00)	1.3×10^{-5}** (3.11)	1.0×10^{-3}** (2.637)
HPI	-4.35 (-1.98)	-2.3×10^{-3}** (-5.28)	-0.039 (-0.785)
Undernourished children (mil.)	-1.39 (-0.58)	-2.4×10^{-3}** (-5.37)	0.017 (0.302)
Underweight children (%)	-3.18 (-1.80)	-1.0×10^{-3}** (-3.56)	-0.040 (-0.971)
Life expectancy	2.73 (1.88)	7.9×10^{-4}** (5.75)	0.055 (1.704)

Table 3c

	Government effectiveness	Per capita GDP	Agriculture export
HDI	0.03 (1.46)	1.3×10^{-5}** (5.81)	-3.7×10^{-4} (−0.975)
HPI	1.75 (0.67)	2.8×10^{-3}** (−5.60)	0.008 (0.161)
Undernourished children (mil.)	−7.69** (−2.96)	-2.0×10^{-3}** (−4.56)	−0.014 (−0.291)
Underweight children (%)	−0.49 (−0.24)	-1.1×10^{-3}** (−3.37)	0.027 (0.684)
Life expectancy	2.31 (1.42)	7.5×10^{-4}** (3.90)	−0.016 (−0.498)

	Government effectiveness	Per capita GDP	Fuel and mineral export
HDI	0.04 (1.90)	1.3×10^{-5}** (5.93)	6.8×10^{-4} (1.865)
HPI	1.17 (0.41)	-2.7×10^{-3}** (−4.79)	−0.01 (−0.192)
Undernourished children (mil.)	−7.49** (−2.60)	-1.9×10^{-3}** (−4.03)	−0.075 (−0.141)
Underweight children (%)	−1.25 (−0.56)	-1.0×10^{-3}** (−2.80)	−0.025 (−0.588)
Life expectancy	3.02 (1.82)	7.0×10^{-4}** (3.81)	0.041 (0.395)

Table 5a

	Initial GDP	Enrolment	Investment	English fraction'	European fraction	Agriculture exports
Democracy 90	1.89** (3.10)	0.08** (3.45)	-1.11 (-1.70)	-1.82 (-1.28)	2.39** (2.44)	0.03** (3.06)
Autocracy 90	-1.19** (-2.23)	-0.06** (-2.80)	0.90 (1.58)	2.60** (2.09)	-2.97** (-3.47)	-0.028** (-2.986)

	Initial GDP	Enrolment	Investment	English fraction	European fraction	Fuel and mineral exports
Democracy 90	1.61** (2.71)	0.06** (2.17)	-1.57** (-2.35)	-1.21 (-0.85)	2.52** (2.61)	-0.027** (-2.33)
Autocracy 90	-0.99 (-1.91)	-0.03 (-1.40)	1.38** (2.37)	1.98 (1.60)	-2.99** (-3.57)	0.025** (2.499)

Table 5b

	Democracy 90	Log GDP 1970	Current Per capita GDP	Agriculture export
HDI	0.01** (2.31)	0.12** (5.74)	5.6×10^{-6}** (3.25)	3.1×10^{-4} (0.824)
HPI	-1.46** (-4.00)	-	-2.1×10^{-3}** (-5.44)	0.062 (1.413)
Undernourished children (mil.)	-0.41 (-0.92)	-	-2.7×10^{-3}** (-5.83)	-0.015 (-0.274)
Underweight children (%)	-0.78** (-2.43)	-	-1.1×10^{-3}** (-4.04)	0.063 (1.597)
Life expectancy	0.95** (3.64)	-	6.2×10^{-4}** (4.53)	-0.035 (-1.125)

	Democracy 90	Log GDP 1970	Current Per capita GDP	Fuel and mineral export
HDI	0.01** (2.82)	0.11** (4.78)	5.3×10^{-6}** (2.78)	-2.2×10^{-5} (-0.052)
HPI	-1.83 (-4.70)	-	-2.0×10^{-3}** (-5.11)	-0.062 (-1.437)
Undernourished children (mil.)	-0.48 (-0.97)	-	-2.6×10^{-3}** (-5.55)	0.014 (0.249)
Underweight children (%)	-1.06** (-3.07)	-	-1.1×10^{-3}** (-3.75)	-0.068 (-1.700)
Life expectancy	1.04** (3.77)	-	6.4×10^{-4}** (5.23)	0.050 (1.64)

Table 5c

	Log GDP 1970	Enrolment 1960	Investment 1970	English fraction	Europen fraction	Agr. exports	Fuel and mineral export	Democracy 1970
Rule of Law 98	0.37** (2.53)	0.02** (4.33)	-0.19 (-1.24)	-0.15 (-0.47)	-0.09 (-0.40)	0.001 (0.613)	-	0.04 (1.80)
Rule of law 98	0.52** (3.52)	0.01** (2.66)	-0.32 (-1.66)	0.15 (0.43)	-0.28 (-1.21)	-	- 0.006** (-2.597)	0.01 (.69)
Government Effectiveness 98	0.30 (1.77)	0.03** (4.00)	-0.15 (-0.85)	-0.24 (-0.62)	0.05 (0.19)	0.002 (0.656)	-	0.03 (1.04)
Government Effectiveness 98	0.49** (2.79)	0.02** (2.41)	-0.24 (-1.23)	-0.13 (-0.47)	0.05 (0.13)	-	- 0.009** (-2.667)	0.01 (0.23)

	Log GDP 1970	Enrolment 1960	Investment 1970	English fraction	European fraction	Agr exports	Fuel and mineral export	Autocracy 1970
Rule of Law 98	0.39** (2.86)	0.04** (4.32)	-0.2 (-1.35)	-0.12 (-0.34)	-0.14 (-0.65)	0.0008 (0.574)		-0.04 (-1.87)
Rule of law 98	0.55** (3.73)	0.01** (2.66)	-0.31 (-1.99)	0.16 (0.50)	-0.3 (-1.30)	-	- 0.007** (-2.582)	-0.02 (-0.68)
Government Effectiveness 98	0.32 **(**1.95**)**	0.03**** (**3.92**)**	-0.16 (-0.87)	-0.22 (-0.56)	0.01 (0.04)	0.002 (0.555)	-	-0.04 *(-1.43)*
Government Effectiveness 98	0.49** (2.88)	0.02** (2.37)	-0.23 (-1.19)	0.05 (0.11)	-0.14 (-0.51)	-	- 0.009** (-2.573)	-0.02 (-0.60)

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