Resource curse or not: A question of appropriability*

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Abstract

This paper shows that whether natural resources are good or bad for a country's development crucially depends on the interaction between institutional setting and the type of resources possessed by the country. Some natural resources are, for economical and technical reasons, more likely to cause problems such as rent-seeking and conflicts than others. This potential problem can, however, be countered by good institutional quality. In contrast to the traditional resource curse hypothesis, we show the impact of natural resources on economic growth to be non-monotonic in institutional quality. Countries rich in minerals are cursed only if they have low quality institutions, while the curse is reversed if institutions are sufficiently good.

Keywords: Natural Resources, Appropriability, Property Rights, Institutions, Economic Growth, Development

JEL: O40, O57, P16, O13, N50

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1 Introduction

A major puzzle in economic development is the existence of a negative correlation between economic growth and large natural resources. Some of the fastest growing economies over the last few decades are countries with very little natural wealth (such as Hong Kong, Singapore, Korea, and Taiwan), whereas some of the poorest economic performers (like Angola, Sierra Leone, and the Democratic Republic of Congo) are countries with enormous resources. A number of recent studies have concluded that the negative relationship between resource abundance and growth also holds for large samples of countries after controlling for other relevant characteristics.[1] This relationship, the so called 'resource curse', has become widely accepted as one of the stylized facts of our times.[2]

However, the resource curse seems far from inevitable. While oil appears to have been the cause of recurrent problems in countries like Venezuela and Ecuador, Norway has become one of the world's richest economies largely thanks to its oil endowments. The possession of diamonds has arguably been disastrous for the development of countries like Sierra Leone, Liberia and the Democratic Republic of Congo. However, this does not seem be the case in countries like Australia, South Africa or Botswana – one of the world's fastest growing economies over the past thirty years. There are several examples of countries rich in similar resources that have experienced extremely different economic growth. Studying the examples in Table 1, it seems that for every catastrophic failure there is a counter example of success.

In this paper, we show that the effect of natural resources on economic development is not determined by resource endowments alone, but rather by the interaction between *the type of resources* that a country possesses, and the *quality of its institutions.* This combination of factors determines what we call the *appropriability* of a resource. The concept of appropriability captures the likelihood that natural resources lead to rent-

[1]E.g. Sachs and Warner (1995); Gylfason et al. (1999); Leite and Weidmann (1999). Ross (1999) provides an overview of much of this literature.

[2]Wright (2001, p. 1)

seeking, corruption or conflicts which, in turn, harm economic development. We will show that in countries where resources are highly appropriable - as determined by the type of resources as well as institutional quality - resource abundance is problematic, while in countries where resources are less appropriable, they can contribute to economic growth.

Table 1: Relative growth performance in ten resource rich economies

	Growth 1975-1998	Main resource[a]	Institutional quality[b]
Botswana	4.99	Diamonds	0.706
Chile	3.71	Copper	0.668
Norway	2.82	Crude Petrol	0.966
Australia	1.97	Minerals	0.932
Canada	1.73	Minerals	0.974
Sample Average	1.53		0.638
Ecuador	-0.79	Crude Petrol	0.592
Niger	-1.45	Minerals	0.520
Zambia	-1.94	Copper	0.434
Sierra Leone	-2.05	Diamonds	0.406
Congo, Democratic Rep.	-5.39	Ores and Metals	0.232

[a] The listing of main resources is based on UNCTAD data on export structure in 1975.
[b] The measure of institutional quality is a "Property Rights Index" based on data from Keefer and Knack (2002). The index score for a country is between zero and one where higher scores mean better institutional quality. See Appendix Table A2 for details.

It is important to stress the two dimensions of our concept. On the one hand, certain resources are, by their physical and economical characteristics, more likely to cause appropriative behavior. Resources which are very valuable, can be stored, are easily transported (or smuggled), and are easily sold are, for obvious reasons, more attractive to anyone interested in short-term illegitimate gains. This suggests that resources such as diamonds or precious metals are more problematic than, say, agricultural products.[3] On the other hand, this does not mean that all countries with potentially problematic types of resources will suffer, while others will do fine. The potential problem of having certain types of resources can be countered by having good institutions. Given the right

[3]Indeed, many case studies of development failure and resource abundance are concerned with mineral rich countries, rather than countries rich in natural resources in general. Campbell (2002) deals with conflict diamonds, Karl (1997) gives examples of problems related to oil, and Auty (1993) studies countries dependent on non-ferrous metals.

institutional framework, finding oil or diamonds has the potential of boosting a country's economic development, while the same resources are likely to lead to problems in a country with poor institutions.

Consider the cases of Ecuador and Norway: in 1967 and 1969, respectively, these countries discovered unexpectedly vast amounts of oil, which have ever since constituted an important share of their GDP.[4] In terms of institutional setting, however, these countries were very different. Ecuador had just ended a short period of military government, which was to return in 1972. Norway on the other hand was one of the worlds oldest democracies with firmly established institutions. At the time of the oil discoveries, the institutional gap between Ecuador and Norway was thus definitely to Ecuador's disadvantage. According to the hypothesis suggested in this paper, Ecuador would be expected to have more difficulties than Norway in transforming the oil revenues into long-term development. In the past decades the yearly growth rate of the Norwegian economy has been on average seven times higher than that of Ecuador.

Diamonds perhaps stand out as the most potentially problematic type of resources in their extreme value (per unit) and the ease with which they can be smuggled. When it comes to the ease of extraction, it is important to distinguish between primary (kimberlitic) diamonds, which require costly mining technology, and secondary (alluvial) diamonds, for which the extraction costs are virtually zero. Mining of primary diamonds requires large investments and therefore good property rights protection is essential for such investments to be undertaken. The insecure property rights in a country like Tanzania, which is known to have large amounts of kimberlitic pipe, have made it difficult to attract investors and therefore this natural endowment has not enhanced its economic growth. On the other hand, a country like Botswana, which has a higher institutional quality than the world average, has successfully exploited its kimberlitic diamond resources over the past thirty years. The same is true for Australia, which quickly managed

[4] According to our own calculations based on figures from World Development Indicators, oil has constituted 10 to 15 per cent of GDP in both Ecuador and Norway between the late 1970s and 2000.

to turn its recent diamond findings (during the 1980s) into a source of income.

When it comes to alluvial diamonds these are known to be very problematic in the absence of good institutions. The civil wars in Angola, the Democratic Republic of Congo and Sierra Leone are, for example, to a large extent fuelled and sustained by illegal trade in diamonds.[5] However, alluvial diamonds have not caused problems everywhere. First discovered in 1867, South Africa has had large deposits of alluvial diamonds.[6] The economic effects of these findings as compared to the discoveries in Sierra Leone in 1930 have arguably been very different. But so have institutions. While both countries were British colonies, the Cape Colony, which later expanded and eventually became South Africa, obtained representative government with two elected houses as early as 1854. Sierra Leone on the other hand, had the lowest colonial status in the British Empire, and it was not until the 1950s that Sierra Leone started to have any form of representative institutions. While the diamond findings in South Africa quickly drew investors and became an industry with firm property rights, the same resource in Sierra Leone largely remained up-for-grabs and has been a problem ever since it was found.[7]

In the following we will show that the economic impact of resource endowments systematically depends on the interaction between the types of resources and a country's institutions. In Section 2 we will relate our ideas to previous writings on the effects of resource abundance on economic development. In Section 3, we specify our hypothesis and present our data. In particular, we report how we have constructed our measure for the most appropriable resources. Section 4 tests our hypothesis using OLS regressions

[5] Campbell (2002) gives a full account of the devastating consequences of illicit diamonds in Sierra Leone. Recently the UN as well as the World Diamond Council (WDC) have recognised these problems and started projects to try to stop the illegal diamond trade.

[6] Even though South Africa has very large alluvial deposits, the main sources of diamond are kimberlitic.

[7] This description of institutions in these countries is clearly very simplistic. In the early 20th century the Cape colony lost some of its representative institutions and later came to limit franchise and political rights only to the white population. Regarding Sierra Leone, it was not a colony for which Britain had ever sought, but rather one they had to take on. Sierra Leone eventually obtained the status of Protectorate in 1895, which meant minimal British administrative and political arrangements combined with actions to prevent crime and lawlessness. For more details see the Oxford History of the British Empire (2001).

of GDP growth on different measures of natural resources, institutions and their interactions. We also address the issue of endogenous institutions and run 2SLS regressions instrumenting for institutional quality. In Section 5 we check the robustness of our results with respect to influential observations, sample size, the influence of armed conflicts and the choice of institutional variables. Section 6 concludes.

2 Related literature

There is strong evidence that resource abundant countries have had lower average growth rates in the Post-war period as compared to their resource-poor counterparts. However, there seems to be little agreement on why this relationship exists. The different theories that have been advanced can usefully be grouped into economic and political-economy explanations.[8]

Most of the recent *economic explanations* are versions of the so called "Dutch Disease".[9] The basic argument in these models is that windfall gains from natural resources (either through sudden increases in the price of the resource, or through the discovery of new resources) have a crowding-out effect on other sectors of the economy. For example, in Sachs and Warner (1995), following Matsuyama (1992), positive externalities in the form of learning-by-doing are assumed to only be present in the manufacturing sector of the economy. This implies that the larger is the natural resource sector (and the smaller is the manufacturing sector), the smaller is the positive externality feeding the growth process. However, these theories typically predict that the effect of natural resources on growth should unambiguously be negative: the more natural wealth, the worse the outcome. As such, these theories cannot explain why Botswana and Norway have been

[8]One could, of course, add "pure" political explanations, such as the "rentier effects" and (anti) "modernization effects" (see Ross (2001) for a discussion of these) as well as sociological studies of negative effects of resources on development (see Ross, 1999, footnote 2).

[9]For example, Corden and Neary (1982); Neary and van Wijnbergen (1986) and Krugman (1987). For other economic theories based on, for example, declines in terms-of-trade and sensitivity to volatile commodity prices, see the overview in Ross (1999).

successful, while Sierra Leone and Ecuador have not.[10]

A number of papers have put forward more *politico-economic explanations* for why natural resources have negative effects on growth. Lane and Tornell (1999) and Torvik (2002) have developed theoretical models of rent-seeking where resource abundance increases the incentives to engage in "non-productive" activities to capture the rents from the resources. Even though these papers certainly give important insights, they also predict a monotone adverse effect of natural resources on economic growth. Collier and Hoeffler (1998, 2002a) point to resources as a source of armed conflict. They find a non-linear relationship between natural resources and the risk of armed conflicts, but they still do not explain why some resource rich countries prosper whereas others fail.[11]

Auty (1997); Woolcook et al. (2001) and Isham et al. (2003) have – as we do in this paper – stressed the importance of different types of resources. What they term "point source" resources, such as plantation crops and minerals, are more likely to cause problems than "diffuse" natural resources, such as rice, wheat and animals. These theories provide predictions on why different resource-rich countries may be affected differently by their natural wealth. Those with plantation crops, oil or diamonds are more likely to have bad outcomes than those with rice, wheat, and livestock. This prediction seems to be supported by data. However, these theories cannot account for the facts in Table 1. Why is it that when comparing countries with similar natural resources, some seem to gain from their endowments when others lose? The reason we suggest is that the relationship between natural resources and growth is non-monotonic in institutional quality. Relating to the theories of resources as a source of rent-seeking or conflict, the idea is that better

[10] In Gelb (1988) several studies find that the mechanisms suggested by these models were not there in the data. Resource booms have not shifted capital and labour away from manufacturing. Furthermore governments seemed to be able to counter the "disease" if necessary. As concluded by Neary and van Wijnbergen (1986): "In so far as one general conclusion can be drawn it is that a country's economic performance following a resource boom depends to a considerable extent on the policies followed by its government...".

[11] Given the insights on the importance of conflicts from Collier and Hoeffler (1998, 2002a) we control for this and show that our results are not purely driven by resources causing conflict and thereby harming growth.

institutions increase the costs of non-productive activities.[12] Merging these with theories suggesting that types of resources matter, we also claim that the non-monotonicity will depend on what resources the country is rich in. Specifically, our prediction is that institutional quality is most crucial for countries rich in diamonds and precious metals. Such countries, which have poor institutions, are expected to have the largest negative effects of resources, while similar countries with good institutions are predicted to have large gains from these.

In emphasizing the interaction between types of resources and institutions we face the crucial issue of potential endogeneity of institutions with respect to resources. As shown by Engerman and Sokoloff (2002), the differences in initial factor endowments between North and South America have played an important role in shaping the different institutions. Put simply, their argument is that some countries enjoyed conditions favorable for growing crops, such as sugar, which were most efficiently produced on large plantations. This led to concentrations of wealth, political power, and human capital, and in the long run to worse economic outcomes. In similar spirit, Acemoglu et al. (2002) argue that initial conditions shaped the types of institutions set up in areas colonized by Europeans. They suggest that "extractive institutions" were set up where large gains could be made from extractive policies and where settlement was difficult due to the disease environment. These areas were often densely-settled and initially relatively rich. "Institutions of private property", on the other hand, were set up in places where Europeans settled in large numbers, which were often poor and sparsely populated at the time of settlement. These institutional differences later came to determine which areas could take advantage of the opportunities to industrialize.[13] Easterly and Levine (2002) and Rodrik et al. (2002) go as far as to argue that once institutional quality is controlled for there is no separate effect from "geographical factors". While there is no doubt that geographical factors in

[12]This idea echoes Rodrik (1999), who stresses the role of institutions of conflict management.

[13]Acemoglu et al. (2001) specifically argue for the importance of settler mortality in shaping early institutions which, through the persistence in institutional quality, has come to produce different long-run economic outcomes.

general, and resource endowments in particular, have played an important role in shaping institutions, this does not imply that all resources which are relevant today have been part of this development. In some cases institutional differences precede the discovery of resources and consequently determine the effect of these discoveries on the economy. For example, at the time of the oil discoveries in Norway and Ecuador, these countries had very different institutions, and we would argue that these differences determined the diverse impacts of these discoveries on the economy. The same is true for many other countries and resources. Nevertheless, there is a potential endogeneity problem and therefore, we address the possibility of institutions being endogenous and show that our results hold when instrumenting for institutional quality.

In closely related and independent work, Mehlum et al. (2002) and Robinson et al. (2002) share our prediction of resources being non-monotonic in institutional quality. Mehlum et al. (2002) develop a model where entrepreneurs choose between becoming "producers" or "grabbers". The relative payoff from these activities depends on how "grabber friendly" the institutions are, which also determines the effect of natural resources on the economy. More natural resources raise the national income if institutions are "production friendly", but reduce the national income if they are "grabber friendly". Robinson et al. (2002) develop a model with similar predictions regarding the non-monotonic effect of resources depending on institutional quality, but where instead political incentives generated by resources are key. In countries with good institutions resources are positive because the perverse political incentives are mitigated, but in countries with bad institutions resources remain a curse.

Our study could be viewed as a test of these theories and we will indeed show that the effect of resources on economic performance depends on institutional quality. But we do not test whether the channel is through the misallocation of talent between productive activities and rent-seeking, through perverse political incentives, or through conflict over resources. The reason is that we believe all these channels to be important and affected by institutional quality in similar ways. Instead we add the dimension of resource type to our analysis and show that how much institutions change the impact of resources crucially depends on the type of resources a country has.

3 Our hypothesis and data

In contrast to the standard resource curse, our basic hypothesis is the following: Natural resource abundance is negative for economic development only if the country lacks the proper institutions for dealing with the potential conflicts and the rent-seeking behavior in which the resources may otherwise result. A lack of proper institutions is likely to be more serious for countries rich in physically and economically appropriable resources.

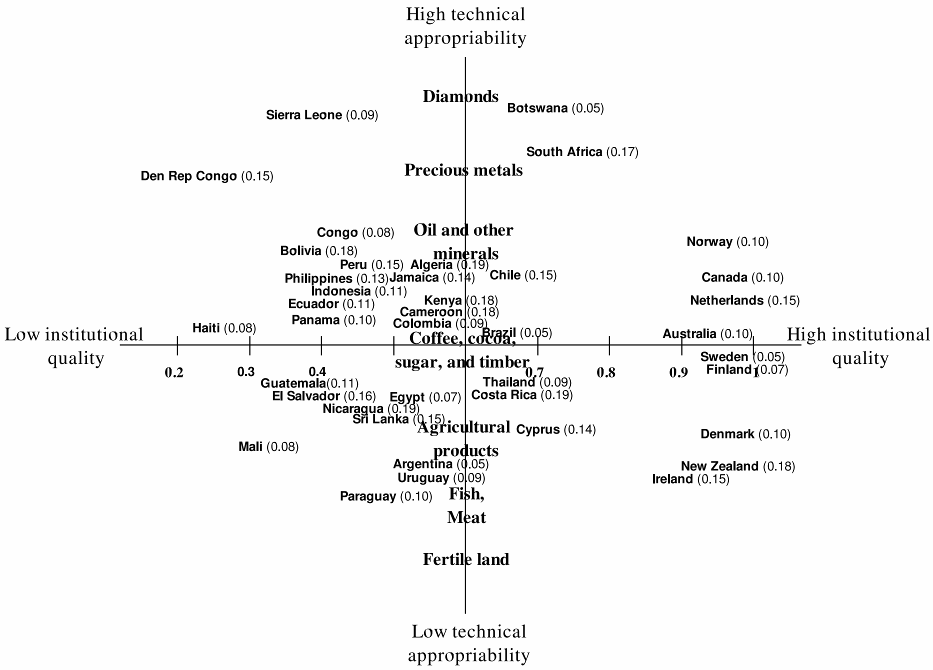


Figure 1: The two dimensions of resource appropriability. The number adjacent to each country name is the share of primary exports in GDP in 1971. See the text for details.

Plotting countries with respect to the two dimensions of resource appropriability can serve as a simple illustration of our theory. Figure 1 shows a number of countries with similar shares of primary exports in GDP (a common proxy for natural resources) graphed with respect to type of resource and institutional quality.[14] In the first and fourth quadrant are countries with type of resources that are potentially problematic in that they are more likely to cause appropriative behavior (than those in the second and third quadrant).[15] Those on the left-hand side of the y-axis have lower than average measures of institutional quality, while those on the right-hand side have better than average institutions.[16] According to any theory which emphasizes the share of primary exports as important for economic performance, the contribution from resources to economic growth should, ceteris paribus, be roughly the same for all these countries.

Our prediction is that countries in the first quadrant will benefit from their natural wealth, while those in the fourth quadrant will instead be "cursed" by their endowments. For countries in the second and third quadrant - countries with less appropriable types of resources - the effects of the interaction between natural resources and institutions are less instrumental for economic development. This can be stated as two separate hypotheses.

The institutional dimension of appropriability: Natural resource abundance is neg-

[14]The countries included are all those in our data set with shares of primary export in GDP between 0.05 and 0.20. The average value for the respective quadrants is 0.11 for the first, 0.14 for the second, 0.11 for the third and 0.13 for the fourth quadrant. This means that in terms of this proxy for natural resource wealth the countries in the respective quadrants are, on average, very similar.

[15]Countries are classified according to their three leading primary exports in 1975. The lead export is the main determinant of the country's position in the graph and the second and third most important primary product determine the "direction" in which the country is placed. In Brazil and Thailand, for example, sugar is the lead export product. But in Brazil the second and third export products are coffee and iron ore, while in Thailand they are rice and maize, so Brazil is moved up toward minerals relative to the heading "coffee, cocoa, sugar and timber", while Thailand is moved down toward agriculture products. Some countries, such as Australia, are dominated by relatively equal shares of minerals and agricultural products and are therefore positioned in between these labels. Exactly how these natural resources should be ranked in terms of technical appropriability is, of course, debatable. In our analysis, we will only distinguish between a broad measure of natural resources (which includes all primary products) and narrower measures of more appropriable resources which only include ores and metals, and an even narrower measure of what we define as the most appropriable resources, only including precious metals and diamonds. See Auty (1997) and Woolcook et al. (2001) for a slightly different distinction between types of resources.

[16]Institutional quality is measured as an (unweighted) average of indexes for the quality of the bureaucracy, corruption in government, rule of law, the risk of expropriation of private investment and repudiation of contracts by the government. See Appendix Table A2 for details.

ative for economic development only under poor institutions.

The technical dimension of appropriability: The impact of institutional quality and abundant natural resources is more pronounced, the more technically appropriable are the country's natural resources.

The basic econometric specification for testing the proposed effects of resources and institutions in country i becomes

$$growth_i = X_i'\alpha + \beta_1 NR_i + \beta_2 Inst_i + \beta_3 (NR_i \times Inst_i) + \varepsilon_i \quad , \tag{3.1}$$

where *growth* is the average yearly growth rate of GDP, X is a vector of controls including initial GDP per capita level, period averages of openness and investment ratios, dummy variables for Sub Saharan Africa and Latin America respectively and a constant. NR is a measure of natural resource wealth (for which we will use our four measures discussed below) and $Inst$ is our measure of institutional quality. $NR \times Inst$ is the interaction between natural resources and institutional quality.

According to our first hypothesis β_1 should be negative (the standard resource curse finding), β_2 should be positive (the standard finding that good institutional quality is beneficial for growth) and β_3, the coefficient for the interaction between natural resources should be positive and - if it is to reverse the resource curse - have an absolute value larger than β_1.[17] This would mean that as long as the institutional quality is good enough, natural resources will have a positive net effect on economic growth. Furthermore, our second hypothesis implies that the impact on the growth rate of GDP of both the negative effect of the resources themselves (β_1) and the interaction with institutional quality (β_3) should be stronger, the more appropriable are resources and the weaker are institutions. Put differently, the institutional quality is more important for countries rich in technically appropriable resources than for others.

[17] The fact that our measure of institutional quality has been rescaled to a 0-1 measure allows us to directly compare the coefficients.

When addressing our second hypothesis, we are limited by the availability of data for all natural resource measures for each country. This leaves us with a sample of 80 countries, both industrialized and developing (see Appendix Table A1 for a complete listing). Our dependent variable, *growth*, is defined as the average yearly growth rate of GDP between 1975 and 1998.

We use four different measures of natural resources to capture a gradual increase in physical and economical appropriability. As the broadest measure we use the share of primary exports to GNP from Sachs and Warner (1995), *PrimExp* (by them labelled *SXP*). In terms of appropriability this measure includes everything from meat to precious metals, that is the whole range of the y-axis in Figure 1. Second broadest is *OrMetExp*, which includes the exports of ores and metals as a share of GDP – this corresponds to the upper half of the y-axis. A similar measure in terms of appropriability is *MinProd*, the share of mineral production in GNP.[18] This differs in two respects, however. It does not include ores and it is a production – not an export – measure. If technically appropriable resources are likely to be diverted on their way from production to export, this proxy is expected to contain less measurement error.

Our fourth, and narrowest, measure *MidasProd* is the value of production of gold, silver, and diamonds (industrial as well as gem stone) as a share of GDP – that is, the very top of the y-axis in Figure 1. This measure is based on a combination of production and price data. Production data are from the Minerals Yearbook, where production is reported in volumes. For price data on silver and gold, we employ average yearly market prices reported by the U.S. Geological Survey (1999). Such prices do not exist for diamonds because of the large variation in quality. What we do have is the U.S. import quantities and values of diamonds (industrial and gem stone) from different countries. These are used to obtain the per carat price for each country and quality, which we multiply with production data. The total value of gold, silver and diamonds for each country is divided

[18]This measure is also taken from Sachs and Warner (1995), where it is called *SNR*.

by GDP to obtain $MidasProd$.[19]

To reduce the risk of reverse causality we use initial year measures for all four resource proxies.[20] To capture institutional quality we employ the (unweighted) average of indexes for the quality of the bureaucracy, corruption in government, rule of law, the risk of expropriation of private investment, and repudiation of contracts by the government from Keefer and Knack (2002). Our control variables are the level of GDP per capita in 1975, investment and trade openness.[21] Sources and exact definitions of all variables are presented in Appendix Table A2. Table 2 reports the correlations between these main variables and enables us to address a number of issues. First, it indicates that the measures of natural resources in themselves are not proxies for a country's level of development. In fact, the correlation between per capita GDP in 1975 and the different measures of natural resources is fairly low. Moreover, this potential problem seems to be largest for the broadest measure of natural resources ($PrimExp$), while the narrower measures are less correlated with the GDP level. Second, in Table 2, we find institutions to be quite modestly (negatively) correlated with the measures of natural resources. Third, Table 2 reports the initial GDP level and investments to be highly correlated with institutions. This is addressed in the robustness section.

[19]The net value of alluvial diamonds is clearly higher (due to lower extraction costs) than that of kimberlitic diamonds. However, we cannot distinguish between different production costs for any natural resource and therefore, we use the export value of the respective resources.

[20]The exception is $MidasProd$. Due to heavy price volatility during the years surrounding 1975, we use the average of 1972, 1974, 1976, 1978 and 1980, to avoid the choice of a specific starting year to influence our results. Our findings are similar when using $MidasProd$ for 1974 or 1976, however.

[21]One control variable we have excluded is average years of schooling in the population, since it is highly correlated with the other control variables. The regression results are robust to the inclusion of *schooling*, however.

Table 2: Correlation matrix for the entire sample

	Growth	*Inst*	*Prim*	*OrMet*	*Min*	*Midas*	*GDP75*	*Open*
Institutions	**0.39***	1						
PrimExp	**-0.34***	**-0.29***	1					
OrMetExp	-0.14	-0.12	**0.47***	1				
MinProd	**-0.45***	**-0.33***	**0.40***	**0.42***	1			
MidasProd	-0.03	-0.07	-0.02	**0.31***	**0.30***	1		
GDP75	**0.19**	**0.83***	**-0.31***	-0.17	**-0.22**	-0.14	1	
Openness	**0.23**	0.17	**0.30***	**0.30***	-0.01	0.03	0.08	1
Investments	**0.55***	**0.73***	**-0.31***	-0.11	**-0.31***	-0.15	**0.69***	**0.30***

Figures in bold denote significance at least at the 10 per cent level; * at the one per cent level.

4 Main results

To test our hypotheses, we first run regressions using the broadest measure of natural resources (*PrimExp*). Then, we use gradually narrower definitions of natural resources, letting the measure of resources include fewer, but more physically and economically appropriable resources. If more appropriable resources are better for economic development when institutional quality is good, as well as increasingly problematic when institutions are bad, this should appear in the regression outcomes. As the measure of natural resources narrows down toward more technically appropriable resources, we expect the (negative) effect of resources (β_1) as well as the (positive) effect of the interaction term (β_3) to be more pronounced.

Columns (1)-(4) in Table 3 show our main results. In the first column, we use the broadest measure of natural resources (*PrimExp*). The signs of our three regressors of interest are in line with our first hypothesis, and while resources and the interaction are not individually significant, they are jointly significant at the five-per cent level. The interaction effect is not sufficiently large to outweigh the direct negative effect of resources, however. This equation is fairly similar to the one presented in a parallel paper by Mehlum et al. (2002). However, they use different data, a slightly different specification, and consider the period 1965-1990 which can explain the differences in our results.[22] All

[22]They use the same data set as Sachs and Warner (1997) which includes 87 countries. The data from the Penn World Table are from Mark 5.6, while we use Mark 6.1, so revisions may be one explanation for

control variables are significant and have the expected signs.

Table 3: The main results

	(1)	(2)	(3)	(4)
	PrimExp	*OrMetExp*	*MinProd*	*MidasProd*
Resources	-6.392	-25.424***	-20.106***	-95.656***
	(4.084)	(8.596)	(4.548)	(27.804)
Institutions	6.763***	4.893***	4.614***	5.564***
	(1.963)	(1.644)	(1.362)	(1.357)
ResInst	4.152	49.602***	36.408***	167.251***
	(6.156)	(18.609)	(8.971)	(38.508)
*GDP*75	-2.212***	-2.046***	-1.955***	-2.019***
	(0.377)	(0.326)	(0.309)	(0.288)
Openness	0.504*	0.218	0.277	0.142
	(0.274)	(0.298)	(0.246)	(0.245)
Investments	0.087***	0.092***	0.103***	0.089***
	(0.026)	(0.028)	(0.027)	(0.026)
Observations	80	80	80	80
R^2	0.63	0.65	0.67	0.70
Joint(p)	0.044	0.009	0.000	0.000

Notes: Dependent variable is *growth*. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a constant term and regional dummies for Latin America and Sub Saharan Africa (not shown). *Joint(p)* denotes whether the coefficient estimates of resources, and the interaction of resources and institutions are jointly significant.

We then narrow down the measure towards more physically and economically appropriable resources, reported in columns (2)-(4) in Table 3. Now, natural resources, institutions, and their interaction are all significant at the one per cent level (and resources and the interaction are jointly significant). The interaction effect outweighs the impact of the resources and hence, resources tend to be positive for growth for good enough quality of institutions.

This supports our hypothesis that more appropriable resources are indeed more problematic, unless a country has sufficiently good institutions. Since the size of the natural resource variables differs greatly, a direct comparison of the coefficient estimates is not very informative. We evaluate the impact of different resources by calculating the marginal effects of a standard deviation change at different levels of institutional quality, using the

the difference in our results. They also use another variable for openness. In particular, they do not use any regional dummies, which we believe make the largest difference. When excluding regional dummies from our regression presented in column (1), Table 3, we obtained results very similar to theirs.

coefficients from Table 3, columns (1)-(4). Formally,

$$\Delta growth = (\widehat{\beta}_1 + \widehat{\beta}_3 \widetilde{Inst}) \times sdNR \quad ,$$

where $\widetilde{Inst}$ is the level of institutional quality, and $sdNR$ is a standard deviation change in the resource measures.[23] For each of the four resource measures, we evaluate the growth impact for four different levels of institutional quality, the minimum level in the sample, 0.232 (the value for Democratic Republic of Congo), the average, 0.634 (between the value for Trinidad and Tobago and Costa Rica), the average level of institutions plus one standard deviation, 0.854 (between Hong Kong and Singapore), and the maximum, 0.995 (Switzerland). Table 4 reports the calculated effects. It illustrates both our hypotheses. First, reading the table top-down, given the production of natural resources, institutional quality is conducive to growth (the *institutional dimension of appropriability*). Second, reading left-right, the importance of good institutions increases in the physical and economic appropriablility of resources (the *technical dimension of appropriability*).

Table 4: Marginal effects of resources on growth (for different levels of institutional quality)

	$PrimExp$	$OrMetExp$	$MinProd$	$MidasProd$
Worst *institutions*	-0.548	-0.946	-1.127	-1.425
Average *institutions*	-0.378	0.425	0.304	0.279
Aver. + 1 st.dev. *institutions*	-0.288	1.152	1.062	1.183
Best *institutions*	-0.228	1.629	1.560	1.776

Given the recent insights provided by Acemoglu et al. (2001, 2002) and Rodrik et al. (2002) regarding the importance of the quality of institutions for economic development, further investigating the role of institutions in our regression (3.1) is crucial. There are basically two concerns. The first is that natural resources would determine institutions, which in turn would drive economic development - as hypothesized by Engerman and

[23] For example, using $MinProd$ and the mean level of *institutions* (0.634) gives: $(-20.1 + 36.4 * 0.638) * 0.097 = 0.304$. The interpretation is that, ceteris paribus, a country with an average level of institutional quality would increase its annual growth rate by 0.3 per cent if it were to increase its mineral production by one standard deviation.

Sokoloff (2002) and Isham et al. (2003), for example. This would mean that our empirical model is misspecified and our resource measures should instead be used to instrument for institutions.

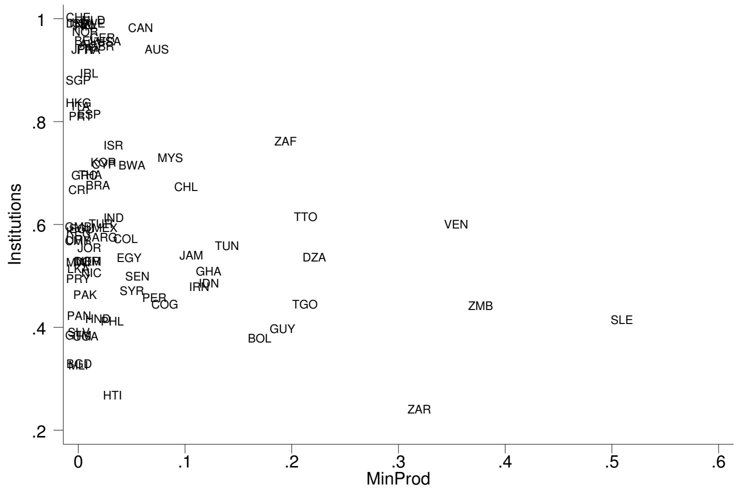


Figure 2: Plot of $MinProd$ against *institutions*

Besides Table 2 showing that the correlation between our different measures of natural resources with *institutions* is low, Figure 2 plots *institutions* against $MinProd$. Bearing in mind that $MinProd$ is the **most** correlated measure of natural resources, it is not clear that natural resources determine institutional quality in our sample.

The second concern arises from the fact that institutions could be correlated with the error term in our regression equation (3.1), so that our specification would suffer from endogeneity. To address this concern we perform a regression based Hausman test for endogeneity, which fails to reject the null hypothesis that *institutions* and the interaction term of *institutions* and *natural resources* are exogenous, as reported in Table 3.[24] For one measure however, $OrMetExp$, the hypothesis is rejected at the five-per cent level. Nevertheless, we choose to instrument *institutions* (and the interaction) with *latitude*

[24] In our structural model $growth = X_i'\alpha + \beta_1 NR_i + \beta_2 Inst_i + \beta_3(NR_i \times Inst_i) + \varepsilon_i$, we suspect $Inst$ and hence $NR \times Inst$ to be endogenous. We run the first-stage reduced form regressions $Inst_i = X_i'\alpha + \beta_1 NR_i + Z_i'\gamma + v_1$ and $NR_i \times Inst_i = X_i'\alpha + \beta_1 NR_i + Z_i'\eta + v_2$ where Z' is our set of instruments. Then, we include the Least Squares residuals $\widehat{v}_1$ and $\widehat{v}_2$ in the structural equation. In one specification out of four (using $OrMetExp$) we reject exogeneity of $Inst$ and $NR \times Inst$, i.e. the joint F-test for the OLS-residuals is significant.

and *EurFrac*, the fraction speaking any European language (and *latitude* and *EurFrac* interacted with resources) by using 2SLS. This set of instruments derives from Hall and Jones (1999) and are also used in Alcalá and Ciccone (2004).

In Table 5, columns (1)-(4), we present the results from these estimations. The first stage regressions are reported in Appendix Table B1. In terms of instrument relevance, the excluded instruments enter jointly significant in every first-stage regression. Importantly, in no specification is a single "good" instrument alone responsible for the significance in both first-stage regressions (in which case the model would be unidentified). The Hansen J-test of exogeneity of excluded instruments, presented in Table 5, suggests instruments to be valid.[25] In all four regressions, the coefficient for *institutions* is larger as compared to those obtained under OLS, which is consistent with attenuation bias due to measurement error in the OLS-estimates. However, the 2SLS coefficients are less precisely measured, so *institutions* loses in significance. Turning to our resource measures, in column (1), the coefficient of *PrimExp* falls by around thirty per cent, and the interaction is now virtually zero. In column (2), our second export-based measure, *OrMetExp*, retains its expected properties, though both coefficients are around half the OLS-estimates and no longer significant. For the (production-based) measures of highly technically appropriable resources in columns (3)-(4), the outcomes are similar to those obtained under OLS, both regarding coefficient values and statistical significance.

[25] In addition, we included *latitude* directly in the OLS-specification. While it entered with a positive coefficient in all regressions, it was never near any conventional level of significance.

Table 5: Results when instrumenting for institutions.

	(1) *PrimExp*	(2) *OrMetExp*	(3) *MinProd*	(4) *MidasProd*
Resources	-4.443	-12.461	-16.998***	-89.995***
	(4.771)	(9.859)	(6.259)	(28.203)
Institutions	7.592**	6.839*	6.021	6.554*
	(3.463)	(3.788)	(4.019)	(3.452)
ResInst	0.664	23.586	30.646**	158.769***
	(7.112)	(20.405)	(12.699)	(39.762)
*GDP*75	-2.294***	-2.250***	-2.161***	-2.184***
	(0.646)	(0.649)	(0.762)	(0.626)
Openness	0.508*	0.229	0.261	0.138
	(0.271)	(0.293)	(0.261)	(0.254)
Investments	0.082***	0.090***	0.096***	0.084***
	(0.027)	(0.028)	(0.027)	(0.027)
Observations	80	80	80	80
R^2	0.62	0.63	0.66	0.70
Joint(*p*)	0.026	0.431	0.028	0.000
Ovid	0.207	0.311	0.134	0.511
Hausman	0.697	0.030	0.787	0.797

First-stage results in Appendix Table B1

Notes: Dependent variable is *growth*. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a constant term and regional dummies for Latin America and Sub Saharan Africa (not shown). *Joint*(*p*) denotes whether the coefficient estimates of resources, and the interaction of resources and institutions are jointly significant. *Ovid* reports the p-values from the Hansen J-overidentification test for instruments. *Hausman* reports p-values of the regression-based Hausman test for endogeneity as explained in the text. The null hypothesis is that *institutions* are exogenous.

We also tried to use settler mortality – as suggested in Acemoglu et al. (2001) – as an instrument for *institutions*. This means, on the one hand, that we potentially obtain more precise estimates (given that the usual assumptions hold). On the other hand, we now have a much smaller sample. Data on settler mortality only exist for 50 countries in our data set. OLS estimates in this smaller sample are similar to our main results. The results from instrumentation are presented in Appendix Tables B2 (first-stage results), and B3 (IV-estimates). In this smaller sample, our excluded instruments lose their relevance. However, for the specifications where instruments pass the F-test (*OrMetExp* and *MidasProd*), the original results go through. On balance, except for our broadest measure, *PrimExp*, our conclusion is that the 2SLS estimates do not differ considerably from the OLS regressions. Hence, we maintain OLS as our estimator.

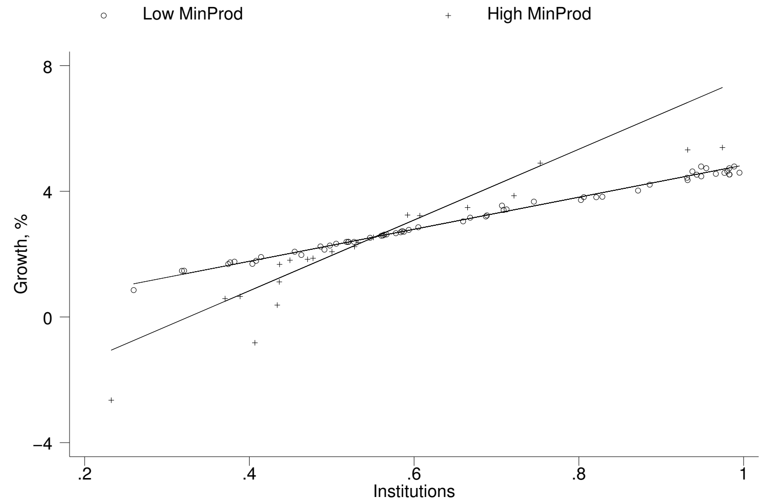


Figure 3: The partial effect of *institutions* on *growth* when dividing the sample in groups of below-the-average and above-the-average natural resources.

Figure 3 shows the **partial effects** of the combination of institutions and natural resources on economic growth. (Here, we use $MinProd$ as a measure of natural resources, while analogous figures for the other measures of natural resources are presented in Appendix B1.) The sample is divided into two groups depending on whether the country has a natural resource level above the mean. Countries with less than the mean production of minerals ($MinProd$) are represented by 'circles', while countries with a higher than mean production of natural resources have a 'plus'. We fit two regression lines (one for each group) by using the regression coefficients in column (3) of Table 3, and the respective group averages.[26]

As hypothesized, countries with less natural resources score better than those with plenty of natural resources when institutions are poor. However, for sufficiently good institutions, the effect is reversed. From the coefficients in Table 3, we calculate this institutional threshold level to be 0.55.[27] Above this cutoff level, the partial contribution of resources is higher for a high $MinProd$ country than for low $MinProd$ country, while

[26]Using $MinProd$ for country i, in our structural model $growth_i = \widehat{\beta}_1 \overline{MinProd}_j + \widehat{\beta}_2 Inst_i + \widehat{\beta}_3(\overline{MinProd}_j \times Inst_i)$, where $\overline{MinProd}_j$ is the group mean of group j with $j \in \{low; high\}$. The mean of $MinProd$ is 0.058, while the average value for those countries with $MinProd$ less than the mean is 0.013 and the average for those countries with more than the mean is 0.182.

[27]That is, $inst_{cutoff} = -\widehat{\beta}_1/\widehat{\beta}_3$.

the opposite holds below the institutional cutoff. In other words, countries with more resources need relatively better institutions to have the same growth effect as countries with fewer resources. Moreover, giving further support to our technical appropriability hypothesis, the institutional threshold level increases somewhat in the technical appropriability of the resource. More specifically, for $OrMetExp$ the institutional cutoff is 0.51, for $MinProd$ 0.55, and for $MidasProd$ 0.57.

5 Robustness of the results

This section aims at checking the robustness of our results. In the previous section, we had a wide sample of countries, including both industrialized and developing countries. We now restrict the sample in various ways. First, we focus on developing countries only, and find that the results do not depend on the inclusion of rich countries. Furthermore, we show that dropping potential outliers does not remove our results. Another part of this section addresses the concern that our results would be driven by a specific continent. Africa is often mentioned as the continent with the *resource curse* problem, so that it might be suspected that excluding Africa would alter our results. While the results turn out to be somewhat less pronounced, they are still present, however. Excluding Latin America has a minor effect on the main results.

The subsequent section tackles how measures of conflict affect our main results. The reason is simply that countries at war ceteris paribus have a lower economic output and if natural resources fuel conflicts, the importance of the appropriability effect in our main results may be driven by the existence of conflicts in these countries. This effect turns out to be without importance for our results, however. Finally we investigate whether the institutional measure used influences the outcome. Although our main results are qualitatively robust to different institutional measures, these regressions reveal some interesting quantitative effects. In addition, Table 2 reported a high correlation between institutions and initial GDP level and investments. To check to what extent these correlations influence our conclusions, we used a more parsimonious empirical specification dropping and adding control variables. These results are presented in Appendix Table B4 for the use of $MidasProd$.[28]

5.1 Excluding the developed countries

Although it is reassuring that our hypothesis has empirical support in a large sample of countries, much of the *resource curse* debate has concerned the lack of development in resource-intensive developing countries in the last decades. Do our hypotheses hold when restricting the sample to only contain developing countries? This would seem quite challenging for our results since, by dropping rich countries, we exclude many countries with high institutional quality, some of which are rich in natural resources and which may be driving the "positive" side of the interaction effect. Columns (1)-(4) in Table 6 report the results when excluding all the countries that where members of the OECD in 1975.[29]

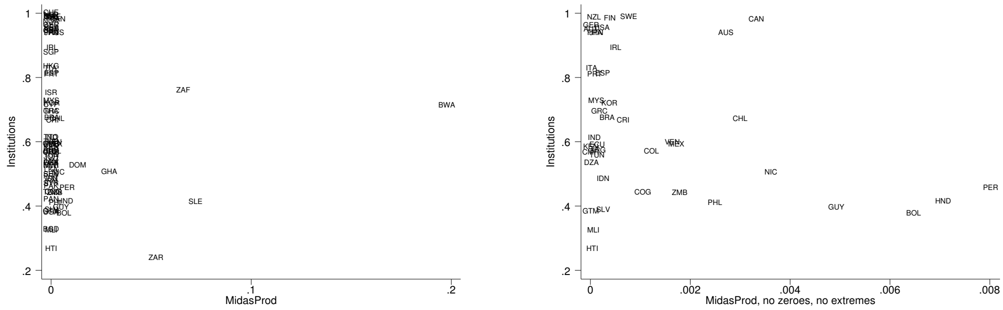
We find support for a non-monotonic relation between natural resources and growth, even when considering the developing countries separately. Good institutions are still crucial when having plenty of highly technically appropriable resources. If anything, institutional quality in itself appears to be somewhat more important for growth in developing countries. (For example, comparing the coefficients in column (4) in Table 6 with the corresponding column in Table 3, gives at hand that the coefficient for *institutions* is slightly larger in the sample with only developing countries, while the *resources* and the *interaction term* coefficients are slightly smaller.)

[28] One specification also includes schooling (see footnote 21). The use of other measures of natural resources yields the same changes. Moreover, following Sachs and Warner (2001), to address the issue of reverse causality we have included growth of GDP per capita in the previous period (in our case 1960-1974). Including lagged GDP growth does not alter our main results in any significant respect. These results are available from the authors upon request.

[29] The excluded countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, United Kingdom, and USA.

5.2 Are Botswana and Sierra Leone driving the results?

Naturally, there are countries in our sample differing considerably from all the rest. Just when eye-balling the data there are certain countries that are outliers either with respect to their growth performance over the period or their initial endowment of natural resources. Considering Figures 4(a) and 4(b), obvious outliers in these respects for the $MidasProd$ measure of natural resources are Botswana and Sierra Leone, for example.[30]



(a) Full Sample

(b) No Extremes

Figure 4: *MidasProd* and *institutions*

To check for influential observations, i.e. observations with either a high leverage or a large residual, we use the DFITS index when estimating equation (3.1). Observations with a DFITS index larger than the absolute value of $2\sqrt{k/n}$ (where k is the number of independent variables, including the constant, and n the number of observations), are excluded from the sample.[31] Thereby, we obtain a specific sample for each measure of natural resource endowment. Columns (5)-(8) in Table 6 report the results and the countries excluded from the sample with each measure of natural resources. The outcome varies to a surprisingly small extent when excluding outliers. The qualitative results are in general the same, but the coefficients for natural resources measured as $MidasProd$

[30] As seen from Figure 4(a), $MidasProd$ may be problematic in two ways. It has some clear outliers and many countries in the sample simply do not have any production of diamonds or precious metals. Besides our exclusion of influential observations using DFITS, we also ran regressions on $MidasProd$ while excluding extreme observations. Excluding countries with zero production has little effect. When also dropping all observations with at least as high a $MidasProd$ as that of the Dominican Republic (leaving us with a sample of 43 countries), the interaction term turns insignificant (p-value 0.14), though the three variables of interest are still jointly significant at the 99 per cent level. These estimates are available from the authors upon request.

[31] $DFITS_i = r_i\sqrt{h_i/(1-h_i)}$, where r_i are the studentised residuals and h_i the leverage.

turn individually insignificant. However, they are still highly jointly significant, so the appropriability effect is in line with the basic results.

5.3 Is Africa (or Latin America) responsible for our results?

While the previous section showed that the hypothesis in this paper provides a good explanation for the developing countries as a group, it might be that the results are entirely driven by particular regions. Africa is known as a continent with abundant resources, in particular precious metals, but also for its wars and low income per capita levels. It is thus a concern that our main results (presented in Table 3) could be driven by the development of the African continent. In Table 7, columns (1)-(4), we re-estimate equation (3.1), but drop Africa from the sample. The results clearly indicate that in the presence of highly appropriable resources (especially $MidasProd$), good institutions are quintessential for economic development also when excluding Africa.

Columns (5)-(8) in Table 7 show the same to be true when excluding Latin America. This is particularly reassuring since recent studies have pointed at the importance of initial factor endowments and other geographical factors for the shaping of institutions in Latin America. For example, Sokoloff and Engerman (2000) argue that the casual relation runs from the initial resource endowment fostering a certain institutional setting, which can or cannot be beneficial for long-run economic development. Sugar, coffee and cocoa economies in Latin America are often used to illustrate the point, but also mineral rich economies such as Chile and Peru. The idea is that the production of these resources is both valuable and easy to control for a small elite. This elite has all the incentives to ensure that the ownership of land remains concentrated in its hands, which is most easily achieved by impeding the spread of education and democratic institutions. Thereby, initial resource endowment is suggested to generate a strong path dependence affecting the pattern of economic development. That is, in the setting of this paper, it could be suspected that natural resources have determined the institutional formation in these countries. Columns (5)-(8) in Table 7 indicate that our main results are not driven by the presence of Latin American countries.

5.4 Importance of civil wars

A potentially important mechanism, already mentioned in the Introduction, through which natural resources could affect economic development is by creating conflicts. Alluvial diamonds are maybe the resource most known for generating conflicts, but also oil (as in Sudan) can apparently fuel conflicts. We test whether conflicts affect the importance of appropriability for economic development by including two different measures. The first measure, $conflict$, is a dummy for the occurrence of any kind of conflict during the period. The country in question can thus be involved in a international or internal war, or be having a conflict with a neighbouring country. *Civil war* instead assumes the value of one if there were a civil war with at least a thousand battle-related deaths in the period. Neither the inclusion of $conflict$ nor of *civil war* has a significant effect on the results, as reported in Table 8; if anything, the appropriability effect of resources becomes slightly more important. Now, this does not show anything but that our main results are not driven by conflicts.

5.5 Robustness to other institutional measures

The last robustness check consists of using alternative measures of institutional quality. Even though institutional measures in general tend to be highly correlated, we test if our basic equation (3.1) holds with a variety of institutional measures. More specifically, we use seven measures ranging from $Polity75$ from the Polity IV data set (Marshall and Jaggers, 2002) to Rule of Law in 1998 ($RLaw98$) from Kaufmann et al. (2002). To reduce the number of tables, we only report the outcomes when using $MidasProd$ as the measure of initial natural resource endowment. In addition, to increase the comparability of the estimates, we have rescaled the institutional indexes so as all of them range between 0 and 1.

Table 9 reports the regression results. The interaction effect of *MidasProd* and *institutions* is always positive, as expected, and significant. This means that our results do not appear to be sensitive to the chosen measure of institutional quality. However, the magnitude of the appropriability effect is approximately five times larger when using *Repud84* instead of *Polity75*, given the same level of natural resources (*Institutions* has a quantitatively intermediate appropriability effect). These results are suggestive of the mechanisms driving the appropriability of a resource. Copper, oil, kimberlitic diamonds and other investment intensive and very valuable resources are extremely sensitive to the investment climate in the host country. Nothing can hurt investments as much as a regime repudiating contracts, since this radically increases the riskiness of heavy investments. The extent of democratic rule, as captured by *Polity*75, on the other hand seems less important for investment decisions as long as the companies are on friendly terms with the regime.

6 Summary and concluding remarks

Kenneth Kaunda, the former President of Zambia, has been quoted to say " *We are in part to blame, but this is the curse of being born with a copper spoon in our mouths*", referring to Zambia's poor economic performance.[32] In another quote referring to the deterministic, negative effects of having abundant resources, Leonardo Simão (Minister of Foreign Affairs of Mozambique) has said, "*Mozambique is different [from Angola]. We are fortunate not to have oil and not to have diamonds*".[33] This paper suggests that such statements need some modification. The problem for Zambia, and many other countries, does not lie in the resource richness per se, but in the combination of having poor institutions and resource wealth. Our results indicate that a sufficient improvement in institutional quality turns

[32]Ross (1999).

[33]Speech delivered at the Swedish Institute of International Affairs, Stockholm, Sweden on June 18, 1999.

resource abundance into an asset rather than a curse.

Furthermore, we have shown the type of natural resources a country possesses to be of crucial importance. The negative effects of poor institutional quality are much more severe in countries rich in potentially problematic types of resources, as compared to those rich in other natural resources. Conversely, the rewards for good institutions are greatest for the countries with more appropriable types of resources. For all our measures of mineral-intensity, the positive interaction term outweighs the negative effect of the resources themselves, and this effect is highly significant. We find the strongest and most significant effects when using the value of production of precious metals and diamonds.

What are the quantitative implications of our findings? Taking the point estimates seriously, our results suggest that if a country, such as Sierra Leone (with an average growth rate of -2.05 per cent since 1975) were to manage to close the gap in institutional quality with a country like Botswana (with a growth rate of 4.99 per cent over the period), then its yearly growth rate would also approach that of Botswana. Thus, Sierra Leone has the potential of performing like Botswana, but it lacks the necessary institutional setting.

This paper challenges the traditional *resource curse* which, taken literally, would simply suggest that a country would be better off without its resources. We find this hard to believe. Identifying a non-montone relationship between institutions and resources, and the particular role of certain types of minerals, we show that it is possible to reverse the curse. The literal policy advice of this paper would thus be to "*Get your institutions right, especially if you have plenty of diamonds and precious metals*". Naturally, this is not very informative in terms of implementation, but it does suggest that countries can do something more to improve their economic situation than giving away their resources – as suggested by the resource curse hypothesis.

References

Daron Acemoglu, Simon Johnson, and James A. Robinson. The Colonial Origins of Comparative Development: An Empirical Investigation. *American Economic Review*, 91(5):1396–1401, 2001.

Daron Acemoglu, Simon Johnson, and James A. Robinson. Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution. *The Quarterly Journal of Economics*, 117(4):1231–1294, November 2002.

Francisco Alcalá and Antonio Ciccone. Trade and productivity. *Quarterly Journal of Economics*, 119(2):613–646, 2004.

Richard M. Auty. *Sustaining Development in Mineral Economies: The Resource Curse Thesis.* Routledge, London and New York, 1993.

Richard M. Auty. Natural resource endowment, the state and development strategy. *Journal of International Development*, 9(4):651–663, 1997.

Robert J. Barro and Jong-Wha Lee. International Data on Educational Attainment, Updates and Implications. Manuscript, Harvard University, August 2000.

Greg Campbell. *Blood Diamonds: Tracing the Deadly Path of the World's Most Precious Stones*. Westview Press, Boulder, 2002.

Paul Collier and Anke Hoeffler. Greed and grievance in civil war. *Centre for the Study of African Economies Working Paper*, (01), 2002a.

Paul Collier and Anke Hoeffler. On the incidence of civil war. *Journal of Conflict Resolution*, 46:13–28, 2002b.

Paul Collier and Anke Hoeffler. On economic causes of civil war. *Oxford Economic Papers*, 50:563–573, 1998.

W. Max Corden and J. Peter Neary. Booming sector and de-industrialisation in a small open economy. *Economic Journal*, 92:825–848, 1982.

William Easterly and Ross Levine. Tropics, germs and crops: How endowments influence economic development. *NBER Working Paper 9106*, 2002.

Stanley L. Engerman and Kenneth L. Sokoloff. Factor endowments, inequality, and the path of development among the new world economies. Work in Progress, 2002.

Alan H. Gelb. *Windfall Gains: Blessing or Curse?* Oxford University Press, New York, 1988.

Thorvaldur Gylfason, Tryggvi T. Herbertson, and Gylfi Zoega. A mixed blessing: Natural resources and economic growth. *Macroeconomic Dynamics*, 3:204–225, 1999.

Robert E. Hall and Charles I. Jones. Why Do Some Countries Produce so Much More Output per Worker than Others? *The Quarterly Journal of Economics*, 114(1):83–116, February 1999.

Jonathan Isham, Michael Woolcook, Lant Pritchett, and Gwen Busby. The varieties of resource experience: How natural resource export structures affect the political economy of economic growth. *Middlebury College Discussion Paper 03-08*, 2003.

Terry Lynn Karl. *The Paradox of Plenty: Oil Booms and Petro-States.* University of California Press, Berkeley, 1997.

Daniel Kaufmann, Aart Kraay, and Pablo Zoido-Lobatón. Governance matters II – updated indicators 2000/01. *World Bank Policy Research Working Paper 2772*, 2002.

Philip Keefer and Stephen Knack. Polarization, Politics, and Property Rights: Links between inequality and growth. *Public Choice*, 111:127–154, 2002.

Stephen Knack and Philip Keefer. Institutions and Economic Performance: Cross-Country Tests Using Alternative Institutional Measures. *Economic and Politics*, 7 (3):207–227, 1995.

Paul Krugman. The narrow moving band, the Dutch disease, and the competitive consequences of Mrs. Thatcher: Notes on trade in the presence of dynamic scale economies. *Journal of Development Economics*, 27(1-2):41–55, October 1987.

Rafael La Porta, Florencio Lopez de Silanes, Andrei Shleifer, and Robert W. Vishny. The quality of government. Manuscript, Harvard University, August, 1998.

Philip R. Lane and Aaron Tornell. The voracity effect. *American Economic Review*, 89 (1):22–46, 1999.

Carlos Leite and Jens Weidmann. Does mother nature corrupt? natural resources, corruption, and economic growth. *International Monetary Fund Working Paper 99/85*, 1999.

Monty G. Marshall and Keith Jaggers. *Polity IV Project. Political Regime Characteristics and Transitions, 1800-2002.* Integrated Network for Social Conflict Research (INSCR) Program. Center for International Development and Conflict Management. University of Maryland, 2002. Available at www.cidcm.umd.edu/inscr/polity.

Kiminori Matsuyama. Agricultural productivity, comparative advantage and economic growth. *Journal of Economic Theory*, 58:317–334, 1992.

Halvor Mehlum, Karl Moene, and Ragnar Torvik. Institutions and the resource curse. Mimeo, 2002.

Minerals Yearbook. U.S. Bureau of Mines (department of the interior). Washington, DC. U. S. Government printing office. (Various years).

J. Peter Neary and Sweder J. G. van Wijnbergen. *Natural Resources and the Macroeconomy.* MIT Press, Cambridge, Mass, 1986.

Oxford History of the British Empire. *The Nineteenth Century.* Oxford University Press, Oxford, 2001. Ed. Roger Luis.

James A. Robinson, Ragnar Torvik, and Thierry Verdier. Political foundations of the resource curse. *CEPR Discussion paper 3422*, 2002.

Dani Rodrik. Where did all the Growth go? External Shocks, Social Conflict, and Growth Collapses. *Journal of Economic Growth*, 4:385–412, 1999.

Dani Rodrik, Arvind Subramanian, and Francesco Trebbi. Institutions rule: The primacy of institutions over geography and integration in economic development. *CEPR Discussion Paper 3643*, 2002.

Michael L. Ross. Does oil hinder democracy? *World Politics*, 53(3):325–361, 2001.

Michael L. Ross. The political economy of the resource curse. *World Politics*, 51(2): 297–322, 1999.

Jeffrey D. Sachs and Andrew M. Warner. The curse of natural resources. *European Economic Review*, 45(4-6):827–838, 2001.

Jeffrey D. Sachs and Andrew M. Warner. Natural resource abundance and economic growth. *NBER Working Paper 5398*, 1995.

Jeffrey D. Sachs and Andrew M. Warner. Sources of slow growth in African economies. *Journal of African Economies*, 6:335–376, 1997.

Kenneth L. Sokoloff and Stanley L. Engerman. History lessons: Institutions, factor endowments, and paths of development in the new world. *Journal of Economic Perspectives*, 14(3):217–232, 2000.

Håvard Strand, Lars Wilhelmsen, and Nils Petter Gleditsch. *Armed Conflict Dataset Codebook, Version 1.1.* International Peace Research Institute, Oslo, 2002.

Ragnar Torvik. Natural resources, rent seeking and welfare. *Journal of Development Economics*, 67:455–470, 2002.

UNCTAD. Handbook of international trade and development statistics. United Nations. (Various years).

U.S. Geological Survey. (Department of the Interior). Metal Prices in the United States through 1998. Washington, DC. U. S. Government printing office, 1999. (available at http://minerals.usgs.gov).

Michael Woolcook, Lant Pritchett, and Jonathan Isham. The social foundations of poor economic growth in resource rich economies. In Richard M. Auty, editor, *Resource Abundance and Economic Development*, New York, 2001. Oxford University Press.

Gavin Wright. Resource-based growth then and now. Stanford University. (Prepared for the World Bank Project "Patterns of Integration in the Global Economy"), 2001.

Tables

Table 6: Results for developing countries, and when excluding outliers.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$PrimExp$	$OrMetExp$	$MinProd$	$MidasProd$	$PrimExp$	$OrMetExp$	$MinProd$	$MidasProd$
$Resources$	-3.613	-35.257***	-18.034***	-87.623***	-8.110**	-20.416**	-22.293***	-89.245
	(7.049)	(7.416)	(6.057)	(28.932)	(3.069)	(7.859)	(3.679)	(74.173)
$Institutions$	9.579***	5.502**	5.932***	6.832***	4.317***	3.656***	3.327***	5.142***
	(3.232)	(2.264)	(2.178)	(2.063)	(1.314)	(1.370)	(1.250)	(1.347)
$ResInst$	-0.430	71.792***	32.108**	153.329***	7.227	36.804**	39.733***	159.326
	(12.691)	(14.261)	(13.160)	(41.081)	(4.969)	(17.732)	(7.610)	(98.810)
$GDP75$	-2.038***	-1.872***	-1.855***	-1.938***	-1.795***	-1.650***	-1.633***	-1.856***
	(0.408)	(0.348)	(0.415)	(0.350)	(0.244)	(0.248)	(0.249)	(0.276)
$Openness$	0.451	0.261	0.231	0.115	0.543**	0.267	0.370*	0.253
	(0.357)	(0.357)	(0.302)	(0.299)	(0.219)	(0.232)	(0.215)	(0.218)
$Investments$	0.058	0.077**	0.093**	0.080**	0.084***	0.080***	0.093***	0.085***
	(0.037)	(0.038)	(0.040)	(0.036)	(0.020)	(0.024)	(0.022)	(0.023)
Observations	58	58	58	58	73	74	74	75
R^2	0.65	0.71	0.68	0.72	0.74	0.71	0.71	0.68
$Joint(p)$	0.129	0.000	0.008	0.000	0.002	0.002	0.000	0.000

Notes: Dependent variable is *growth*. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a constant term and regional dummies for Latin America and Sub Saharan Africa (not shown). $Joint(p)$ denotes whether the coefficient estimates of resources, and the interaction of resources and institutions are jointly significant. Excluded countries in (1) are: Botswana, Dem. Rep. of Congo, Guyana, Haiti, Nicaragua, and South Africa; in (2): Belgium, Botswana, Dem. Rep. of Congo, Hong Kong, Haiti, and Nicaragua; in (3): Botswana, Dem. Rep. of Congo, Haiti, Nicaragua, Sierra Leone, and Venezuela; and in (4): Botswana, Dem. Rep. of Congo, Haiti, Nicaragua, and Sierra Leone.

Table 7: Results when excluding Sub Saharan Africa or Latin America.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	PrimExp	*OrMetExp*	*MinProd*	*MidasProd*	*PrimExp*	*OrMetExp*	*MinProd*	*MidasProd*
Resources	-6.551	-6.906	-14.186**	-403.961**	-6.325	-27.107**	-21.568***	-87.306***
	(5.064)	(6.760)	(6.563)	(177.626)	(4.926)	(10.803)	(4.023)	(29.269)
Institutions	5.366***	5.587***	5.082***	5.540***	7.241***	5.368***	4.833***	5.608***
	(1.550)	(1.501)	(1.481)	(1.361)	(2.313)	(1.879)	(1.399)	(1.351)
ResInst	4.427	12.562	23.048**	629.596*	4.794	49.217**	41.682***	154.989***
	(6.709)	(14.857)	(11.280)	(354.121)	(6.946)	(24.097)	(7.486)	(40.608)
*GDP*75	-2.067***	-2.079***	-2.034***	-2.101***	-2.286***	-2.098***	-1.975***	-2.008***
	(0.317)	(0.324)	(0.341)	(0.324)	(0.437)	(0.364)	(0.283)	(0.258)
Openness	0.515*	0.236	0.303	0.301	0.598**	0.419	0.473*	0.366
	(0.259)	(0.311)	(0.266)	(0.254)	(0.285)	(0.332)	(0.269)	(0.273)
Investments	0.084***	0.090***	0.093***	0.093***	0.092***	0.095***	0.107***	0.090***
	(0.025)	(0.027)	(0.026)	(0.025)	(0.026)	(0.028)	(0.026)	(0.024)
Observations	64	64	64	64	58	58	58	58
R^2	0.60	0.58	0.59	0.60	0.71	0.74	0.78	0.81
Joint(p)	0.102	0.587	0.106	0.068	0.160	0.001	0.000	0.000

Notes: Dependent variable is *growth*. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a constant term and regional dummies for Latin America and Sub Saharan Africa (not shown). *Joint*(p) denotes whether the coefficient estimates of resources, and the interaction of resources and institutions, are jointly significant.

Table 8: Results when including measures of conflicts.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	PrimExp	*OrMetExp*	*MinProd*	*MidasProd*	*PrimExp*	*OrMetExp*	*MinProd*	*MidasProd*
Resources	-6.919	-26.720***	-21.856***	-95.803***	-6.316	-27.982***	-19.363***	-89.229***
	(4.624)	(8.416)	(5.072)	(28.239)	(4.108)	(8.707)	(4.808)	(30.521)
Institutions	6.390***	4.388**	3.736**	5.520***	5.847***	3.374**	4.115***	4.952***
	(2.191)	(1.806)	(1.518)	(1.489)	(2.045)	(1.589)	(1.406)	(1.428)
ResInst	5.001	51.067***	39.765***	167.403***	4.201	52.958***	35.102***	158.615***
	(6.807)	(18.011)	(9.641)	(38.984)	(6.141)	(19.045)	(9.143)	(41.933)
GDP75	-2.167***	-1.975***	-1.837***	-2.013***	-2.124***	-1.903***	-1.909***	-1.968***
	(0.389)	(0.344)	(0.311)	(0.304)	(0.360)	(0.289)	(0.290)	(0.270)
Openness	0.483*	0.203	0.222	0.138	0.426	0.150	0.228	0.092
	(0.267)	(0.293)	(0.242)	(0.246)	(0.291)	(0.308)	(0.272)	(0.265)
Investments	0.085***	0.088***	0.098***	0.088***	0.086***	0.090***	0.102***	0.088***
	(0.026)	(0.029)	(0.026)	(0.026)	(0.025)	(0.027)	(0.026)	(0.026)
Conflict	-0.166	-0.267	-0.434	-0.028				
	(0.402)	(0.385)	(0.395)	(0.359)				
Civil War					-0.569	-0.826	-0.380	-0.443
					(0.501)	(0.506)	(0.511)	(0.531)
Observations	80	80	80	80	80	80	80	80
R^2	0.63	0.65	0.67	0.70	0.64	0.67	0.67	0.71
Joint(*p*)	0.053	0.005	0.000	0.000	0.056	0.002	0.001	0.000

Notes: Dependent variable is *growth*. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a constant term and regional dummies for Latin America and Sub Saharan Africa (not shown). *Joint*(*p*) denotes whether the coefficient estimates of resources, and the interaction of resources and institutions, are jointly significant.

Table 9: Results when using alternative institutional measures

	(1) $Polity75$	(2) $PropRight84$	(3) $RLaw84$	(4) $Exprop84$	(5) $Repud84$	(6) $KKZ98$
$MidasProd$	-53.676*	-102.199***	-69.226	-154.248***	-154.841***	-58.965***
	(27.213)	(32.204)	(48.935)	(32.485)	(57.234)	(17.719)
$AltInst$	0.512	4.274***	2.121*	3.648***	4.279***	3.550***
	(0.564)	(1.191)	(1.082)	(1.021)	(1.096)	(1.076)
$ResInst$	81.498***	184.947***	108.694*	253.365***	292.938***	128.846***
	(29.339)	(48.624)	(58.775)	(45.963)	(95.151)	(27.085)
$GDP75$	-1.140***	-1.960***	-1.426***	-1.543***	-1.800***	-1.497***
	(0.238)	(0.304)	(0.356)	(0.222)	(0.252)	(0.264)
$Openness$	0.019	0.142	0.192	0.129	0.049	-0.016
	(0.231)	(0.248)	(0.229)	(0.240)	(0.268)	(0.234)
$Investments$	0.118***	0.092***	0.095***	0.086***	0.111***	0.098***
	(0.027)	(0.025)	(0.025)	(0.024)	(0.023)	(0.023)
Observations	78	76	76	76	76	80
R^2	0.63	0.69	0.62	0.69	0.68	0.69
$Joint(p)$	0.000	0.000	0.000	0.000	0.000	0.000

Notes: Dependent variable is *growth*. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a constant term and regional dummies for Latin America and Sub Saharan Africa (not shown). $Joint(p)$ denotes whether the coefficient estimates of resources, and the interaction of resources and institutions are jointly significant.

Appendix A. Sources and summary statistics

Table A1: Countries in the sample

Algeria	Jamaica
Argentina	Japan
Australia	Jordan
Austria	Kenya
Bangladesh	Korea, Republic of
Belgium	Malawi
Bolivia	Malaysia
Botswana	Mali
Brazil	Mexico
Cameroon	Netherlands
Canada	New Zealand
Chile	Nicaragua
Colombia	Niger
Congo, Democratic Republic*	Norway
Congo, Republic of	Pakistan
Costa Rica	Panama
Cyprus*	Paraguay
Denmark	Peru
Dominican Republic	Philippines
Ecuador	Portugal
Egypt	Senegal
El Salvador	Sierra Leone*
Finland	Singapore*
France	South Africa
Gambia, The	Spain
Germany	Sri Lanka
Ghana	Sweden
Greece	Switzerland
Guatemala	Syria
Guyana	Thailand
Haiti	Togo
Honduras	Trinidad and Tobago
Hong Kong	Tunisia
Iceland	Turkey
India	USA
Indonesia	Uganda
Iran	United Kingdom
Ireland	Uruguay
Israel	Venezuela
Italy	Zambia

* These countries are, due to data availability, measured until 1996.

Table A2: Definitions and sources of variables

PrimExp	Share of exports of primary products in GNP in 1971. Source: Sachs and Warner (1995), where it is labelled SXP.
OrMetExp	Value of export of ores and metals as a share of GDP in 1975. Source: UNCTAD (1975, 1979)
MinProd	Share of mineral production (does not include fuels) in GNP in 1971, where "mineral production" is the production value of the 23 highest valued minerals in the world as of 1973. Source: Sachs and Warner (1995) where it is labelled SNR.
MidasProd	Value of the production of gold, silver, platinum group metals and diamonds as a share of GDP, average 1972 to 1980. Source: Own calculations from Minerals Yearbook (various years), and U.S. Geological Survey (1999).
Institutions	Derived from the IRIS data originally constructed by Knack and Keefer (1995) based on data from the International Country Risk Guide. The five Property Right Index components are Quality of the bureaucracy, Corruption in government, and Rule of law, scoring from 0-6, and Risk of expropriation of private investment, and Repudiation of contracts by government, scored 0-10. Higher scores mean better quality, lower corruption and lower risks. By transforming the first three into ten point scales (as do Keefer and Knack, 2002), the (unweighted) sum gives an index from 0 to 50 which we rescale into an index between zero and one. Source: Keefer and Knack (2002)).
Growth	Average yearly growth rate (in per cent) between 1975 and 1998. Calculated as ln(rgdpch98)-ln(rgdpch75)* 100/20, where rgdpch is the PPP-adjusted GDP per capita between 1975 and 1998. Source: Penn World Table, Mark 6.1.
GDP75	Real GDP per capita in constant dollars (Chain index) expressed in international prices ln(rgdpch75). Source: Penn World Table, Mark 6.1
Schooling	Average schooling years in the total population 1975. Source: Barro and Lee (2000).
Openness	Natural logarithm of average openness (openc) 1975 to 1998. Source: Penn World Table, Mark 6.1.
Investments	Average investment share of real GDP per capita (ki) 1975 to 1998. Source: Penn World Table, Mark 6.1.
Latitude	The absolute value of the latitude of the country, scaled to take values between 0 and 1. Source: La Porta et al. (1998).
Conflict	Dummy for occurrence of conflict during period. It refers to any type of conflict with at least 25 battle-related deaths per year during the conflict. Source: Strand et al. (2002).
Civil war	Dummy for any civil war started during the period leading to at least 1000 battle-related deaths. Source: Collier and Hoeffler (2002b).

Table A3: Summary statistics, entire sample

Variable	Mean	S.D.	Min	Max
Growth	1.533	1.965	-5.391	5.968
PrimExp	0.121	0.101	0.006	0.543
OrMetExp	0.041	0.068	0	0.357
MinProd	0.058	0.097	0	0.509
MidasProd	0.006	0.025	0	0.198
Institutions	0.638	0.215	0.232	0.995
GDP75	8.332	0.98	6.389	9.923
Openness	4.045	0.55	2.79	5.899
Investments	16.875	7.701	2.38	44.231
N		80		

Table A4: Summary statistics, developing countries

Variable	Mean	S.D.	Min	Max
Growth	1.341	2.241	-5.391	5.968
PrimExp	0.137	0.107	0.01	0.543
OrMetExp	0.046	0.078	0	0.357
MinProd	0.074	0.109	0	0.509
MidasProd	0.008	0.029	0	0.198
Institutions	0.53	0.135	0.232	0.872
GDP75	7.881	0.749	6.389	9.306
Openness	4.054	0.584	2.79	5.899
Investments	14.478	7.538	2.38	44.231
N		58		

Table A5: Summary statistics, other institutional measures

Variable	Mean	S.D.	Min.	Max.	N
polity75	0.532	0.399	0	1	78
propright84	0.574	0.25	0.189	0.992	76
rule84	0.539	0.298	0.167	1	76
expropriati84	0.614	0.215	0.18	0.98	76
repudate84	0.601	0.209	0.16	0.98	76
rlaw98	0.574	0.244	0	1	80

Appendix B

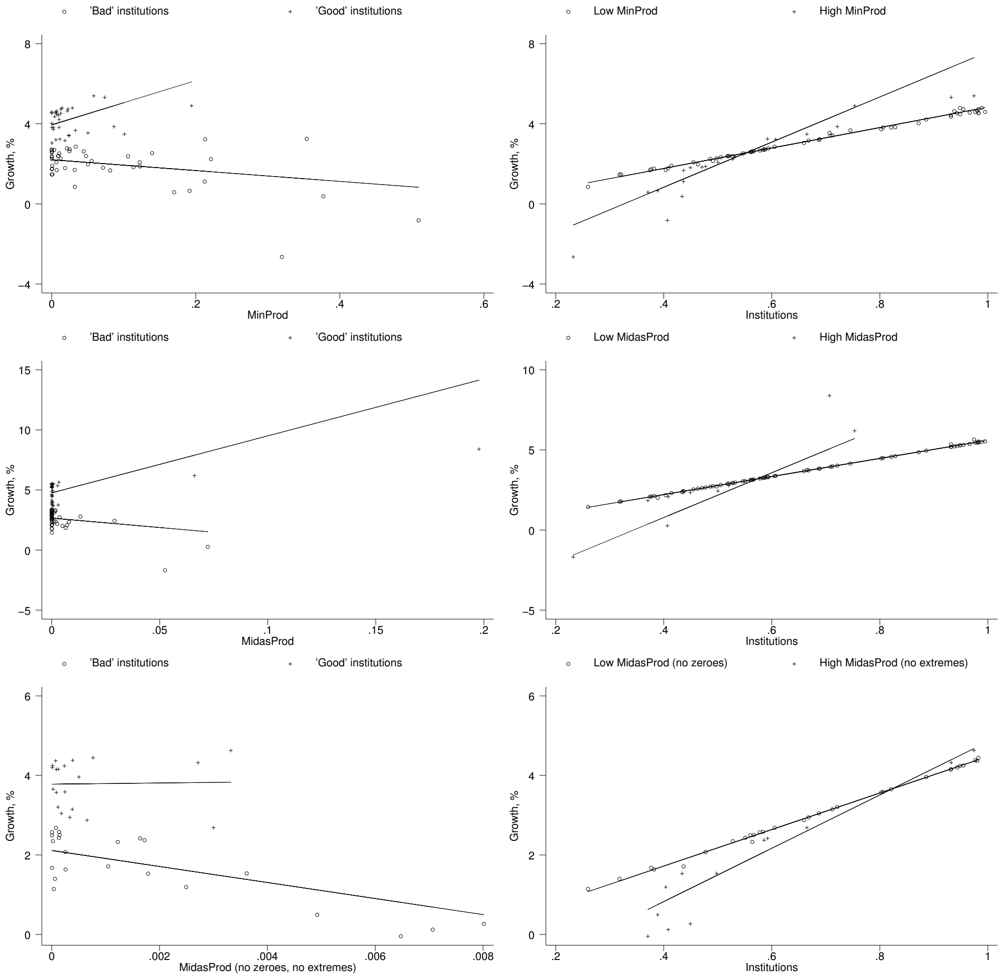


Figure B1: Partial effects of natural resources and institutions on growth, respectively.

These figures are constructed using coefficient estimates from Table 3, columns (3)-(4), and the (not reported) estimates from the regression with $MidasProd$ without extreme observations. (To economise on space we have not reported the corresponding figures using $OrMetProd$, but they look very similar to $MinProd$.) The left-hand panel of Figure B1 presents the partial effect of natural resources on growth given the quality of institutions. The right-hand part gives the flip side - the effect of institutions on growth given the production of natural resources. These are constructed analogously as described in footnote 26.

The interpretation of all figures to the left is that, regardless of the type of natural resource, more of the resources are beneficial (detrimental) for growth given that the country has sufficiently good (poor) quality of its institutions. The right-hand part illustrates that improvements in institutional quality are always worthwhile. However, countries with more resources need better institutions to have the same growth effect as countries with fewer resources.

Above the institutional threshold level, the partial contribution to growth of resources is higher for a country with plenty of resources than for a country with few resources. Below the institutional cutoff, the effect is reversed. Furthermore, considering our technically appropriability hypothesis, the institutional threshold level increases in the technical appropriability of the resource. More specifically, for $OrMetProd$ the institutional cutoff is 0.51, for $MinProd$ 0.55, for $MidasProd$ 0.57, and for $MidasProd$ excluding extremes, it is 0.82.

Table B1: First-stage regressions when instrumenting *institutions* with *latitude* and *fraction speaking any European language*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$PrimExp$	$PrimExpX$	$OrMetExp$	$OrMetExpX$	$MinProd$	$MinProdX$	$MidasProd$	$MidasProdX$
latitude	0.198**	-0.066***	0.152*	-0.014**	0.195**	-0.031***	0.210***	-0.000
	(0.093)	(0.023)	(0.086)	(0.007)	(0.076)	(0.011)	(0.074)	(0.001)
ResLat	0.297	0.789***	2.433***	0.979***	-0.574	0.803***	8.970**	1.747***
	(0.434)	(0.181)	(0.864)	(0.141)	(0.960)	(0.256)	(4.072)	(0.152)
$EurFrac$	0.094***	0.004	0.095***	0.002	0.084***	0.004	0.091***	0.000
	(0.026)	(0.006)	(0.026)	(0.002)	(0.024)	(0.003)	(0.026)	(0.000)
Observations	80	80	80	80	80	80	80	80
Significance of instruments:								
$F(3,70)$	6.38	8.22	8.18	16.68	4.99	7.94	8.14	76.39
$p-value$	0.001	0.000	0.000	0.000	0.003	0.000	0.000	0.000

Notes: The dependent variable is *institutions* in odd-numbered columns, and the interaction of *institutions* and natural resources in even-numbered columns. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Significance of instruments reports the F-test for joint significance of excluded instruments. See Section 4 for details.

Table B2: First-stage regressions when instrumenting *institutions* with *settler mortality*, *latitude* and *fraction speaking any European language*

	(1) $PrimExp$	(2) $PrimExpX$	(3) $OrMetExp$	(4) $OrMetExpX$	(5) $MinProd$	(6) $MinProdX$	(7) $MidasProd$	(8) $MidasProdX$
latitude	0.044	-0.061	-0.035	-0.010	-0.059	-0.036	0.007	-0.002***
	(0.153)	(0.056)	(0.088)	(0.009)	(0.130)	(0.023)	(0.088)	(0.001)
$ResLat$	0.387	0.675	4.227***	0.916***	1.515	0.661	33.650***	1.828***
	(1.111)	(0.500)	(1.006)	(0.152)	(1.542)	(0.446)	(6.491)	(0.109)
$EurFrac$	0.121**	0.001	0.133**	0.003	0.125**	0.007	0.114**	-0.000
	(0.056)	(0.016)	(0.049)	(0.005)	(0.053)	(0.008)	(0.053)	(0.000)
$lsettler$	-0.061***	0.001	-0.037*	-0.001	-0.028	0.003	-0.038*	0.000
	(0.020)	(0.007)	(0.021)	(0.001)	(0.021)	(0.003)	(0.022)	(0.000)
$ResSet$	0.191**	-0.009	0.170*	0.007	0.093	-0.051*	2.406***	0.025**
	(0.072)	(0.037)	(0.096)	(0.009)	(0.099)	(0.026)	(0.598)	(0.012)
Observations	50	50	50	50	50	50	50	50
Significance of instruments:								
F	2.62	0.64	5.43	10.62	1.36	4.33	6.44	1822.92
$p-value$	0.039	0.668	0.001	0.000	0.260	0.003	0.000	0.000

Notes: The dependent variable is *institutions* in odd-numbered columns, and the interaction of *institutions* and natural resources in even-numbered columns. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. Significance of instruments reports the F-test for joint significance of excluded instruments. See Section 4 for details.

Table B3: Results when instrumenting for institutions using settler mortality.

	(1) *PrimExp*	(2) *OrMetExp*	(3) *MinProd*	(4) *MidasProd*
Res	15.654	-36.407*	-12.907	-81.665**
	(19.030)	(20.136)	(8.367)	(30.608)
Institutions	5.582	0.408	4.067	10.422**
	(6.461)	(6.577)	(6.938)	(4.846)
ResInst	-34.878	74.139*	21.420	151.961***
	(32.018)	(39.997)	(17.521)	(44.199)
*GDP*75	-1.155	-1.260	-1.732	-2.758***
	(1.323)	(1.026)	(1.312)	(0.882)
Openness	0.293	0.233	0.162	0.112
	(0.365)	(0.416)	(0.346)	(0.392)
Investments	0.083	0.092**	0.094**	0.071
	(0.063)	(0.039)	(0.043)	(0.047)
Observations	50	50	50	50
R^2	0.48	0.60	0.65	0.62
Joint(*p*)	0.150	0.185	0.263	0.002
Ovid	0.318	0.239	0.200	0.086

First-stage results in Appendix Table B2

Notes: Dependent variable is *growth*. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a constant term and regional dummies for Latin America and Sub Saharan Africa (not shown). *Joint*(*p*) denotes whether the coefficient estimates of resources, and the interaction of resources and institutions are jointly significant. *Ovid* reports the p-values from the Hansen J-overidentification test for instruments. *Hausman* reports p-values of the regression-based Hausman test for endogeneity as explained in the text. The null hypothesis is that *institutions* are exogenous.

Table B4: Dropping and adding control variables.

	(1)	(2)	(3)	(4)	(5)
$MidasProd$	-95.656***	-99.194***	-96.459***	-99.798***	-133.200***
	(27.804)	(30.421)	(23.472)	(22.356)	(28.746)
$Institutions$	5.564***	4.777***	6.864***	7.183***	-0.728
	(1.357)	(1.559)	(1.249)	(1.312)	(0.889)
$ResInst$	167.251***	173.805***	169.683***	174.995***	221.847***
	(38.508)	(42.496)	(32.300)	(30.703)	(41.842)
$GDP75$	-2.019***	-2.159***	-1.957***	-2.001***	
	(0.288)	(0.319)	(0.296)	(0.316)	
$Openness$	0.142	0.141	0.389		
	(0.245)	(0.240)	(0.283)		
$Investments$	0.089***	0.091***			
	(0.026)	(0.027)			
$Schooling$		0.122			
		(0.106)			
Observations	80	80	80	80	80
R^2	0.70	0.71	0.66	0.65	0.49
$Joint(p)$	0.000	0.000	0.000	0.000	0.000

Notes: We add and drop control variables as specified in Section 3. Column (1) redisplays the regression reported in column 4 of Table 3. Dependent variable is *growth*. Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions include a constant term and regional dummies for Latin America and Sub Saharan Africa (not shown). $Joint(p)$ denotes whether the coefficient estimates of resources, and the interaction of resources and institutions are jointly significant.