

## Volume 34, Issue 3

### The resource curse, rule of law and accountability in African countries: a dynamic panel analysis

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#### Abstract

We investigate the resource curse phenomenon using the African Governance Index that ranks African countries according to their governance quality. First, we allow countries to endogenously select in good- and bad-governance groups. Secondly, using an Arellano-Bond dynamic panel-data estimation, we analyze the effect on bad-governance countries of the endowment taking into account (i) that institutional quality today depends on institutional quality in recent years and (ii) that the resource endowment today will produce a lagged effect on institutional quality. Our findings confirm the existence of the resource curse problem.

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We thank, without implications, an anonymous referee for useful suggestions.

**Citation:** Riccardo Marchi Adani and Roberto Ricciuti, (2014) "The resource curse, rule of law and accountability in African countries: a dynamic panel analysis", *Economics Bulletin*, Vol. 34 No. 3 pp. 1905-1916.

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**Submitted:** October 21, 2013. **Published:** August 25, 2014.

## 1. Introduction

Natural resources, such as minerals, oil and gas, constitute for a state a source rent; a government can sell the right to extract the natural resource to a private firm in exchange of royalties or participation in the firm's profits or can decide to set up a state-owned extractive firm and directly enjoy the dividends.

However, there is strong evidence that often a large endowment of natural resources tends to reduce economic growth and is associated with non-democratic regimes (for a survey see van der Ploeg, 2011). This phenomenon is often defined as “resources curse” because the endowment of natural resources tends to constitute a curse rather than a blessing. The key link to explain this phenomenon is the public sector: rents from natural resources are transformed into public expenditure. The reason why the public sector tends to growth is that politicians have an incentive in creating government jobs in order to be re-elected if the country is a democracy, or simply to remain in power if the country is a dictatorship. In that way, an offer of employment in the public sector is done in exchange of a vote, or simply in acceptance of the status quo in a non-democratic regime, using public money available from natural resources’ rent, is the mechanism used by a politician to remain in power. Robinson, Torvik and Verdier (2006) developed a formal model to explain the wrong political incentives that an abundance of natural resources generates in the state's ruling political class. This yields to an over-expansion of an inefficient public sector, whose existence is not justified by economic reasons, and rents are not used to boost the economy, but simply allocated in the non-productive sector. Moreover, an over expanding public sector tends to crowd out private investments, thus reducing the potential for economic growth of a country.

Although the resource curse is quite widespread, a natural question to rise is why it did not happen in countries like Norway: the answer lays in the institutions. Where institutions are developed enough, with check and balance between executive, legislative and judicial powers and where national accountability and laws constraints politicians from creating parasitical public sectors, here countries will benefit from a great endowment of natural resources. Where, instead, institutions are not developed, a resource boom may become a curse for the country. An important conclusion from the Norwegian experience is that, when analyzing the effect of resources to institutions, we should take into account past institutions since their low quality is a prerequisite to a resource curse problem.

The aim of this paper is to analyze the effect of resource endowment to institutional quality. Since the presence of a resource curse problem depends itself on previous institutional quality, we must use a dynamic panel data model. Furthermore, we allow for an endogenous selection of the countries between those with good and bad governance.

Section 2 sketches the theory behind our model. Section 3 presents our data on institutions quality, the Ibrahim index of African Governance, and on resources endowment, where we construct a synthetic indicator of the value of oil, natural gas, coal, uranium, diamonds, gold, silver, platinum and other 15 minerals extracted in African countries in the 2002-2011 decade. and section 4 provides empirical estimates using the Arellano-Bond estimator. Section 5 concludes.

## 2. Dynamics of the resource curse

This section will sketch a theoretical framework to describe the dynamics of the resource curse problem. First, the resource endowment has a non-monotonic negative effect on development (both economic and institutional); as Robinson, Torvik and Verdier (2006) state:

*“this is inconsistent with the cross country evidence. For every Venezuela and Nigeria, there is a Norway or a Botswana. A satisfactory model should explain why resources seem to induce prosperity in some countries but not others”.*

Countries with good institutions will be able to use resource rents to increase their economic performance and possibly increase the quality of their institutions, due to the higher revenue available. This because well-developed institutions have enough checks and balances to prevent a politician to take a predatory behavior or to promote unproductive activities and patronage using government expenditure. In contrast, in countries without such mechanisms there is nothing that prevent a self-interested politician to expand the public sector and “*bribe voters by offering them well paid but unproductive jobs and inefficient subsidies and tax handouts*” (van der Ploeg 2011). Since resource rents increase for the politician the value of being in office, rent-seeking will increase and thus institutional quality decreases. In that sense we can talk of a quality trap when resources are discovered: below a certain threshold quality of institutions will decrease whereas above institutions will not be affected or even improve.

A consequence of this framework is that a cross-section analysis is useless to analyze the problem because we need to focus on the dynamic evolution of the quality of institutions over time, given a natural resource endowment, to assess whether there is a resource curse problem. Moreover, another important question is to determine a set of prerequisites sufficient for a country to escape the institutional trap when resources are discovered. It is also very likely that the resource endowment today will produce a lagged effect into institutional quality because the process we are describing takes time. It is unrealistic to assume that the day after an oilfield is discovered, politicians are able to reshape institutions to exploit rents. But this also implies that institutions have a drift component, since quality today depends also from institutional quality in recent years.

### 3. Data

We consider a longitudinal panel data set with 50 countries, all the African countries except Sudan, South Sudan, Somalia (where a government *de facto* did not exist for some years) Comoros and Swaziland, from 2002 to 2011. Data comes mainly from three sources: the Ibrahim Index of African Governance for institutional quality, the US Geological Survey for data on minerals and the US Energy Administration for data on oil, natural gas and coals. Other minor sources are the World Nuclear Association for data on Uranium, Kitco for the price of platinum and palladium and International Diamond Consultant<sup>1</sup> for the price of gem quality diamonds.

#### 3.1 The Ibrahim Index of African Governance

The Ibrahim Index of African Governance measures the quality of institutions in 53 African countries.<sup>2</sup> Institutions, and thus the way they are measured, are defined in a broader way than it is commonly used in the political economics literature; the index uses 88 indicators, grouped into 14 subcategories and 4 overarching categories to measure the effective delivery of public goods and services to African citizens. The four main categories are (i) Safety and Rule of Law, (ii) Participation and Human Rights, (iii) Sustainable Economic Opportunity and (iv) Human Development. Our dependent variable will be the first, the one that properly

<sup>1</sup> Retrieved from [www.stansleyresearch.com](http://www.stansleyresearch.com).

<sup>2</sup> Dataset and methodology are available at <http://www.moibrahimfoundation.org/iiag/>. See also Rotberg and Gisselquist (2009).

defined the quality of institutions, and is constructed measuring the rule of law, accountability, personal safety and national security.

Other two categories, namely participation and human rights and sustainable economic opportunities, may explain institutional quality. As for the first one, economic development, even a sustainable one that takes into account also the development of infrastructure, the rural sector and the business environment, is positively affected by a good institutional quality. For the second one we have a problem of collinearity: the more political rights are developed, the better people can control the government and, hence, enforce a higher institutional quality. However, it is also true that a good government has an incentive to increase political rights, since he wants people to understand his “good quality”.

### 3.2 The resource endowment

Natural resources can be divided into two broad groups: minerals and fossil fuels. We use the word minerals in a broader way than a geologist do, in order to include other significant source of rent like phosphate rocks that are not exactly minerals. Africa is rich in both of them, and their variability in distribution is very high: we have countries with both resources, countries with just minerals or with just oil and gas and also some without a large endowment of natural resources. The minerals we considered are aluminum, bauxite, beryl, chromites, cobalt, copper, diamonds (both at gem and industrial quality), gold, iron, lithium, manganese, mercury, nickel, platinum, palladium, phosphate rocks, silver, uranium and zinc. Fossil fuels are oil, natural gas and coal. For each country we observed its production yearly and we have data on the international price in a given year for each commodity.

There are two different ways to look at the natural resources rent of a country. The first one is to estimate the exact rent a country receives due to her endowment of natural resources. This rent will be a fraction of the value of the total production of that country. Data are provided by the World Bank for selected resources like oil and for total rents. These figures are generally expressed in terms of GDP percentage and may also reflect the different bargaining power a country has with the foreign extractive firms. Another way is to calculate the value of the natural resources' total production of a country; the rent that this country receives then will be a fraction of that figure. In analyzing the natural resource curse, we think it is more appropriate to follow the latter since it allows us to avoid any problem related with the bargaining power a country has with the foreign extractive firm or all the costs related to the set-up of a national extractive firm. Finally, it allows us to avoid any corruption problem.

Assuming that natural resources, as most commodities for most agents, have a decreasing return to scale, we simply take the logs of the total value of natural resources produced by a country. For country  $i$  at time  $t$ , we have that:

$$\Phi_{it} = \ln(\sum_{n=1}^{24} p_{nt} R_{nt}) \quad (1)$$

our indicator is constructed taking the log of the sum of the total value of the 24 natural resources we observed. The total value is given by price  $p_{nt}$  times quantity  $R_{nt}$  for each  $n$  resource extracted in a country in a given year.

## 4. Empirical estimates

We estimate the following model:

$$Q_{it} = \beta_0 + \beta_1 Q_{i,t-1} + \beta_2 \Phi_{i,t-1} + \beta_3 \mathbf{X}_{it} + \varepsilon_{it} \quad (2)$$

where for any country  $i$  at period  $t$  we have that the quality of institutions,  $Q_{it}$ , depends on past institutions quality, past endowment  $\Phi_{it-1}$ , and a vector of country specific characteristics  $X_{it}$ .  $\varepsilon_{it}$  is the error term.

We use a linear dynamic panel data model to include the first lag of the dependent variable. Arellano and Bond (1991) derived an estimator for a model where, by construction, the unobserved panel-level effects are correlated with the lagged dependent variables, thus making standard estimators inconsistent. Moreover, it allows to consider some independent variables as endogenous with respect to the error term (in this case we use for them a GMM type instrument for the differenced equation to correct the endogeneity and to remove the fixed effect component), thus allowing for collinearity between them and the dependent variable and to add lags of them in the specification of the model.

We begin by considering the full sample of African countries, using the category “Safety and Rule of Law” to measure institutions quality, the synthetic indicator  $\Phi_{it-1}$  described before for resource endowment, GDP growth, population and rural population as exogenous country-specific characteristics and the score obtained by the country in the other three categories as endogenous country-specific characteristics. These latest three are: (i) Sustainable Human Development, (ii) Participation and Human Rights that is an important factor to constraints a government from misusing resources rent and, finally, Human Development. To check for robustness, we also run a regression with these three scores replaced by some of the raw indicators that made up them: social exclusion, equity of public resource use, education provision and quality, human and political rights, quality of public administration and of budget management, road and rail network and it infrastructure. Results are in table 1: lagged resource endowment is not always significant. Slightly better results are obtained if we consider a smaller subset of more “problematic” resources: oil, gold and diamonds. As we could expect we have an important drift component in the quality of institutions and, finally, the score obtained in human rights and participation is significant. In columns 5 and 6, for the subset indicator of rule of law that consider only judicial independence and the protection of property rights, lagged values of natural resources and “problematic” resources are significant, together with Political rights, Public administration, Human rights and GDP growth.

[Table 1 about here]

In the next set of regression we exclude those countries that have a significantly high level of accountability, a powerful independent judicial system and low level of corruption. To identify them we apply a switching regression estimates for a two-component model in which observations are drawn from two different regression regimes, separation into the separate regimes is unobserved (also called a mixture model, see Hartley, 1978).<sup>3</sup>

The identified good countries are Benin, Botswana, Ghana, Lesotho, Mauritius, Namibia, Senegal, South Africa and Tanzania. All of these indicators are within the Safety and Rule of Law category score that we used as a dependent variable in the previous model. A high degree of accountability implies that voters can control for how resource rents are allocated. A powerful and independent judicial system is an effective check and balance against misconducts by the government. An independent judicial system is central to assure that a good quality institutional framework in not just *de jure*, but also *de facto*. Finally, the absence of corruption in public sector is a clear indicator of good-quality institutions. Tables 2 and 3 report the results for the selection of the two regimes. Not surprisingly, table 2 shows that bad

<sup>3</sup> We have implemented the switching regression procedure embedded in Stata (Switchr).

governance is negatively and significantly correlated with Accountability of public officials, Bureaucracy and corruption, Accountability, transparency, corruption and Judicial independence. Table 3 shows that a bad governance regime is negatively correlated with the lagged value of natural resources and rural population, whereas it is positively related with the rule of law, the level of human development and GDP growth. In turn, a good governance regime is positively related with the rule of law, human development, human rights and GDP growth.

Table 4 shows the results of model (2) for the sub-sample of bad-governance countries. Compared with those in table 1 they are more coherent with the “resource curse” story, confirming our claim that the source of the negative effects of natural resources lies in bad governance. The coefficient of natural resources value, lagged one period, is always significant, and this is also true for problematic resources. A positive and sizable drift component in institutional quality is found. Other significant variables that exert a positive effect on governance quality are Sustainable economic opportunity, Human rights, Political rights and Public administration. When we run other regressions on the sub-category “rule of law” (columns 5 and 6), our results are weaker for Human rights and Public administration.

[Table 4 here]

## 5. Conclusions

The paper analyzed the resource curse problem using a dynamic framework and considering that (i) institutional quality today depends from past institutional quality and (ii) the resource endowment today will produce a lagged effect into institutional quality because politicians need time to reshape institutions in order to exploit rents from a resource endowment. We confirm the existence of the resource curse problem for the large sample of bad-governance countries. We show that the misallocation of natural resources’ rents results in a decreasing quality of institutions, but this effect exhibit a one year lag and holds only if a country has not *ex ante* well developed institutions. The Ibrahim Index of African Governance allows us to provide a much broader and consistent quantitative value to institution quality, since the index is made up of many different and complementary indicator that range from accountability to judicial independence and lack of corruption.

Our main policy prescription, as Collier and Goderis (2007) suggested in a long run analysis of the resource curse problem, is transparency and compulsory rules. A state must clearly declare to the public revenues from natural resources, and the right to extract that resources should be allocated with an open auction procedure. Moreover, if institutions are not well developed, the introduction of compulsory guidelines to set how money from natural resources rents could be spent will prevent rents’ misallocation by the government, provided that rules are enforceable. For example, by prescribing that part of that money must be spent in the region where those resources are extracted may increase the stability of the state and reduce the probability of a secession (often followed by a civil war) of that region.

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Table 1 – Arellano-Bond estimates

DEP. VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)
	Safety rule of law	Safety rule of law	Safety rule of law	Safety rule of law	Subcat rule of law	Subcat rule of law
L1. Safety rule of law	0.539*** (0.082)	0.479*** (0.096)	0.569*** (0.104)	0.544*** (0.110)		
L1. Subcat rule of law					0.490*** (0.140)	0.485*** (0.133)
L1. Total resources value	-0.085 (0.066)		-0.133** (0.055)		-0.114 (0.087)	
L1. Problematic resources value		-0.194** (0.077)		-0.156*** (0.051)		-0.291** (0.142)
Sustainable economic opportunity	-0.010 (0.077)	0.022 (0.075)				
Human development	-0.064 (0.107)	-0.085 (0.105)				
Participation human rights	0.318*** (0.071)	0.329*** (0.077)				
Population	-1.38e-07 (1.34e-07)	-2.08e-07 (1.39e-07)	-9.48e-08 (1.15e-07)	-1.46e-07 (1.02e-07)	2.84e-08 (1.80e-07)	-6.55e-08 (1.83e-07)
Gdp growth	0.095*** (0.016)	0.096*** (0.019)	0.090*** (0.025)	0.091*** (0.025)	-0.065 (0.052)	-0.072 (0.052)
Rural population	5.91e-07* (3.21e-07)	7.32e-07** (3.73e-07)	7.66e-08 (2.92e-07)	2.37e-07 (2.85e-07)	-5.03e-07 (4.84e-07)	-5.13e-07 (4.98e-07)
Social exclusion			0.0036 (0.026)	0.018 (0.027)	-0.102* (0.061)	-0.073 (0.058)
Equity of public resource use			0.0002 (0.026)	-0.004 (0.025)	0.0002 (0.0515)	-0.020 (0.048)
Education provision and quality			0.049** (0.025)	0.032 (0.023)	0.0855 (0.0557)	0.064 (0.056)
Human rights			0.052** (0.025)	0.048** (0.024)	0.061 (0.046)	0.077* (0.044)
Political rights			0.059 (0.042)	0.053 (0.041)	0.186** (0.091)	0.163** (0.082)
Public administration			0.065*** (0.022)	0.058** (0.023)	0.090** (0.043)	0.109** (0.049)
Constant	13.420** (6.080)	15.681** (7.049)	17.087*** (6.488)	18.876*** (6.963)	23.753** (10.566)	22.308** (9.859)
Observations	388	388	326	326	326	326

Robust standard errors in parentheses. \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1.



Table 2- Model for the classification regression (dependent variable: Prob(bad-governance))

Accountability of public officials	-0.009*** (0.001)
Bureaucracy and corruption	-0.006*** (0.001)
Accountability, transparency, corruption	-0.034*** (0.001)
Judicial independence	-0.016*** (0.001)
Constant	2.367*** (0.063)
Observations	367

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 3 - Model for the linear regression

	Regime 1 (bad-governance countries)	Regime 2 (good-governance countries)
L1. Safety rule of law	0.623*** (0.049)	0.948*** (0.016)
L1. Total resource value	-0.047** (0.023)	-0.003 (0.005)
Sustainable economic opportunity	0.071 (0.051)	-0.023 (0.019)
Human Development	0.085** (0.039)	0.024** (0.011)
Participation human rights	0.204*** (0.033)	0.036*** (0.010)
Population	3.96e-08 (3.65e-08)	7.41e-09 (1.43e-08)
GDP growth	0.124*** (0.035)	0.062*** (0.017)
Rural population	-9.36e-08 (5.72e-08)	-1.21e-08 (2.20e-08)
Constant	3.161* (1.616)	0.747 (0.459)
Observations	73	294

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 4 - Accountability, independent judicial system and corruption in bad governance countries.

DEP. VARIABLE	(1)	(2)	(3)	(4)	(5)	(6)
	Safety rule of law	Safety rule of law	Safety rule of law	Safety rule of law	Subcat rule of law	Subcat rule of law
L1. Safety rule of law	0.474*** (0.0905)	0.461*** (0.115)	0.546*** (0.109)	0.524*** -0.113		
L1. Subcat rule of law					0.488*** (0.141)	0.480*** (0.137)
L1. Total resources value		-0.243*** (0.084)		-0.172*** -0.039		-0.212** (0.088)
L1. Problematic resources value	-0.039 (0.121)	-0.089 (0.109)				
Sustainable economic opportunity	0.359*** (0.071)	0.352*** (0.076)				
Human development	2.72e-08 (1.11e-07)	-9.27e-08 (1.13e-07)	-7.82e-08 (1.46e-07)	-1.33e-07 -1.31e-07	-3.39e-08 (2.26e-07)	-1.42e-07 (2.23e-07)
Participation human rights	0.088*** (0.018)	0.088*** (0.023)	0.101*** (0.027)	0.101*** (0.026)	-0.076 (0.059)	-0.074 (0.061)
Population	3.39e-07 (3.09e-07)	5.70e-07* (3.02e-07)	1.77e-07 (3.56e-07)	2.93e-07 (3.68e-07)	-2.78e-07 (5.88e-07)	-7.60e-08 (6.03e-07)
Gdp growth			0.014 (0.032)	0.0124 (0.036)	-0.094 (0.080)	-0.092 (0.075)
Rural population			0.003 (0.026)	0.007 -0.030	-0.025 (0.051)	-0.021 (0.053)
Social exclusion			0.086*** (0.024)	0.065*** (0.024)	0.106* (0.058)	0.079 (0.060)
Equity of public resource use			0.047* (0.026)	0.043* (0.024)	0.084 (0.051)	0.081* (0.048)
Education provision and quality			0.085* (0.050)	0.074 (0.048)	0.211** (0.100)	0.208** (0.097)
Human rights			0.077*** (0.024)	0.075*** (0.023)	0.104* (0.054)	0.104* (0.057)
Political rights	16.59** (7.074)	17.10** (8.294)	14.10** (6.161)	15.59** (6.955)	19.36* (10.37)	18.90* (10.68)
Public administration			0.077*** (0.025)	0.074*** (0.023)	0.104* (0.054)	0.104* (0.057)
Constant	16.59** (7.074)	17.10** (8.294)	14.10** (6.161)	15.59** (6.955)	19.36* (10.37)	18.90* (10.68)
Observations	316	316	254	254	254	254

Robust standard errors in parentheses. \*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1.

