Oil, Governance and the (Mis)Allocation of Talents in Developing countries

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Abstract

While scholars have claimed that oil rent tends to orient talented people toward rent-seeking activities in poorly governed countries, no empirical evidence has yet been provided. This paper sheds light on this question. Using a sample of 69 developing countries, we show that oil rent tends to orient talents toward productive activities in well-governed countries and rent-seeking activities in poorly governed countries. The results are robust to different specifications, datasets on governance quality, estimation methods and endogeneity issues. Oil affects the demand for each profession through a technological effect, showing a complementarity between oil and engineering, manufacture and construction, but it also increases the 'size of the cake'. Therefore, when institutions are weak, oil increases the incentive to opt for professions with better access to rent (law, business, and social sciences) rather than careers in engineering, creating a deviation from the optimal allocation between the two types of profession.

Keywords: Oil rent, governance, rent-seeking, tertiary education

JEL Classification: QO; E02; O15

1. Introduction

The seminal work of Sachs and Warner (1995) showed a negative correlation between dependence on natural resources and economic growth, which the authors attributed to the Dutch disease phenomenon[1]. Succeeding authors have found that natural resources are positively correlated with vulnerability (Hausmann and Rigobon, 2003) and armed conflicts (Collier and Hoeffler, 2000) and negatively correlated with democracy (Ross, 2001) and education (Gylfason, 2001). However, research to date has provided limited insights on the mechanisms through which natural resources harm social and economic outcomes, a necessary step in order to design policies that will invert these trends.

Education plays an important role in the debate over the resource curse. Gylfason (2001) and Birdsall et al. (2001) argue that there is a negative correlation between dependence on natural resources and investment in education, while Stijns (2006) finds that mineral resources increase investment in education and the accumulation of human resources, but none of them look at the composition of education. Murphy et al. (1991) argue that growth is spurred when the most talented people become entrepreneurs rather than rent-seekers because they stimulate innovation and technological development. In their empirical analysis, the authors relate entrepreneurship to training in engineering science and rent-seeking activities to training in law schools. The authors find that a larger number of engineers positively affects growth, while a greater number of law majors tends to reduce economic growth. However, Murphy et al. (1991) do not empirically identify the determinants of the allocation of talents.

Our work builds upon Mehlum et al. (2006), who argue that the impact of natural resources on growth will depend on whether institutions are "grabber friendly" or "producer friendly". In their model, entrepreneurs allocate themselves between production or grabbing activity, and poor institutions allow a higher share of resource rent to go to grabbers. The authors empirically confirm that the impact of natural resources on the growth rate of a country depends on the quality of their institutions. Our paper takes the empirical evidence

[1] The Dutch disease explains that the exploitation of natural resources generates an increase in the real exchange rate of the country, causing a loss of competitiveness, which harms the rest of the economy.

one step further by actually looking at the field of specialization of university students conditional on oil resources and institutions.

The publications on this topic typically separate talents into pure producers (or entrepreneurs) and pure grabbers (e.g. Murphy et al. 1991; Mehlum et al. 2006; Baland and Francois 2000). This simplification, motivated by analytical convenience, is problematic, first because the assumption that some professions are inherently less productive than others is highly debatable, and second because it does not allow for the distinction between a technological effect and a rent-seeking effect. By contrast, the initial assumption in our model is that all professions contribute to production, but some professions have better access to rent than others. As a result, the combination of natural resources and poor institutions generates an excessive supply of the professions with better access to rent, which reduces their marginal productivity.

In this paper, an empirical analysis of 69 developing countries shows that, in countries with good governance, oil rents shift the orientation of talents from law, management, and social sciences degrees, to degrees in engineering, manufacture and construction, while the effect is reversed in countries with poor governance. The analysis sheds light on the channels through which the resource curse arises: when institutions are weak, oil rent diverts talents from the most productive activities to activities that provide better access to rent. According to Murphy et al. (1991), this shift of activities reduces long-term growth. These results coincide with the findings of Tornell and Lane (1999) and Mehlum et al. (2006), who show that the resource curse occurs only when institutions are initially weak. Our results demonstrate that the resource curse occurs, at least partially, through an inefficient reallocation of human resources. This paper is the first to empirically find that the Dutch disease occurs through the composition of the specializations in tertiary education.

The results are interpreted through the framework of a simple theoretical model, which assumes the complementarity of two talent types: engineers and lawyers (in the empirical section, the former actually represents tertiary graduates in engineering, manufacture and construction, and the latter includes specializations in law, business, and social sciences). While the two professions contribute to production, lawyers can also grab a share of total production, and this share increases when institutions are vulnerable. In the absence of corruption, the change in the allocation of talents caused by rent only results from the

complementarities in the production technology. Hence in the econometric analysis, the negative impact of oil rent on the proportion of lawyers relative to engineers indicates that oil resources are more complementary with engineers than lawyers. Therefore, it is optimal for a country with more oil resources to have a higher proportion of engineers. Furthermore, the theory predicts that when the institutional quality is low, oil rents will drag talents toward professions that have better access to rent, creating a departure from the benchmark observed in countries with good institutions, which is confirmed by the empirical analysis.

The remainder of the paper is as follows. Section 2 briefly reviews the literature on the Dutch disease, rent-seeking and the allocation of talents. Section 3 provides a simple theoretical framework that helps interpret the empirical results, which are presented in Section 4 in cross-section regressions. Section 5 displays the robustness checks, including the panel regression analysis and the consideration of endogeneity issues. Finally, section 6 concludes and draws policy implications.

2. Literature review

Gylfason (2001) showed that oil-producing countries tend to have low levels of education. His results appear to be robust to three indicators of education: public expenditure on education relative to national income, expected years of schooling for girls, and gross secondary-school enrolment. The author argues that dependence on natural resources leads to the inadvertent or deliberate neglect of progress in human capital, concluding that nations who believe that natural capital is their greatest asset develop a false sense of security and become negligent about the accumulation of human capital.

These results are corroborated by Birdsall et al. (2001), who suggest that dependence on natural resources tends to break the virtuous circle between education, growth, and equality. They find that higher private returns on human capital led to higher rates of private investment, including among the poorest. This, in turn, leads to an increase in productivity and a decrease in inequality. Birdsall et al. (2001) argue that in a country with natural resources, governments are tempted to deviate from policies that create this virtuous circle.

The Dutch disease effects of natural resources adversely affect areas of high labor intensity, such as the agricultural sector in developing countries, which tends to reduce returns in human capital in sectors employing the poor. Ultimately, less investment, and therefore no increase in productivity or reduction of inequalities, will occur.[2]

While the aforementioned papers discuss the relationship between natural resources and human capital, they do not account for learners' type of qualification. Murphy et al. (1991) showed that the allocation of talents matters, with engineering college majors contributing to growth significantly more than law concentrators. They explain that agents move toward the acquisition of a talent as a reaction to the incentives provided by the country. These incentives are mainly determined by the size of the market, the nature of the contract, and the returns to scale of the activity. Murphy et al. (1991) further argue that the misallocation of talents explains the slow economic development in many African and Latin American countries, and the rapid development of East Asian countries.

Baland and Francois (2000) are interested in the role of natural resources in rent seeking activities, analyzing rents derived from quantitative restrictions on imports, as developed by Krueger (1974). They find it to be path dependent; if rent seeking was initially low, a resource boom will further reduce it, but if it was initially high the boom would increase it further. The existence of multiple equilibria results from the assumption that entrepreneurial activity destroys the scope for rent seeking. In this paper we do not assume this, both for simplicity and because of the lack of empirical evidence in favor of it.

Mehlum et al. (2006) examine entrepreneurs' allocation between productive and unproductive activities, focusing on rent generated by natural resources. On the one hand, the exploitation of natural resources increases the income of the country, but on the other hand, it causes the displacement of private agents (including entrepreneurs) from the most productive sectors of the economy to the natural resource sector, inducing rent-seeking behaviors. Agents will therefore make a tradeoff between using their resources for productive activities and using these resources to capture rent. The decision to move from one category of activity to the other will depend on the profitability of each sector, and Mehlum et al. (2006) suggest that profitability will depend on the quality of the institutions in place. The authors argue that if institutions are of good quality, production activities are more profitable than rent-seeking

[2] Stijns (2006) disputes these results. The author uses abundance in natural resources as a variable, and finds that natural resource abundance positively affects education levels.

activities. Indeed, in the absence of good quality institutions, the opportunity cost of rent-seeking activities decreases. Consequently, entrepreneurs abandon the productive sectors to engage in rent-seeking activities. This diversion from the productive sector leads to a decline in productivity throughout the economy, and, this decrease in productivity leads to lower growth. Natural resources will therefore be a blessing or a curse, depending on the quality of the home institutions (Mehlum et al., 2006).

This paper investigates the determinants of the allocation of talents in developing countries, with a focus on how oil resources affect the incentives faced by university students. Among all natural resources, oil seems to be the resource with the highest occurrence of the resource curse (Ross, 2004; Manzano and Rigobon, 2006), primarily due to the importance of oil rents (Manzano and Rigobon, 2006). Therefore, it is key to investigate whether the presence of such rents leads students to choose courses that lead to rent-seeking activities.

3. Theoretical Framework

3.1. A simple model of complementary talents and rent seeking

This section presents a simple general model inspired by Murphy et al. (1991) and Mehlum et al. (2006). In contrast with their work, this version allows the "grabbers" to contribute to production and simplifies the production process by assuming one general production function for the whole economy. This framework is arguably more acceptable because it does not claim *a priori* that graduates in engineering, manufacture and construction (referred to as "engineers" in this section) always contribute to growth more than graduates in law, business, and social sciences (referred to as "lawyers"). In this version, the two talent types are complementary, but lawyers have better access to rent when institutions are poor. Therefore, in the presence of natural resources and poor institutions, it is the excess supply of lawyers which causes their marginal productivity to fall below the one of engineers. Importantly, this representation allows for the decomposition of the impact of resource rent into a technological effect (resulting from the complementarities in production function) and a rent-seeking effect. While the technological effect occurs in every country, the rent-seeking effect occurs only in countries with poor governance.

It is assumed that talents can choose their allocations between two types of professions: engineers and lawyers[3]. Both professions contribute to the production of the country and are complementary, but lawyers can grab the part of the rent that depends on the quality of the institutions.

The total production of the country is given by:

$Y = f(R, E, L)$,

where R is the exogenous amount of natural resources of the country, E is the proportion of engineers and L is the proportion of lawyers. $f(R, E, L)$ is a production function which satisfies a positive and decreasing marginal productivity of each production factor ($f_x > 0$ and $f_{xx} < 0$ for any $x = R, E, L$), complementarity between the factors of production ($f_{xy} > 0$ for any $x, y = R, E, L$ and $x \neq y$) and constant returns to scale ($f(\gamma R, \gamma E, \gamma L) = \gamma f(R, E, L)$). Other production, such as capital and non-qualified labor, can be included in the exogenous parameters of the production function; in this case, $f(R, E, L)$ is the value of the production after remuneration of all factors of production other than R, E and L. The total population of engineers and lawyers is normalized to one: $E + L = 1$.

In the absence of rent-seeking, each talent is remunerated at its marginal productivity, and the resource rent is equally spread among all talents[4]:

$$w_E^G = f_E + Rf_R \quad (1)$$
$$w_L^G = f_L + Rf_R \quad (2)$$

w_E^G and w_L^G represent the respective salary of the engineer and lawyer with good institutions, without any grabbing.

Since the production function is CRS, then $E\, w_E + L\, w_L = Rf_R + Ef_E + Lf_L = Y$.

In the presence of rent seeking, the lawyer has the capacity to capture a share r of the total production (which is then equally divided among all lawyers):

$$w_E = (1 - r)(f_E + Rf_R) \quad (3)$$

[3] The two professions in the model are called 'engineer' and 'lawyer' for conciseness, but in fact 'engineer' represent professions in engineering, manufacturing, and construction, and 'lawyer' represents professions in law, business, and social sciences. In fact, these constructs can represent any two profession types which are complementary and where one profession has better access to rent than the other.

[4] Given that $E + L = 1$, the share of the rent to each talent is given by $\frac{Rf_1}{E+L} = Rf_1$. It could also be assumed that a fixed share $\propto$ of the resource rent is shared by the talents, and the rest is spread among the rest of the population by replacing Rf_1 by $\propto Rf_1$. This has no implication on the conclusions of the model.

$$w_L = f_L + Rf_R + r\frac{1-L}{L}(f_E + Rf_R) \quad (4)$$

In a poorly governed country, r is higher, which increases the reward of the lawyers at the expense of the engineers. Note that equation (1) and (2) represent special cases of equations (3) and (4): when $r = 0$, then $w_E = w_E^G$, and $w_L = w_L^G$.

Each talent has the possibility of choosing between becoming an engineer or a lawyer. Hence, at equilibrium, both salaries are equal: $w_E = w_L$. After simplification, this leads to the following equation:

$$\left(1 - \frac{r}{1-E}\right) f_E = f_L + 2r\, Rf_R \quad (5)$$

which can be rewritten:

$$f_E - f_L = \frac{r}{1-E} f_E + 2r\, Rf_R \quad (6)$$

Equation (6) shows that the marginal productivity of the engineer is strictly higher than that of the engineer if and only if $r > 0$, and it is equal when $r = 0$.

The impact of an increase in natural resources on the proportion of engineers at equilibrium is given by the equation:

$$\frac{dL}{dR} = \frac{f_{LR} - \left(1 - \frac{r}{L}\right) f_{ER} + 2r\frac{d(Rf_R)}{dR}}{(f_{EL} - f_{EE})\left(1 - \frac{r}{L}\right) + (f_{LE} - f_{LL}) + \frac{r}{L^2} f_E} \quad (7)$$

In the special case where $r = 0$, then $\frac{dL}{dR} = \frac{f_{LR} - f_{ER}}{(f_{EL} - f_{EE}) + (f_{LE} - f_{LL})}$ (8),

which is negative if and only if $f_{31} < f_{21}$, which implies that the complementarity between lawyers and natural resources is less than the complementarity between engineers and natural resources. This occurs if oil extraction, and all sectors stimulated by the presence of natural resources, requires a higher proportion of engineers than the rest of the economy. Equation (8) defines the "technological effect," since it results from the shape of the production function.

→ on calculate $\frac{dL}{dR}|_R$ → resource rent

We make the reasonable assumption that $\frac{dRf_R}{dR} \equiv f_R + R\left(f_{RR} + (f_{RL} - f_{RE})\frac{dL}{dR}\right) > 0$, which simply implies that the resource rent Rf_1 increases when the natural resource R increases. Because the denominator of the RHS of equation (7) is always positive[5], the sign of $\frac{dL}{dR}$ is equal to the sign of the numerator of the RHS. Hence, for any set of parameters, if $f_{LR} < f_{ER}$, then there exists a r^* such that $\frac{dL}{dR} < 0$ when $r < r^*$ and there exists an $r^{**} > r^*$ such that $\frac{dL}{dR} > 0$ when $r > r^{**}$, where r^* and r^{**} are functions of L and of the exogenous parameters of the model[6]. Therefore, the model predict a reversal of sign of the impact of the resource rent on the allocation of talents: the impact of the natural resource on the proportion of lawyers is expected to be negative with good institutions, but positive when institutions are bad.

This theoretical model provides three insights. First, it is not necessary to assume that lawyers (and other professions with access to rent-seeking) are less productive. Instead, it is in fact the existence of the rent, combined with the decreasing marginal productivity of each profession, which causes the marginal productivity of the lawyer to be lower than that of the engineer. The possibility for the lawyer to acquire a rent creates a deviation from the optimal allocation of talents, providing an excess of lawyers, which is a source of inefficiency.

Second, this model makes the distinction between the technological effect and the grabbing effect of the resource on the allocation of talents. In the absence of corruption, one should still expect natural resource to have some impact on the allocation of talents. It will increase the number of students in the profession that is most complementary with the natural resource. This is the technological effect, which can be estimated by looking at the impact of natural resource on the allocation of talents in countries with good institutions. This becomes the benchmark to which countries with bad institutions can be compared to in order to obtain the effect on talent choice that results from the intention to grab rent. The model predicts that when the possibility for corruption becomes high enough, the resource rent will always increase the number of lawyers because the benefits from the appropriation of the rent outweigh the technological effect. Hence, in the empirical section, when examining the impact of resources and institutions on the proportion of lawyers, the coefficient in front of

[5] $1 - \frac{r}{L}$ is necessarily positive because $r > L$ is not compatible with $w_E = w_L$.

[6] The proof comes from the fact that 1) $\frac{dL}{dR} < 0$ when $r = 0$ and $f_{31} < f_{21}$, 2) $\frac{dL}{dR} > 0$ when $r = L$, and 3) $\frac{dL}{dR}$ is a continuously differentiable function of r.

natural resources alone will indicate the direction of the technological effect (i.e., it will be negative if oil resources are more complementary with engineers than lawyers). By contrast, the multiplicative variable 'natural resources * vulnerability of institution' is expected to have a positive impact on the proportion of lawyers relative to the proportion of engineers.

Finally, the model has implicit consequences on long term growth. Since Murphy et al. (1991) showed that lawyers contribute less to growth than engineers, then this model implies that the impact of oil resource on growth is conditional on the condition of institutions. Within the framework of this model, the long term economic consequences of the allocation of talents can be analysed with a dynamic version, where 'learning by doing' generates economic growth. In this case, it is expected that the deviation from the optimal allocation of professions will lead to a slower productivity gain in engineering than in rent-seeking professions, which would harm economic growth. However this goes beyond the scope of this paper.

3.2. Theoretical discussion

The effect of oil rents on the allocation of talents conditional on governance quality could be affected by either the demand or the supply side. On the demand side, individuals may opt for trainings that facilitate rent-seeking when the governance and institutional background of the countries is poor. In such a context, participating in rent-seeking activities is less subject to sanctions and gives a high payoff to rent-seekers. On the supply side, countries that are oil rich but poorly governed may provide fewer engineering degrees. As a form of political patronage, this can be a strategy for the government to better control the voters through the instruments of wages and employment. Whether intentional or not, governments with bad governance are more likely to use oil resources to inflate the size and remuneration of the administration rather than redirecting the oil resources toward productive public or private investments.

The model emphasizes the demand side and how the talents react to the change in incentives that result from the combination of natural resources and the quality of institutions. However, the possibility of grabbing is higher in countries with poor institutions because of political patronage. It can also be argued that countries with good governance are more likely to sterilise a part of the oil rent, while countries with poor institutions will use it for public

expenditures[7]. Grabbing can happen through illegal bribes, but also legally, through employment beyond government needs and remunerations that exceed the marginal productivity of employees. Hence, the effect described in this paper may be a demand effect as well as a supply effect through political patronage or an unjustified expansion of the public sector. An estimation of which effect is dominant and observation of how the resources are grabbed offers promising areas for future research.

4. Empirical Analysis

In this part, we describe the sample and variables retained in the study. Then, we carry out an econometric analysis using cross-section and panel approaches. In each approach, we confront our results in terms of alternative explanations for our model.

4.1. Econometric model and definition of variables

This paper tests the hypothesis that the effect of oil rents on the allocation of talents toward rent-seeking activities increases with bad governance. We follow Murphy et al. (1991) in their theoretical discussion on the determinants of the allocation of talents for the selection of the control variables. They specify the following equation:

$$G_i = X_i'\beta + (\alpha + \delta\, INST\, VUL_i)OIL_i + \gamma INST\, VUL_i + d_j + \varepsilon_i \qquad (9),$$

where ε_i is the residual term, d_j is the regional dummies, and i specifies the country.

The vector **X** gathers the proxies of the determinants of talent allocation as suggested by Murphy et al. (1991). This includes the size of government, the degree of openness, the cost of registering property, and the access to credit by the private sector. The size of government, the degree of openness, and the access to credit are taken from the World Development Indicators (2009), and the cost of registering property is taken from the World Bank's 'Doing Business' data. To these variables were added regional dummies (d_j), controlling for regional variability in the allocation of talents.

[7] In this case, the impact of talent would depend on the composition of public spending.

The dependent variable G_i is a proxy for the intensity of grabbers among talents. G_i is defined as enrollment in law, business, and social sciences minus enrolment in engineering, manufacture, and construction, and it is expressed as a percentage of the total enrolment in tertiary education.

The definition of talents adopted here is broader than that of Murphy et al. (1991), who retain Enrolment in law as a proxy for the choice of careers in rent-seeking activities, and Enrolment in engineering as a proxy for career choices in productive activities. As the proxy includes other professions, the argument that some professions are inherently more productive than others becomes even more controversial. However, the argument that, in general, students in law, business, and social sciences can expect better access to rent[8] than students in engineering, manufacturing, and construction is more defensible and can be seen in the specialization of most government positions in developing countries.[9] All the dependent variables are drawn from the database of the Statistical Yearbook of UNESCO.

$\boldsymbol{OIL_i}$ represents oil rent as a percentage of GDP. In the literature, the most common variables used to measure resources wealth are the percentage of exports of natural resources in total exports, and the percentage of exports of natural resources in GDP. Papers using either of these variables tend to confirm the hypothesis of the resource curse (Sachs and Warner, 1995; Leite and Weidmann, 1999). However, some studies using other measures, such as the level of production (Stijn, 2006) or sub-soil assets (Brunnschweiler and Bulte, 2008) have led to a rejection of the existence of the resource curse. Rosser (2006) argues that studies on the resource curse should measure the consequences on behaviors that are caused by resource rent rather than those caused by the distortion of the structure of exportation that results from resource exploitation. In this study, what seems to matter the most is how the presence of oil shapes people's incentives in the tertiary education. Oil rent variable, by measuring the instantaneous real macroeconomic contribution of the resources (through redistribution via government spending, private sector consumption, etc), appears the most relevant proxy to use as it affects directly households and individuals' utility functions through many ways.

[8] Some social sciences disciplines may not have better access to rent (e.g., linguistics, history, anthropology), but the data do not allow for a higher level of desegregation, and on average, it remains true that students in law, business, and social sciences can expect better access to rent than those in engineering, manufacturing, and construction.

[9] This point seems to us trivial and realistic. However, the interested reader can look for the training (degrees) of the various members of governments of developing countries through the website of the Central Intelligence Agency (CIA): https://www.cia.gov/library/publications/world-leaders-1/pdf-version/pdf-version.html

The calculation of oil rent is carried out at several stages (Bolt et al., 2002). In the first stage, one obtains unit rent by the difference between international market price and the unit extraction cost. In the second stage, unit rent is multiplied by the oil production; the result is oil rent. The measurement of oil rent as a percentage of GDP is common and the most direct estimate of the size of the rent relative to the size of the economy. It has been used in several empirical works on the effects related to revenues drawn from natural resource exploitation (Collier and Hoeffler, 2005; Omgba, 2009; Andersen and Aslaksen, 2013).

$\boldsymbol{INSTVUL_i}$ is an indicator of the vulnerability of governance drawn from the Worldwide Governance Indicators (WGI) database of the World Bank. The WGI project has reported aggregate and individual governance indicators for 212 countries and territories since 1996.[10] Six dimensions of governance are reported: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption.[11] The six indicators were defined in the appendix. Institutional quality is an important determinant of the management of revenues from exploitation of natural resources in the resource curse literature (see, e.g., Sala-i-Martin and Subramanian; 2003; Mehlum et al., 2006), but it is also an important element in the allocation of talents, as shown by Murphy et al. (1991).

[10] Kaufmann, Kraay, and Mastruzzi (2009) construct a meta-indicator that aggregates a host of different measures, from firm, investor, and population surveys to expert and international organization assessments to construct their overall measurements of the quality of governance. Data are available at the Worldwide Governance Indicators (WGI) project website:
http://info.worldbank.org/governance/wgi/index.asp
For more details on the construction of the indices, refer to Kaufmann, Kraay and Mastruzzi (2009). "Governance Matters VIII: Aggregate and Individual Governance Indicators, 1996-2008". World Bank Policy Research Working Paper Series, 4978.

[11] It should be noted that these governance indicators are based on data from expert assessments and polls, and surveys of government officials and businesses, and therefore capture perceptions of the government process rather than any formal aspects of the actual government structure in any given country. This creates the important problem that perceptions are shaped not just by the government environment, but also by many other aspects of the socio-economic environment, thereby creating its own set of endogeneity and reverse causality issues. For example, economic growth gives evaluators the perception that institutions are good, which in turn is used in growth regressions to give the impression that good institutions generate economic growth. Many scholars are critical of the World Governance Dataset (Arndt and Oman, 2006; Kurtz and Shrank, 2006; Kurtz and Shrank, 2007). Kaufmann, Kraay and Mastruzzi (2006) have categorized some of these critiques as concerns about the comparability of the indicators across countries and across time; concerns about bias in expert polls or in particular sources; and concerns about the independence of the different data sources and the consequences for the aggregate indicators (Kaufmann, Kraay and Mastruzzi, 2006). More recently, Thomas (2010) dismissed the Worldwide Governance Indicators (WGI) as an "elaborate and unsupported hypothesis" because of the failure to demonstrate the 'construct validity' of these indicators. A short answer to Thomas (2010) is provided by Kaufmann et al. (2010), who contest the need to meet the criteria of construct validity and therefore minimize this critique.

We first use an indicator of the overall quality of governance, which, by using the principal component analysis method, combines all six dimensions into a single index. The aggregate index of governance is the first principal component of the vector of six indicators of governance already constructed. Table A1 in Appendix shows that the first principal component accounts for almost 81% of the overall variance. This table also presents the eigenvectors and the correlation between the synthetic indicator and each variable. The resulting aggregated indicator of governance has been rescaled to range between 0 and 1. Subsequently, this paper uses each indicator of governance quality separately to assess the impact of oil rents on the allocation of talents conditional on the level of governance quality. The first approach follows Mehlum et al. (2006), who integrate the governance vulnerability index as a whole in their growth model and find a resource curse conditional on the quality of institutions. The second approach divides the governance vulnerability index into its six components, as different institutional variables may show different effects on the allocation of talents.

To build the indicators of governance used in the econometric estimations, we normalize and reverse all the original indicators of governance vulnerability by the following formula:

$$INST\ VUL_i = \frac{max(Inst) - Inst_i}{max(Inst) - min(Inst)},$$

where $min(Inst)$ and $max(Inst)$ represent the minimum and maximum of each indicator of governance quality, respectively. This transformation ensures that $INST\ VUL_i$ will have a range between 0 and 1. Hence, $INST\ VUL_i$ increases with the deterioration of the quality of governance. Moreover, since the indices are distributed over the same interval [0, 1], the standardization facilitates direct comparison across different equations.

The fact that $INST\ VUL_i = 0$ corresponds to the country with the highest institutional quality is central to the interpretation of the regressions. This allows for the interpretation of α as the effect of oil rents on the allocation of talents toward rent-seeking activities in countries with the lowest institution vulnerability, and thus constitutes a benchmark against which other countries will be compared. Hence, α measures the technological effect described in the theoretical section: how the allocation of talents is affected by the oil resource in the absence

of grabbing. This allocation corresponds to the one that equalizes the marginal productivity of both professions.

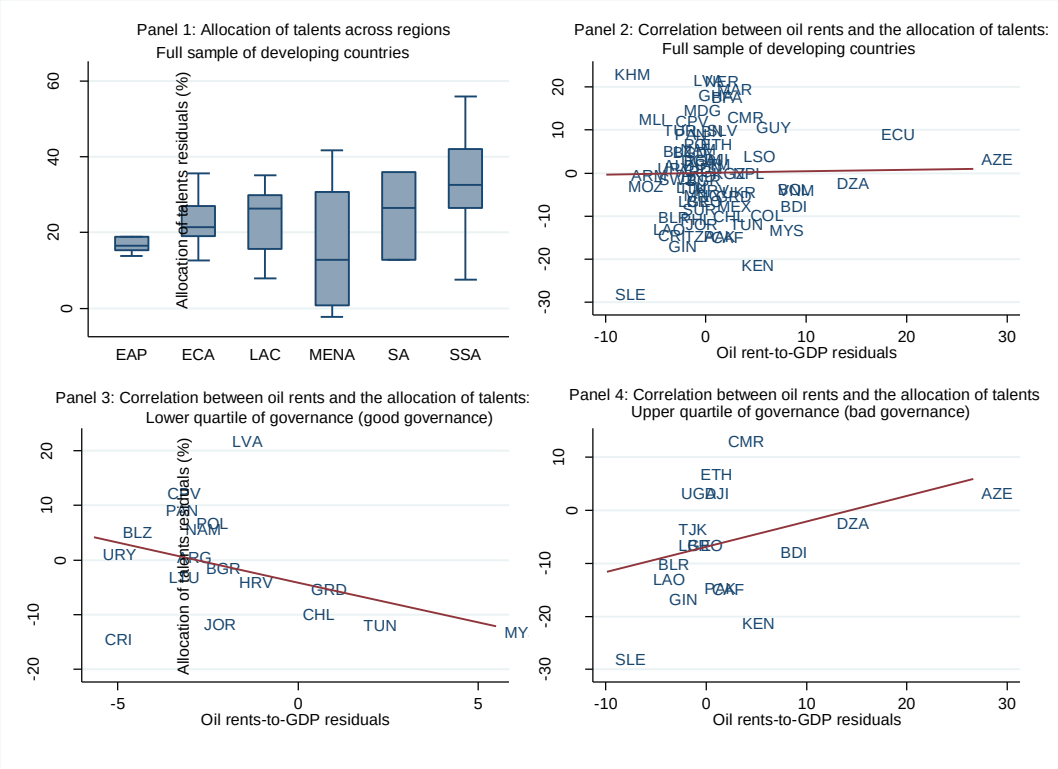
We do not have a strong prior on the expected sign of α, which depends on the professions that are needed to contribute to the extraction of the resource and generation of the rent, but also to the repercussions of the increased wealth of the country, through such things as investments and price effects. The sign of α will be positive if the oil resource is complementary with lawyer more than with engineer, and it will be negative otherwise.

The hypothesis tested in this paper is that $\delta > 0$. In other words, the effect of oil rents on the intensity of grabbers (G_i) is significantly higher among countries with poor institutions $(INST_i)$ than among countries with good institutions. If δ is significantly positive, then the departure from the impact of rent resources in countries with good institutions can be attributed to the fact that some specializations offer more opportunities for rent-seeking when institutions are poor.

4.2. Preliminary evidence

Figure 1 provides a visual analysis of the relationship between oil rent, GDP and governance. Panel 1 provides descriptive statistics per region. The lower and upper hinges of each box show the 25th and 75th percentiles of the samples, the line in the box indicates the respective medians, and the end-points of whiskers mark next adjacent values. Panels 2, 3 and 4 plot the level of oil rents-to-GDP and G_i (the allocation of talents in law relative to engineering), using the residuals derived from regressions of these two variables, each regressed on the same set of control variables as in Table 1. Panel 2 shows no clear correlation in the full sample. By contrast, Panels 3 and 4 show a negative correlation among countries with good governance and a positive correlation among countries with bad governance. In other words, oil rent increases the intensity of "grabbers" only in countries with bad governance.

Figure 1: Allocation of talents across regions, and correlation with oil rents



Notes: The allocation of the talents variable is defined as enrolment in law, business, and social sciences minus the enrolment in engineering, manufacturing, and construction, and is expressed as a percentage of the total enrolment in tertiary education.

In the box plots of Panel 1, the lower and upper hinges of each box show the 25th and 75th percentiles of the samples, the line in the box indicates the respective medians, and the end-points of whiskers mark next adjacent values. EAP: East Asia and Pacific, ECA: Europe and Central Asia, LAC: Latin America and Caribbean, MENA: Middle East and North Africa, SA: South Asia, SSA: Sub-Saharan Africa.

Panels 2, 3, and 4 plot the level of oil rents-to-GDP on the x-axis and the measure of the allocation of talents on the y-axis. The measure of the allocation of talents and the oil rents-to-GDP ratio in Panels 2, 3, and 4 are residuals derived from regressions of these two variables, each regressed on the same set of control variables as in Table 1: real GDP growth, income per capita, trade openness, foreign direct investment-to-GDP, government consumption ratio, credit to the private sector, and the indicators of business climate. This gives adjusted measures of the allocation of talents and oil rents that are purged from any collinearity with standard determinants of allocation of talents.

The governance index is the aggregation of the six indicators of governance built by Kaufmann, Kraay, and Mastruzzi (2009) using principal component analysis (see Table A1, Appendix A): Corruption, Rule of law, Regulatory quality, Government effectiveness, Political stability, and Voice and accountability. The resulting governance index has been rescaled to be between 0 and 1, with higher value indicating a bad level of governance.

Brazil and Thailand are 2 outliers that have been removed from Figure 1 but remain in all the regressions.

Source: Authors' calculations using UNESCO Statistical Yearbooks, World Development Indicators, and World Governance Indicators.

4.3. Main OLS results

Equation (9) is estimated by the OLS method with a full set of regional dummies. To provide the most data on our dependent variable (allocation of talents) and on governance quality, we utilize the largest possible sample of developing countries by taking a cross-section of 69 countries and averaging over the period 2000-2008.[12]

Table 1 presents the results of the model estimations, which allows for an effect of oil rents on the allocation of talents that depends on the quality of institutions. In the first two columns (1 and 2), the dependent variable is G_i, the proportion of lawyers minus that of engineers. The Governance vulnerability variable is the institutional quality variable obtained from the method of principal component analysis using the six variables of the WGI database.

[12] Due to the limited availability and the short timeframe of the UNESCO and World Governance Indicators datasets, the cross-sectional data are presented as the main results and the panel data as a series of robustness checks available in section 5.6. The countries with only one observation in the UNESCO dataset were dropped in the panel data analysis, which increases the risk of a selection bias. At the end, it is the combination of the evidence in cross-section and panel data analysis which make a strong case for the relationship between institutions, resources and the allocation of talents described in this paper.

Table 1.Conditional effect of oil rents on the allocation of talents according to the level of an aggregated governance quality index: OLS with regional dummies.

	Difference between law & engineering		Proportion of law over law and engineering students	
	(1)	(2)	(3)	(4)
Oil rents-to-GDP	-5.412**	-2.794*	-4.711***	-2.985**
	(2.66)	(1.91)	(2.96)	(2.25)
Oil rents-to-GDP * Governance Vuln	9.491***		8.031***	
	(2.80)		(3.09)	
Oil rents-to-GDP * Initial governance Vuln		5.129**		5.149**
		(2.13)		(2.41)
Governance Vulnerability	-23.931		-5.530	
	(1.31)		(0.38)	
Initial governance Vulnerability		-30.746**		-12.361
		(2.04)		(0.97)
GDP growth	-1.377	-1.113	-0.007	0.028
	(1.09)	(1.04)	(0.01)	(0.04)
GDP growth volatility	0.377	0.458	0.824	0.854
	(0.52)	(0.68)	(1.35)	(1.37)
Initial income per capita (log)	-2.047	-2.517	-0.364	-1.317
	(0.84)	(1.18)	(0.19)	(0.70)
Trade openness	0.052	0.039	0.048	0.039
	(0.96)	(0.79)	(1.06)	(0.87)
FDI-to-GDP	-0.596	-0.350	-0.214	-0.120
	(1.39)	(0.87)	(0.58)	(0.33)
Government consumption	-0.381	-0.297	0.055	0.050
	(1.28)	(1.10)	(0.21)	(0.20)
Private sector credit-to-GDP	-0.061	-0.085	-0.047	-0.057
	(0.61)	(0.98)	(0.61)	(0.69)
Registering property costs	0.097*	0.098**	0.103**	0.106***
	(1.87)	(2.55)	(2.58)	(2.72)
Protection of investors	0.069	-0.017	0.063	0.018
	(0.51)	(0.15)	(0.71)	(0.20)
Intercept	55.162*	62.239**	68.367***	79.490***
	(1.78)	(2.24)	(2.97)	(3.82)
N	69	69	69	69
R^2	0.312	0.298	0.463	0.454
Joint significance of oil rents coefficients: p-value	0.018	0.066	0.008	0.037
Governance vulnerability turning point	0.570	0.545	0.587	0.580
Countries above the turning point	48	51	45	40

Notes: Robust t-statistics are in parentheses. All models include the full set of regional dummies. All the original series of governance drawn from the WGI dataset have been reverted so that high values refer to bad governance quality. The governance vulnerability used here is the aggregation of the WGI indices using principal component analysis. The composite index is ranged between 0 and 1. *** p<0.01, ** p<0.05, * p<0.1

The negative sign and the significance of the coefficient associated with the variable Oil-rent-to-GDP in column 1 reflect a negative impact of oil rents on students' incentives toward orientation to rent-seeking activities when the country has good governance (Governance vulnerability equal to 0). This indicates that countries most able to properly manage the oil rent have generated an increase in tertiary graduates in engineering, manufacture and construction relative to those in law, business, and social sciences. This is informative of the most efficient allocation, resulting from the technological effect in the absence of corruption or other sources of inefficiencies caused by institutional vulnerability. This offers, then, a benchmark against which the other countries can be compared.

The significance of the positive coefficient of the multiplicative variable (Oil rent*Governance vulnerability) shows that the lower the governance quality, the more oil rent encourages students to opt for law rather than engineering careers. The turning point is found at a governance vulnerability index between 0.545 and 0.587, remaining remarkably consistent across the four specifications. Hence, interpreting the results of column 1, oil rent reduces the proportion of lawyers over engineers in the countries with a vulnerability index below 0.57 (21 countries in this sample) but increases it in countries with a vulnerability index above 0.57 (48 countries). Therefore, the majority of developing countries appear to have institutions whose weaknesses have caused the oil rent to generate an increase in professions with better access to rent despite the fact that better resource management should have increased the number of engineers.

The conclusions are similar in column 2, which uses the Governance quality variable in the initial period (2000) instead of averaging over the entire period (2000-2009). Using the governance quality observed at the beginning of the period reduces a potential endogeneity bias that would arise from the problem of reverse causality between the oil rents and the allocation of talents. The coefficient associated with the Oil rent-to-GDP variable is still negative and significant, while the coefficient associated with the multiplicative variable (Oil rent * Initial governance vulnerability) is still positive and significant.

4.4. Use of an alternative dependent variable

The results show that the allocation of talents depends on the presence of oil revenues and the governance quality of the countries. However, having a dependent variable, taken as the difference between the enrolment in law, business, and social sciences and the enrolment in engineering, manufacturing, and construction, imposes a symmetrical impact of the explanatory variables on both sectors. As Murphy et al. (1991) note, certain items that affect the number of lawyers may act disproportionately on the population of engineers. In regressions 3 and 4 of Table 1, the dependent variable is the proportion of Enrolment in law, defined as the enrolment in law, business, and social sciences as a percentage of the sum of the enrolment in law, business, and social sciences and the enrolment in engineering, manufacturing, and construction. The results are quite similar, including the turning point, which increased from 0.57 to 0.587.

The key results of this paper show that oil revenues have a negative impact on the proportion of students who choose to be educated in law, business, or social sciences compared to those who opt for engineering, manufacturing, and construction when institutions are good but a positive effect when institutions are bad. This differential in the impact of oil on the allocation of talents is attributed to the fact that if institutions are poor, then law, business and social sciences become more attractive careers because they have, on average, better access to the resource rent.

4.5. Breakdown of the aggregate index of governance quality

Previous results indicate that the effect of oil rents on the allocation of talents is conditional on the level of overall governance quality. However, previous research does not indicate which specific components of governance affect the allocation of talent. It is possible that one particular component dominates the composite indicator. Therefore, we next examine each individual measure of quality of governance to improve our ability to make appropriate recommendations. Table 2 shows the estimation results of various governance variables on talent allocation,[13] including lack of accountability, political instability and violence, government ineffectiveness, lack of regulatory quality, lack of rule of law, and corruption. The coefficients associated with oil rents remain negative. The coefficients associated with the multiplicative variables (Oil rents * Governance Vulnerability Indicators) are all positive and are highly significant on four of these indicators: Corruption, Lack of Rule of law, Lack of Regulatory quality, and Government ineffectiveness. The significance of corruption and the lack of regulatory quality are in line with the predictions of Murphy et al. (1991), who highlight the role of property rights and the possibility of easy access to rents as the main determinants of the allocation of talents. Interestingly, the misallocation of talents is due not only to illegal grabbing (corruption and lack of rule of law), but also to legal grabbing: government ineffectiveness and Lack of Regulatory quality tend to discourage private investment and (legally) mismanage the public resources provided by the rent.

[13] The six indicators of governance quality are tested separately. The six indicators could be used simultaneously in the models, but this resulted in unreliable results with no statistically significant coefficients. We interpreted this result by the high colinearity between each of the six dimensions of governance.

Table 2: Conditional effect of oil rents on the allocation of talents according to the levels of several dimensions of governance quality: OLS with regional dummies.

	Difference between enrollment in law versus engineering					
	(1)	(2)	(3)	(4)	(5)	(6)
Oil rents-to-GDP	-6.497***	-7.055***	-4.901***	-5.017***	-2.100	0.420
	(3.19)	(3.19)	(3.02)	(3.64)	(1.42)	(0.43)
Oil rents-to-GDP * Corruption	8.982***					
	(3.25)					
Oil rents * Lack of Rule of law		12.448***				
		(3.33)				
Oil rents * Lack of Regulatory quality			9.769***			
			(3.21)			
Oil rents * Gov. ineffectiveness				9.218***		
				(3.90)		
Oil rents * Political stability					4.224	
					(1.58)	
Oil rents * Lack of Voice&Account.						-0.164
						(0.10)
Corruption	-6.159					
	(0.39)					
Lack of Rule of law		-22.954				
		(1.24)				
Lack of Regulatory quality			-28.738*			
			(1.68)			
Government ineffectiveness				-20.359		
				(0.96)		
Political instability					-24.895**	
					(2.08)	
Lack of Voice&Accountability						-30.427***
						(2.87)
GDP growth	-1.462	-1.441	-0.887	-1.159	-1.324	-0.937
	(1.07)	(1.16)	(0.72)	(0.90)	(1.02)	(0.74)
GDP growth volatility	0.312	0.464	0.395	0.451	0.275	0.229
	(0.41)	(0.65)	(0.53)	(0.63)	(0.36)	(0.30)
Initial income per capita (log)	-0.338	-2.051	-1.544	-1.277	-2.683	-2.894
	(0.15)	(0.91)	(0.73)	(0.50)	(1.13)	(1.38)
Trade openness	0.064	0.070	0.050	0.064	0.003	0.059
	(1.15)	(1.21)	(0.93)	(1.17)	(0.05)	(1.05)
FDI-to-GDP	-0.754*	-0.672	-0.430	-0.603	-0.329	-0.489
	(1.68)	(1.60)	(1.02)	(1.42)	(0.75)	(1.16)
Government consumption	-0.366	-0.426	-0.259	-0.362	-0.349	-0.447
	(1.14)	(1.37)	(0.94)	(1.19)	(1.25)	(1.60)
Private sector credit-to-GDP	-0.064	-0.040	-0.082	-0.059	-0.009	-0.077
	(0.67)	(0.40)	(0.85)	(0.64)	(0.09)	(0.76)
Registering property costs	0.088	0.097*	0.109**	0.106*	0.085	0.083
	(1.53)	(1.91)	(2.03)	(1.99)	(1.59)	(1.55)
Protection of investors	0.150	0.078	0.056	0.108	0.003	-0.068
	(1.15)	(0.63)	(0.39)	(0.76)	(0.02)	(0.50)
Intercept	32.515	53.864*	48.533*	43.550	61.993**	65.876**
	(1.16)	(1.84)	(1.80)	(1.27)	(2.18)	(2.56)
N	69	69	69	69	69	69
R^2	0.301	0.332	0.305	0.322	0.284	0.309
Joint significance of oil rents coefficients: p-value	0.008	0.004	0.007	0.001	0.246	0.474
Governance vulnerability threshold	0.723	0.567	0.502	0.544		
Countries above the threshold	38	54	57	55		

Notes: Robust t-statistics are in parentheses. All models include the full set of regional dummies. All the original series of governance drawn from the WGI dataset have been reverted so that high values refer to bad governance quality. Governance measures are ranged between 0 and 1. Absolute *t* statistics are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Conditional effect of oil rents on the allocation of talents according to the levels of several dimensions of governance quality: Testing an alternative dependent variable. OLS with regional dummies.

	Proportion of law over law and engineering students					
	(1)	(2)	(3)	(4)	(5)	(6)
Oil rents-to-GDP	-4.892***	-5.051***	-3.876**	-3.608***	-1.718	-0.414
	(2.77)	(2.91)	(2.60)	(3.25)	(1.58)	(0.44)
Oil rents-to-GDP * Corruption	6.665***					
	(2.85)					
Oil rents * Lack of Rule of law		8.783***				
		(3.03)				
Oil rents * Lack of Regulatory quality			7.532***			
			(2.74)			
Oil rents * Gov. ineffectiveness				6.460***		
				(3.39)		
Oil rents * Political stability					3.232*	
					(1.72)	
Oil rents * Lack of Voice&Account.						0.881
						(0.61)
Corruption	1.188					
	(0.09)					
Lack of Rule of law		-8.555				
		(0.58)				
Lack of Regulatory quality			-9.055			
			(0.56)			
Government ineffectiveness				-1.044		
				(0.06)		
Political instability					-10.567	
					(1.18)	
Lack of Voice&Accountability						-15.213*
						(1.71)
GDP growth	-0.137	-0.023	0.296	0.212	0.135	0.188
	(0.17)	(0.03)	(0.38)	(0.27)	(0.17)	(0.24)
GDP growth volatility	0.805	0.885	0.760	0.832	0.743	0.725
	(1.32)	(1.44)	(1.22)	(1.37)	(1.17)	(1.19)
Initial income per capita (log)	0.229	-0.848	-0.334	0.339	-1.186	-1.543
	(0.14)	(0.48)	(0.17)	(0.15)	(0.63)	(0.88)
Trade openness	0.055	0.058	0.041	0.053	0.024	0.044
	(1.23)	(1.22)	(0.92)	(1.18)	(0.49)	(0.92)
FDI-to-GDP	-0.302	-0.232	-0.053	-0.208	-0.004	-0.087
	(0.78)	(0.62)	(0.15)	(0.57)	(0.01)	(0.23)
Government consumption	0.060	0.023	0.109	0.072	0.052	0.021
	(0.22)	(0.08)	(0.44)	(0.28)	(0.20)	(0.08)
Private sector credit-to-GDP	-0.063	-0.038	-0.064	-0.044	-0.029	-0.079
	(0.83)	(0.46)	(0.83)	(0.59)	(0.35)	(0.96)
Registering property costs	0.097**	0.102**	0.109***	0.105**	0.100**	0.098**
	(2.31)	(2.54)	(2.72)	(2.48)	(2.58)	(2.44)
Protection of investors	0.102	0.048	0.060	0.089	-0.019	-0.030
	(1.21)	(0.57)	(0.62)	(0.99)	(0.20)	(0.29)
Intercept	59.802***	73.113***	66.916***	58.258**	78.451***	83.270***
	(2.97)	(3.50)	(2.80)	(2.20)	(3.93)	(4.35)
N	69	69	69	69	69	69
R^2	0.463	0.464	0.450	0.468	0.431	0.436
Joint significance of oil rents coefficients: p-value	0.019	0.008	0.019	0.005	0.188	0.587
Governance vulnerability threshold	0.734	0.575	0.515	0.559		
Countries above the threshold	34	52	54	52		

Notes: Robust t-statistics are in parentheses. All models include the full set of regional dummies. All the original series of governance drawn from the WGI dataset have been reverted so that high values refer to bad governance quality. Governance measures are ranged between 0 and 1. Absolute *t* statistics are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Conditional effect of oil rents on the allocation of talents according to the *initial* levels of several dimensions of governance quality: Testing an alternative dependent variable. OLS with regional dummies

	Difference between enrollment in law versus engineering					
	(1)	(2)	(3)	(4)	(5)	(6)
Oil rents-to-GDP	-6.100***	-3.460	-1.830	-3.970***	-1.569	0.171
	(2.84)	(1.50)	(1.02)	(2.92)	(1.45)	(0.14)
Oil rents-to-GDP * Corruption	8.607***					
	(2.92)					
Oil rents * Lack of Rule of law		5.611				
		(1.64)				
Oil rents * Lack of Regulatory quality			3.991			
			(1.15)			
Oil rents * Gov. ineffectiveness				7.343***		
				(3.06)		
Oil rents * Political stability					3.539	
					(1.64)	
Oil rents * Lack of Voice&Account.						0.225
						(0.12)
Corruption (initial values)	-6.398					
	(0.40)					
Rule of law (initial values)		-33.232*				
		(1.96)				
Regulatory quality (initial values)			-34.835**			
			(2.20)			
Government effectiveness (initial values)				-20.996		
				(1.04)		
Political stability (initial values)					-28.278***	
					(2.93)	
Voice&Accountability (initial values)						-32.417***
						(3.23)
GDP growth	-1.360	-1.473	-0.999	-1.124	-0.942	-0.919
	(1.01)	(1.17)	(0.80)	(0.84)	(0.81)	(0.81)
GDP growth volatility	0.333	0.414	0.547	0.541	0.404	0.259
	(0.43)	(0.56)	(0.73)	(0.75)	(0.55)	(0.36)
Initial income per capita (log)	-0.397	-3.372	-2.552	-1.791	-2.767	-3.032
	(0.17)	(1.47)	(1.21)	(0.69)	(1.31)	(1.51)
Trade openness	0.058	0.050	0.046	0.049	0.002	0.052
	(1.05)	(0.92)	(0.86)	(0.92)	(0.03)	(0.96)
FDI-to-GDP	-0.701	-0.459	-0.421	-0.539	-0.311	-0.488
	(1.41)	(1.09)	(1.02)	(1.25)	(0.73)	(1.24)
Government consumption	-0.352	-0.459	-0.266	-0.356	-0.310	-0.362
	(1.08)	(1.47)	(0.97)	(1.12)	(1.21)	(1.31)
Private sector credit-to-GDP	-0.048	-0.081	-0.093	-0.047	-0.038	-0.102
	(0.50)	(0.77)	(0.94)	(0.48)	(0.38)	(1.04)
Registering property costs	0.092	0.107**	0.102*	0.108**	0.088*	0.081
	(1.59)	(2.19)	(1.97)	(2.06)	(1.76)	(1.64)
Protection of investors	0.123	0.018	-0.020	0.060	0.005	-0.021
	(0.94)	(0.14)	(0.14)	(0.41)	(0.04)	(0.17)
Intercept	32.910	72.156**	59.925**	48.499	60.408**	66.251***
	(1.14)	(2.42)	(2.31)	(1.39)	(2.55)	(2.77)
N	69	69	69	69	69	69
R^2	0.292	0.304	0.295	0.297	0.324	0.343
Joint significance of oil rents coefficients: p-value	0.017			0.013		
Governance vulnerability threshold	0.709			0.541		
Countries above the threshold	34			46		

Notes: Robust t-statistics are in parentheses. All models include the full set of regional dummies. All the original series of governance drawn from the WGI dataset have been reverted so that high values refer to bad governance quality. Governance measures are ranged between 0 and 1. Absolute *t* statistics are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Conditional effect of oil rents on the allocation of talents according to the *initial* levels of several dimensions of governance quality: Testing an alternative dependent variable. OLS with regional dummies

	Proportion of law over law and engineering students					
	(1)	(2)	(3)	(4)	(5)	(6)
Oil rents-to-GDP	-4.883***	-3.335*	-2.372	-3.378***	-1.121	-0.766
	(2.75)	(1.95)	(1.64)	(3.36)	(1.45)	(0.68)
Oil rents-to-GDP * Corruption	6.801***					
	(2.83)					
Oil rents * Lack of Rule of law		5.210**				
		(2.10)				
Oil rents * Lack of Regulatory quality			4.808*			
			(1.77)			
Oil rents * Gov. ineffectiveness				6.052***		
				(3.51)		
Oil rents * Political stability					2.335	
					(1.64)	
Oil rents * Lack of Voice&Account.						1.364
						(0.84)
Corruption (initial values)	-2.078					
	(0.16)					
Rule of law (initial values)		-16.966				
		(1.20)				
Regulatory quality (initial values)			-15.448			
			(1.18)			
Government effectiveness (initial values)				-3.892		
				(0.25)		
Political stability (initial values)					-9.628	
					(1.34)	
Voice&Accountability (initial values)						-15.654*
						(1.98)
GDP growth	-0.108	-0.135	0.048	0.210	0.389	0.224
	(0.14)	(0.19)	(0.06)	(0.27)	(0.50)	(0.31)
GDP growth volatility	0.815	0.858	0.855	0.846	0.786	0.748
	(1.33)	(1.40)	(1.34)	(1.31)	(1.23)	(1.24)
Initial income per capita (log)	-0.110	-1.886	-1.195	-0.093	-0.980	-1.559
	(0.06)	(1.01)	(0.67)	(0.04)	(0.56)	(0.94)
Trade openness	0.053	0.045	0.038	0.046	0.023	0.040
	(1.19)	(0.99)	(0.87)	(1.04)	(0.49)	(0.82)
FDI-to-GDP	-0.294	-0.119	-0.083	-0.172	0.024	-0.082
	(0.71)	(0.33)	(0.23)	(0.48)	(0.06)	(0.22)
Government consumption	0.053	-0.005	0.096	0.074	0.087	0.069
	(0.20)	(0.02)	(0.39)	(0.28)	(0.35)	(0.27)
Private sector credit-to-GDP	-0.058	-0.064	-0.077	-0.038	-0.040	-0.086
	(0.76)	(0.76)	(0.97)	(0.49)	(0.49)	(1.05)
Registering property costs	0.100**	0.108***	0.107***	0.108**	0.102**	0.097**
	(2.42)	(2.76)	(2.71)	(2.60)	(2.64)	(2.54)
Protection of investors	0.084	0.006	0.016	0.059	-0.016	-0.008
	(0.97)	(0.07)	(0.17)	(0.65)	(0.17)	(0.09)
Intercept	64.714***	88.108***	78.729***	63.848**	73.988***	82.719***
	(3.09)	(4.08)	(3.94)	(2.60)	(4.26)	(4.97)
N	69	69	69	69	69	69
R^2	0.463	0.456	0.446	0.467	0.428	0.446
Joint significance of oil rents coefficients: p-value	0.019	0.051	0.141	0.004	0.223	0.434
Governance vulnerability threshold	0.718	0.640		0.558		
Countries above the threshold	27	46		43		

Notes: Robust t-statistics are in parentheses. All models include the full set of regional dummies. All the original series of governance drawn from the WGI dataset have been reverted so that high values refer to bad governance quality. Governance measures are ranged between 0 and 1. Absolute *t* statistics are in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.6. Correlation or Causality?

The relationship between oil and the proportion of talents in law is positive when the quality of institution is high but negative when it is poor. In this section, we discuss the potential endogeneity issues and whether we can infer from the results that the quality of governance shifts the impact of oil on the allocation of talents because it affects the possibility of rent-seeking.

The allocation of talents in the economy may affect the oil resources or the quality of institutions and bias the results. However, the talents in question are in university and have not yet contributed to the economy, which greatly reduces the risk of inverse causality, in particular in regressions using the initial quality of institutions. The possibility remains that the allocation of talents at a given date is positively correlated with the prior allocation of talents, which itself influenced institutions and oil revenues[14]. This type of endogeneity is relatively well addressed with the GMM, which instruments variables suspected of endogeneity by their lagged values. The results presented in section 5.1 show the robustness of our conclusions when using fixed effects and GMM.

Institutions are known for being prone to measurement errors, given the fuzziness of the concept and the subjectivity of any attempt to measure it. The conclusions of this paper are robust to the use of different measures of institution. Measurement error is not a primary source of concern, as it would only cause an attenuation bias and lead to the conclusion that a more accurate measure of the quality of institutions would show a more consequent shift of the impact of oil on the allocation of talents. Because institutions are a broad concept, we examine the impact of different components of the WGI and find quite intuitive results about which institutions most affect the impact of oil resources on the allocation of talents.

Alternatively, the observed correlation could simply reflect the fact that institutions are positively correlated with country characteristics that affects the impact of oil on the allocation of talents. In order to reduce the risk of omitted variable bias, we controlled for the variables identified by the literature as the main determinants of the allocation of talents and included regional dummies. Our theoretical framework raised the GDP as a potential omitted variable, because the "technological effect" of the oil resource on the allocation of talents can

[14] Additional arguments limit the concern of endogeneity. Oil revenues tend to be determined by natural resources much more than the local availability of engineers. Furthermore, this phenomenon would explain our results only if the presence of engineers would have an impact on oil resources that is conditional on the quality of institution. Alternatively, the same results could appear if the presence of lawyers had an impact on institutions that becomes more positive in the presence of oil resources. However, there is no basis for these alternative explanations.

vary with the country's level of economic development. The robustness check in section 5.3 rules out this concern. Also, to better address the omitted variable bias that may affect the estimation of the key parameters of interest, this paper goes beyond cross-sectional estimates by estimating a static and dynamic panel data analysis of the baseline model. The use of fixed effects reduces the risk of unobserved heterogeneity, while the GMM system uses the lag of the variables suspected of endogeneity to instrument these variables, which reduces this potential bias. Section 5.1 discusses in more detail the advantages of these strategies and shows results that confirm our main findings.[15]

We have chosen not to instrument the quality of institutions with the variables used in the literature because of skepticism toward what they capture. For example, Albouy (2012) shows that the most commonly used instrument in the literature (that of Acemoglu et al., 2001) is not robust once the mistakes in the mortality rates of colons are corrected, leading to unreliable instrumental variable estimates. As is often the case in macro-economic regressions, the risk of endogeneity cannot be fully ruled out, yet this paper attempts to provide a reliable estimate of the impact of oil resources and the quality of institutions on the allocation of talents. Despite the fact that each specification has its weaknesses, the combined results provide strong evidence that when the quality of institution is low, the oil resource increases the orientation of talents toward activities with better access to rent.

5. Robustness checks and endogeneity issues

5.1. Panel data estimates

We take advantage of a panel data structure to check the robustness of our previous results. Because cross-sectional estimates – with one observation per country – are likely to suffer from omitted variable bias, we use a panel data specification, which controls for the unobservable heterogeneity either through country fixed effects or controlling for path dependence (with the GMM). Controlling for country fixed effects reduces the bias due to

[15] In the dynamic panel data version of the baseline model, we take advantage of the methodology used by Blundell and Bond (1998) by instrumenting institutional variables using internal instruments (see Yang, 2008, on the use of dynamic panel GMM techniques to investigate the relationship between democracy and aggregate volatility).

unobserved factors in the relationship between oil rents, institutions, and the allocation of talents.[16] However, because of the small within country variation both in the dependent variable and in the governance measures, country fixed effects are likely to absorb a large share of the model's variance, leading to less precise estimates.

Two types of panel data specifications are considered. The first specification includes a fixed effect for each country (u_i) and year (n_t):

$$G_{i,t} = \left(\theta_1 + \theta_2\, INST\, VUL_{i,t}\right) OIL_{i,t} + \sigma\, INST\, VUL_{i,t} + X'_{i,t}\beta + u_i + n_t + \varepsilon_{i,t} \qquad (10)$$

The second specification is a dynamic panel model which controls for the lagged value of the dependent variable:

$$G_{i,t} = \rho G_{i,t-1} + \left(\theta_3 + \theta_4\, INST\, VUL_{i,t}\right) OIL_{i,t} + \sigma_1\, INST\, VUL_{i,t} + X'_{i,t}\beta + u_i + \varepsilon_{i,t} \qquad (11)$$

This method has many advantages. First, it is likely that a country's allocation of talents strongly depends upon the composition observed in the past period. This can be explained by the fact that changes in this variable take time, as a large part of the observed allocation of talents is affected by structural factors (e.g., infrastructure, institutions, globalization). Therefore, neglecting such path dependence may induce biased estimates and misspecification of the model.

Second, resorting to estimators designed to estimate a dynamic panel data model takes advantage of the lag structure to instrument the explanatory variables suspected of endogeneity (such as the institution variables), including the lagged dependent variable (see Blundell and Bond, 1998; Windmeijer, 2005).[17]

[16] This bias was partially reduced in the cross-sectional estimates through the inclusion of regional dummies; however, heterogeneity within regions was not controlled for.

[17] The OLS estimator is inconsistent since the lagged dependent variable is introduced in addition to country fixed effects. The system-Generalized Method of Moments (GMM) estimator must be implemented. The equations in levels and the equations in first differences are combined in a system and estimated with an

Panel data estimates are presented in Tables 6 and 7. The results are qualitatively similar to those obtained from the cross-sectional estimates. Note that the number of countries has dropped from 69 in the OLS regression to 63 in the FE regression and to only 41 countries in the GMM regression. The risk of an increasing selection bias as we use specifications that require more rounds of data has guided our choice to use the OLS regressions as the main results, and the panel data estimates as robustness checks.

After the introduction of fixed effects in table 6, the results still point to the existence of an effect of oil rents on the allocation of talents that is conditional on the quality of institutions. The effect of oil resources on the allocation of talents varies significantly depending on the governance vulnerability when the latter is proxied by the degree of rule of law, regulatory quality, government effectiveness, and also when all six indicators are combined into a single index through the principal component analysis. The fact that these results are observed using only the within country variation indicates that, for a given country, when an oil resource boom occurs, the talents tend to go toward rent-seeking careers only when the county has weak institutions. The fact that this effect is observed within a short period of time after a resource boom indicates the need for policy intervention during this period in order to limit the inefficient allocation of talents resulting from the combination of high resources and weak institutions.

Table 7 presents the results of the dynamic panel specification where the institutional variables as well as their interaction terms are instrumented. The results observed in this table are in line with those of our main specification and confirm that the effect of oil rent on the allocation of talents is conditional on the quality of institutions.

Table 6. Oil rents, governance, and the allocation of talents: Panel data estimates (Fixed Effect Regressions).

	Corruption	Rule of law	Regulatory qual.	Government effec.	Political stability	Voice and Acc.	Aggregate index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Oil rents-to-GDP	-2.506	-4.861**	-4.784***	-4.279***	-0.307	0.301	-5.638**
	(1.13)	(2.25)	(3.23)	(3.09)	(0.28)	(0.25)	(2.27)

extended system-GMM estimator which allows for the use of lagged differences and lagged levels of the explanatory variables as instruments (Blundell and Bond, 1998). This paper uses the two-step system-GMM estimator developed by Blundell and Bond (1998) for dynamic panel data with the Windmeijer (2005) correction for finite sample bias. To deal with the well-known problem of instrument proliferation raised by the system GMM estimator (Roodman, 2009), the matrix of instruments is collapsed and the number of lags is limited at a maximum of 2 and year dummies are not included.

Oil rents-to-GDP * Governance	3.076	6.825**	7.457***	7.042***	-1.100	-1.384	8.228**
	(0.90)	(2.02)	(3.02)	(2.89)	(0.39)	(0.85)	(2.05)
Governance vulnerability index	3.113	-6.295	-24.137***	-18.565**	-3.118	1.881	-12.842
	(0.42)	(0.74)	(2.84)	(2.22)	(0.57)	(0.25)	(1.27)
Nb. of observations	266	266	266	266	266	266	266
Nb. of countries	63	63	63	63	63	63	63
Joint significance of oil rents coefficients:							
p-value	0.382	0.068	0.006	0.010	0.438	0.362	0.060
Governance threshold		0.712	0.642	0.608			0.685
Percentage of Obs. above the threshold		31.579	29.323	37.970			34.211
R2	0.227	0.238	0.275	0.265	0.223	0.224	0.241

Note: The dependent variable is the allocation of talents in each country. The allocation of talents is defined as the enrolment in law, business and social sciences, minus the enrolment in engineering, manufacturing, and construction, and is expressed as a percentage of the total enrolment in tertiary education. All the original series of governance drawn from the WGI dataset have been reverted so that high values refer to bad governance quality and are comprised between 0 and 1. The aggregate governance vulnerability used here is the aggregation of the WGI indices using principal component analysis. All specifications include a full set of control variables except the World Bank Doing Business Indicators in order to maximize the panel sample size. *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Oil rents, governance, and the allocation of talents: Dynamic Panel data estimates (System-GMM estimates *a la* Blundell and Bond, 1998).

	Corruption	Rule of law	Regulatory qual.	Government effec.	Political stability	Voice and Acc.	Aggregate index
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Oil rents-to-GDP	-4.239**	-3.200**	-1.722	-0.914	0.037	0.153	-2.260**
	(2.33)	(2.08)	(1.51)	(1.06)	(0.01)	(0.15)	(2.23)
Oil rents-to-GDP*Governance	6.562**	4.988**	2.854	1.307	0.061	-0.375	3.382**
	(2.29)	(2.01)	(1.64)	(0.74)	(0.01)	(0.27)	(2.14)
Governance vulnerability index	-7.181	-11.591	-11.112	5.576	-5.302	3.397	-7.337
	(0.47)	(0.80)	(0.83)	(0.26)	(0.59)	(0.25)	(0.63)
Allocation of talents (t-1)	0.605***	0.641***	0.627***	0.777***	0.745***	0.669***	0.648***
	(3.43)	(4.42)	(3.05)	(3.42)	(3.14)	(3.59)	(3.92)
Nb. of observations	181	181	181	181	181	181	181
Nb. of countries	41	41	41	41	41	41	41
Joint significance of oil rents coefficients:							
p-value	0.061	0.095	0.231	0.243	0.938	0.837	0.081
Governance threshold	0.646	0.642					0.668
Percentage of Obs. above the threshold	46.409	41.436					33.149
m1:p-value	0.038	0.033	0.051	0.049	0.033	0.033	0.042
m2: p-value	0.429	0.420	0.471	0.476	0.426	0.472	0.459
Hansen OID: p-value	0.585	0.620	0.231	0.166	0.328	0.302	0.302
Nb. of instruments	20	20	20	20	20	20	20

Note: The dependent variable is the allocation of talents in each country. The allocation of talents is defined as the enrolment in law, business and social sciences, minus the enrolment in engineering, manufacturing and construction, and is expressed as a percentage of the total enrolment in tertiary education. All the original series of governance drawn from the WGI dataset have been reverted so that high values refer to bad governance quality and are comprised between 0 and 1. The aggregate governance vulnerability used here is the aggregation of the WGI indices using principal component analysis. All specifications include a full set of control variables except the World Bank Doing Business Indicators to maximize the panel sample size. The estimator is the two-step System-GMM method with the Windmeijer (2005) finite sample correction. Oil rents, governance variables, oil rents crossed with governance indicators, GDP per capita, and economic growth are treated as endogenous. The lagged value of the dependent variable, macroeconomic volatility, and financial development are treated as predetermined and the remaining controls are taken as strictly exogenous. The matrix of instruments is always collapsed to reduce the over-fitting bias generated by a potential proliferation of instruments. *** p<0.01, ** p<0.05, * p<0.1.

5.2. The use of other indicators of corruption

Due to their subjectivity, institutional variables are often subject to measurement errors (Acemoglu et al., 2001). The use of various governance variables in the previous section provides an initial indication of the robustness of our findings. As an additional robustness check, we reiterate the analysis with alternative databases. For this evaluation, we replace the data from WGI with data from Transparency International and ICRG on corruption in order to investigate whether taking other sources of data corruption will amend our results.[18] Corruption indicators are emphasized because our theoretical approach stresses rent grabbing over other institutional vulnerabilities. Table 8 presents the results using the new measures of corruption. Independent of the choice of the corruption variable, the results corroborate those obtained in the previous section.

[18] Again, the governance variables are rescaled to be between 0 and 1, with higher values indicating a bad level of governance quality. Countries' specific initial values (as of the year 2000) of the ICRG corruption indicator are used. Initial values for the Transparency International corruption indicator led to a reduction in the sample size, so each country's specific averages were used.

Table 8. Testing alternative variables of corruption. OLS with regional dummies.

Dependent variable:	**Difference between law & engineering**		**Proportion of the enrolment in law**	
	(1)	(2)	(3)	(4)
Oil rent-to-GDP	-5.760***	-0.902***	-4.958***	-0.496**
	(-3.715)	(-4.004)	(-3.421)	(-2.605)
Oil rents * Corruption (*TI*)	6.879***		5.826***	
	(3.641)		(3.512)	
Oil rents * Corruption (*ICRG*)		0.477***		0.221**
		(3.276)		(2.023)
Corruption (*TI*)	-2.781		4.354	
	(-0.209)		(0.451)	
Corruption (*ICRG*)		-3.092		-1.230
		(-1.160)		(-0.690)
Real GDP per capita growth	-1.066	-1.720	-0.108	0.234
	(-0.880)	(-1.640)	(-0.156)	(0.287)
Initial real GDP per capita	0.401	-0.500	0.113	-0.307
	(0.191)	(-0.239)	(0.0677)	(-0.193)
Trade openness	0.0557	-0.0298	0.0257	-0.0536
	(1.148)	(-0.661)	(0.628)	(-1.047)
Foreign direct investment-to-GDP	-0.461*	-0.130	-0.0283	0.110
	(-1.869)	(-0.581)	(-0.124)	(0.521)
Government consumption-to-GDP	-0.220	0.451	0.105	0.230
	(-0.783)	(1.660)	(0.451)	(1.027)
Private credit-to-GDP	-0.0539	-0.0204	-0.0269	-0.0168
	(-0.741)	(-0.221)	(-0.439)	(-0.207)
Registering property cost	0.104**	0.0901**	0.128***	0.112***
	(2.475)	(2.201)	(4.629)	(3.963)
Protection of investors index	0.102	-0.0233	0.116	0.0295
	(0.960)	(-0.166)	(1.540)	(0.288)
Constant	23.54	37.73*	60.04***	73.12***
	(0.819)	(1.779)	(3.167)	(4.349)
Observations	69	57	69	57
R-squared	0.272	0.371	0.425	0.482

Robust t-statistics are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. (*TI*) Transparency International corruption measure and (*ICRG*) International Country Risk Guide are alternative corruption measures.

5.3. Is the technological effect conditional on the level of economic development?

A potential weakness of the analysis is that the "technological effect" can be conditional on the level of economic development. For example, the ability of a country to train and involve its own engineers in the extraction of resources can vary among countries with different levels of development. Given that institutions are correlated with the level of development, the difference in the impact of oil on the allocation of talents among countries with bad versus good institutions could be due to heterogeneity in the technological effect rather than a grabbing effect. It would thus reflect a difference in the impact of oil among countries with different levels of wealth. In this case, the endogeneity bias is due to the omission of the control variable "Oil rents-to-GDP * log of Initial GDP" (OIL *GDP for conciseness). Hence, Table 9 introduces this variable (per capita). When introduced without OIL * INST VULN, the coefficient in front of OIL*GDP is non-significant and even negative (column 1 and 2), which shows that the impact of oil on the allocation of talents does not vary with wealth. Further, when OIL*GDP is introduced with OIL * INST VULN, then OIL*GDP is shown to have no significant impact on the allocation of talents, and OIL * INST VULN maintains an impact of about the same magnitude and size (column 3 and 4). This confirms that the results were not driven by an omitted variable bias, due to heterogeneity of impact of oil on rents with respect to wealth rather than the quality of institutions.

Table 9: Robustness check: Controlling for the non-linearity with the level of economic development.

	(1) Difference between law & engineering	(2) Proportion of the enrolment in law	(3) Difference between law & engineering	(4) Proportion of the enrolment in law
Oil rents-to-GDP	2.442	2.441	-3.742	-2.816
	(0.85)	(1.13)	(0.90)	(0.86)
Oil rents-to-GDP * Initial GDP per capita (log)	-0.323	-0.344	0.109	-0.020
	(0.76)	(1.07)	(0.24)	(0.05)
Oil rents-to-GDP * Initial governance Vuln.			5.485*	5.084**
			(1.97)	(2.21)
Initial governance Vulnerability	-29.173*	-12.349	-31.514*	-12.250
	(1.85)	(1.13)	(1.92)	(0.91)
GDP growth	-1.014	-0.170	-1.071	0.021
	(0.89)	(0.22)	(0.95)	(0.03)
GDP growth volatility	0.360	0.596	0.468	0.856
	(0.52)	(1.09)	(0.68)	(1.35)
Initial income per capita (log)	-2.154	-1.686	-2.683	-1.294
	(0.93)	(0.91)	(1.13)	(0.65)
Trade openness	0.030	0.008	0.039	0.039
	(0.59)	(0.17)	(0.78)	(0.88)
FDI-to-GDP	-0.236	0.011	-0.341	-0.124
	(0.56)	(0.03)	(0.83)	(0.32)
Government consumption	-0.241	0.091	-0.301	0.050
	(0.90)	(0.38)	(1.10)	(0.19)
Private sector credit-to-GDP	-0.120	-0.065	-0.081	-0.058
	(1.35)	(0.88)	(0.93)	(0.69)
Registering property costs	0.100**	0.122***	0.097**	0.105**
	(2.57)	(4.36)	(2.49)	(2.61)
Protection of investors	-0.010	0.035	-0.024	0.020
	(0.08)	(0.36)	(0.20)	(0.20)
Intercept	58.477**	85.156***	63.742**	79.255***
	(2.01)	(4.37)	(2.14)	(3.62)
N	69	69	69	69
R2	0.272	0.387	0.299	0.454
Joint significance of oil rents coefficients: p-value			0.109	0.059

Notes: Robust t-statistics are in parentheses. All models include the full set of regional dummies. All original series of governance drawn from the WGI dataset have been reverted so that high values refer to bad governance quality. The governance vulnerability used here is the aggregation of the WGI indices using the principal component analysis. The composite index is ranged between 0 and 1. *** p<0.01, ** p<0.05, * p<0.1

5.4. Results from simultaneous regressions

Because students must make a simultaneous decision between the two sectors (law and engineering), the models describing the dynamics of these two sectors can be linked via the correlation between the two error terms of the equations. In this context, the SURE method allows us to take this feature into account and provides estimates of the system of the two equations.[19] As can be seen in Table 10, the two dependent variables are the enrolment in law (column 1) and enrolment in engineering (column 2). The enrolment ratio in law is defined as enrolment in law, business, and social sciences as a percentage of the total enrolment in tertiary education. The proportion of enrolment in engineering is defined as the enrolment in

[19] Regional dummies are included in each equation of the SURE model to control for the unobserved regional characteristics which can determine the allocation of talents.

engineering, manufacturing, and construction as a percentage of the total enrolment in tertiary education. The results show that the combination of oil and corruption generates both an increase in the enrolment in law and a reduction in the enrolment in engineering. In other words, resource rich countries that suffer from governance problems train more lawyers and fewer engineers than those with good governance.

Table 10. Results from simultaneous equations.

Estimation method :	SURE	
Dependent variable:	Enrolment in Law	Enrolment in Engineering
	(1)	(2)
Oil rent-to-GDP	-3.170**	1.875*
	(-2.014)	(1.705)
Oil rents * Corruption	4.363**	-2.489*
	(2.021)	(-1.662)
Corruption	14.52	9.404
	(1.546)	(1.511)
Real GDP per capita growth	-2.049**	-1.248**
	(-2.349)	(-2.195)
Initial real GDP per capita	1.984	-0.242
	(0.985)	(-0.186)
Trade openness		0.00240
		(0.103)
Foreign direct investment-to-GDP		0.552*
		(1.840)
Government consumption-to-GDP	-0.597*	
	(-1.660)	
Private credit-to-GDP		0.0256
		(0.619)
Registering property cost		-0.0522**
		(-2.147)
Protection of investors index		-0.00228
		(-0.0333)
Electricity distribution losses		-0.309***
		(-2.653)
Constant	37.72*	18.69
	(1.831)	(1.503)
Observations	50	50
R-squared	0.305	0.529

Robust t-statistics are in parentheses. Regional dummies are included in each equation. *** p<0.01, ** p<0.05, * p<0.1.

6. Conclusion

This paper provides an empirical analysis of the interaction between oil rents, governance, and the allocation of talents in developing countries. It investigates the determinants of occupational choices in a population of students in law, business, and social sciences and students in engineering, manufacturing, and construction, and finds that the impact of oil revenues on the allocation of talent varies with the quality of the governance. While oil rents tend to orient talents toward engineering degrees in countries with better institutions, they tend to orient talents toward law degrees in countries with poor institutions. The empirical strategy uses countries with good governance as a benchmark that is informative of the optimal allocation in the absence of corruption. This approach is informative of what we call the technological effect, which emphasizes the optimal reallocation of talents in the economy that results from an increase in oil. The regressions show that this effect is positive; hence, when used properly, oil tends to increase the need for engineers, either directly, in oil production, or indirectly, in the sectors and investments that are stimulated by the injection of capital in the economy. The latter effect includes any macro-economic change caused by a change in relative prices, such as Dutch disease.

The fact that oil has a different impact on the allocation of talents when institutions are poor is a source of concern, because it indicates an excess of talents who enroll in activities that tend to have a greater access to the resource rent. As explained in the theoretical model, because of the complementarity between the different professions, this misallocation will be a source of inefficiency due to the gap that it generates between the marginal productivity of the lawyers and that of the engineers. Combining these results with those of Murphy et al. (1991), who find that engineers better contribute to long term growth than lawyers, provides a rationale for a resource curse that occurs through a misallocation of talents in the presence of resources and institutions that are unable to prevent rent grabbing.

As shown in the simple theoretical model, the impact of a natural resource on the choice of activity depends on its complementarity with each activity. Because this complementarity can vary with the type of natural resource, it is logical to first limit the analysis to oil. However, while the technological effect can vary with the type of resource, it is expected that any source of income that increases the size of the cake, including not only other natural resources but also potentially international aid, should increase the orientation

toward professions with better access to rent when institutions are weak. It is a natural extension of this work to investigate whether the conclusions of this paper can be generalized to all types of resources or whether they are specific to oil.

The results are robust to the use of cross-sectional data as well as panel data. This shows that an increase in oil resources quickly translates into an orientation of the talents toward rent grabbing activities, and thus, that a policy response should occur in the period following the oil boom, to prevent an inefficient misallocation of talents.

This paper helps construct a better understanding of the underlying mechanism of the resource curse and can contribute to the design of policies that assist nations in using natural resources to better contribute to long-term growth. The results indicate that governments with natural resources must pay particular attention to the specialization of their talents. They need to preserve a reasonable share of talents in engineering and other specializations that contribute to growth but do not give much access to rent. In the short run, this aim can be attained through the creation of scholarships funded by the rent, as allocating a larger share of the rent to research, construction, and long-term investments will increase the return to engineering professions. The government needs to ensure that the remuneration is meritocratic and is in line with the expected productivity of the talents. In the long run, the governments must tackle the root of the issue by suppressing the possibilities for any profession to legally or illegally grab resource rents.

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APPENDICES

Appendix A. Governance Indicators and Principal Component Analysis.

Definition of the 6 Governance Indicators

- *Voice and Accountability* – measuring the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and free media.

- *Political Stability and Absence of Violence* – measuring perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including political violence or terrorism.

- *Government Effectiveness* – measuring the quality of public services; the quality of the civil service and the degree of its independence from political pressures; the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

- *Regulatory quality* – measuring the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.

- *Rule of law* – measuring the extent to which law enforcement agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police and courts, as well as the likelihood of crime and violence.

- *Control of corruption* – measuring the extent to which public power is exercised for private gain (including both petty and grand forms of corruption), as well as "capture" of the state by elites and private interests.

Table A1: Aggregating governance variables: principal components analysis (first eigenvector, correlation)

Variables	Governance quality, Composite index
Control of corruption	0.425
	(0.937)
Rule of law	0.434
	(0.956)
Regulatory quality	0.406
	(0.893)
Government effectiveness	0.425
	(0.935)
Political stability	0.374
	(0.823)
Voice and Accountability	0.381
	(0.840)
Eigenvalue	4.85
Variance proportion	81%

Note: We report the first eigenvector resulting from the first principal component analysis of governance quality. The aggregate index of governance is obtained using the following formula: Inst = 0.425*K1 + 0.434*K2 + 0.406*K3 + 0.425*K4 + 0.374*K5 + 0.381*K6, where K1, K2, K3, K4, K5, and K6 represent *standardized* measures of Control of corruption, Rule of law, Regulatory quality, Government effectiveness, Political stability, and Political stability, respectively. In addition, the numbers in parentheses (below the different eigenvectors) represent the correlation of the first principal component with the corresponding governance variable. The governance quality variables have been rescaled so that high values indicate high level of bad governance.

Source: Authors' calculations using UNESCO Statistical Yearbooks, World Development Indicators, and World Governance Indicators

Appendix B. Descriptive statistics and list of countries

Table B1 : Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Difference between enrolments in law and engineering as a percentage of total enrolment in the tertiary education	82	25.532	12.867	-2.259	55.991
Enrolment in law as a percentage of enrolments in law and engineering	82	77.723	12.541	47.094	99.531
Enrolment in law as a percentage of total enrolment in the tertiary education	86	35.876	11.099	5.149	58.148
Enrolment in engineering as a percentage of total enrolment in the tertiary education	82	10.719	6.931	0.139	30.175
Oil rent-to-GDP ratio	132	5.891	14.321	0	90.784
Aggregated governance index	134	0.497	0.186	0	1
Corruption	134	0.605	0.189	0	1
Rule of law	134	0.502	0.188	0	1
Regulatory quality	134	0.489	0.179	0	1
Government effectiveness	134	0.503	0.181	0	1
Political stability	134	0.434	0.221	0	1
Voice and Accountability	134	0.473	0.245	0	1
Corruption (Transparency International)	132	0.714	0.188	0	1
Corruption (ICRG measure)	95	0.498	0.162	0	1
GDP growth	135	4.606	2.804	-5.643	15.905
log GDP per capita	132	6.888	1.121	4.439	8.948
Trade openness	130	84.183	37.058	0.670	200.456
FDI-to-GDP ratio	129	5.037	4.822	-6.599	25.736
Government sonsumption-to-GDP ratio	126	15.116	6.008	5.210	40.227
Private credit-to-GDP ratio	130	30.330	25.861	1.956	138.021
Registering property cost as a percentage of property value	115	7.068	5.778	0.067	28.933
Strength of investor protection index (0-10)	118	4.707	1.337	0.7	8.7
Electric power transmission and distribution losses (% of output)	89	19.238	15.765	3.492	114.423

Source: Authors' calculations using UNESCO Statistical Yearbooks, World Development Indicators, and World Governance Indicators

Table B2 : List of countries (69)

Albania	Kyrgyz Rep.
Algeria	Lao PDR
Argentina	Latvia
Armenia	Lebanon
Azerbaijan	Lesotho
Bangladesh	Liberia
Belarus	Lithuania
Belize	Madagascar
Bolivia	Malaysia
Brazil	Mali
Bulgaria	Mexico
Burkina Faso	Mongolia
Burundi	Morocco
Cambodia	Mozambique
Cameroon	Namibia
Cape Verde	Nepal
Central African Rep.	Niger
Chile	Pakistan
Colombia	Panama
Costa Rica	Philippines
Croatia	Poland
Djibouti	Romania
Ecuador	Sierra Leone
El Salvador	Suriname
Ethiopia	Swaziland
Georgia	Tajikistan
Ghana	Tanzania
Grenada	Thailand
Guatemala	Tunisia
Guinea	Turkey
Guyana	Uganda
Honduras	Ukraine
Indonesia	Uruguay
Jordan	Vietnam
Kenya	