

# Rent-Seeking and Career Choice: Evidence from Colombia's Royalty Reform

Cristhian Acosta\*    Rachid Laajaj<sup>†</sup>    Brigitte Castañeda<sup>‡</sup>

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**PRELIMINARY VERSION, PLEASE DON'T DISSEMINATE**

## Abstract

Exogenous increases in natural resource revenues misallocate human capital by shifting university students' career choices away from engineering towards management fields. We exploit a 2011 reform in Colombia that abruptly altered the distribution of hydrocarbon royalties across municipalities, providing quasi-experimental variation in municipal resource revenue. Using an Instrumental Variables strategy, we find that higher royalty receipts significantly increase the share of students choosing management careers over engineering. This effect is substantially larger in municipalities with more prior corruption allegations, consistent with talent responding to rent-seeking opportunities. Our findings demonstrate a key mechanism through which resource windfalls, particularly in environments with weak institutions, can hinder long-term growth by diverting skilled individuals from productive activities.

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\*Universidad de los Andes, Bogotá, Colombia. E-mail: [cj.acosta@uniandes.edu.co](mailto:cj.acosta@uniandes.edu.co)

<sup>†</sup>Universidad de los Andes, Bogotá, Colombia. E-mail: [rlaajaj@uniandes.edu.co](mailto:rlaajaj@uniandes.edu.co)

<sup>‡</sup>Universidad de los Andes, Bogotá, Colombia. E-mail: [k.castaneda@uniandes.edu.co](mailto:k.castaneda@uniandes.edu.co)

# 1 Introduction

A country’s most valuable resource for long-term growth is its skilled workforce. But where do talented individuals choose to apply their skills? Do they pursue productive careers that create new wealth and foster innovation, or do they focus on rent-seeking activities that primarily redistribute existing wealth? The balance between these paths significantly impacts economic development (Baumol, 1990; Murphy *et al.*, 1991). This allocation of talent depends critically on the incentives faced by individuals, which are shaped by a country’s institutions and the potential returns from different activities (Acemoglu, 1995; Mehlum *et al.*, 2006). Resource windfalls, such as revenues from oil or minerals, can alter these incentives, potentially making rent-seeking more profitable and diverting talent away from productive sectors, particularly when institutions are weak (Torvik, 2002).

Despite a well-established theoretical literature on the allocation of talent and the resource curse, direct empirical evidence on how resource revenues at a granular level impact individuals’ crucial educational investment decisions—specifically, their choice of field of study—remains limited. This paper provides quasi-experimental evidence on how increases in natural resource revenues affect the allocation of a country’s most valuable resource: human capital. We analyze how a sudden and exogenous shift in the distribution of hydrocarbon royalties across municipalities in Colombia influenced the career choices of university students.

In environments with opportunities for rent capture, careers that provide access to public funds or regulatory power may offer private returns beyond their official salaries. This changes the structure of incentives for individuals deciding on their education. Following established literature, we classify careers into those broadly associated with productive activities, like engineering, and those often linked to rent-seeking opportunities, such as management fields including business, accounting, law, and economics (Ebeke *et al.*, 2015; Murphy *et al.*, 1991). An increase in available rents can disproportionately increase the expected returns of careers with better access to these rents,

motivating students to shift their educational choices towards these fields. This can lead to a misallocation of talent, reducing overall productivity and hindering economic growth.

Our study focuses on Colombia’s 2011 reform to the royalty distribution system, which fundamentally altered how hydrocarbon revenues were allocated across municipalities. This reform drastically reduced the direct share of royalties going to producing municipalities while increasing transfers to non-producing ones through new funds based on criteria like poverty and population. This sudden and significant change in municipal resource endowments, largely exogenous to local effort related to resource extraction itself (unlike previous systems), provides a compelling quasi-experimental setting. We leverage this variation, employing an Instrumental Variables approach based on the theoretical royalty values predicted by the new distribution rules, to estimate the causal effect of municipal royalty receipts on the composition of student enrollment in higher education.

Using a rich dataset on university enrollment decisions across Colombian municipalities, we find empirical evidence consistent with the rent-seeking hypothesis. An exogenous increase in the royalties received by a municipality leads to a significant increase in the proportion of students from that municipality opting for management careers relative to engineering careers. Furthermore, we show that this effect is substantially stronger in municipalities that had a history of higher corruption allegations prior to the reform. This heterogeneity provides direct support for the hypothesis that the observed shift in career choices is indeed partly driven by the perceived or actual opportunities for rent-seeking associated with increased resource revenues, particularly where institutional environments were already more susceptible to corruption.

Our findings offer new micro-level insights that contribute to several important areas of economic research. By analyzing individual career choices in response to a localized resource shock, we provide direct empirical evidence on a key mechanism through which the “resource curse” might operate: distorting educational investment and the initial allocation of human capital. Our study builds on and complements exist-

ing macro-level work [Ebeke \*et al.\* \(2015\)](#), offering a cleaner identification strategy due to the nature of the policy reform and the use of granular data. We demonstrate how changes in economic returns, specifically those stemming from resource rents, influence talent allocation, providing empirical support for theoretical models [Acemoglu \(1995\)](#); [Murphy \*et al.\* \(1991\)](#). Moreover, by highlighting the amplification of this effect in areas with higher pre-existing corruption, we shed light on the critical interaction between resource wealth and institutional quality in shaping talent flows and generating inefficiencies, linking our results to the broader literature on corruption and development [Olken & Pande \(2012\)](#).

The remainder of this paper is structured as follows. Section [3](#) provides essential details on the Colombian royalty system reform and the institutional context. Section [2](#) presents the review of the literature related to the allocation of talent. Section [??](#) describes the data sources and variable construction used in our analysis. Section [4](#) outlines our empirical strategy, including the Instrumental Variable approach for identification and discussion of parallel trends. Section [5](#) presents the main empirical results on the effect of royalties on career choices. Section [6](#) explores the mechanisms driving these results, particularly the role of corruption and institutional quality. Finally, Section [7](#) discusses the implications of our findings and concludes.

## 2 Literature Review

In this literature, the agents of the economy decide to participate between a productive and non-productive sector. In terms of occupation, there is a separation between productive entrepreneurship (*producers*) and non-productive entrepreneurship (*rent-seekers*) ([Baland & Francois, 2000](#); [Baumol, 1990](#); [Mehlum \*et al.\*, 2006](#); [Murphy \*et al.\*, 1991](#)). On the other hand, in education, engineering careers are related to entrepreneurship, whereas social science careers are associated with rent-seeking ([Ebeke \*et al.\*, 2015](#); [Murphy \*et al.\*, 1991](#)). However, both types of talents are assumed to be complementary in the production process, but the latter having better access to rents ([Ebeke \*et al.\*,](#)

2015). The decision of agents to move from one sector to another depends on the structure of expected returns, which, in turn, depends on the quality of the institutions (Acemoglu, 1995; Mehlum *et al.*, 2006). When institutions are weak (favorable to capture), the profits that encourage talents to move to non-productive activities are greater than productive activity, due to the malfunctioning of bureaucracy and corruption (Gylfason *et al.*, 1999; Mehlum *et al.*, 2006). In contrast, when institutions are strong (conducive to production) natural wealth attracts entrepreneurs in production activities due to their greater profitability Mehlum *et al.* (2006).

Given the boom in natural resources, inefficiency in the economy is generated when productive agents mostly prefer to engage in non-productive activities (Baland & Francois, 2000; Lane & Tornell, 1996; Mehlum *et al.*, 2006; Torvik, 2002). This generates a low innovation activity that hinders potential growth, associated with institutions that are friendly with rent capture. Murphy *et al.* (1991) find that the allocation of talent of students with engineering careers contributes more to growth than to law, which explains the slow growth of some Latin American and African countries. Another source of inefficiency, proposed in (Olken & Pande, 2012), corresponds to the fact that public employees concentrate their efforts when performing rent-seeking activities.

The most direct empirical evidence on how resource windfalls affect talent allocation in developing countries is provided by Ebeke *et al.* (2015). They find that increased oil production has a heterogeneous impact depending on institutional quality: promoting engineering careers where institutions are strong (a technological effect), but diverting talent towards careers with better access to income under weak institutions (a rent-seeking effect). Our paper builds upon this work by exploiting a quasi-experimental setting in Colombia that yields arguably more exogenous variation in resource revenue than the oil field discoveries used by Ebeke *et al.* (2015). Specifically, the 2012 Colombian royalty redistribution reform generated significant changes in municipal revenues independent of local production dynamics. This allows us to isolate the rent-seeking effect from the technological effect more cleanly than in Ebeke *et al.* (2015)'s cross-country analysis, which relies on stronger assumptions to disentangle the two

mechanisms.

The literature relates the income derived from extraction of natural resources with activities of rent-seeking and corruption. [Caselli & Michaels \(2009\)](#) find that an increase in oil production in Brazil's coastal municipalities increases corruption. In particular, they show that these rents lead to a higher rate of re-election of current leaders when institutions are weak, possibly generated by expansion of public employment, administrative expenditure [Bhavnani & Lupu \(2016\)](#); [Monteiro & Ferraz \(2010\)](#) and vote buying in exchange for small payments or public goods [Stokes \*et al.\* \(2013\)](#). In summary, the weakness of institutions leads to an increase in income from the exploitation of natural resources, leading to rent capture and corruption [Bhattacharyya & Hodler \(2010\)](#).

There is a tendency in the literature to analyze the allocation of talent between countries. However, this paper acquires relevance because it finds empirical evidence from a microeconomic analysis, when analyzing this problem within a country. The income redistribution, generated by the reform to the royalties system of 2012, in Colombia, allows associating the evidence found with the rent-seeking effect. This is explained because the nature of the reform excludes the technological effect, given that for most subnational governments it is impossible to contribute to the generation of income since they do not have non-renewable natural resources. Finally, the information available at the student level enriches the analysis and this allows building the categories of careers related to rent-seeking and the extraction of resources.

### 3 The Colombian Royalty System Reform

In Colombia, the State owns the subsoil and non-renewable natural resources, as stipulated by the 1991 Constitution. Exploitation of these resources by public or private entities requires economic compensation to the State, known as royalties. These royalties are calculated based on technical variables related to production volume, price, and participation percentages at the point of extraction.

Figure 1 illustrates the pronounced geographic concentration of royalty revenues in Colombia before the 2012 reform. Under the prior legal framework<sup>1</sup>, approximately 80% of total royalties were allocated directly to a limited number of producing and port municipalities and departments. According to official government figures, with the reform, the number of beneficiary municipalities went from 522, who were mainly producers, to 1,089 municipalities, equivalent to 99% of the country's municipalities. The above is consistent, since this redistribution policy increases regional equality by allocating resources from the SGR to municipalities that are not producers.

The remaining 20% were managed by the National Royalty Fund (FNR) for a broader, but still restricted, indirect distribution. Concerns were raised regarding the limited effectiveness of resource utilization in many producing areas and, crucially, the inequitable distribution that excluded the vast majority of the country's municipalities from significant benefits.

Driven by the aim of promoting regional equality, competitiveness, and more effective resource management, Legislative Act 5 of 2011 and Law 1530 of 2012 established the General System of Royalties (Sistema General de Regalías, SGR). This reform fundamentally altered the distribution mechanism and drastically expanded the pool of beneficiaries. As a consequence of this policy, the number of municipalities receiving royalty funds increased dramatically from 522 (primarily producers) to 1,089, covering 99% of the country's municipalities. This substantial expansion of beneficiaries reflects the policy's objective of increasing regional equality through wider resource distribution.

Under the SGR, access to most royalty resources requires all subnational entities, regardless of production status, to submit investment projects for evaluation and approval by Collegiate Business and Decision Bodies (OCADs)<sup>2</sup>.

The SGR significantly changed the distribution percentages and introduced new

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<sup>1</sup>Laws 141 of 1994 and 756 of 2002

<sup>2</sup>The OCADs are responsible for defining the investment projects, presented by the municipalities, to be financed with resources from the SGR. There are municipal, departmental and autonomous corporations OCADs.

funds. The direct allocation to producing municipalities and departments saw a substantial reduction in its share of total royalties compared to the pre-2012 system. To illustrate the magnitude of this shock for producing areas, a municipality producing less than 10,000 barrels per day, which previously received 32% of its generated royalties directly, saw this share fall to 8.8% in 2012 and further to 3.2% by 2015. Concurrently, new funds, such as the Regional Compensation Fund and the Science, Technology, and Innovation Fund, increased the pool of resources distributed based on criteria like poverty and population<sup>3</sup>. The Regional Compensation Fund’s participation in total SGR resources, which prioritizes poverty and population criteria for municipalities, gradually increased from 15% in 2012 to 21.6% in 2015. This redistribution made significant royalty revenues accessible to a much larger number of non-producing municipalities for the first time, effectively shifting resource control and potential benefits across the country. This policy thus created a large and abrupt change in the allocation of resource rents across nearly all municipalities in Colombia, providing the key exogenous variation exploited in our study.

Our data includes information on hydrocarbon extraction, which constituted over 80% of Colombia’s royalties between 1994 and 2009. In 2008, 91 municipalities in our sample reported oil and gas extraction activity. We focus on oil and gas production for our instrument because their international prices are largely exogenous to Colombia’s output (ranking 21st in global exports), unlike coal, where Colombia is a larger player. The 2012 reform dramatically increased the reach of these royalties. While only 522 municipalities (mainly producers) previously received benefits, the reform extended eligibility to 1,089 municipalities, covering 99% of the country.

Table 1 presents summary statistics for our key variables across municipalities during the 2009-2015 period, as well as time-invariant municipal characteristics measured pre-reform.

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<sup>3</sup>For instance, 40% of the Regional Compensation Fund resources were allocated to municipalities, with distribution within municipalities based on criteria such as population and poverty indicators.



## 4 Empirical Strategy

### 4.1 Identification Strategy

This section addresses the methodology used to determine the effect of royalties on the allocation of talent, where the variation generated by the reform is exploited. Furthermore, it is considered that the royalties received by the municipalities are endogenous. For this reason, the use of instrumental variables is necessary. In particular, the instrument is the theoretical value of royalties that corresponds to the predicted amount of income received by municipalities in the analysis period.

In general terms, the main challenge of analyzing the performance of non-producing and producing municipalities is that the latter makes an effort that is endogenous to the production decision. Additionally, royalties generate endogeneity due to simultaneous causality. The allocation of talent determines the level of royalties, since municipalities must submit projects to access resources, which depend on their effort. Therefore, municipalities could resort to technical support from project formulators with training related to social sciences. This would generate more income for the municipality, increasing incentives for students to choose those careers. To address this endogeneity problem, the instrument based on the theoretical value of royalties is implemented.

To alleviate this problem, the theoretical value of royalties for municipalities is predicted. The predicted value is estimated from the royalty generation formula in a year prior to the analysis period and adjusted using the SGR fund participation percentages. Gradual changes in some funds were determined by the 2012 reform and are exogenous to the municipalities. The idea is to estimate royalties caused in an initial year and apply distribution percentages to predict the royalties received during the analysis period.

In summary, the empirical strategy uses instrumental variables for a municipal panel between 2009–2015. The treatment is continuous and corresponds to the intensity of royalties received by municipalities, both producers and non-producers, as a result of the 2012 redistribution policy.

### Difference-in-Differences Approach

Initially, to demonstrate the rent-seeking effect associated with the local appropriation of resources, a difference-in-differences model is proposed to measure the effect of the reform on the allocation of talent in municipality  $i$  in year  $t$ . This strategy controls for observable and unobservable time-invariant factors at the municipal level. To detect heterogeneous effects, an interaction between a producer dummy  $D_i^{\text{Prod}}$  and reform dummy  $D_t^{\text{Ref}}$  is included. Additionally, municipal fixed effects ( $\alpha_i$ ) and year fixed effects ( $\beta_t$ ) are included. The model to be estimated is:

$$y_{it} = \alpha_i + \beta_t + \gamma_r \left( D_t^{\text{Ref}} \times D_i^{\text{Prod}} \right) + \delta' (X_i \times \beta_t) + \varepsilon_{it} \quad (1)$$

where  $y_{it}$  are the outcome variables (e.g., share of social sciences or engineering), and  $X_i$  is a vector of pre-period control variables interacted with time effects. The coefficient  $\gamma_r$  captures the effect of royalties on the allocation of talent in high-producing municipalities.

Since royalty intensity is endogenous, it is instrumented using the theoretical value of royalties ( $tv_{it}$ ). The theoretical value is estimated using royalty generation in 2008 and adjusted with new distribution shares under the reform. Non-producing municipalities were included in the distribution after the reform, which provides variation for the instrument.

### Instrumental Variable Approach

The instrumental variables model is specified in two stages. The second stage is:

$$y_{it} = \alpha_i + \beta_t + \gamma_{fr} \widehat{royal}_{it} + \lambda' (X_i \times \beta_t) + \omega_{it} \quad (2)$$

where  $\widehat{royal}_{it}$  is the predicted log of royalties.  $\gamma_{fr}$  is the coefficient of interest, capturing the impact of royalties on talent allocation.

The first-stage regression is:

$$royal_{it} = \alpha_i + \beta_t + \sigma_{fr} \cdot tv_{it} + \rho' (X_i \times \beta_t) + \mu_{it} \quad (3)$$

where  $\sigma_{fr}$  measures the strength of the instrument—how well the theoretical value predicts actual royalties received.

The liquidation process applies production and commercialization data for hydrocarbon extraction at wellhead and mine mouth. Royalties are estimated for field  $f$  in month  $m$  for hydrocarbon  $j$  in municipality  $i$  using:

$$vf_i = \sum_{j=1}^2 \sum_{m=1}^{12} \sum_{f=1}^{n_i} q_{ifmj} \cdot pn_{ifmj} \cdot p_{mj} \cdot e_m \quad (4)$$

where  $vf_i$  is the value of the formula that corresponds to the royalties generated by municipality  $i$ ;  $q_{ifmj}$  represents the production;  $pn_{ifmj}$  corresponds to the royalty participation rate, which ranges between 8% and 25% in favor of the State;  $p_{mj}$  denotes the price in dollars per hydrocarbon extraction unit; and  $e_m$  represents the exchange rate of Colombian pesos per US dollar.

After obtaining  $vf_i$ , distribution percentages of SGR funds are applied. The theoretical value  $tv_{it}$  is:

$$tv_{it} = [DA_{it} \cdot vf_i] + [RD_t \cdot vf \cdot share_i] \quad (5)$$

where  $DA_{it}$  is the direct allocation to producers,  $RD_t$  is the share for new funds (e.g., pension savings, regional compensation), and  $share_i$  is the municipality's participation:

$$share_i = \frac{0.4 \cdot \left(\frac{pop_i}{pop}\right)^{0.4} \cdot 0.6 \cdot \left(\frac{nbi_i}{nbi}\right)^{0.6}}{\sum_{i=1}^n \left[0.4 \cdot \left(\frac{pop_i}{pop}\right)^{0.4} \cdot 0.6 \cdot \left(\frac{nbi_i}{nbi}\right)^{0.6}\right]} \quad (6)$$

where  $pop_i$  is the municipal population,  $pop$  is the sample total,  $nbi_i$  is the index of unsatisfied basic needs for municipality  $i$ , and  $nbi$  is the national average.

## 4.2 Parallel Trends

To address the assumption of parallel trends, both a graphical analysis and a quantitative test are used. These approaches help verify that, before the reform, the allocation of talent in producing and non-producing municipalities followed a similar path.

First, we examine the behavior of royalty intensity. Panel A of Figure 4 shows the average per capita royalties for producing and non-producing municipalities. In the case of producers, there is a sharp decline—of more than 100,000 pesos per capita—from their peak in 2011 to 2012, the year the reform came into effect. In contrast, for non-producing municipalities, and a year after the reform, royalty levels increased by roughly half of what producers lost. After 2012, the income gap from natural resource extraction between municipalities narrows.

Panel B of Figure 4 illustrates the behavior of the dependent variable—allocation of talent—across municipalities from 1998 to 2016. During most of this period, producing and non-producing municipalities follow a similar cyclical pattern with minor differences. Notably, the divergence begins in 2011, a year before the reform’s official implementation, consistent with potential anticipation of its effects following public debates and legislative progress. That year, producing municipalities experienced a 4 percentage point drop in talent allocation, while non-producers saw only a 1 percentage point decrease. The most significant gap appears in 2012, when allocation of talent reached approximately 4% for producers and 9% for non-producers.

Figure 3 graphically presents the coefficients from the interaction between year dummies and the producer dummy across the study period. These results confirm the absence of pre-reform differences between producing and non-producing municipalities and show that the effect of the reform is short-term, lasting three periods.

One possible explanation for the increase in the gap before the reform is that candidates for higher education careers anticipated the implementation. The reform was initially introduced as a legislative act in July 2011 and became law the following year<sup>4</sup>.

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<sup>4</sup>In August 2010, Legislative Act No. 577 of 2010 was recorded in the Gazette of Congress, which

## 5 Results

### 5.1 Descriptive Statistics

Table 1 presents summary statistics for the variables used in our analysis, covering both panel-level data for municipalities from 2009 to 2015 and time-invariant municipal characteristics measured prior to the reform. Regarding municipal public finance, on average, municipalities receive substantial national transfers (General Participation System, SGP), averaging \$483,887 per capita, followed by tax revenues (\$131,316 per capita). Royalties transferred represent the third largest source of local funding, averaging \$82,988 per capita across the sample period, highlighting their significance for municipal budgets and the potential for rent-seeking to be relevant.

Our instrumental variable, the theoretical value of royalties, which predicts municipal revenue based on the reform’s distribution rules, averages \$75,975 per capita. This value captures the exogenous variation in expected royalties. It is important to note that after the reform, the relationship between royalties generated from extraction and actual royalties received by municipalities changed significantly due to the new distribution mechanisms, strengthening the potential exogeneity of the theoretical value as an instrument for received royalties.

Concerning our key outcome variables on talent allocation, Table 1 shows that, on average across municipalities and years, the proportion of first-semester university students enrolled in Engineering programs (mean 26.03%) is slightly higher than in Management/Social Science programs (mean 22.20%). Combined, these two broad categories represent a significant portion of overall student enrollment. To account for factors other than the royalty shock that might influence career choices, particularly related to access, we include controls for the local supply of higher education programs. On average, municipalities offer a limited number of engineering programs (mean 1.06), while the average number of social science programs is slightly higher (mean 1.58). We also control for distance to major educational hubs like Bogotá (mean 321.5 km),

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established the General System of Royalties and amended articles 360 and 361 of the Political Constitution.

which proxy for broader educational opportunities beyond the immediate municipality. Additional controls for pre-reform municipal characteristics include measures of poverty (NBI), overall government performance (IDI and its components), and other public finance metrics.

## 5.2 Main Results

Our results provide robust evidence that the royalty reform significantly influenced students' career choices in Colombia. Exploiting the exogenous variation in the distribution of royalties introduced by the reform and employing our Instrumental Variable strategy, the estimates show that municipalities receiving higher per capita royalties experienced a shift (4 p.p.) in the allocation of talent toward careers associated with rent-seeking behavior.

The main outcome of interest is the change in the composition of university enrollment. Our primary IV estimate (Table 2, Column 3) shows that a one million Colombian pesos per capita increase in royalties (in 2008 terms) leads to a 9.8 percentage point (pp) increase in the difference between the share of students enrolled in management/social sciences versus engineering careers.

This aggregate shift is driven by two components: An increase in the share of students enrolling in management/social science programs by 3.9 pp (Table 2, Column 1). And a decline in the share of students enrolling in engineering programs by 5.9 pp (Table 2, Column 2).

These findings provide strong empirical support for the rent-seeking hypothesis. As the reform led to increased resource availability at the municipal level, potentially creating more opportunities for rent capture through roles often associated with management/social science fields (such as public administration or project management), students were incentivized to pursue degrees that facilitate access to these potential rents.

In particular, this evidence is compatible with the theory that suggests that when rents increase, so do the incentives to choose careers related to social sciences. On

the contrary, when rents decrease, as is the case of the producing municipalities, fewer incentives are brought about for aspiring students to choose these programs. The theory assumes that there is a decrease in the total salary of these professions, because they cannot compensate with the capture of rents. Consequently, talents move to other careers such as engineering.

Further supporting this narrative, the reduced-form results (Table 3, Column 3) show that the theoretical (predicted) value of royalties itself is significantly associated with a 2.667 pp increase in the gap between social sciences and engineering enrollment, even before accounting for the actual amount of received transfers.

The validity of our Instrumental Variable approach relies on the strength of the instrument. Table 4 presents the first-stage estimates, confirming that the theoretical value is a powerful predictor of the actual royalties received by municipalities. The F-statistic for the instrument in the main first-stage regression (Table 4, Column 1) is 42.88, well above conventional thresholds, indicating that the theoretical value is sufficiently strong.

### **5.3 Heterogeneity by Institutional Quality: The Role of Corruption**

One important aspect of our study is to investigate if the impact of resource royalties on career decisions is influenced by the quality of local institutions, particularly the existing level of corruption. The rent-seeking hypothesis suggests that resource windfalls are more likely to distort incentives and divert talent towards unproductive activities in environments where institutions are weak and corruption is prevalent, making rent capture easier and more profitable.

To test this, we estimate our IV model separately and include interaction terms allowing the effect of royalties to differ based on whether a municipality had a high or low level of accumulated corruption cases prior to the 2012 reform (as presented in Table 5). The results provide strong evidence that institutional quality significantly

mediates the relationship between resource revenue and talent allocation.

Table 5 (Column 3) shows the effect of royalties on the management and engineering enrollment gaps. In municipalities with a *low* level of pre-reform corruption (captured by the base “Royalties” coefficient), an increase in royalties per capita shows a positive effect on the gap (2.264 pp), consistent with a shift towards management; however, this effect is not statistically significant. This suggests that where institutions are relatively stronger, even with increased resource availability, the incentives for a large-scale shift towards rent-seeking careers are limited.

However, the results reveal a starkly different picture in municipalities with a *high* level of pre-reform corruption: the interaction term (‘Royalties  $\times$  High Corruption’) captures the *additional* effect of royalties in these areas. This interaction is large and highly statistically significant (11.730 pp). This means that in high-corruption municipalities, the total effect of a one-million-peso-per-capita increase in royalties on the management-engineering gap is substantially larger ( $2.264 + 11.730 = 13.994$  pp). Looking at the components (Columns 1 and 2 of Table 5), this amplified effect in high-corruption areas is driven by both a larger additional increase in management enrollment and a larger additional decrease in engineering enrollment than in low-corruption areas.

This significant heterogeneity strongly supports the rent-seeking mechanism. Where institutions are weaker (proxied by higher pre-reform corruption), the increased pool of royalty funds represents a more accessible “cake” for potential capture. These greater opportunities for rent extraction within the public sector or related activities boost the expected private returns of management and social science careers relative to engineering. Students in these environments respond to these altered incentives by shifting their educational investment towards fields perceived to offer better access to these rents. This finding underscores the critical role of institutional quality in amplifying the distorting effects of resource windfalls on human capital allocation, diverting skilled individuals away from potentially more productive sectors in which institutional weaknesses make rent-seeking less viable.



## 5.4 Heterogeneity by Producing Municipality

While our main analysis focuses on the effect of increased royalties using the IV strategy, it is also insightful to examine the direct impact of the reform on municipalities that were historically the primary beneficiaries—the producing municipalities. The 2012 reform significantly reduced the direct share of royalties going to these areas, effectively decreasing the potential pool of easily accessible local rents compared to the previous system. According to the rent-seeking hypothesis, a decrease in rent potential should incentivize talented individuals to shift *away* from careers associated with rent capture and potentially towards more productive fields like engineering.

Table 6 presents Difference-in-Differences estimates comparing talent allocation trends in producing municipalities versus non-producing municipalities after the 2011/2012 reform period began (using a dummy for the reform starting in 2011). Consistent with the prediction, producing municipalities experienced a statistically significant shift in career choices. Relative to non-producing municipalities, the share of students enrolling in management/social science careers decreased by 1.213 pp (Column 1), while the share enrolling in engineering careers increased by 2.093 pp (Column 2). This resulted in a significant 3.306 pp decrease in the management-engineering enrollment gap (Column 3) in producing municipalities post-reform. These results align with the rent-seeking perspective: where the local rent potential from royalties was reduced, talent appears to have moved away from fields linked to rent-seeking opportunities and towards engineering.

We further explore whether this response in producing municipalities varies by their pre-reform level of corruption. Table 7 presents DID estimates specifically for producing municipalities, interacted with a dummy indicating whether they had a high level of accumulated corruption cases before the reform. The results reveal that the shift away from management/social science careers and towards engineering is particularly pronounced and statistically significant in high-corruption producing municipalities (Table 7, interaction with  $D(\text{Corruption}_1)$ , Columns 1, 2, and 3). In these areas, the management-engineering gap decreased by a significant 4.139 pp. In contrast, in low-

corruption producing municipalities (interaction with  $D(\text{Corruption}_0)$ ), the estimated shift is smaller and not statistically significant.

This heterogeneity within the group of producing municipalities reinforces the role of institutional quality in the talent allocation mechanism. The reduction in direct royalty access led to a significant shift away from management/social science careers, but primarily in producing municipalities where pre-existing weak institutions (high corruption) likely meant that rent-seeking within the public sector was a more viable and attractive path to begin with. When the fuel for these rent-seeking opportunities (direct royalties) was reduced by the reform, the incentives for such careers decreased most markedly in these vulnerable environments, leading to a larger observed reallocation of talent towards engineering. This provides a complementary perspective to our main IV findings, showing the talent allocation mechanism operates in both directions depending on whether municipalities experienced an increase or decrease in rent potential from royalties, and that institutional context matters on both sides of the equation.

## 6 Mechanisms

Our baseline results and heterogeneity analysis conditional on corruption strongly suggest that rent-seeking is a key mechanism driving the observed shift in talent allocation. Resource windfalls, particularly in areas with weaker institutions, appear to make careers with potential access to rents more attractive. We further explore this channel through three complementary analyses: examining the impact of royalties on local institutional performance, analyzing the effect on specific career fields within management/social sciences, and linking these career choices to data on public officials and career-level corruption exposure.

Figure 5 illustrates that, post-reform, municipalities that gained from the redistribution tended to exhibit lower performance levels compared to producing municipalities. While these are correlations, they are consistent with increased resource inflows poten-

tially fueling rent-seeking and hindering effective governance, creating an environment where the perceived returns to careers facilitating rent capture are higher.

## **Institutional Performance**

The rent-seeking hypothesis suggests that increased resource revenues can lead to less effective government, as officials may focus on capturing rents rather than public service [Olken & Pande \(2012\)](#). If rent-seeking rises, we expect institutional performance to decline. We investigate this by looking at the causal effect of higher royalties on municipal institutional quality indicators (Table 8).

Our IV results in Table 8 largely support this. Increased royalties significantly reduced overall integral performance (-8.459 pp) and particularly lowered efficiency (-13.780 pp) and fiscal performance (-3.925 pp). These declines are consistent with increased resource inflows being associated with less effective government functioning, potentially due to expanded opportunities for rent capture.

## **Specific Career Fields**

To understand which specific careers within the broad “management/social sciences” category are driving the overall shift, we estimate the effect of royalties on enrollment shares for individual fields (Table 9). The results show that the increase in royalties significantly boosts enrollment in certain management careers. Most notably, there is a significant increase in the share of students choosing Business degrees (Table 9, Column 1 shows a positive and significant effect). Enrollment also increases in other fields like Law, although the effect is not always statistically significant for all specifications (Table 9, Column 3). The effects on Accounting and Economics are generally insignificant (Table 9, Columns 2 and 4). These findings indicate that the talent diversion is concentrated in specific fields perceived as potential pathways to positions offering rent-seeking opportunities.

## 7 Conclusion

This paper provides compelling quasi-experimental evidence that resource windfalls can significantly distort the allocation of human capital by influencing students' university career choices. Exploiting the exogenous variation in municipal royalty revenues induced by Colombia's 2012 reform, we find that increased resource inflows cause a notable shift in student enrollment away from engineering and towards management and social science fields. Crucially, this talent diversion is substantially stronger in municipalities with higher levels of pre-reform corruption, demonstrating that weak institutions amplify the distorting effects of resource wealth by making rent-seeking opportunities more accessible and attractive.

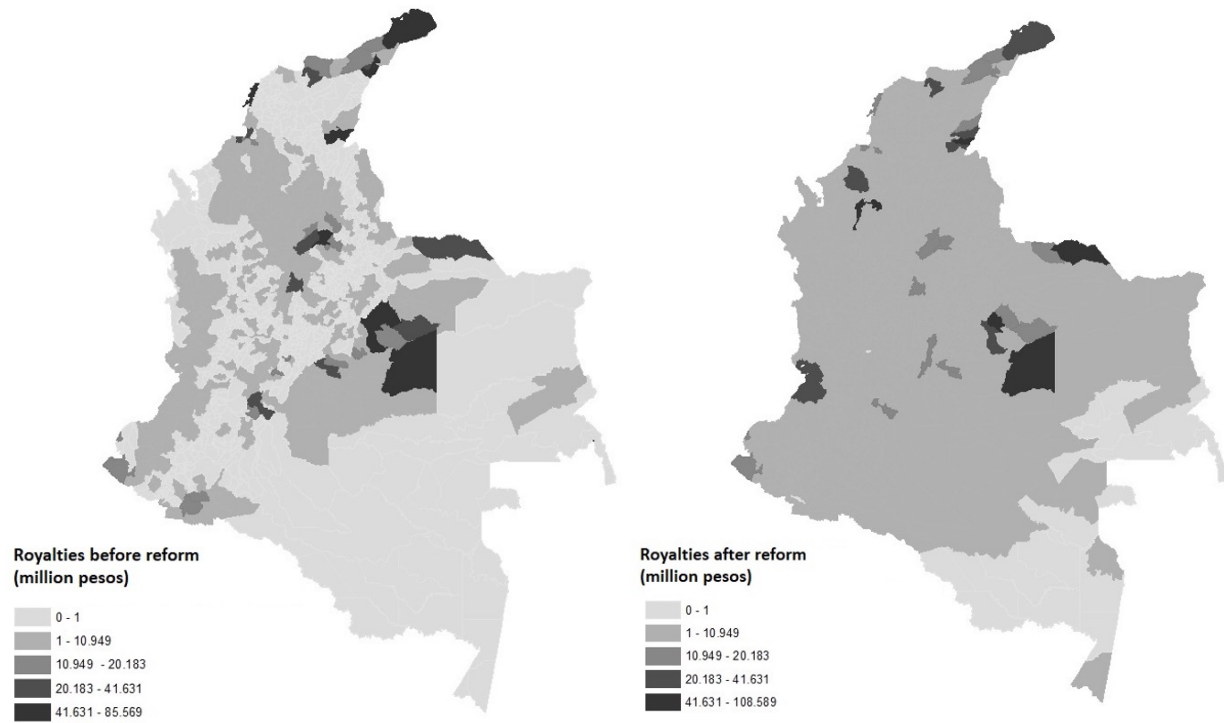
Our findings underscore a vital micro-level mechanism contributing to the “resource curse”: resource windfalls, particularly in environments with poor governance, can redirect skilled individuals away from productive innovation towards potentially less productive activities focused on rent capture. This has significant implications for long-term economic development. The results highlight the critical importance of robust institutions and effective anti-corruption measures in resource-rich regions, not only for direct fiscal management but also for safeguarding the optimal allocation of a country's talent pool. Future research could explore the long-term labor market outcomes of students who made these career choices following the reform and investigate whether similar patterns of talent misallocation are observable at earlier stages of education.

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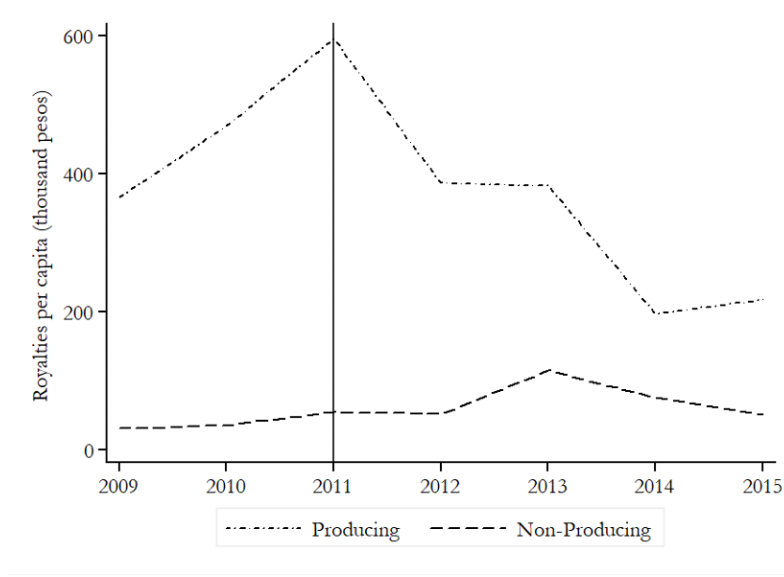
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Figure 1: Natural resources before and after the reform in 2012



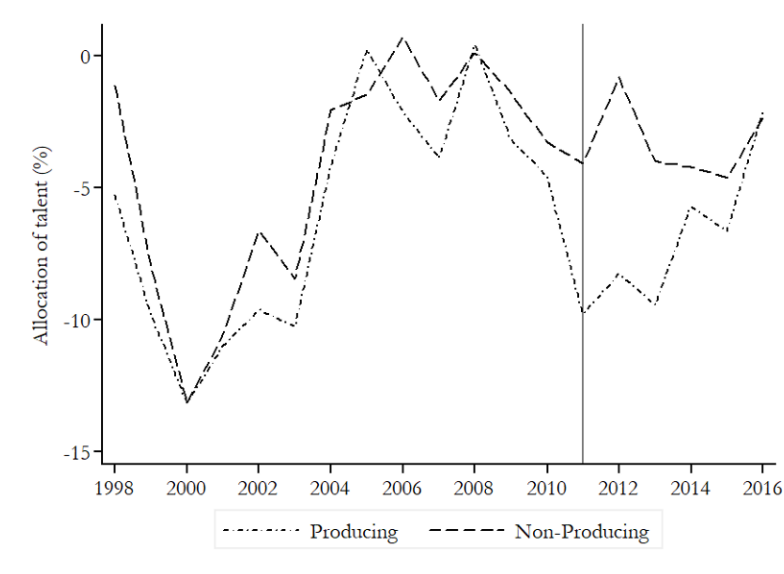
*Note:* These maps illustrate the distribution of royalty revenues across Colombian municipalities before (left panel) and after (right panel) the 2012 reform. Before the reform, royalties were heavily concentrated in a few resource-rich areas. After the reform, the distribution became more homogeneous, benefiting a greater number of municipalities—particularly non-producing ones.

Figure 2: Royalties and allocation of talent



**Panel A:** Royalties in producing and non-producing municipalities

*Note:* This panel presents the average per capita royalties received by producing and non-producing municipalities over time. The vertical line at 2011 marks the year before the implementation of the royalty reform, serving as a reference point for the institutional change.

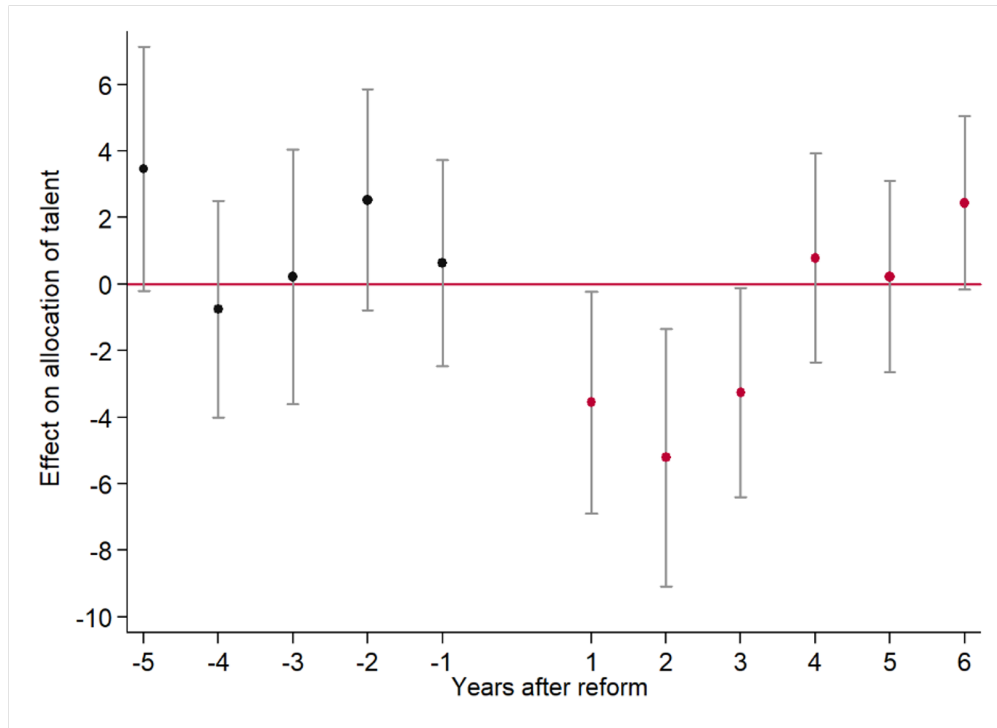


**Panel B:** Allocation of talent in producing and non-producing municipalities

*Note:* This panel shows the evolution of the talent allocation indicator—the gap between social sciences and engineering enrollment—by municipality type. The vertical line (2011) indicates the pre-reform year of the new royalty regime. After the reform, the trend in talent allocation begins to diverge between producing and non-producing municipalities, suggesting a potential causal effect of the change in royalty distribution on students' career choices.

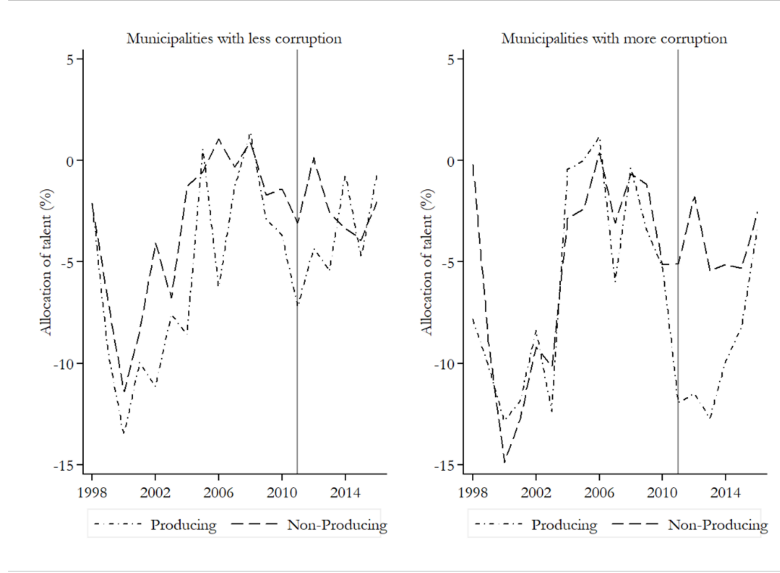


Figure 3: Allocation of talent in producing and non-producing municipalities



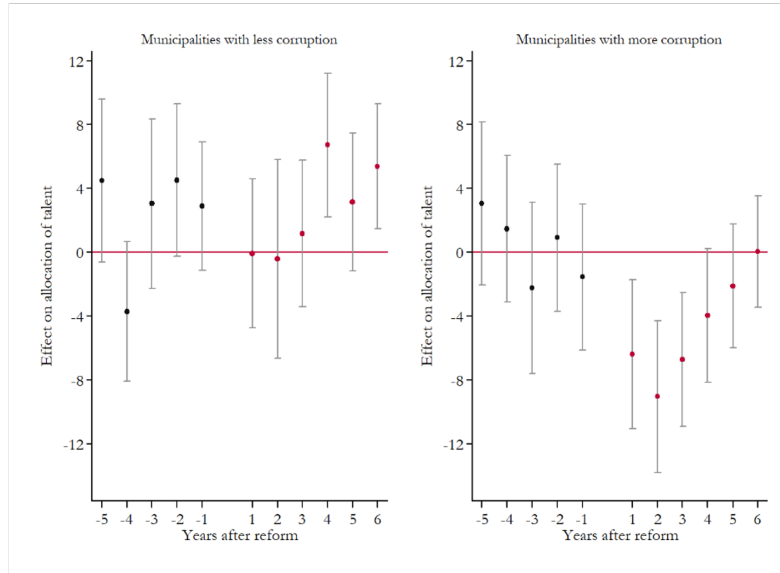
*Note:* The figure displays the coefficients from the interaction terms between year dummies and the producer municipality indicator, estimated using a difference-in-differences model with fixed effects. Black dots represent the pre-reform years, and red dots correspond to the post-reform years. Error bars indicate 95% confidence intervals. There is no evidence of pre-existing differences in talent allocation between producer and non-producer municipalities prior to the reform, supporting the parallel trends assumption. After the reform, a short-term negative effect is observed for up to three years, which gradually dissipates in the following periods.

Figure 4: Royalties and allocation of talent



**Panel A:** Allocation of talent in producing and non-producing municipalities by corruption level

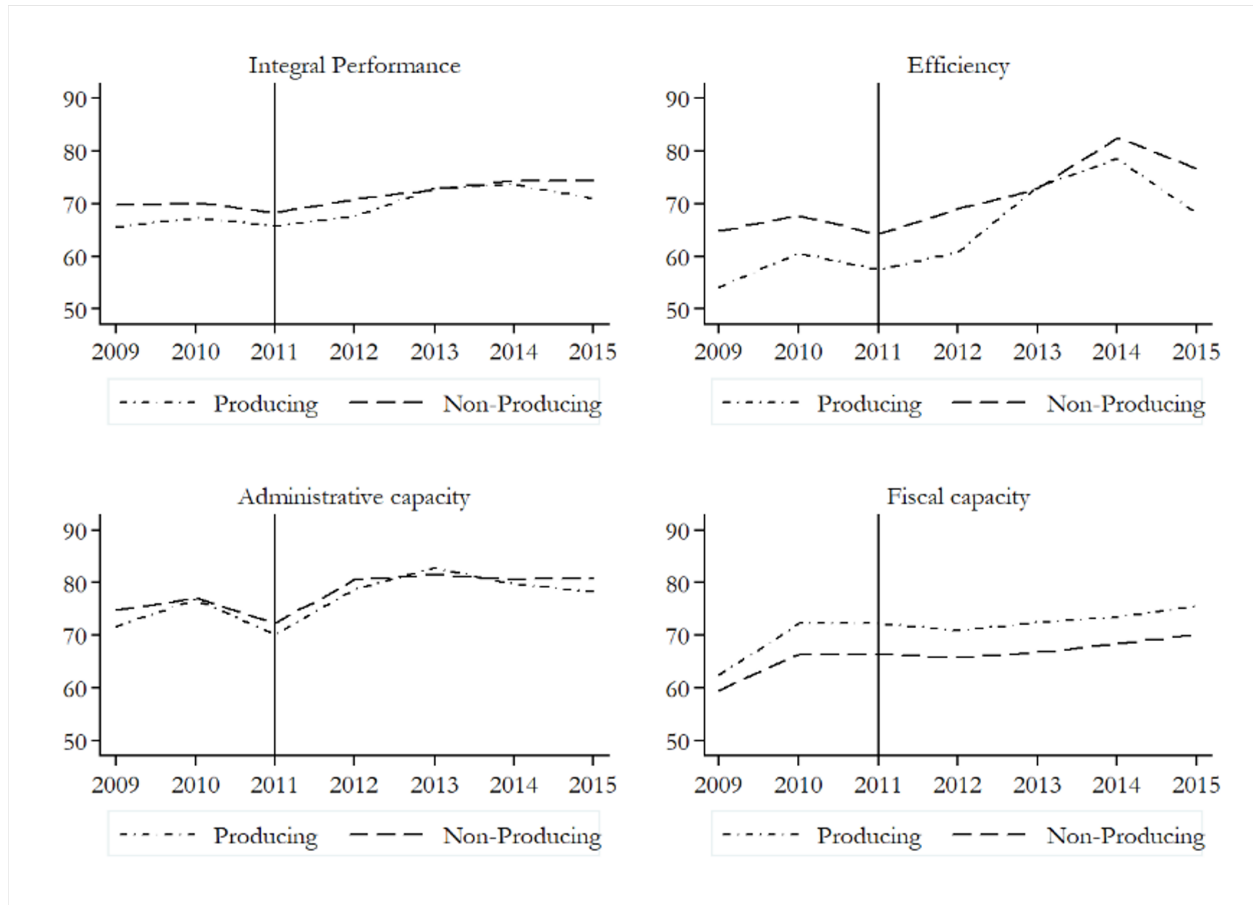
*Note:* The figure shows the evolution of talent allocation between producing and non-producing municipalities, separated by corruption level (left: municipalities with less corruption, right: with more corruption). The vertical line in 2011 is a visual reference to the announcement of the reform to the General System of Royalties.



**Panel B:** Parallel trends and post-reform effect by corruption level

*Note:* This panel displays the estimated differences in talent allocation between producing and non-producing municipalities before and after the reform, based on local corruption levels. The left plot shows municipalities with lower corruption, while the right plot shows those with higher corruption. Each point represents the estimated coefficient of the interaction between the producing municipality dummy and a year relative to the reform, with 95% confidence intervals.

Figure 5: Institutional Indicators



**Note:** Each panel shows the evolution of different institutional performance indicators—integral performance, efficiency, administrative capacity, and fiscal capacity—for producing and non-producing municipalities between 2009 and 2015. The vertical line at 2011 marks the year prior to the implementation of the 2012 royalty reform. Following the reform, a divergence is observed, with non-producing municipalities exhibiting a relative decline in performance across most dimensions. This suggests that the redistribution of royalties may have negatively affected institutional quality, particularly in municipalities that became net beneficiaries of the new allocation scheme.

Table 1: Descriptive Statistics

<i>Variable</i>	<b>Obs.</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
<i>Panel-level variables</i>					
Allocation of talent (%)	7,723	-3.83	19.01	-100	100
Share of enrollment in Management (%)	7,723	22.20	11.17	0	100
Share of enrollment in Engineering (%)	7,723	26.03	12.25	0	100
Royalties per capita	7,784	84.22	322.24	0	8,645
Theoretical value per capita	7,777	72.41	319.26	0	11,490
<i>Municipal-level variables</i>					
Open Government Index (%), 2009	1,101	65.20	11.66	20.93	91.90
Efficiency indicator (%), 2008	1,101	53.83	13.37	10.35	97.64
Fiscal performance indicator (%), 2008	1,096	59.76	6.38	34.03	88.46
Administrative capacity indicator (%), 2008	1,086	74.47	17.69	1.54	100
Indicator of legal requirements (%), 2008	1,047	78.71	17.28	3.31	100
Efficacy indicator (%), 2008	915	63.95	23.22	0.17	100
Integral Performance Index (IDI) (%), 2008	891	69.34	10.02	31.11	91.39
Years of schooling, 2005	1,106	7.10	1.12	2.30	11.78
Distance to capital (km), 2005	1,110	79.10	57.65	0	376.12
Unsatisfied Basic Needs (NBI) (%), 2005	1,108	44.81	20.53	5.43	100
Number of schools (Saber 11), 2008	1,110	1.06	11.52	0	357
Number of social science programs, 2008	1,111	1.58	12.25	0	298
Number of engineering programs, 2008	1,111	2.44	20.34	0	564
Log Population, 2008	1,110	9.56	1.10	6.87	15.78
Log GDP per capita, 2008	1,097	8.73	0.76	5.29	11.85
Log SGP transfers per capita, 2008	1,100	0.37	0.21	0	3.07
Log Tax revenues per capita, 2008	1,101	0.08	0.09	0	0.98

*Note:* This table presents summary statistics for both panel-level and municipal-level variables used in the analysis. Panel-level variables correspond to annual observations from 2009 to 2015, resulting in 7,723 observations unless otherwise noted. These include indicators of talent allocation and academic enrollment proportions, as well as measures of innovation outcomes such as royalties and theoretical value, both expressed in millions of 2008 Colombian pesos per capita. Logarithmic transformations were applied to population, GDP per capita, SGP transfers, and tax revenues to reduce skewness. All percentage variables are bounded between 0 and 100.

Table 2: Royalties and Allocation of Talent

	<i>Share of enrollment in Management (%)</i> (1)	<i>Share of enrollment in Engineering (%)</i> (2)	<i>Difference in enrollment share (M – E, %)</i> (3)
Royalties	3.971** (1.719)	-5.893*** (2.088)	9.864*** (3.356)
Municipality FE	✓	✓	✓
Year FE	✓	✓	✓
Controls (interacted with year FE)	✓	✓	✓
Observations	7,664	7,664	7,664
Municipalities	1,097	1,097	1,097

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

**Note:** The analysis period corresponds to 2009–2015. The dependent variable *allocation of talent* corresponds to the difference between students enrolled in social sciences and engineering, as a proportion of total enrollment in higher education. The variable *royalties* are expressed in millions of 2008 Colombian pesos per capita. All regressions include municipal fixed effects, year fixed effects, and the interaction of controls with year fixed effects: years of schooling (2005), distance to the capital and to Bogotá, Open Government Index (IGA) (2008), tax revenues (2008), Unsatisfied Basic Needs (NBI) (2008), number of schools in superior and very superior Saber 11 categories (2008), number of engineering and social science programs (2008), population (2008), GDP (2008), and SGP transfers (2008). Standard errors are clustered at the municipal level. Robust standard errors in parentheses.

Table 3: Reduced form. Theoretical value and allocation of talent

	<i>Share of enrollment in Management (%)</i> (1)	<i>Share of enrollment in Engineering (%)</i> (2)	<i>Difference in enrollment share (M – E, %)</i> (3)
Theoretical value	1.074*** (0.399)	-1.593*** (0.475)	2.667*** (0.725)
Municipality FE	✓	✓	✓
Year FE	✓	✓	✓
Controls (interacted with year FE)	✓	✓	✓
Observations	7,664	7,664	7,664
Municipalities	1,097	1,097	1,097

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

**Note:** The analysis period corresponds to 2009–2015. The dependent variable *allocation of talent* corresponds to the difference between students enrolled in social sciences and engineering, as a proportion of total enrollment in higher education. The proportions of management and engineering refer to their shares in the total number of students enrolled. All regressions include municipal fixed effects, year fixed effects, and the interaction of controls with year fixed effects: years of schooling (2005), distance to the capital and to Bogotá, Open Government Index (IGA) (2008), tax revenues per capita (2008), Unsatisfied Basic Needs (NBI) (2008), number of schools in superior and very superior Saber 11 categories (2008), number of engineering and social science programs (2008), population (2008), GDP per capita (2008), and SGP transfers per capita (2008). Standard errors are clustered at the municipal level. Robust standard errors in parentheses.

Table 4: First Stage: Theoretical Value

Dependent variable:	(1)	(2)
	Royalties	
Theoretical value ( $\hat{Z}_1$ )	0.270*** (0.041)	
Municipality FE	✓	✓
Year FE	✓	✓
Controls (interacted with Year FE)	✓	✓
R-squared	0.792	0.776
F Statistic	42.88	47.88
Observations	7,664	7,664
Municipalities	1,097	1,097

*Note:* The analysis period corresponds to 2009–2015. The dependent variable *royalties* refers to per capita royalties received by each municipality. All regressions include municipal fixed effects and year fixed effects, as well as interactions of control variables with year fixed effects. Standard errors are clustered at the municipality level. Robust standard errors in parentheses.

\* p<0.10, \*\* p<0.05, \*\*\* p<0.01.

Table 5: Effect of Royalties on Enrollment Shares, Conditional on Corruption Levels (2008–2010)

	Share of enrollment in Management (%) (1)	Share of enrollment in Engineering (%) (2)	Difference in enrollment share (M – E, %) (3)
Royalties	2.725 (1.935)	0.461 (2.777)	2.264 (3.622)
Royalties × High Corruption	4.278** (2.064)	-7.456*** (2.509)	11.730*** (4.086)
Municipality FE	✓	✓	✓
Year FE	✓	✓	✓
Controls (interacted with year FE)	✓	✓	✓
Observations	7,664	7,664	7,664
Municipalities	1,097	1,097	1,097

\*p<0.1; \*\*p<0.05; \*\*\*p<0.01

**Note:** The analysis period corresponds to 2009–2015. The dependent variables correspond to the proportion of students enrolled in Management (column 1), Engineering (column 2), and their difference (column 3) over the total higher education enrollment. *Royalties* represents the effect in municipalities that received royalties and exhibited low levels of accumulated corruption (2008–2010). The interaction term *Royalties × High Corruption* captures the additional effect in municipalities with high levels of accumulated corruption during the same period. Royalties are expressed in millions of 2008 Colombian pesos per capita. All regressions include municipal fixed effects, year fixed effects, and interactions of controls with year fixed effects: years of schooling (2005), distance to the capital and Bogotá, Open Government Index (IGA) (2008), tax revenues per capita (2008), Unsatisfied Basic Needs (NBI) (2008), number of schools in superior and very superior Saber 11 categories (2008), number of engineering and social science programs (2008), population (2008), GDP per capita (2008), and SGP transfers per capita (2008). Standard errors are clustered at the municipality level. Robust standard errors in parentheses.

Table 6: Reform and Allocation of Talent in Producing Municipalities

	<i>Share of enrollment in Management (%)</i> (1)	<i>Share of enrollment in Engineering (%)</i> (2)	<i>Difference in enrollment share (M – E, %)</i> (3)
D(Reform <sub>t≥2011</sub> ) × D(Producer)	-1.213** (0.520)	2.093*** (0.563)	-3.306*** (0.931)
Municipality FE	✓	✓	✓
Year FE	✓	✓	✓
Controls (interacted with year FE)	✓	✓	✓
Observations	7,664	7,664	7,664
Municipalities	1,097	1,097	1,097

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

**Note:** The analysis period corresponds to 2009–2015. The dependent variables correspond to the share of students enrolled in Management (column 1), Engineering (column 2), and the difference between them (column 3) relative to the total number of students enrolled in higher education. The variable  $D(Reform_{t \geq 2011})$  is a dummy equal to 1 from 2011 onward.  $D(Producer)$  is a dummy for municipalities that produce natural resources. All regressions include municipal fixed effects, year fixed effects, and the interaction of controls with year fixed effects: years of schooling (2005), distance to the capital, Open Government Index (IGA) (2008), tax revenues per capita (2008), Unsatisfied Basic Needs (NBI) (2008), number of schools in superior and very superior Saber 11 categories (2008), number of engineering and social science programs (2008), population (2008), GDP per capita (2008), and SGP transfers per capita (2008). Standard errors are clustered at the municipality level. Robust standard errors in parentheses.

Table 7: Reform and Allocation of Talent in Producing Municipalities (by Corruption Samples)

	<i>Share of enrollment in Social Sciences (%)</i> (1)	<i>Share of enrollment in Engineering (%)</i> (2)	<i>Difference in enrollment share (SS – E, %)</i> (3)
D(Reform <sub>t≥2011</sub> ) × D(Producer) × D(Corruption <sub>0</sub> )	-0.616 (0.847)	0.689 (0.878)	-1.305 (1.400)
D(Reform <sub>t≥2011</sub> ) × D(Producer) × D(Corruption <sub>1</sub> )	-1.162* (0.623)	2.977*** (0.670)	-4.139*** (1.141)
Municipality FE	✓	✓	✓
Year FE	✓	✓	✓
Controls (interacted with year FE)	✓	✓	✓
Municipalities (Low Corruption)	545	545	545
Municipalities (High Corruption)	552	552	552

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

**Note:** The analysis period corresponds to 2009–2015. The dependent variables refer to the proportion of students enrolled in social sciences (column 1), engineering (column 2), and the difference between the two (column 3) relative to total higher education enrollment. Reform is a dummy equal to 1 from 2011 onwards. Producer indicates municipalities extracting natural resources. Corruption levels are classified using a binary indicator: D(Corruption<sub>0</sub>) for low corruption municipalities, and D(Corruption<sub>1</sub>) for high corruption municipalities. All regressions include municipal fixed effects, year fixed effects, and the interaction of controls with year fixed effects: years of schooling (2005), distance to the capital, Open Government Index (IGA) (2008), tax revenues per capita (2008), Unsatisfied Basic Needs (NBI) (2008), number of schools in superior and very superior Saber 11 categories (2008), number of engineering and social science programs (2008), population (2008), GDP per capita (2008), and SGP transfers per capita (2008). Standard errors are clustered at the municipal level. Robust standard errors in parentheses.

Table 8: Royalties and Institutional Indicators

	<i>Integral Performance</i> (1)	<i>Efficiency</i> (2)	<i>Administrative Capacity</i> (3)	<i>Fiscal Performance</i> (4)	<i>Transparency</i> (5)
<i>Panel A. Theoretical Value</i>					
Royalties	-8.459*** (3.247)	-13.780** (7.657)	-1.620 (4.634)	-3.925*** (1.396)	7.891*** (2.660)
Municipality FE	✓	✓	✓	✓	✓
Department-Year FE	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓
Controls (interacted with year FE)	✓	✓	✓	✓	✓
Observations	6,601	6,764	7,583	7,654	7,679
Municipalities	1,071	1,078	1,097	1,097	1,097

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

**Note:** The analysis period corresponds to 2009–2015. The dependent variables are institutional indicators published by the National Planning Department (DNP), including the integral performance index and its components: efficiency, administrative capacity, fiscal performance, and transparency. All indicators are normalized between 0 and 1, where higher values denote better institutional performance. Royalties are expressed in millions of 2008 Colombian pesos per capita. All regressions include municipality fixed effects, department-year fixed effects, year fixed effects, and interactions of controls with year fixed effects: distance to the capital, distance to Bogotá, Open Government Index (IGA) (2008), tax revenues per capita (2008), Unsatisfied Basic Needs (NBI) (2008), population (2008), GDP per capita (2008), and SGP transfers per capita (2008). Standard errors are clustered at the municipality level. Robust standard errors in parentheses.

Table 9: Instrumental Variable: Royalties and Enrollment in Social-Science Careers

	<i>Share of enrollment in Administration (%)</i> (1)	<i>Share of enrollment in Accounting (%)</i> (2)	<i>Share of enrollment in Law (%)</i> (3)	<i>Share of enrollment in Economics (%)</i> (4)
<i>Panel A. Theoretical Value</i>				
Royalties	3.487*** (1.321)	0.569 (1.199)	0.196 (0.614)	-0.280 (0.235)
Municipality-Year FE	✓	✓	✓	✓
Year FE	✓	✓	✓	✓
Controls (interacted with year FE)	✓	✓	✓	✓
Observations	7,664	7,664	7,664	7,664
Municipalities	1,097	1,097	1,097	1,097

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

**Note:** The analysis period corresponds to 2009–2015. The dependent variables are the proportions of students enrolled in each social-science career (Administration, Accounting, Law, and Economics) over total higher education enrollment. Royalties are expressed in millions of 2008 Colombian pesos per capita. All regressions include municipality-year fixed effects, year fixed effects, and interactions of controls with year fixed effects: years of schooling (2005), distance to the capital and Bogotá, Open Government Index (IGA) (2008), tax revenues per capita (2008), Unsatisfied Basic Needs (NBI) (2008), number of schools in superior and very superior Saber 11 categories (2008), number of engineering and social science programs (2008), population (2008), GDP per capita (2008), and SGP transfers per capita (2008). Standard errors are clustered at the municipality level. Robust standard errors in parentheses.



# A1 Data Appendix

## A.1 Variables and Sources

### Royalties

Prior to the 2012 reform, the collection of royalty revenues was managed by different entities depending on the resource. The National Hydrocarbons Agency (Agencia Nacional de Hidrocarburos, ANH) collected revenues from hydrocarbons, the National Mining Agency (Agencia Nacional Minera, ANM) from mining extraction, and the National Fund of Royalties (Fondo Nacional de Regalías, FNR) handled indirect royalties for non-producing or port municipalities. Our data includes information on the total income generated from the extraction of oil, gas, precious metals, coal, and other minerals. Specifically, royalty information for the 2009–2012 period corresponds to transfers made by the ANH and the ANM to producing municipalities.

With the 2012 reform, the General System of Royalties (Sistema General de Regalías, SGR), overseen by the National Planning Department (Departamento Nacional de Planeación, DNP), unified the management of resources from the exploitation of natural resources in Colombia. For the period 2012–2015, royalty information was obtained from the DNP, based on the allocation of royalties to beneficiary municipalities. This includes resources from pension savings funds, regional compensation funds, and direct allocation.

Given the potential endogeneity of actual royalties received, we construct an instrumental variable: the theoretical value of royalties caused by the extraction of hydrocarbons (oil and gas). This theoretical value is estimated from the royalty generation formula, adjusted by the distribution percentages determined by the reform. The data for the elements of the formula (production, prices, exchange rates) were taken from the ANH dataset for the year 2008, available by municipality, disaggregated by field and type of hydrocarbon. The Ministry of Mines and Energy is responsible for the official payment of royalties, based on information provided by the ANH.

## Higher Education

The database of the System for the Prevention of Desertion in Higher Education (Sistema para la Prevención de la Deserción de la Educación Superior, SPADIES) monitors students enrolled in Higher Education Institutions (HEIs). This system provides information on students enrolled in various technical, technological, and university-level programs, allowing us to track career choices. By linking the SPADIES data with information from the Colombian Institute for the Promotion of Higher Education (Instituto Colombiano para el Fomento de la Educación Superior, ICFES), we can approximate the municipality of origin of students based on the city where they took the national standardized test Saber 11.

Higher education careers were classified into two main categories based on the literature: i) management/social science careers, related to activities potentially offering rent-seeking opportunities; and ii) engineering careers, generally associated with productive entrepreneurship. The first category includes administration (business and public), accounting, law, and economics programs. Examples of engineering careers include Chemical, Mining and Metallurgy, Mechanical, and Petroleum Engineering, among others. The full list of programs in each category is provided in Appendix [A.2](#).

Based on this classification, we constructed the dependent variables at the municipal level for the analysis period (2009–2015). The main outcome is the "allocation of talent," defined as the difference between the proportion of students enrolled in management/social sciences and engineering programs, relative to the total number of students enrolled in higher education [Ebeke et al. \(2015\)](#). Other outcome variables include the proportion of students in management/social sciences relative to the sum of both categories, and the proportion of students in each category relative to total higher education enrollment.

## Public Officials

Information on public officials in Colombia is available on the online platform of the Public Employment Information and Business System (Sistema de Información

y Gestión del Empleo Público, SIGEP). This platform provides curriculum vitae details for officials in national and territorial entities, including their training, current position, experience, and salary range. Due to data access limitations, we constructed a database of national public employees, yielding a sample of approximately 66,000 employees from 1,019 municipalities, filtered by place of birth. Additionally, a sample of 100,000 national and territorial officials from 1,099 municipalities is used. The careers of these officials are classified into the aforementioned management/social science and engineering categories.

## **Corruption**

Corruption data was collected from the Prosecutor General’s Office (Fiscalía General de la Nación), responsible for administering justice in Colombia. The information originates from the accusatory oral penal system (Sistema Penal Oral Acusatorio, SPOA), which records investigations for various crimes. We identify cases related to corruption of public officials by selecting crimes against public administration, excluding those committed against public servants.

## **Institutional Indicators**

The DNP evaluates the institutional performance of territorial entities through the Integral Performance Indicator (Indicador de Desempeño Integral, IDI). To examine the causal effect of royalties on institutional capacity, we utilize the IDI. However, the IDI includes a fiscal performance component directly affected by increases in royalties, potentially worsening performance due to a reduced share of own revenues. To avoid this, we use a version of the IDI calculated without the fiscal performance component, focusing on dimensions like efficiency, administrative capacity, legal requirements, and efficacy.

## Municipal General Characteristics

To control for time-invariant municipal characteristics in our regressions, we use data from the municipal panel of the Economic Development Studies Center (Centro de Estudios sobre Desarrollo Económico, CEDE) at Universidad de Los Andes. This panel contains information on general characteristics, violence, government, and land for Colombian municipalities. For this research, we use variables related to general characteristics and government structure. These controls are measured in a year prior to the beginning of the analysis period (2009) and are interacted with year fixed effects in all regressions.

## A.2 Categories of Careers

The careers classified under **Management and Social Sciences** include programs in administration (business and public), accounting, law, and economics.

The careers classified under **Engineering** are grouped by knowledge areas: 1) Architecture; 2) Biomedical and related; 3) Environmental, sanitary and related; 4) Administrative and related; 5) Agricultural, forest and related; 6) Agro-industrial, food and related; 7) Agronomic, livestock and related; 8) Civil and related; 9) Mines, metallurgy and related (including petroleum/gas engineering); 10) Systems, telematic and related; 11) Electrical and related; 12) Electronic, telecommunications and related; 13) Industrial and related; 14) Mechanical and related; and 15) Chemical and related. A full list of specific programs within each area is provided for reference.

## A.3 Constructing Corruption Indicator by Career

Given limitations in directly measuring corruption by specific career paths within the public sector, we construct an indirect measure based on the cases of investigated officials and their reported positions (e.g., advisor, professional, manager). This indicator combines the frequency of corruption cases associated with specific positions with the proportion of officials from a given career who hold those positions. Specifically, for

each career, we calculate a weighted sum where the weights reflect how frequently positions typically held by graduates of that career are associated with corruption cases. This index serves as a measure of the overrepresentation of corruption cases within public sector roles commonly occupied by individuals from specific careers related to rent-seeking.