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Oil, governance and the (mis)allocation of talent in developing countries

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ABSTRACT

This paper sheds light on the relationship between oil rent and the allocation of talent, toward rent-seeking versus more productive activities, conditional on the quality of institutions. Using a sample of 69 developing countries, we demonstrate that oil resources orient university students toward specializations that provide better future access to rents when institutions are weak. The results are robust to various specifications, datasets on governance quality and estimation methods. Oil affects the demand for each profession through a technological effect, indicating complementarity between oil and engineering, manufacturing and construction; however, 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 rents (law, business, and the social sciences), rather than careers in engineering, creating a deviation from the optimal allocation between the two types of specialization.

1. Introduction

The seminal work of Sachs and Warner (1995) indicated a negative correlation between the dependency on natural resources and the level of economic growth, which the authors attributed to the Dutch disease phenomenon.[1] Since the publication of their work, several studies have examined the resource curse hypothesis with mixed results. Some findings support the resource curse hypothesis. It has been demonstrated that resource-rich countries are less democratic (Ross, 2001; Tsui, 2010), are more vulnerable to economic shocks (Hausmann and Rigobon, 2003), more prone to armed conflict (Collier and Hoeffler, 2000), and with low human capital (Gylfason, 2001). However, other studies have provided evidence against the existence of the resource curse. For example, it has been demonstrated that an abundance of oil can have a positive effect on growth (Alexseev and Conrad, 2009), that it does not necessarily affect the occurrence of armed conflict (Cotet and Tsui, 2013), and that it increases the accumulation of human capital (Stijns, 2006). Torvik (2009) argues that while these diverse results contribute to the debate, the key factor is not the average performance of a group of countries per se but that certain countries producing the same natural resource succeed while others fail. Explaining this occurrence requires new insights into the mechanisms through which natural resources harm or foster social and economic outcomes.

Murphy et al. (1991) indicate that the composition of education is critical for long-term growth and economic development. The authors 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 affect growth, while a greater number of law majors tend to reduce economic growth. However, Murphy et al. (1991) do not empirically identify the determinants of the allocation of talent, and none of the aforementioned studies investigates the impact of natural resources on the composition of education.

Our work builds upon Mehlum et al. (2006), who argue that the impact of natural resources on growth depends on whether institutions are "grabber friendly" or "producer friendly". In their model, entrepreneurs are divided between producers and grabbers, 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

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[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 that harms the rest of the economy.

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their institutions. Our paper takes the empirical evidence one step further by providing a more granular explanation that observes the fields of specialization of university students conditional on oil resources and institutions.

Publications on this topic typically separate talent into pure producers (or entrepreneurs) and pure grabbers (e.g., Baland and Francois, 2000; Mehlum et al., 2006; and Murphy et al., 1991). 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. For this reason, we consider a framework similar to Mehlum et al. (2006) which also allows the grabbers to contribute to production. The two types of talent are complementary in the production process, but grabbers have better access to rent than producers. As a result, the combination of natural resources and poor institutions generates an excessive supply of grabbers, which reduces their marginal productivity.

In this paper, an empirical analysis based on a sample of 69 developing countries indicates that in countries with good governance, oil rents shift the orientation of the talent from law, management, and social sciences degrees to degrees in engineering, manufacturing and construction, while the effect is reversed in countries with poor governance. These results are interpreted through a theoretical framework adapted from Mehlum et al. (2006) in a setup whereby the presence of oil rents and vulnerable institutions drives talent from producer to grabber careers, which harms the economy in the long run.

For simplification, Mehlum et al. (2006) assumed that the grabbers do not contribute at all to production. However, if some professions were exclusively dedicated to rent-seeking, tackling corruption would be an easy task. Our empirical test of whether the allocation of talent is driven by rent-seeking considers that both types of profession are productive (and complementary among them) but that one type of profession (which we will call lawyers) has greater access to resource rents than the other one (called engineers). Hence, the analysis allows for a technological effect of the resource rent: because the oil rent affects the marginal productivity of the two types of professions differently and thus its optimal allocation. Countries with good institutions provide a benchmark, indicating that in the absence of corruption, oil rents increase the proportion of engineers, but when institutions are vulnerable, the resource rent increases the proportion of lawyers, which confirms that the (mis)allocation of talent is driven by rent-seeking. The empirical analysis also indicates that an increase in natural resources results in an increase in the wages of grabbers compared to the wages of producers, indicating that part of the appropriation of the resource rent is accomplished through public administration sector wages.

The remainder of the paper is as follows. Section 2 briefly reviews the literature on the Dutch disease, rent-seeking and the allocation of talent. The cross-section econometric results are presented in Section 3 in cross-section regressions and together with an extensive set of robustness checks, including panel regression analysis and the consideration of endogeneity issues. Section 4 investigates the possibility of alternative interpretations of our baseline results. It demonstrates the short-term impact of oil discoveries on wages as additional evidence of the rent-seeking mechanism. Finally, Section 5 presents conclusions and draws policy implications.

2. Literature review

Few studies have investigated the effect of natural resources on human capital accumulation. Gylfason (2001) finds that oil-producing countries tend to have low levels of human capital investment, expressed as public expenditure on education relative to national income, expected years of schooling for girls, or gross secondary-school enrolment. The author argues that reliance on natural resources leads to the inadvertent or deliberate neglect of progress in 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. By contrast, Stijns (2006) disputes these results and finds that natural resource abundance positively affects education levels.

While the aforementioned papers discuss the relationship between natural resources and the level of human capital, they do not account for the learner type of qualification or more broadly for the composition of the attained level of human capital. Murphy et al. (1991) demonstrated that the allocation of talent matters, with engineering college majors contributing to growth significantly more than law graduates. They argue that the misallocation of talent explains the slow economic development in many African and Latin American countries and the rapid development of East Asian countries.

Baland and Francois (2000) examined 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 were to be initially low, a resource boom would further reduce it, but if it were initially high, the boom would increase it further.

Mehlum et al. (2006) examine the allocation of entrepreneurs between productive and unproductive activities, focusing on rents 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 a displacement of private agents (including entrepreneurs) from the productive sector of the economy to the rent-seeking sector. The talent will therefore make a tradeoff between using their resources for productive activities and using these resources to capture the available rent. The decision to move from one category of activity to the other depends on the profitability of each sector, which ultimately depends on the quality of the institutions in place. If institutions are of good (poor) quality, production activities are more (less) profitable than 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).

Our paper investigates the determinants of the allocation of talent 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 (Manzano and Rigobon, 2006; Ross, 2001), primarily due to the importance of oil rents (Manzano and Rigobon, 2006). Therefore, it is necessary to investigate whether the presence of such rents encourage students in tertiary education to choose specializations that lead to rent-seeking activities.

3. Empirical analysis

In this part, we describe the sample and variables used in the study. Then, we carry out an econometric analysis using cross-section and panel approaches. After this, the section presents several robustness checks that include panel data estimates, and investigates alternative explanations to our main results.

3.1. Econometric model and data description

This paper tests the hypothesis that the effect of oil resources on the allocation of talent toward rent-seeking activities increases with bad

governance. In contrast with Mehlum et al. (2006), we assume that grabbers also contribute to the production process, which affects the empirical strategy. We assume that producers are directly involved in the production process and grabbers are in charge of the allocation of resources to increase the efficiency of firms. When the governance is good, producers and grabbers are remunerated at their marginal contribution to the production process. When the governance is poor, this separation of tasks provides the grabbers with better access to the resource rents, which makes the profession more attractive to students.

We call technological effect of resource rents the change of allocation between the talents due to the impact of resource rents on the marginal productivity of the two professions. The technological effect can be measured by looking at the impact of resource rents on talent allocations among countries with non-vulnerable institutions. This provides a benchmark against which countries with more vulnerable institutions are compared to assess the rent-seeking effect. Hence to test our rent-seeking hypothesis, we investigate whether the quality of institutions significantly alters the impact of resource rents on the allocation of talents.

We draw on the earlier specification by Murphy et al. (1991), but we augment the model with the interaction term between oil and the quality of domestic institutions. More formally, the model is specified as follows:

$$G_i = \alpha OIL_i + \delta OIL_i \times INSTVUL_i + \gamma INSTVUL_i + X_i'\beta + d_j + \varepsilon_i \quad (1)$$

where ε_i is the residual term, d_j is the regional dummies, and i specifies the country. Controlling for region fixed effects reduces the influence of region-specific omitted factors (such as historical legacies, culture and climate) that affect both the amount of oil exploited and the allocation of talent.

The vector X gathers the proxies of the determinants of talent allocation as suggested by Murphy et al. (1991). This includes the level of economic development (proxied by the natural logarithm of real GDP per capita), the size of government, the degree of openness, the cost of registering property and the access to credit by the private sector. The level of real GDP per capita, the size of government, the degree of openness, and the access to credit are taken from the World Development Indicators, and the cost of registering property is taken from the World Bank's 'Doing Business' data. We control for the size of foreign direct investment inflows in each country (normalized by GDP) to ensure that the model takes into account the foreign involvement in domestic capital accumulation in each country, which is likely to affect the demand of the different types of talent. The use of GDP as one of the control variables reduces the risk that the technological effect would be conditional on the quality of institutions.

The dependent variable G_i is a proxy for the intensity of grabbers among the talent G_i is defined as enrolment in law, business, and social sciences minus enrolment in engineering, manufacturing, and construction, and it is expressed as a percentage of the total enrolment in tertiary education. The definition of talent 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.[2] As the proxy includes other professions, the argument, made by Murphy et al. (1991) and Mehlum et al. (2006), that some professions are inherently more productive than others becomes even more controversial.

This paper avoids this assumption, recognizing only that, in general, students in law, business, and social sciences can expect better access to rent than students in engineering, manufacturing, and construction, which is more defensible and can be observed in the specialization of most government positions in developing countries.[3] Useful data on the academic degrees of political leaders, drawn from Dreher et al. (2009), indicate that 69.7% of political leaders received a degree in law, business, or the social sciences, as opposed to only 5% who received them in engineering or technical science.[4]

OIL_i represents oil rent as a percentage of GDP.[5] In the literature, the most common variables used to measure resource wealth are exports of natural resources as a percentage of total exports and exports of natural resources as a percentage of GDP. Papers using either of these variables tend to confirm the hypothesis of the resource curse (Leite and Weidmann, 1999; Sachs and Warner, 1995). However, some studies using other measures, such as the level of production (Stijns, 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 effects on behaviors that are caused by resource rents 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 student incentives in tertiary education. The oil rent variable measures the instantaneous real macroeconomic contribution of resources and also directly affects households and individual payoffs. The relatively large geographical coverage of these data is important to limit possible selection bias, and the frequency of data will allow performing robustness checks through the mean of the panel data. To address potential concerns about the endogeneity of the resource rent, in Section 3.9, we estimate the effect of natural resources on the allocation of talent by replacing the oil rent variable with the amount of oil reserves from the data compiled by Cotet and Tsui (2013).

$INSTVUL_i$ is an indicator of the vulnerability of governance that is drawn from the Worldwide Governance Indicators (WGI) database of the World Bank and normalized. The WGI project has reported aggregate and individual governance indicators for 212 countries and territories since 1996.[6] Six dimensions of governance are measured: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control

[2] All the dependent variables are drawn from the database of the Statistical Yearbook of UNESCO.

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

[4] For further investigation, a country-by-country list of the members of governments can be found in https://www.cia.gov/library/publications/world-leaders-1/index.html.

[5] The calculation of oil rents is carried out at several stages (Bolt et al., 2002). In the first stage, one obtains unit rents by the difference between the international market price and the unit extraction cost. In the second stage, unit rent is multiplied by oil production; the result is oil rent. The measurement of oil rents 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 studies on the effects related to revenues drawn from natural resource exploitation (Andersen and Aslaksen, 2013; Collier and Hoeffler, 2005; Omgba, 2009).

[6] Kaufmann et al. (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 et al. (2009). "Governance Matters VIII: Aggregate and Individual Governance Indicators, 1996–2008". World Bank Policy Research Working Paper Series, 4978.

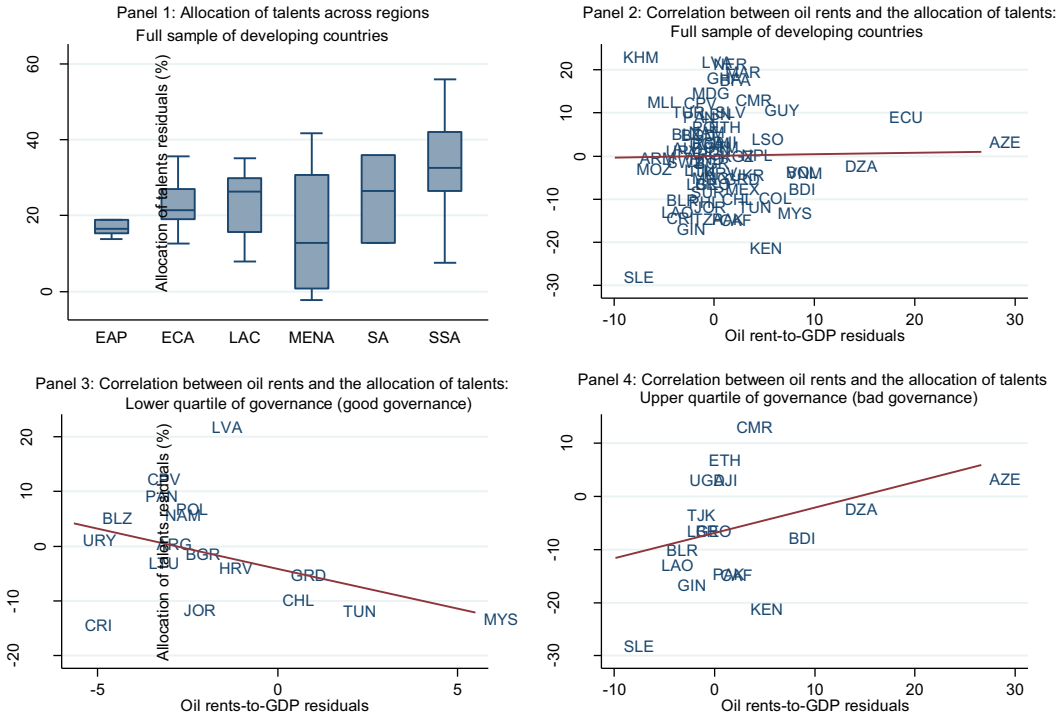

Fig. 1. Allocation of talent across regions and the relationship with oil rent conditional on governance. Notes: The allocation of the talent variable is defined as enrolment in law, business, and the social sciences minus the enrolment in engineering, manufacturing, and construction and is expressed 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 display the 25th and 75th percentiles of the samples, the line in the box indicates the respective medians, and the end-points of whiskers mark the next adjacent values. EAP: East Asia and Pacific, ECA: Europe and Central Asia, LAC: Latin America and the Caribbean, MENA: Middle East and North Africa, SA: South Asia, SSA: Sub-Saharan Africa. Panels 2, 3, and 4 plot a measure of oil rents-to-GDP on the x-axis and a measure of the allocation of talent on the y-axis. The measure of the allocation of talent and the oil rents-to-GDP ratio are residuals derived from regressions of these two variables, each of which is 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 talent and oil rents that are purged from any collinearity with the standard determinants of the allocation of talent. The governance index is the aggregation of the six indicators of governance built by Kaufmann et al. (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 a higher value indicating a bad level of governance. Brazil and Thailand are 2 outliers that have been removed from Fig. 1 but remain in all the regressions. Source: Author calculations using UNESCO Statistical Yearbooks, World Development Indicators, and World Governance Indicators.

of corruption.[7] The six indicators are defined in the appendix. Institutional quality is an important determinant of the management of revenues from the exploitation of natural resources in the resource curse literature (see, e.g., Sala-i-Martin and Subraamnian (2003); Mehlum et al. (2006)), but it is also an important element in the allocation of talent, as indicated by Murphy et al. (1991).

We first develop 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.[8] The resulting aggregated indicator of governance has been rescaled to have a 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 talent 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 have different effects on the allocation of talent.

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:

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

where $min(Inst)$ and $max(Inst)$ represent the minimum and maximum of each indicator of governance quality, respectively. This transformation ensures that $INST\ VUL_i$ $INST\ VUL_i$ will have a range

[7] 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, they capture perceptions of the government process rather than any formal aspects of the actual government structure in any given country. This creates the significant problem that perceptions are shaped not just by the government environment but also by many other aspects of the socio-economic environment, thereby creating an additional 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 Arndt and Oman (2006) (see Kurtz and Shrank, 2007). In addition, perceptions need not be significantly correlated with reality. For example, on the perception of corruption, Olken (2009) interviewed Indonesian villagers on a road project. The author found that Indonesian villagers understood that the materials used were overcharged, but they could not estimate it properly, as this requires experience and knowledge of public works. However, Banerjee et al. (2012) noted that this relative bias in the measurement is expected to be less in cross-country studies. Kaufmann et al. (2006) categorized some of the 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 et al. 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.

[8] Table A1 in the Appendix indicates that the first principal component accounts for nearly 81% of the overall variance. This table also presents the eigenvectors and the correlation between the synthetic indicator and each variable.

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

	Difference between law and 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.

between 0 and 1. Hence, $INST\ VUL_i$ increases with the deterioration of the quality of governance. Moreover, because 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 talent toward rent-seeking activities in countries with the lowest relative institution vulnerability and thus constitutes a benchmark against which other countries will be compared. Hence, α measures the technological effect described in Section 3.2: how the allocation of talent 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 on the repercussions of the increased wealth of the country, through such factors as investments and price effects. The sign of α will be positive if the oil resource is complementary with lawyers more than with engineers, 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, 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 weak.

3.2. Preliminary evidence

Fig. 1 provides a visual analysis of the relationship between oil rents, the allocation of talent and governance. Panel 1 provides the descriptive statistics per region. The lower and upper hinges of each box display the 25th and 75th percentiles of the samples, the line in the box indicates the respective medians, and the end-points of whiskers mark the next adjacent values. Panels 2, 3 and 4 plot the level of oil rents-to-GDP and G_i (the allocation of talent in law relative to engineering) using the residuals derived from regressions of these two variables, each of which is regressed on the same set of control variables as in Table 1. Panel 2 indicates no clear correlation in the full sample. By contrast, Panels 3 and 4 exhibit 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.

This evidence suggests an impact of oil rent on the allocation of talent that is conditional on the quality of institutions.

3.3. Main OLS results

Eq. (1) is estimated by the OLS method with a full set of regional dummies. To provide the most data on our dependent variable (allocation of talent) 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.[9]

Table 1 presents the results of the model estimations, which allows for an effect of oil rents on the allocation of talent 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.

The negative sign and the significance of the coefficient associated with the variable Oil-rent-to-GDP in column 1 reflect the negative impact of oil rents on student incentives for rent-seeking activities when the country has good governance (Governance vulnerability equal to 0). This indicates that countries most able to properly manage oil rents have generated an increase in tertiary graduates in engineering, manufacturing and construction relative to those in law, business, and the social sciences. This is indicative 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) indicates 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 robust across the four specifications. Hence, the results of

[9] 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. In the end, it is the combination of the evidence in cross-section and panel data analysis that makes a strong case for the relationship between institutions, resources and the allocation of talent described in this paper.

column 1 indicate that oil rent reduces the proportion of lawyers over engineers in 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 oil rents to generate an increase in professions with better access to rents despite the fact that better resource management should have increased the number of engineers.

For an illustration of the magnitude of the impact, we take the case of a non-oil-producing country starting with a median enrollment difference between law and engineering (the explained variable in columns 1 and 2 of Table 1). Keeping all things equal, we now assume that this country becomes an oil producer with an oil rent equal to the median among oil producers (1.3% of GDP). Then, according to the coefficients of the first column of Table 1, the new enrollment in law minus engineering would reach 21.6% (the 35th percentile) if the country has good governance (Governance vulnerability equal to 0), but it would reach 31.1% (the 67th percentile) if the country has poor governance (Governance vulnerability equal to 1). Hence, governance appears to be a statistically but also economically significant determinant of the impact of oil on the allocation of talent.

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 the potential endogeneity bias that would arise from the possible reverse causality between oil rents and the allocation of talent. The coefficient associated with the Oil rent-to-GDP variable remains negative and significant, while the coefficient associated with the multiplicative variable (Oil rent * Initial governance vulnerability) is still positive and significant. In Section 3.6

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 enrolment 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 and 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 and 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 and 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 and 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. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

to Section 3.10, we investigate the issue of the potential endogeneity of both oil rents and governance.

3.4. Use of an alternative dependent variable

The results indicate that the allocation of talent depends on the presence of oil revenues and the governance quality of countries. However, having a dependent variable, measured as the difference between the enrolment in law, business, and the social sciences and the enrolment in engineering, manufacturing, and construction, imposes a symmetrical impact (in absolute terms) 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 the social sciences as a percentage of the sum of the enrolment in law, business, and the 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. (see also Table 3)

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

3.5. Breakdown of the aggregate index of governance quality

Previous results indicate that the effect of oil rents on the allocation of talent is conditional on the level of overall governance quality. However, previous works did not indicate the specific components of governance that affects the allocation of talent. It is possible that one particular component dominates the composite indicator that we built using the principal component analysis. For example, the mechanisms described in the paper, through which the interaction between oil resources and the quality of domestic institutions affects the allocation of talent, could matter more in a context of high corruption, lack of rule of law, lack of domestic accountability and government ineffectiveness. Indeed, in a context of high corruption (or ineffective bureaucracy), capturing the rents by diverting public resources or building patronage stands as a possible mechanism that could explain the choices of training that are dominant in the public sector. Therefore, we next examine each individual measure of quality of governance to better disentangle and identify the most relevant dimension.

Table 2 displays the estimation results of various governance variables on talent allocation, including lack of accountability, political instability and violence, government ineffectiveness, lack of regulatory quality, lack of rule of law, and corruption.[10] 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 regarding four of these indicators. The significance of corruption and the lack of regulatory quality are in line with the predictions of Murphy et al. (1991), who highlighted the role of property rights and the possibility of easy access to rents as the main determinants of the allocation of talent. Interestingly, the misallocation of talent is due not only to illegal grabbing (corruption and the lack of the rule of law) but also to legal grabbing: government ineffectiveness and lack of regulatory quality tend to discourage private investment and (legally) mismanage the large public resources provided by natural resource revenues. The results indicate that various forms of institutional vulnerabilities (though they are somewhat correlated among themselves) that interacted with the oil resource variable affect the distribution of talent. Among the dimensions of institutional vulnerabilities that were examined, we find that domestic accountability and political stability do not seem to matter statistically. This result is not surprising. If political instability makes civil servant jobs more risky as well, the distribution of talent will not necessarily be skewed toward this sector.

3.6. The use of other indicators of corruption

Governance variables are known for being prone to measurement errors. In the case where measurement errors are uncorrelated with omitted variables, this would simply cause an attenuation bias of our variables of interest (biased toward zero), which would imply that our results are a lower bound of the real effect. However, if the measurement error is correlated with an omitted variable, it would create an endogeneity bias if the variable is not properly controlled for in the structural equation. For example, the level of economic development may be correlated with errors if people tend to infer there is less corruption because they observe good economic development. In order to reduce the risk of endogeneity bias, we have controlled for the variables that are suspected to be correlated with measurement errors.

As an additional robustness check, we repeat the analysis on alternative databases. We replace the WGI with data from Transparency International on corruption to investigate whether the results are robust to the use of other measures of governance.[11] Corruption indicators are emphasized because our theoretical approach stresses rent grabbing over other institutional vulnerabilities. Table 4 presents the results using the alternative measure of corruption. Independent of the choice of the corruption variable, the results corroborate the main conclusions.[12]

Table 4
Testing an alternative measure of corruption. OLS with regional dummies.

Dependent variable:	Difference between law and engineering	Proportion of the enrolment in law
	(1)	(2)
Oil rent-to-GDP	−5.720***	−4.829***
	(−3.645)	(−3.298)
Oil rents * corruption (*TI*)	6.836***	5.684***
	(3.563)	(3.407)
Corruption (*TI*)	−2.689	4.656
	(−0.199)	(0.483)
Real GDP per capita growth	−1.100	−0.220
	(−0.909)	(−0.305)
GDP growth volatility	0.142	0.464
	(0.199)	(0.841)
Initial real GDP per capita	0.310	−0.185
	(0.146)	(−0.108)
Trade openness	0.0556	0.0253
	(1.130)	(0.609)
Foreign direct investment-to-GDP	−0.503	−0.167
	(−1.342)	(−0.519)
Government consumption-to-GDP	−0.219	0.110
	(−0.763)	(0.452)
Private credit-to-GDP	−0.0493	−0.0119
	(−0.626)	(−0.176)
Registering property cost	0.104**	0.126***
	(2.449)	(4.448)
Protection of investors index	0.0972	0.102
	(0.949)	(1.279)
Constant	24.05	61.69***
	(0.844)	(3.291)
Observations	69	69
R-squared	0.272	0.431

Robust t-statistics are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (*TI*) Transparency International corruption measure is the alternative corruption measure.

3.7. Initial values of governance

We attempt to reduce the endogeneity of governance variables by using their values observed at the beginning of our sample. This should help reduce a possible reverse causality bias that may arise from the allocation of talent to the subsequent levels of governance quality in each country. The results are presented in Tables 5 and 6, depending on the definition of the allocation of talent that is used. The results reiterate the key role played by high corruption, governance ineffectiveness, the rule of law, and weak regulatory quality in shaping the marginal impacts of oil rents on the allocation of talent.

[10] 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 as due to the high collinearity between each of the six dimensions of governance.

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

[12] One possibility would have been to instrument governance quality with some variables such as settler mortality *a la* Acemoglu et al. (2001) or with some variables capturing the legal origins of the economic systems of different countries. We found these variables to be poor instruments for governance quality (the results are available from the authors upon request). While such instruments performed well in explaining variables related to the quality of institutions, they appeared to be not strong predictors of governance quality in our dataset.

Table 5
Effect of oil rents and initial governance on the allocation of talent (difference between enrolment in law and engineering): OLS with regional dummies.

	Difference between enrolment 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 and 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 and 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. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

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

A potential weakness of the analysis is that the so-called "technological effect" that we discussed throughout the paper can be conditional on the level of economic development. For example, the ability of a country to train and involve its own local engineers in the extraction of the natural 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 talent 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 development.

In this case, the endogeneity bias is due to the omission of the control variable "Oil rents-to-GDP * log of Initial GDP per capita" (OIL *GDP for conciseness). Hence, Table 7 introduces this variable. When introduced without controlling for the variable OIL * INST VULN, the coefficient associated with OIL*GDP is nonsignificant and even negative (columns 1 and 2), which indicates that the impact of oil on the allocation of talent does not significantly vary with the level of economic development. Further, when OIL*GDP is introduced along with OIL * INST VULN, the interaction term OIL*GDP is demonstrated to have no significant impact on the allocation of talent, and OIL * INST VULN maintains an impact of approximately the same magnitude and size as observed in previous specifications (columns 3 and 4). This suggests that the main results are not entirely driven by this omitted variable bias.

Table 6
Effect of oil rents and initial governance on the allocation of talents (proportion of "law"): 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 and 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 and 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. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

3.9. Use of oil reserves to limit the risk of endogeneity of the measure of natural resources

We examine the issue of the potential endogeneity of oil resources because the main variable we used so far (oil rents) is likely to be endogenous due to the nonrandomness of oil production or costs, which are likely to be correlated with a country's human capital and its composition. Inspired by the recent work of Cotet and Tsui (2013), we substitute our measure of oil rents with the oil reserves. Cotet and Tsui (2013) constructed a comprehensive panel dataset of oil discoveries and reserves for a large set of countries over time. Oil reserves are calculated using the information on cumulative oil discoveries deducting cumulative production. As oil reserves better capture the idea of oil wealth, we re-estimate the baseline models using oil reserves as the measure of oil resources. To address the potential endogeneity of governance quality, we use the initial values of the index instead of the country averages. The aggregate governance index is used in these econometric specifications for conciseness. Results are presented in Table 8. We find robust evidence that the presence of oil resources affects the allocation of talent conditional on the quality of governance. In the presence of governance vulnerability, oil resources are positively associated with a distribution of talent more oriented toward the type of training closely related to rent-seeking activities.

3.10. Panel data estimates

The allocation of talent in the economy may affect oil resources or the quality of institutions and bias the results. However, the talents we observe in the sample are university students not fully contributing to the labor force yet. This granularity greatly reduces the risk of

Table 7
Robustness check: Controlling for the impact of oil rents conditional on the level of economic development.

	(1)	(2)	(3)	(4)
	Difference between law and engineering	Proportion of the enrolment in law	Difference between law and engineering	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.

Table 8
Oil reserves, governance vulnerability and, the allocation of talents in developing countries.

Dependent variable: Allocation of talents (difference between law and engineering)		
	(1)	(3)
Log (value of oil reserves, per capita)	−10.92***	−10.76**
	(4.071)	(4.874)
(Log value of oil reserves per capita) * governance vulnerability	22.26***	21.80**
	(8.258)	(10.30)
Governance vulnerability (initial values)	−30.38*	−32.41*
	(15.53)	(16.40)
Real GDP growth	−0.862	−1.049
	(0.921)	(1.064)
Growth volatility	0.462	0.422
	(0.687)	(0.742)
GDP per capita	−2.034	−2.759
	(2.182)	(2.349)
Trade openness	0.0406	0.0426
	(0.0485)	(0.0515)
FDI-to-GDP	−0.306	−0.397
	(0.405)	(0.421)
Government size	−0.294	−0.408
	(0.268)	(0.292)
Financial development	−0.0972	−0.0880
	(0.0836)	(0.104)
Registering property cost	0.103**	0.106**
	(0.0389)	(0.0486)
Investors' protection index	−0.00812	0.0141
	(0.117)	(0.134)
Intercept	56.96**	62.79**
	(27.77)	(28.86)
Region fixed-effects	No	Yes
Observations	69	69
R-squared	0.298	0.314

Notes: Robust t-statistics are in parentheses. 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.

potential reverse causality. However, the possibility remains that the allocation of talent at a given date may be positively correlated with the initial level of the allocation of talent, which itself did affect the quality of institutions and the exploitation of oil resources.[13] To address this type of concern, as well as any source of endogeneity due to time-invariant omitted variables, this section presents results using fixed-effects (FE) panel data analyses.

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 time-invariant country-specific heterogeneity either through country fixed effects or controlling for path dependence (with the dynamic panel GMM). Controlling for country fixed effects reduces the bias due to unobserved time-invariant factors in the relationship between oil rents, institutions, and the allocation of talent.[14] 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 fixed-effects (FE) for each country (u_i) and year (n_t):

$$G_{i,t} = \left(\theta_1 + \theta_2\, INSTVUL_{i,t}\right) OIL_{i,t} + \sigma\, INSTVUL_{i,t} + X'_{i,t}\beta + u_i + n_t + \varepsilon_{i,t} \quad (2)$$

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

$$G_{i,t} = \rho G_{i,t-1} + \left(\theta_3 + \theta_4\, INSTVUL_{i,t}\right) OIL_{i,t} + \sigma_1\, INSTVUL_{i,t} + X'_{i,t}\beta + u_i + \varepsilon_{i,t} \quad (3)$$

This method has many advantages. First, it is likely that a country's allocation of talent 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 talent is affected by structural factors (e.g., infrastructure, institutions, globalization, and the preferences of agents). Therefore, neglecting such path dependence may induce biased estimates and a misspecification of the model.

Second, resorting to the estimators designed to estimate a dynamic panel data model helps take advantage of the lag structure of the explanatory variables as potential instrumental variables for the regressors suspected of endogeneity (such as the institution variables),

[13] This concern is also addressed by the use of oil reserves rather than the oil rent.
[14] This bias was partially reduced in the cross-sectional estimates through the inclusion of regional dummies; however, heterogeneity *within* regions was not controlled for.

Table 9
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)
Oil rents-to-GDP * governance vuln.	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: Robust t-statistics are in parentheses. 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 10
Oil rents, governance, and the allocation of talent: 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 vuln.	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 talent (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: Robust t-statistics are in parentheses. The dependent variable is the allocation of talent in each country. The allocation of talent is defined as the enrolment in law, business and the 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 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.

including the lagged dependent variable (see Blundell and Bond (1998); Windmeijer (2005)).[15]

The panel data estimates are presented in Tables 9 and 10. The results are qualitatively similar to those obtained from the cross-sectional estimates. Note that the number of countries drops 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 9, the results still point to the existence of an effect of oil rents on the allocation of talent that is conditional on the quality of institutions. The effect of oil resources on the allocation of talent varies significantly depending on the governance vulnerability when the latter is proxied by the degree of rule of law, regulatory quality, and 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 now using the within-country variation indicates that, for a given country, when an oil resource boom occurs, the allocation of talent is skewed toward training and field specializations that are associated with a high probability of rent-seeking activities in the presence of bad institutions. The fact that this effect is observed within a short period of time after a

[15] The OLS estimator is inconsistent because 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 extended system-GMM estimator that 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 address 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 to a maximum of 2, and year dummies are not included.

Table 11
Oil discoveries and ex post wage dynamics.

Dependent variable: log difference of public sector wages and wages in the oil industry. Pooling estimates						
	(1)	(2)	(3)	(4)	(5)	(6)
Log (value of oil discoveries, per capita)	−0.0701	0.205	−3.071***	−1.252***	−1.287***	−1.851***
	(0.133)	(0.227)	(0.549)	(0.249)	(0.306)	(0.588)
Governance vulnerability		−3.476***	−0.600	−0.616	−0.612	−2.400**
		(0.958)	(0.640)	(0.411)	(0.398)	(0.944)
Log (value of oil discoveries) * governance vuln.			4.403***	2.395***	2.412***	3.379***
			(0.786)	(0.289)	(0.329)	(0.953)
Log (value of oil reserves, per capita), lagged				−0.431***	−0.399***	−0.208*
				(0.0782)	(0.104)	(0.115)
Cumulative number of wildcats being drilled					−0.00130	−0.00265
					(0.00231)	(0.00162)
Intercept	−0.141*	2.171***	−0.0319	0.750**	0.719**	1.825***
	(0.0775)	(0.650)	(0.342)	(0.310)	(0.310)	(0.587)
Number of countries	44	24	24	24	24	24
Region fixed effects	Yes	Yes	No	No	No	Yes
Observations	183	96	96	96	96	96
R-squared	0.171	0.376	0.195	0.505	0.505	0.599

Clustered standard errors at the country level are displayed in parentheses.
*** p < 0.01, ** p < 0.05, * p < 0.1.
Log (value of oil discoveries) is the log of (1 + value of oil discoveries during the previous 3 years).

resource boom indicates the need for policy intervention during this period to limit the inefficient allocation of talent resulting from the combination of high resources and weak institutions.

Table 10 presents the results of the dynamic panel specification where the institutional variables as well as their interaction terms are instrumented in the GMM framework. The results observed in this table are in line with those from our main specification and confirm that the effect of oil rent on the allocation of talent is conditional on the quality of institutions, especially dimensions such as corruption.

4. Interpretation of the results and alternative explanations

4.1. Additional evidence using oil discoveries and the wage gap

Section 4 presents a series of pieces of evidence demonstrating that the quality of institutions shapes the relationship between oil and the allocation of talent. We demonstrate that this shift is due to a rent-seeking mechanism according to which, in countries with poor governance, oil rents increase the payoff of positions that have a higher access to rent. From a theoretical perspective, in the case in which part of the rent is attributed "openly" through positions and salaries that exceed the marginal productivity of the workers (in a form of patronage), one would expect to observe that in the years following a significant discovery of oil resources, the difference between the wage of the grabber and the wage of the producer should be large exclusively in countries exhibiting weak institutions. In countries with good governance, this effect should follow the direction of the technological effect on the allocation of talent identified in Section 4; hence, it is expected to be negative.

We define the dependent variable as the difference in the log of wages in public administration and wages in the hydrocarbon sector, from the database compiled by Freeman and Oostendorp (see Oostendorp (2012), The Occupational Wages around the World, OWW, Database: Update for 1983–2008, World Development Report 2013 Background paper).[16] For each country, the measure of natural resources is the log of the value of oil discoveries in the last three years. We examine the short-term impact of oil discoveries because the theoretical discussion predicts that the difference in wages will persist until the reallocation of talent occurs, i.e., once students who have chosen their specialization in tertiary education, after the oil discovery, enter the job market.

Because for many countries only one data point is available, we pooled country observations and controlled for unobservable heterogeneity using region fixed effects. To address the potential endogeneity of oil discoveries, we control for the number of wildcats being drilled following Cotet and Tsui (2013) and Tsui (2010). We also control for the value of oil reserves before the discoveries to control for the initial hydrocarbon status of each country.

Table 11 displays the results of the wage gap model. Columns 1 and 2 indicate that when the multiplicative variable 'Log (value of oil discoveries) * Governance vulnerability' is not introduced, we find no impact of oil discoveries on the wage differential between the public administration and the hydrocarbon sector. However, once we introduce the multiplicative variable, we find results that are fully in line with our expectations and in line with the story revealed by the baseline results of the paper.

In countries with good governance, an oil discovery increases the wages in the hydrocarbon sector more than wages in the public sector in the years following the discovery (technological effects). By contrast, in countries with vulnerable institutions, oil discoveries benefit the workers in the public sector more than those in the hydrocarbon sector. This provides strong additional evidence in favor of the rent-seeking hypothesis suggested in this paper and indicates that the redistribution of resources is at least in part done openly in the form of official wages. However, it also prompts the key question as to whether governments aware of the bad governance quality use oil revenue windfalls to catch up in terms of governance by investing in the country's human capital levels and the regulatory framework. If this is the case, it would mean that our baseline results are not entirely explained by the hypothesis that oil revenues and bad institutions encourage the talented to opt for training and fields of specialization that maximize their chance of engaging in rent-seeking activities. The results would imply a "good" allocation of talent shaped by government policies and programs aimed at strengthening the quality of the administration for a better management of the oil revenue windfalls. Below, we formally test this hypothesis.

4.2. Rent-seeking or investment in human capital to improve institutions?

One alternative explanation of the results is that when institutions are highly vulnerable, a benevolent policy maker can use the available

[16] It would have been ideal to also use sectoral wages for local engineers or all wages in the private sector; however, these data are not available. The industry codes for public administration and the hydro-carbon sector are PA and BB (Crude petroleum and natural gas production) in this dataset, respectively. We use the annual monthly wages expressed in U.S. dollars.

Table 12
Do oil discoveries affect governance quality in developing countries?

Dependent variable: Change in governance vulnerability between 1996–1999 and 2000–2008				
	(1)	(2)	(3)	(4)
Initial level of governance vulnerability	−0.203***	−0.216***	−0.221***	−0.204***
	(0.0461)	(0.0523)	(0.0590)	(0.0584)
Log (cumulative value of oil discovered 1985–1995, per capita)	0.0154**	0.0102*	0.0111*	0.0131
	(0.00677)	(0.00557)	(0.00570)	(0.00816)
Initial level of Log GDP per capita	−0.0169**	−0.0186**	−0.0208**	−0.0221**
	(0.00717)	(0.00775)	(0.00842)	(0.0106)
Percentage of Muslim	−5.60e-05	−8.03e-05	−0.000129	3.62e-05
	(0.000143)	(0.000148)	(0.000163)	(0.000227)
British legal origin	0.00510	0.00501	0.0117	0.0160
	(0.0138)	(0.0139)	(0.0146)	(0.0163)
Log (cumulative value of oil reserves, per capita)		0.00598	0.00751	0.00805
		(0.00559)	(0.00584)	(0.00619)
Number wildcats being drilled			6.03e-05	−0.000149
			(0.000222)	(0.000297)
Intercept	0.208***	0.216***	0.228***	0.258***
	(0.0644)	(0.0679)	(0.0733)	(0.0879)
Region fixed effects	No	No	No	Yes
Observations	120	120	101	101
R-squared	0.141	0.144	0.164	0.209

Robust standard errors at the country level are shown in parentheses.
*** p < 0.01, ** p < 0.05, * p < 0.1.

oil resources to improve administrative capacity to maximize the long-term developmental impact of the oil windfalls. Countries would use the oil discoveries to improve governance quality as soon as they can afford to do so, perhaps because they recognize the importance of institutional quality to maximize the impact of the natural capital on long-term growth. This scenario is nearly the opposite of our suggested rent-seeking interpretation of the results and is compatible with the evidence on the reallocation of talent and the impact of wages. The benevolent policy-maker scenario assumes that oil discoveries would improve domestic institutions in countries that are initially more vulnerable. We use the data compiled by Cotet and Tsui (2013) on the amount of oil discovered in each country to test this hypothesis.

In Table 12, we test whether cumulative oil discoveries during the past 10 years are associated with improvement in governance quality ex post. We in fact find that oil discoveries are good predictors of governance *vulnerability* in developing countries, even when the traditional determinants of governance quality are accounted for. In Table 12, the dependent variable is computed as the change in the averages of the governance vulnerability index for each country between 1996–1999 and 2000–2008.[17] We then look at the effect of prior cumulative oil discoveries (expressed in dollar values and observed over the period 1985–1995) on these changes in governance vulnerability indices. The specification is similar to a "granger causality" test whereby we assess the contribution of pre-determined values of a given correlate to the changes in the outcome variable of interest.

The results indicate a convergence of governance in the data. The beta-convergence parameter is approximately −0.2. More interestingly for our analysis, the amount of oil discovered during the preceding decade is positively associated with the governance *vulnerability*. The coefficient is always positive but no longer significant, when regional dummies are controlled for. This suggests that governance quality has not improved in countries in which significant amounts of oil were discovered decades ago; if anything, it had the opposite effect. Hence, the evidence does not confirm the scenario of a benevolent policy maker using the resource rents to invest in the quality of institutions.

The results are similar to the recent micro-econometric work by Vicente (2010), who indicated that oil discovery in Sao Tome and Principe deteriorated governance quality. The results are also in line with Tsui (2010), who found that oil discoveries have a negative impact on democracy.

Table 13
Correlation institutional quality and student of developing countries in USA.

	Difference between law & engineering
Difference between law and engineering	1.0000
Control of corruption	0.1177
Government Effectiveness	0.0727
Political stability	0.3577
Regulatory quality	0.2934
Rule of law	0.0327
Voice and accountability	0.2068

Source: Data on students are from Institute of International Education (2012). Institutional variables are from the World Bank.

4.3. Studies abroad

This study has used data on domestic universities. However, some students in tertiary education study abroad, and therefore, the reallocation of talent we have been describing throughout the paper could be observed in the data if, in countries with resource rents and poor institutions, students were more likely to study abroad if they study engineering than if they study law.

This possible concern is not corroborated by the empirical evidence. First, a recent study by the OECD (2013) indicates that students who pursue their studies abroad are primarily interested in law and social science studies. Second, we have calculated the equivalent of our variable of interest for students in the United States originating from developing countries: the enrolment in law, business, and the social sciences *minus* enrolment in engineering, as a percentage of the total foreign students in the United States. The data on international studies are drawn from the Institute of International Education, which provides a unique database on study by foreign students in the United States. The database contains 25 worldwide countries, including 17 developing countries.[18]

The results of pairwise correlation between the aforementioned variable and each one of the six indicators of governance in the recent year 2012 are presented in Table 13. There are no statistically significant correlations at the 10% level. The idea that in countries with poor governance, law and social science studies are administered locally while engineers are formed abroad does not seem to hold according to the data we examined.

5. Conclusions

This paper provides an empirical analysis of the interaction between oil rents, governance, and the allocation of talent in developing countries. It investigates the determinants of occupational choices in a population of students in law, business, and the social sciences on the one side and students in engineering, manufacturing, and construction on the other side. The main finding of the paper is that when institutions are weak, oil resources orient university students toward specialization

[17] The World Bank Governance Indicators indices are available starting with the year 1996.

[18] Institute of International Education (2012). "Fields of Study of Students from Selected Places of Origin, 2011/12." *Open Doors Report on International Educational Exchange*. Retrieved from http://www.iie.org/opendoors.

fields that provide better future access to resource rent. As is often the case in macroeconomic regressions, the risk of endogeneity cannot be fully ruled out; however, the pattern is consistent and this explanation is compatible with the results obtained in different specifications, outcomes and datasets.

This misallocation is a source of inefficiency due to the gap that it generates between the marginal productivity of the lawyers and that of the engineers when institutions are poor. Combining these results with those of Murphy et al. (1991), who find that engineers contribute more to long-term growth than lawyers, provides a rationale for a resource curse that occurs through a misallocation of talent in the presence of resources and institutions that are unable to prevent rent grabbing. Our results also indicate a deterioration in the quality of institutions following significant oil discoveries, consistent with the recent empirical literature.

From a policy perspective, the results indicate that governments with natural resources must pay particular attention to the specialization of the talent within a country. They need to preserve a reasonable share of the talent in engineering and other specializations that contribute to growth but do not offer much access to rents. In the short run, this aim can be attained through the creation of scholarships funded by rents, as allocating a larger share of rents to research, construction, and long-term investments will increase the return to the engineering professions. The government needs to ensure that the remuneration is meritocratic and is in line with the expected productivity of the talented. In the long run, 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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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

Table B1 (*continued*)

Variable	Obs	Mean	Std. dev.	Min	Max
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 consumption-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	

Appendix C. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.jdeveco.2014.12.004.

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