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Institutions and the resource curse

By
Halvor Mehlum, Kalle Moene and Ragnar Torvik

Department of Economics
University of Oslo

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Halvor Mehlum[2], Karl Moene[3] and Ragnar Torvik[4]

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[2]Frisch Centre, Department of Economics, University of Oslo P.O. Box 1095, Blindern N-0317 Oslo, Norway. E-mail: halvor.mehlum@econ.uio.no.

[3]Department of Economics, University of Oslo P.O. Box 1095, Blindern N-0317 Oslo, Norway. E-mail: k.o.moene@econ.uio.no.

[4]Corresponding author. Department of Economics, Norwegian University of Science and Technology, Dragvoll, N-7491 Trondheim, Norway. E-mail: ragnar.torvik@svt.ntnu.no

Abstract

Countries rich in natural resources constitute both growth losers and growth winners. We claim that the main reason for these diverging experiences is differences in the quality of institutions. More natural resources push aggregate income down, when institutions are grabber friendly, while more resources raise income, when institutions are producer friendly. We test this theory building on Sachs and Warner's influential works on the resource curse. Our main hypothesis: that institutions are decisive for the resource curse, is confirmed. Our results are in sharp contrast to the claim by Sachs and Warner that institutions do not play a role.

Keywords: *Natural resources, Institutional quality, Growth, Rent-seeking*
 JEL: O4, Q0, F43

1 Introduction

One of the important empirical findings in development economics in the 20th century is that natural resource abundant economies have tended to grow slower than economies without substantial resources (Sachs and Warner 1995, 1997a,b, Auty 2001). For instance, the Asian tigers: Korea, Taiwan, Hong Kong and Singapore, are all resource-poor, while growth losers, such as Nigeria, Zambia, Sierra Leone, Angola, Saudi Arabia, and Venezuela, are all resource-rich. On average resource abundant countries lag behind countries with less resources.[1]

Yet this should not lead us to jump directly to the conclusion that there is a resource curse. Also many growth winners are rich in resources such as Botswana, Canada, Australia, and Norway. Moreover, of the 82 countries included in a World Bank study five countries belong both to the top eight according to their natural capital wealth and to the top 15 according to per capita income (World Bank 1994).

To explain these diverging experiences we investigate whether growth winners and growth losers differ systematically in their institutional arrangements. By focusing on the role of institutions we follow the seminal contributions by North and Thomas (1973), Knack and Keefer (1995), Engerman and Sokoloff (2000), and Acemoglu, Johnson and Robinson (2001) that all insist on the decisive role of institutions for economic development. Inspired by their ideas we claim that the variance of growth performance among the resource rich countries is primarily due to *how* resource rents are distributed. Some countries have institutions that favor producers in the distribution of the resource rents, while others have institutions that favor unproductive grabbers.

Clearly, our point is not the presence of rent-seeking or not — most countries have various sorts of such activities. The distinction we make is between producer friendly institutions, where rent-seeking and production are complimentary activities, and grabber friendly institutions, where rent-seeking and production are competing activities. Grabber friendly institutions therefore easily divert scarce entrepreneurial resources out of production and into unproductive activities as a result of natural

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[1]This is documented in Gelb (1988), Sachs and Warner (1995, 1997a,b), Lane and Tornell (1996), and Gylfason, Herbertsson and Zoega (1999). Stijns (2002), however, argues that these results are less robust than the authors claim.

resource abundance.

With grabber friendly institutions there are gains from specialization in various sorts of unproductive influence activities, while there are extra costs of production activities due to discretionary power and favoritism. Typical features of grabber friendly institutions are a weak rule of law and a high risk of expropriation, malfunctioning bureaucracy and corruption in the government.

Our main hypothesis contrasts the rent seeking approach that Sachs and Warner (1995) considered but dismissed. Their specific mechanism asserted that resource abundance lead to a deterioration of institutional quality, which in turn would lower growth. Sachs and Warner found that this hypothesis was empirically unimportant, reverting to the Dutch disease explanation as the empirically relevant one. However, the lack of evidence for the proposition that resource abundance causes institutional decay, is not sufficient to dismiss the rent extraction story altogether as Sachs and Warner seem to do.

The presence of rich natural resources in a country may not in itself cause institutional decay, but may nevertheless put the institutional arrangements to a test. We claim that it is the combination of resource abundance and institutional quality that matters. In countries with producer friendly institutions rich resources attract entrepreneurs into production that cause higher growth. In countries with grabber friendly institutions and resource abundance, however, entrepreneurs are diverted away from production and into unproductive extraction implying a lower growth rate.

Our claim is consistent with observations from several countries. Botswana, where forty percent of GDP stems from diamond revenues has had the world's highest growth since 1965. Acemoglu, Johnson and Robinson (2002) attribute the good performance to good institutions. Indeed, Botswana has the best African score on the Groningen Corruption Perception Index. Norway has a long history of favoring productive enterprises and is among the least corrupt countries in the world. Norway was Europe's poorest country in 1900, but is now one of the richest. The transition was natural resource led, starting with timber, fish and hydroelectric power and continuing with oil and natural gas.

Lane and Tornell (1996) and Tornell and Lane (1999) explain the disappointing

economic performance following significant oil windfalls in Nigeria, Venezuela and Mexico by dysfunctional institutions that invite grabbing. Even more stark examples of grabber friendly conditions can be found in countries where the government is unable to provide basic security. In these countries resource abundance stimulate violence, theft, and looting, by financing rebel groups, warlord competition (Skaperdas 2002), or civil wars. In their study of civil wars Collier and Hoeffler find that "the extent of primary commodity exports is the largest single influence on the risk of conflict"(2000 p. 26). The consequences for growth can be devastating. F. Lane argues "the most weighty single factor in most periods of growth, if any one factor has been most important, has been a reduction in the resources devoted to war "(1958 p. 413).

In support of our claim we discuss a simple model and test its basic predictions. Our model has implications that differ from earlier models of the resource curse. Dutch disease models, like those by van Wijnbergen (1984), Krugman (1987) and Sachs and Warner (1995) predict a monotonic relationship between resources and growth (see Torvik 2001 for a discussion of the Dutch disease models). Existing models explaining the resource curse with rent-seeking, such as those of Lane and Tornell (1996), Tornell and Lane (1999) and Torvik (2002) also predict a monotonic relationship between resource abundance and income. These models explain important aspects of the resource curse, but they do not explain why resource abundance retards growth in some countries but not in others. Our model, however, predicts that there is a resource curse only for countries with bad institutions.

In order to test our model's implications we build on Sachs and Warner (1997a), whose result that natural resource abundance negatively affects growth has earlier been shown to be rather robust when controlling for other factors (see Sachs and Warner 1995, 1997a,b, 2001). We extend these growth regressions by allowing for the growth effects of natural resources to depend on the quality of institutions. Our main finding is that the resource curse applies in countries with grabber friendly institutions, but not in countries with producer friendly institutions.

2   The model

Our main concern is the allocation of entrepreneurs between grabbing and production. The total number of entrepreneurs in the economy is denoted by $N = n_P + n_G$, where n_P are producers while n_G are grabbers. Grabbers target rents from natural resources R and use all their capacity to appropriate as much as possible of this rent. To what extent grabbing succeeds depends on the institutions of the country. In the model the institutional quality is captured by the parameter λ, which reflects the degree to which the institutions favors grabbers versus producers. When $\lambda = 0$, the system is completely grabber friendly such that grabbers share the entire rent, each of them obtaining R/n_G. The higher is λ, the more producer friendly the system. When $\lambda = 1$, the system is completely neutral in the sense that both grabbers and producers each obtain nothing more than their fair share R/N. Formally λ measures the resource rents accruing to each producer relative to that accruing to a grabber.

The pay-off to each grabber, π_G, is a factor, s, times the fair share

$$\pi_G = sR/N \tag{1}$$

while the producers' share of the resource rent is $\lambda sR/N$. The factor s is decreasing in λ since each grabber gets less the more producer friendly the institutions. There is also a positive effect on s from less competition between grabbers. Hence, s is an increasing function of the fraction of producers $\alpha = n_P/N$ and a decreasing function of the institutional parameter λ. When no resources are directly destroyed in the contest without waste, the sum of shares of the resource rent that accrues to each group of entrepreneurs is equal to one. Hence, the following constraint must hold

$$(1 - \alpha)\, s + \lambda \alpha s = 1 \tag{2}$$

It follows directly from (2) that the only function s that implies no waste is simply

$$s\,(\alpha, \lambda) = \frac{1}{(1 - \alpha) + \lambda \alpha} \tag{3}$$

In fact, $s\,(\alpha, \lambda)$ is a much used function in the rent seeking literature.

The profits of a producer, π_P, is the sum of profits from production, π, and the share of the resource rents $\lambda s R/N$. Hence,

$$\pi_P = \pi + \lambda s\left(\alpha, \lambda\right) R/N \qquad (4)$$

In order to determine profits from production, π, we now turn to the productive part of the economy where we follow Murphy, Shleifer, and Vishny's (1989) formalization of Rosenstein-Rodan's (1943) idea about demand-complementarities between industries.

There are L workers and M different goods; each good can be produced in a modern firm or in a competitive fringe. In the fringe the firms have a constant returns to scale technology where one unit of labor produces one unit of the good. Hence, the real wage in the fringe and the equilibrium wage of the economy is also one. A modern firm, however, produces y applying an increasing returns to scale technology.

Each modern firm is run by one entrepreneur and requires a minimum of F units of labor. Labor in excess of F each produces $\beta > 1$ units of output. Hence, the marginal cost is $1/\beta < 1$. Assuming equal expenditure shares in consumption, inelastic demand and Bertrand price competition it follows that: (i) all M goods have a price equal to one and are produced in equal quantities y. Hence total production is My. (ii) each good is either produced entirely by the fringe or entirely by one single modern firm. To see this, observe that the fringe can always supply at a price equal to one. Price competition a la Bertrand implies that the price is set just below the marginal cost of the second most efficient competitor. A single modern firm in an industry only competes against the fringe and the price is set equal to one. If a second modern firm enters the same industry competition drives the price down to $1/\beta$, implying negative profits for both. Hence, only one modern firm will enter each branch of industry.

Profits from modern production are therefore

$$\pi = \left(1 - \frac{1}{\beta}\right) y - F \qquad (5)$$

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Total income Y consists of resource rents, R, in addition to the value added in production, yM. Total income Y is also equal the sum of wage income, L, and profits

$$Y = N \left(\alpha \pi_P + (1 - \alpha) \pi_G \right) + L \tag{6}$$

Inserting from (1) and (11) it follows that

$$Y = R + My = L + R + n_P \pi \tag{7}$$

Combining with (5), we solve for y to get[2]

$$y = \frac{\beta \left(L - n_P F \right)}{\beta \left(M - n_P \right) + n_P} \tag{8}$$

In an economy without modern firms, total income is equal to $L + R$. Completely industrialized $(n_P = \alpha N = M)$ total income of the economy equals $\beta(L - MF) + R$. We assume that the modern technologies are efficient implying that the income in a modernized economy is higher than in a backward economy:

$$L + R < \beta(L - MF) + R \iff \beta > \frac{L}{(L - MF)} \tag{9}$$

We also assume that $N < M$, so that the economy always benefits from more productive entrepreneurs. By inserting from (8) in (5) it follows that π can be written as a function of the number of productive entrepreneurs

$$\pi = \pi \left(n_P \right) \tag{10}$$

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[2]Assuming that the natural resource R consists of the same basket of goods that are previously produced in the economy, or (more realistic) that the natural resource is traded in a consumption basket equivalent to the one the country already consumes. This simplifies the analysis as production of all goods will be symmetric as in Murphy, Shleifer and Vishny (1989). For analysis of demand composition effects of natural resources, the cornerstone in the 'Dutch disease' literature, see for example van Wijnbergen (1984), Krugman (1987), Sachs and Warner (1995) and Torvik (2001). For rent-seeking models with demand composition effects, see Baland and Francois (2000) and Torvik (2002).

Figure 1: Resources and rent seeking
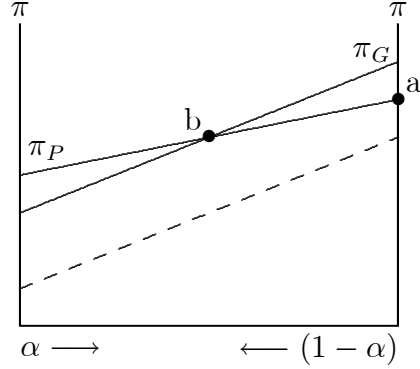
We can show that as a result of (9) $\pi(n_P)$ is everywhere positive and increasing in the number of producers $n_P = \alpha N$. When also including their fraction of the resource rents total profits for a producer are

$$\pi_P = \pi(\alpha N) + \lambda s(\alpha, \lambda) R/N \tag{11}$$

Or equivalently, using (1),

$$\pi_P = \pi(\alpha N) + \lambda \pi_G \tag{12}$$

The equilibrium allocation of entrepreneurs, between producers and grabbers, is determined by the relative profits of the two activities from (1) and (11).[3] Both profit functions π_G and π_P are increasing in the fraction of producers α. This is illustrated in Figure 1, where the dashed curve represents a lower π_G-curve. The π_G will be high relative to π_P if i) the institutional quality λ is low, ii) the resource rent R is high or iii) the number of entrepreneurs is low. In the following we assume that the number of entrepreneurs and the profitability of modern production are sufficiently high to rule out the possibility of equilibria without a single producer. Formally,

$$\frac{R}{N} \leq \pi(0) \tag{13}$$

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[3]The model determines the endogenous variables $\alpha, n_P, n_G, y, s, \pi, \pi_P, \pi_G$ as functions of the exogenous variables and parameters. In the comparative statics exercises we focus on changes in $R, N,$ and λ.

This condition states that some entrepreneurs find it worthwhile to produce rather than to grab, even in cases where institutions are completely grabber friendly. It follows by inserting $\alpha = 0$ and $\lambda = 0$ in the inequality $\pi_P \geq \pi_G$.

Now the economy may be in one of the following two types of equilibria.

a) Production equilibrium, where all entrepreneurs are producers ($\pi_P \geq \pi_G$ and $\alpha = 1$), is illustrated by point a in Figure 1. Total income is from (7)

$$Y = N\pi(N) + R + L \tag{14}$$

b) Grabber equilibrium, where some entrepreneurs are producers and some are grabbers ($\pi_P = \pi_G$ and $\alpha \in (0,1)$), is illustrated by point b in Figure 1. In this equilibrium it follows from (12) that the basic arbitrage equation $\pi_P = \pi_G$ can be expressed as

$$\pi_G(1-\lambda) = \pi(\alpha N) \tag{15}$$

The left-hand side of (15) is the excess resource rents that a grabber has to give up if he switches to become a producer. The right-hand side of (15) is the profit from modern production that is the gain achieved by switching. It follows from (15) that when profits in modern production is known, the profits in both activities follow. Hence, total income can, by combining (15) and (6), be expressed as

$$Y = \frac{N}{1-\lambda}\pi(\alpha N) + L \tag{16}$$

It follows from (12), since $\pi > 0$, that (i) when λ is high, or the resource rent R is low, the only equilibrium is a production equilibrium[4] and (ii) when λ is low, or the resource rent R is large, the only equilibrium is a grabber equilibrium. Note that (13) implies that the π_P-curve starts out above the π_G-curve. When π_G is low the economy is in the production equilibrium. When π_G is high the economy is in the grabber equilibrium. As the π_G-curve crosses the π_P-curve from below, the grabber

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[4]Clearly, irrespective of R, entrepreneurs in a country with $\lambda > 1$ will never enter into grabbing.

equilibrium is stable.[5]

The following proposition holds.

Proposition 1 *More natural resources is a pure blessing in a production equilibrium — a higher R raises national income. More natural resources is a curse in a grabber equilibrium — a higher R lowers national income.*

Proof. That national income goes up with R in the production equilibrium follows directly from (14). The impact of higher R in the grabber equilibrium follows by differentiating the equilibrium condition $\pi_P = \pi_G$, obtaining

$$\frac{d\alpha}{dR} = \frac{\overbrace{\left(\dfrac{\partial \pi_P}{\partial R} - \dfrac{\partial \pi_G}{\partial R} \right)}^{-}}{\underbrace{\left(\dfrac{\partial \pi_G}{\partial \alpha} - \dfrac{\partial \pi_P}{\partial \alpha} \right)}_{+}} < 0$$

The sign of the numerator follows directly from the definitions of π_P and π_G. The sign of the denominator follows from (13) that assures that in equilibrium π_G as a function of α crosses π_P from below (cf Figure 1). Knowing that α is decreasing in R the proposition is immediate from (16). ■

The paradoxical result— that more resources reduce total income— needs further elaboration. There are two opposing effects: the immediate income effect of a higher R is a one to one increase in national income, the displacement effect reduces national income as entrepreneurs move from production to grabbing. The resource curse paradox is that the displacement effect is stronger than the immediate income effect.

An entrepreneur who moves out of production forgoes the profit from modern production $\pi(n_P)$, but obtains an additional share of the resource rent equal to $(1 - \lambda)sR/N$. In equilibrium (15) these two values are equal. With more natural resources the additional resource rents to grabbers obviously go up. Hence, producers are induced to switch to grabbing until a new equilibrium is reached.

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[5]In the figure we have drawn the functions as straight lines. This is a slight misrepresentation. The true curves are both convex and may under special circumstances intersect twice. In that case, only the first intersection is a locally stable equilibrium. The propositions below are true also for such a stable interior equilibrium.

It is a well-known result from the rent-seeking literature that a fixed opportunity cost of grabbing implies that a marginal rise in rents is entirely dissipated by more grabbing activities. Hence, the displacement effect exactly balances the immediate income effect. In our case, however, the demand externality implies that the opportunity cost of grabbing $\pi(n_P)$ declines as entrepreneurs switch from production to grabbing. This externality magnifies the displacement effect and explains why the displacement effect is stronger than the immediate income effect.

The extent of rent dissipation also depends on the quality of institutions:

Proposition 2 *In the grabber equilibrium more producer friendly institutions (higher values of λ) increase profits both in grabbing and production, and thus leads to higher total income. When λ is close to one, the only equilibrium is the production equilibrium.*

Proof. The first part is evident from (15). The last part follows from (11) which shows that as λ increases to one, α eventually goes to 1 and $\pi_P > \pi_G$. ∎

Interestingly, worse opportunities for grabbers raise their income. The reason is that a higher value of λ induces entrepreneurs to shift from grabbing to production. As a consequence, the national income goes up, raising the demand for modern commodities, and thereby raising producer profits even further. In the new equilibrium profits from grabbing and from production are equalized at a higher level.

The extent of grabbing is also determined by the total number of entrepreneurs as stated in the following proposition:

Proposition 3 *In the grabber equilibrium an increase in the number of entrepreneurs N increases the number of producers ($n_P = \alpha N$) and lowers the number of rent-seekers n_G and increases profits in both activities.*

Proof. By differentiating the equilibrium condition $\pi_P = \pi_G$ it follows that

$$\frac{d\alpha}{dN} = \frac{\overbrace{\left(\dfrac{\partial \pi_P}{\partial N} - \dfrac{\partial \pi_G}{\partial N} \right)}^{+}}{\underbrace{\left(\dfrac{\partial \pi_G}{\partial \alpha} - \dfrac{\partial \pi_P}{\partial \alpha} \right)}_{+}} > 0$$

The sign of the numerator follows directly from the definitions of π_P and π_G. The sign of the denominator follows from (13) that assures that in equilibrium π_G as a function of α crosses π_P from below (cf Figure 1). Hence, $n_P = \alpha N$ increases which together with (15) imply that the common level of profits in grabbing and production must go up. Finally, it follows from (3) that $\pi_G = R/(n_G + \lambda n_P)$ and since n_P and π_G increase the number of grabbers n_G must decline. ∎

The proposition states that a higher number of entrepreneurs is a double blessing. Not only do all new entrepreneurs go into production, but their entrance also induces previous grabbers to shift over to production. The reason is the positive externality in modern production. The proposition also states that grabbing is most severe — both absolutely and relatively — in economies where the total number of entrepreneurs is low. These results are important for the dynamics to which we now turn.

3   Transition paths

The size of the modern sector depends on the number of entrepreneurs, the quality of institutions and the level of resource abundance. From (1), (3) and (15) it follows that in an grabber equilibrium

$$\frac{1-\lambda}{(1-\alpha)+\lambda\alpha}\frac{R}{N} = \pi(\alpha N) \tag{17}$$

Equation (17) implicitly defines the fraction of producers in the grabber equilibrium. We denote this relationship by $\alpha = g(N, \lambda, R)$ which is increasing in N and λ, but declining in R. When $g(N, \lambda, R)$ is larger than one, however, we are in the production equilibrium with $\alpha = 1$. Hence, in general we have that

$$\alpha = \min\left(g(N, \lambda, R), 1\right) \tag{18}$$

When the amount of natural resources is above the threshold R^* (defined by $g(N, \lambda, R^*) = 1$) the economy is in the grabber equilibrium. Using (17) the threshold

Figure 2: Resources and rent seeking
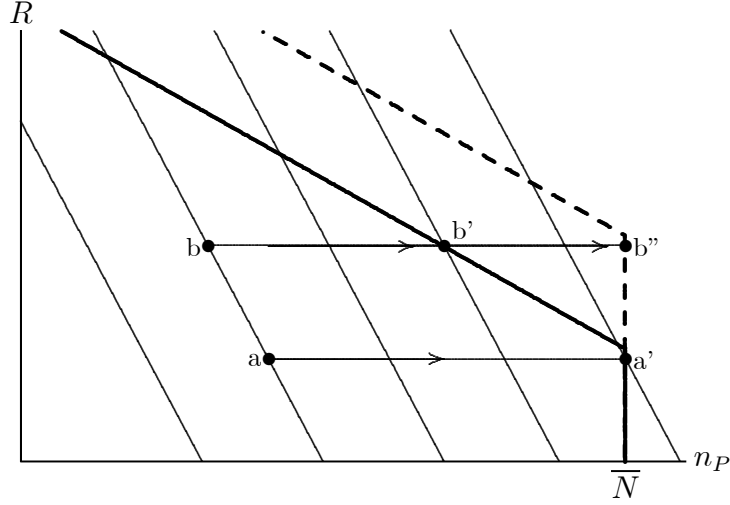
R^* can be expressed explicitly as

$$R^* = N \frac{\lambda}{1 - \lambda} \pi(N) \equiv R^* (N, \lambda) \tag{19}$$

The threshold level of resource abundance R^* is an increasing function of N and λ. When the resource abundance is less than R^* the production equilibrium applies. Formally we have the following:

$$R < R^* \iff \begin{array}{ll} \alpha = 1 & \text{(production equilibrium)} \\ \alpha \in (0, 1) & \text{(grabber equilibrium)} \end{array} \tag{20}$$

The growth of new entrepreneurs is a fixed inflow θ of new entrepreneurs minus the exit rate δ times the number of entrepreneurs N, expressed as $dN/dt = \theta - \delta N$. Here the long-run steady state level of entrepreneurs is equal to $\bar{N} = \theta/\delta$. Countries that have little natural resources in the long run end up in a production equilibrium as long as $R \leq R^* (\bar{N}, \lambda)$ from (19). This condition assures that the value of resources is not sufficiently high to make grabbing attractive when the total number of entrepreneurs has reached its steady state level $\bar{N}$. Countries with more resources, $R > R^* (\bar{N}, \lambda)$, are in the long run not able to avoid the grabber equilibrium.

To see how the dynamics work consider Figure 2 where we measure the number of productive entrepreneurs n_p on the horizontal axis and the value of resources R on the vertical axis. Generally, (18) illustrated by the downward-sloping bold

curve in Figure 2, represents the long run equilibrium number of producers. The more natural resources, the lower the long run number of producers in a grabber equilibrium. Rewriting (17), this long run relationship can be expressed by

$$R = \frac{\bar{N}}{1-\lambda}\pi(n_P) - n_P\pi(n_P) \qquad (21)$$

In the figure we have also drawn iso-income curves. Each curve is downward sloping as more natural resources are needed to keep the total income constant when the number of producers declines. With a total income $Y = \overline{Y}$, an iso-income curve is given by

$$R = -W - n_P\pi(n_P) + \overline{Y} \qquad (22)$$

By comparing this expression with (21) we see that the iso-income curves are steeper than the long run equilibrium curve, as depicted in Figure 2.

We are now ready to illustrate the implications of resource abundance and institutions on income growth. We first focus on two countries, A and B, that have the same quality of *institutions* (the same λ) and by construction the same initial *income* level. Country A has little resources, but a high number of producers, while country B has more resources and fewer producers. Country A, that starts out in point a, ends up in point a', while country B, that starts out in point b, ends up in point b'.

As seen from the figure the resource rich country B ends up at a lower income level than the resource poor country A. The reason is that country A because of its lack of resources, ends up in the production equilibrium, while country B because of its resource abundance ends up in the grabber equilibrium. Accordingly, over the transition period growth is lowest in the resource rich country. This is a specific example of a more general result. As is proved in Proposition 1, country B would increase its growth potential if it had fewer resources.

Assume next that country B instead had more producer friendly institutions and thus a higher λ than country A. As country B now is more immune to grabbing, it can tolerate its resource abundance and still end up in the production equilibrium.

As a result, the long run equilibrium curve for country B shifts up, as illustrated by the dotted curve in Figure 2. With grabber friendly institutions (low λ) country B converges to point b', while with producer friendly institutions (high λ) country B converges to point b". Income is higher in b" than in b'. Over the transition period growth is therefore highest with producer friendly institutions. Moreover with more producer friendly institutions the resource rich country B outperforms the resource poor country A, eliminating the resource curse paradox.

4 Testing

Our main prediction is that the resource curse — that natural resource abundance is harmful for economic development — only hits countries with grabber friendly institutions. Thus countries with producer friendly institutions will not experience any resource curse. Natural resource abundance does therefore hinder economic growth in countries with grabber friendly institutions, but does not in countries with producer friendly institutions.

This prediction challenges the Dutch disease explanation of the resource curse, emphasized in the empirical work by Sachs and Warner (1995 and 1997a). They dismiss one rent-seeking mechanism by showing that there is at most a weak impact of resource abundance on institutional quality. Hence, resource abundance does not *cause* a deterioration of institutions. They do not, however, consider our hypothesis that a poor quality of institutions *is* the cause of the resource curse and that good enough institutions can eliminate the resource curse entirely. If our hypothesis is supported by the data, the role of institutions is confirmed and the Dutch disease story is less palatable.

In order to test our hypothesis against Sachs and Warner's we use their data and methodology. All the data are from Sachs and Warner and are reproduced in the appendix. For a complete description of the data sources we refer to Sachs and Warner (1997b). Our sample consists of 87 countries, limited only by data availability. We use Sachs and Warner's Journal of African Economies article (1997b) rather than the Harvard mimeo (1997a). The reason is that the data series in the Journal of African Economies article covers a longer period, covers a larger number

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of countries, and contains a more suitable measure of institutional quality. [6]

The dependent variable is: *GDP growth* — average growth rate of real GDP per capita between 1965 and 1990. Explanatory variables are: *initial income level* — the log of GDP per head of the economically active population in 1965, *openness* — an index of a country's openness in the same period, *resource abundance* — the share of primary exports in GNP in 1970, *investments* — the average ratio of real gross domestic investments over GDP, and finally *institutional quality* — an index ranging from zero to unity.

The institutional quality index is an unweighted average of five indexes based on data from Political Risk Services: a rule of law index, a bureaucratic quality index, a corruption in government index, a risk of expropriation index, and a government repudiation of contracts index[7]. All these characteristics capture various aspects of producer friendly versus grabber friendly institutions. The index runs from one (maximum producer friendly institutions) to zero. Hence, when the index is zero, there is a weak rule of law and a high risk of expropriation, malfunctioning bureaucracy and corruption in the government; all of which favor grabbers and deter producers.

Our first regression confirms Sachs and Warner's (1995 and 1997a) results on convergence, openness, and natural resource abundance[8]. In regressions 2 and 3 we successively include institutional quality and investment share of GDP, which both have a positive impact on growth. When investment is included, however, institutional quality is no longer significant. This is possibly an indication that institutional quality works via investments.

So far our estimates have added nothing beyond what Sachs and Warner showed. Regression 4, however, provides the new insights to the understanding of the resource curse. In this regression we include the interaction term that captures the essence

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[6]The data used in both papers can be downloaded from Centre for International Development at http://www.cid.harvard.edu/ciddata/ciddata.html

In the appendix we have reported our main regression using the data from (1997a). The results differ only marginally from the results reported below.

[7]A more detailed description of the index is provided by Knack and Keefer (1995).

[8]The minor differences in the estimated coefficients between our regression and Sachs and Warners (1997a) are caused by different starting years — ours is 1965, while their's is 1970 — and that they exclude outliers. In the appendix we include regression results that exactly reproduce Sachs and Warner (1997a) using their data and their rule of law measure as the indicator of institutional quality.

	Regression 1	Regression 2	Regression 3	Regression 4
initial income level	−0.79 (−3.80)*	−1.02 (−4.38)*	−1.28 (−6.65)*	−1.26 (−6.70)*
openness	3.06 (7.23)*	2.49 (4.99)*	1.45 (3.36)*	1.66 (3.87)*
resource abundance	−6.16 (−4.02)*	−5.74 (−3.78)*	−6.69 (−5.43)*	−14.34 (−4.21)*
institutional quality		2.2 (2.04)*	0.6 (0.64)	−1.3 (−1.13)
[*nvestments*			0.15 (6.73)*	0.16 (7.15)*
interaction term				15.4 (2.40)*
Observations	87	87	87	87
Adjusted R^2	0.50	0.52	0.69	0.71

Note: The numbers in brackets are t-values. A star (*) indicates that the estimate is significant at the 5-% level.

Table 1: Regression results. Dependent variable is GDP growth.

of our model prediction:

$$interaction\ term = [\text{resource abundance}] * [\text{institutional quality}]$$

Our prediction is that the resource abundance is harmful to growth only when the institutions are grabber friendly. Therefore we should expect that the interaction term has a positive coefficient. This is indeed what we find. The effect from the interaction term is both strong and significant (with a p-value of .019).

Sachs and Warner (1997a and 2001) address the possible problem of reverse causality between growth and the measure of natural resource abundance. They find no evidence of such problems. Their finding also applies in our case since we use their methodology and variables. There may, however, be a problem with our regression if the quality of the institutions *itself* is determined by the level of GDP. This reverse causality problem is addressed in Acemoglu, Johnson and Robinson (2001). They show, by using settler mortality as an instrument for institutional quality, that the effect of institutions on income becomes stronger. This indicates that our estimate of the impact of institutions on growth, if anything, is too low.

Our results are also confirmed in the regressions contained in the appendix where

we use exactly the same data set and include the same countries as Sachs and Warner (1997). There we, as they did, use rule of law as an indicator of the institutional quality.

The growth impact of a marginal increase in resources is by inserting from regression 4

$$\frac{d\left[growth\right]}{d\left[resource\ abundance\right]} = -14.34 + 15.40\left[institutional\ quality\right] \tag{23}$$

We see that the resource curse is weaker the higher the institutional quality. Moreover, for countries with high institutional quality (higher than the threshold $14.34/15.40 = .93$) the resource curse does not apply. As shown in the appendix, 15 of the 87 countries in our sample have the sufficient institutional quality to neutralize the resource curse.

As mentioned in the introduction there are five countries that belong both to the top eight according to their natural capital wealth and to the top 15 according to per capita income. Of these countries United States, Canada, Norway and Australia have an institutional quality above the threshold. The fifth, Ireland, follows closely with an index value of .83.

5   Concluding remarks

We have shown that the quality of institutions determines whether countries avoid the resource curse or not. The combination of grabber friendly institutions and resource abundance produces a growth trap. Producer friendly institutions, however, help countries to take full advantage of their natural resource abundance.

Dutch disease explanations of the curse emphasize how natural resources crowd out growth generating traded goods production. If the Dutch disease story contained the whole truth, it is difficult to understand why the crowding out of the traded goods sector should be so much stronger in countries with a certain institutional quality. It is particularly hard to believe that Dutch disease policies are related to the rule of law in any serious way. Using the rule of law as our measure of institutional quality, as we have done in the appendix, confirms or results. We take this as an indication that the Dutch disease mechanism does not explain the resource

curse. The explanation is rather found in a dangerous mix of grabber activities, bad institutions, and resource abundance.

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1 Appendix

Regression results with Sachs and Warners (1997a) data.

In this appendix we report the regression result when we use the data that Sachs and Warner (1997a) used. The first column exactly replicates their result. The second column reports our regression 4 with their data. Observe that rule of law has taken the place as our indicator of institutional quality, both as a stand alone variable and in the interaction term. When interpreting the results keep in mind that the rule of law index runs from 0-6 while the institutional quality index runs from 0 to 1.

	Sachs and Warner's regression	Regression 4 (alternative)
[*initial income level*]	−1.76	−1.82
	(−8.56)*	(−8.96)*
[*openess*]	1.33	1.53
	(3.35)*	(3.82)*
[*resource abundance*]	−10.57	−16.36
	(−7.01)*	(−5.06)*
[*rule of law*]	0.36	0.18
	(3.54)*	(1.32)
[*investments*]	1.02	0.95
	(3.45)*	(3.28)*
[*interaction term*]		1.96
		(2.01)*
Observations	71	71
Adjusted R^2	0.72	0.74

Note: The numbers in brackets are t-values. A star (*) indicates that the estimate is significant at the 5-% level.

Table 2: Regression results. Dependent variable is GDP growth.

The data are downloaded from Centre for International Development at http://www.cid.harvard.edu/ciddata/ciddata.html. A short description of the data are as follows (For a complete description consult Sachs and Warner 1997a): *initial income level* — natural log of real GDP divided by the economically-active population in 1970. *GDP growth* — average annual growth in real GDP divided by the economically active population between 1970 and 1990. *resource abundance* — share of exports of primary products in GNP in 1970. *openness* — the fraction of years during the period 1970-1990 in which the country is rated as an open economy. *investments* — log of the ratio of real gross domestic investment (public

plus private) to real GDP averaged over the period 1970-1989. *rule of law* — an index constructed by the Center for Institutional Reform and the Informal Sector which reflects the degree to which the citizens of a country are willing to accept the established institutions to make and implement laws and adjudicate disputes. Scores 0 (low) - 6 (high). Measured as of 1982. *interaction* — variable constructed by multiplying rule of law with resource abundance.

COUNTRY	IQ	LGDPEA	SXP	OPEN	INV	GDP6590
BOLIVIA	0.23	7.82	0.18	0.77	15.34	0.85
HAITI	0.26	7.40	0.08	0.00	6.64	-0.25
EL SALVADOR	0.26	8.15	0.16	0.04	8.19	0.19
BANGLADESH	0.27	7.68	0.01	0.00	3.13	0.76
GUATEMALA	0.28	8.16	0.11	0.12	9.19	0.71
GUYANA	0.28	8.06	0.51	0.12	20.23	-1.47
PHILIPPINES	0.30	7.78	0.13	0.12	16.50	1.39
UGANDA	0.30	7.10	0.27	0.12	2.52	-0.41
ZAIRE	0.30	6.93	0.15	0.00	5.20	-1.15
NICARAGUA	0.30	8.45	0.19	0.00	12.19	-2.24
MALI	0.30	6.71	0.08	0.12	5.89	0.82
SYRIA	0.31	8.37	0.08	0.04	15.31	2.65
NIGERIA	0.31	7.09	0.14	0.00	15.06	1.89
PERU	0.32	8.48	0.15	0.12	17.49	-0.56
HONDURAS	0.34	7.71	0.23	0.00	13.40	0.84
INDONESIA	0.37	6.99	0.11	0.81	21.57	4.74
CONGO	0.37	7.60	0.08	0.00	9.24	2.85
GHANA	0.37	7.45	0.21	0.23	5.05	0.07
SOMALIA	0.37	7.51	0.09	0.00	9.85	-0.98
JORDAN	0.41	8.04	0.09	1.00	16.80	2.43
PAKISTAN	0.41	7.49	0.03	0.00	9.57	1.76
ZAMBIA	0.41	7.66	0.54	0.00	15.98	-1.88
ARGENTINA	0.43	8.97	0.05	0.00	16.87	-0.25
MOROCCO	0.43	7.80	0.11	0.23	11.22	2.22
SRI LANKA	0.43	7.67	0.15	0.23	10.93	2.30
TOGO	0.44	6.82	0.19	0.00	18.35	1.07
EGYPT	0.44	7.58	0.07	0.00	5.13	2.51
ALGERIA	0.44	8.05	0.19	0.00	27.14	2.28
PARAGUAY	0.44	7.88	0.10	0.08	15.53	2.06
ZIMBABWE	0.44	7.58	0.17	0.00	14.87	0.86
MALAWI	0.45	6.68	0.21	0.00	11.29	0.92
DOMINICAN REP	0.45	7.85	0.13	0.00	17.75	2.12
TUNISIA	0.46	7.81	0.10	0.08	14.54	3.44
TANZANIA	0.46	6.58	0.17	0.00	11.60	1.93
MADAGASCAR	0.47	7.63	0.12	0.00	1.39	-1.99
JAMAICA	0.47	8.32	0.14	0.38	18.85	0.78
SENEGAL	0.48	7.69	0.14	0.00	5.11	-0.01
BURKINA FASO	0.48	6.52	0.04	0.00	9.49	1.26
URUGUAY	0.51	8.67	0.09	0.04	14.34	0.88
TURKEY	0.53	8.12	0.04	0.08	22.52	2.92
COLOMBIA	0.53	8.19	0.09	0.19	15.66	2.39
GABON	0.54	8.35	0.33	0.00	28.18	1.73
MEXICO	0.54	8.82	0.02	0.19	17.09	2.22
SIERRA LEONE	0.54	7.60	0.09	0.00	1.37	-0.83
ECUADOR	0.54	8.05	0.11	0.69	22.91	2.21
COSTA RICA	0.55	8.52	0.19	0.15	17.26	1.41
GREECE	0.55	8.45	0.04	1.00	24.57	3.17
VENEZUELA	0.56	9.60	0.24	0.08	22.16	-0.84
KENYA	0.56	7.14	0.18	0.12	14.52	1.61
GAMBIA	0.56	7.17	0.36	0.19	6.05	0.35
CAMEROON	0.57	7.10	0.18	0.00	10.59	2.40
CHINA	0.57	6.94	0.02	0.00	20.48	3.35
INDIA	0.58	7.21	0.02	0.00	14.19	2.03
NIGER	0.58	7.12	0.05	0.00	9.37	-0.69
TRINIDAD & TOBAGO	0.61	9.39	0.08	0.00	13.10	0.76
ISRAEL	0.61	8.95	0.04	0.23	24.50	2.81
THAILAND	0.63	7.71	0.09	1.00	17.56	4.59
CHILE	0.63	8.69	0.15	0.58	18.18	1.13
BRAZIL	0.64	8.16	0.05	0.00	19.72	3.10
KOREA. REP.	0.64	7.58	0.02	0.88	26.97	7.41
IVORY COAST	0.67	7.89	0.29	0.00	10.06	-0.56
MALAYSIA	0.69	8.10	0.37	1.00	26.16	4.49
SOUTH AFRICA	0.69	8.48	0.17	0.00	18.53	0.85
BOTSWANA	0.70	7.10	0.05	0.42	24.61	5.71
SPAIN	0.76	8.87	0.03	1.00	25.05	2.95
PORTUGAL	0.77	8.25	0.05	1.00	22.99	4.54
HONG KONG	0.80	8.73	0.03	1.00	20.79	5.78
ITALY	0.82	9.07	0.02	1.00	25.90	3.15
TAIWAN	0.82	8.05	0.02	1.00	24.44	6.35
IRELAND	0.83	8.84	0.15	0.96	25.94	3.37
SINGAPORE	0.86	8.15	0.03	1.00	36.01	7.39
FRANCE	0.93	9.37	0.03	1.00	26.72	2.58
U.K.	0.93	9.38	0.03	1.00	18.12	2.18
JAPAN	0.94	8.79	0.01	1.00	34.36	4.66
AUSTRALIA	0.94	9.57	0.10	1.00	27.44	1.97
AUSTRIA	0.95	9.18	0.04	1.00	25.89	2.91
GERMANY. WEST	0.96	9.41	0.02	1.00	25.71	2.37
NORWAY	0.96	9.30	0.10	1.00	32.50	3.05
SWEDEN	0.97	9.56	0.05	1.00	22.38	1.80
NEW ZEALAND	0.97	9.63	0.18	0.19	23.79	0.97
CANADA	0.97	9.60	0.10	1.00	24.26	2.74
DENMARK	0.97	9.47	0.10	1.00	24.42	2.01
FINLAND	0.97	9.21	0.07	1.00	33.81	3.08
BELGIUM	0.97	9.27	0.11	1.00	22.26	2.70
U.S.A.	0.98	9.87	0.01	1.00	22.83	1.76
NETHERLANDS	0.98	9.38	0.15	1.00	23.32	2.27
SWITZERLAND	1.00	9.74	0.02	1.00	28.88	1.57

The variables are: IQ - an index of institutional quality,
LGDPEA - the log of GDP per head of the economically active population in 1965,
SXP - the share of primary exports in GNP in 1970, OPEN - an index of a country's openness
INV - the average ratio of real gross domestic investments over GDP
GDP6590— average growth rate of real GDP per capita between 1965 and 1990
For more details see Sachs and Warner (1997a)

Table 3: Dataset used in the main regression.