Moving into greener jobs: Impact of Oil Shocks on Students' Career Choices

Brigitte Castañeda[1] and Jaime Polanco-Jiménez *[2]

[1]Universidad de Los Andes

[2]Pontificia Universidad Javeriana

June 2024

Abstract

This study examines the impact of oil production shocks on students' career choices, with a special emphasis on the shift to greener occupations. We use an econometric methodology to assess how external shocks, such as fluctuations in oil production, influence students' decisions to pursue careers in the polluting or environmental sectors. Our findings show that negative oil production shocks increase the likelihood of students completing technical education programs, particularly in sectors unrelated to oil and gas, suggesting a shift toward more sustainable career paths. However, there is no significant change in university completion rates for environmental programs, highlighting potential barriers to higher education in green sectors. The results underscore the critical role of public policy in facilitating this transition. Policy interventions like financial aid, scholarships, and green job awareness campaigns are crucial to support a workforce shift towards sustainable sectors during economic downturns. This can aid the transition to a low-carbon economy.

JEL Codes: Q52, Q54, J24, I25, O13.

Keywords: Oil Shocks, Green Jobs, Carbon Pricing, Environmental Policy.

*We thank the Carbon Market Mentoring Program created as part of the Supporting Readiness for Article 6 Cooperation (SPAR6C) program, co-led by the GGGI and the UNEP. Special thanks to Jorge Marco for his invaluable insights and to Katherine Ovalle for her challenging policy questions.

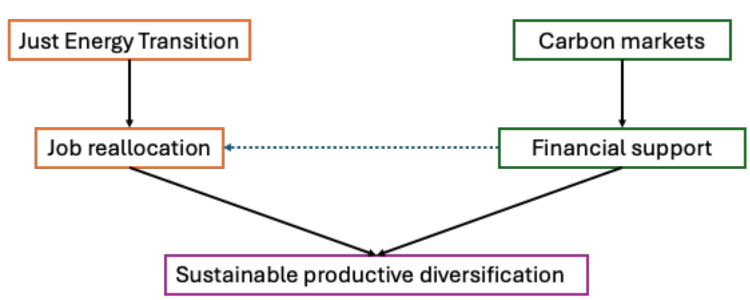
1 Introduction

Carbon pricing is a widely used instrument by countries designed to make polluting sectors internalize the cost of emitting greenhouse gases (GHGs). By raising the prices of emission-intensive goods and services, carbon pricing encourages shifts in demand towards cleaner industries and energy sources (Hafstead & Dunlap, 2020). One of the most crucial considerations for policymakers is how these environmental regulations would affect employment.

This research, supported by GGGI and UNEP under the PMI-SPAR6C program, addresses two key questions: How do students' preferences for studying environmental and mining-energy careers change in response to shocks in oil production? And how can carbon markets facilitate the relocation of green jobs in Colombia? By analyzing external shocks such as falling oil prices and reduced production, we aim to understand how carbon pricing can affect local employment and labor supply.

To answer these questions, we conducted two main activities. First, we performed an econometric analysis to estimate how young people's career choices change in areas affected by a shock to oil activity compared to areas with stable production. Second, we carried out a descriptive analysis of economic activity in municipalities with strong resource extraction histories, exploring potential alternatives for economic diversification, especially activities related to Articles 6.2 and 6.4 of the Paris Agreement.

Since both carbon markets and the just energy transition aim to promote sustainable, low-carbon economic diversification, aligning these efforts to achieve common benefits would be advantageous (see diagram below). Currently, Colombia is in a phase of preparation and regulation of Article 6 of the Paris Agreement, presenting a unique opportunity to enhance the regulation and design of public policies that contribute to overall well-being.



2 Literature Review on Carbon Pricing and Employment

The existing literature on the effects of environmental policies on employment, specifically carbon pricing, indicates that these policies tend to cause a *reallocation of jobs* rather than net gains or losses in employment (Hafstead & Williams, 2020). For instance, the study by Yamazaki (2017) examines the employment impact of British Columbia's revenue-neutral carbon tax implemented in 2008. They found that carbon-intensive and trade-sensitive industries experience a decline in employment with the tax, while clean service industries see an increase in employment. Moreover, the International Monetary Fund (IMF) World Economic Outlook report finds that with appropriate policy measures, the green transformation can lead to moderate employment shifts. In advanced economies, the necessary reallocation is smaller compared to historical shifts from industrial to service sector jobs, whereas emerging markets require greater reallocation due to a greater share of employment in sectors with high emissions (Dept., 2022).

Another crucial factor determining the impact on employment is *geographic location*. Industries are often geographically concentrated, which means that sectoral job reallocation could lead to different changes in net jobs in different regions. This could result in some regions gaining jobs while others losing them, even if the overall effect on employment is small. Part of the success of Germany's transition from coal to renewable energy in the Ruhr region is attributed to its proximity to other industrial centers, its dense population, and its robust educational institutions, which have collectively enhanced the region's ability to adapt and diversify its economy (Buchholz, 2022).

These effects of environmental policies on jobs also vary according to *skill levels*. Jobs that are more green-intensive tend to be held by higher-skilled and urban workers, whereas lower-skilled and rural workers are more likely to be in pollution-intensive jobs. This suggests that the green transition may be more challenging for lower-skilled and rural workers, who may require more support and targeted policies to facilitate their transition (WBG, 2018). High-skilled workers in green industries may experience wage increases due to higher demand for their skills. Conversely, low-skilled workers may face wage stagnation or reduction, particularly if they are unable to transition to new sectors or if the new green jobs created are predominantly high-skilled (Dept., 2022).

Most studies on the impacts of environmental regulations and/or climate policies on employment focus on developed countries. However, when analyzing studies in *developing countries*, such as the paper by Castañeda *et al.* (2024), we encounter additional challenges. First, developing countries often lack comprehensive and high-quality data on employment, wages, and other labor market indicators. Second, a large proportion of the workforce in developing countries is employed informally, without formal contracts or social protections. Third, high unemployment rates mean there is greater competition for the few available jobs in green sectors, which can further marginalize less skilled workers. These factors make it difficult to conduct detailed econometric analyses and model labor market dynamics accurately.

In developing countries like Colombia, according to the World Bank Group (WBG, 2023), meeting Colombia's Nationally Determined Contribution (NDC) mitigation target has the potential to add approximately 347,000 jobs (or 1.6% of the 2022 employment level) between now and 2030 relative to a business-as-usual scenario. However, the sector and poverty impacts will vary. The rate of absorption of displaced workers into expanding sectors will depend on the relevance of these sectors within local economic activity, the availability of similar jobs in local labor markets, and the capacity of firms to upgrade their productive capabilities. The sectors expected to grow as a result of the transition, they will not necessarily reemploy workers laid off in the contracting sectors. Sectors in industry and service activities such as transport, construction, and communication account for the greatest share of total output and gain the most from climate reforms.

In the study on the diversification of the economy post-carbon in the Cesar department of Colombia, where there is a high level of mining activity, it is found that the supply and demand for skills are uncoordinated. There are gaps in soft skills and requirements in professions related to the digital economy, programming, cultural management, media marketing, and similar fields (CESORE, 2021).

3 Contexto

4 Data and Empirical Strategy

4.1 Empirical strategy

To answer this question of whether oil production shocks affect student´s career decisions, I use the following empirical model with fixed effects:

$$Y_{s,f,t} = \phi_s + \phi_f + \phi_t + \beta_1 Shock_{f,t} + \epsilon \tag{1}$$

Where $Y_{s,f,t}$ indicate the proportion of students who studied a career related to oil and gas exploration activities, at school s, located in field f, in year t. $Shock_{f,t}$ is a standardized vector of the oil production variable that describes changes in production relative to their mean and standard deviation. When $Shock_{f,t} > 1.6$, the oil production in field f in year t experienced a positive shock, while when $Shock_{f,t} < -1.6$, it corresponds to a negative shock. ϕ_s, ϕ_f, ϕ_t are the fixed effects of school s, field f, and year t respectively. Finally, ϵ represents the term of error.

A statistically significant estimate for the coefficient in the vector β_1 suggests that production shocks affect students' career choices.

4.2 Data

Oil Production Information on oil production was obtained from the database of the National Hydrocarbons Agency (ANH). The data includes the average monthly oil production in barrels per day for each field from 2013 to 2020.

Schools in Oil Fields Geo-referenced schools were obtained from the DANE Vector Database. Using the land map of operating oil fields from the ANH, we selected only the schools located within the oil fields.

Careers Information on the results of the final year high school knowledge exams (Saber 11), technical institute exams (Saber TyT), and undergraduate program exams (Saber Pro) comes from the Colombian Institute for the Evaluation of Education (ICFES).

We have information on academic performance, as well as extensive anonymized socioeconomic characteristics for each student from 2012 to 2020. We identified around one million students who took both the Saber 11 and Saber Pro exams, meaning those who completed an undergraduate degree. We also identified around five million technical and technological career students who took the Saber 11 and Saber TyT exams. In this sample, we selected only those who studied in schools located within oil fields. Additionally, we classified undergraduate and technical careers related to oil and gas exploitation.[1] 1 lists summary statistics for the model variables.

[1] For example, degrees such as: geología, ingeniería ambiental, ingeniería civil, ingeniería mecánica, ingeniería geológica, ingeniería en energía, ingeniería de petróleo y gas, ingeniería de petróleos, ingeniería química, ingeniería de minas y metalurgia, and technical programs like: técnica profesional en operaciones mineras, tecnología en supervisión de procesos mineros, tecnología en instalaciones hidráulicas sanitarias y de gas, tecnología en gestión para el suministro gases combustibles y no combustibles, tecnología en manejo de petróleo y gas en superficie, tecnología en operación de plantas petroquímicas, tecnología en producción de petróleo, técnico profesional en perforación de pozos petrolíferos, among others...

Figure 1: Map of oil fields that present shocks to production and the schools located within.

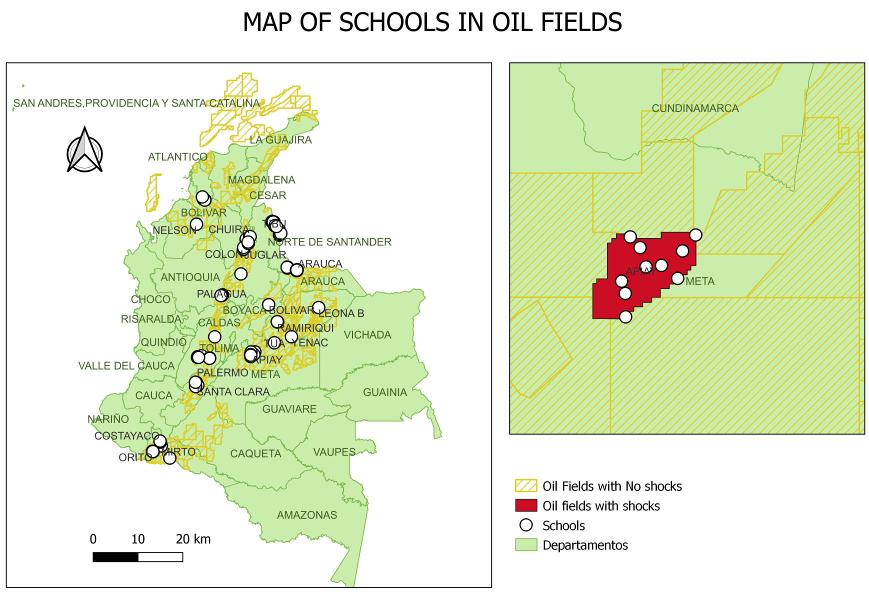


Table 1: Summary statistics

Variable	Mean	Median	Std Deviation
Oil production (barrels per day)	2397.01	2430.46	2469.38
Students per school	52.71	35.00	53.59
% of students with any higher education degree per school	34%	29%	23%
% of students with technical degree per school	10%	9%	9%
% of students with professional degree per school	26%	19%	23%
Students with technical degrees in mining and petroleum	0.09	0.00	0.38
Students with degrees in mining and petroleum	0.05	0.00	0.33
Students with technical degrees in environmental studies	0.10	0.00	0.38
Students with degrees in environmental studies	0.41	0.00	1.00

5 Results

This section presents the findings of your research on the impact of a negative production shock on educational attainment.

5.1 Aggregate effect on tertiary education

A negative production shock has a positive and statistically significant effect on the overall proportion of students completing tertiary education (Model 1 and 2). This suggests that students may be more likely to pursue higher education when faced with limited opportunities in the labor market due to the shock. When controlling for covariates in Model 2 (e.g., average student age, gender ratio), the positive effect of the production shock on overall completion rates remains statistically significant. Interestingly, Model 3 indicates a negative (but not statistically significant) effect on university completion rates specifically. This might suggest students are more likely to complete shorter technical programs rather than full university degrees. On the other hand, Model 4 shows a positive and statistically significant effect on completing technical programs related to the field outside of oil and gas exploration. This suggests the production shock might incentivize students to pursue alternative technical careers.

Proportion of Tertiary Education Completion

Dependent Variables:	Completed Tertiary Education		Completed University	Completed Tech Program
Model:	(1)	(2)	(3)	(4)
Variables				
Oil Production Shock	0.0628***	0.0703***	-0.0159	0.1100***
	(0.0189)	(0.0186)	(0.0306)	(0.0266)
Covariates	No	Yes	No	No
Fixed-effects				
School	Yes	Yes	Yes	Yes
Oil Field	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	1,248	1,246	1,248	1,248
R^2	0.84132	0.85273	0.88341	0.52824
Within R^2	0.00234	0.07738	0.00020	0.01673

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Notes: Standard errors (in parentheses) grouped by schools. The dependent variable is the percentage of students who complete some degree of higher education, whether technical and technological or university, according to the column heading. Covariates include average age, total number of males in a classroom, proportion of students working, standardized math and language outcomes. We control for school, field and year fixed effects, the latter absorbing changes in the price of oil and gas.

5.2 Effect on careers related to the environment

The analysis of the negative oil production shock's impact on careers associated with the environment yields noteworthy results. Initially, the overall completion rate in environment-related fields exhibits no statistically significant change (Model 1). This absence of a clear positive effect suggests that the economic downturn in the oil and gas sector may not have directly led to a surge in student interest in environmental careers.

However, contrary to expectations, we observe a negative effect on student participation in technical and technological programs (Model 3). This unexpected finding implies that, following the shock, fewer students showed interest in pursuing technical education in environmental fields. One plausible explanation could be the perceived instability within the oil and gas sector, prompting students to seek alternative career paths outside of technical or specialized domains.

Proportion of Students on Environmental Fields of Study

Dependent Variables:	Completed Tertiary Education	Completed University	Completed Tech Program
Model:	(1)	(2)	(3)
Variables			
Oil Production Shock	-0.0159	0.0803	-0.0930*
	(0.2175)	(0.2052)	(0.0556)
Fixed-effects			
School	Yes	Yes	Yes
Oil Field	Yes	Yes	Yes
Year	Yes	Yes	Yes
Fit statistics			
Observations	1,248	1,248	1,248
R^2	0.51348	0.51123	0.34816
Within R^2	1.9×10^{-6}	6.33×10^{-5}	0.00045

Clustered (School) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

5.3 Effect on careers related to oil and gas exploitation

The impact of the negative oil production shock on educational programs related to oil and gas exploration reveals a potential decline in student interest. A statistically significant decrease is observed specifically in university program completion (Model 3). This might be due to the longer-term career focus and higher investment associated with university programs compared to technical training.

Furthermore, the shock might have influenced student perceptions. A decline in the oil and gas industry could signal fewer job opportunities or increased uncertainty about the sector's future. Additionally, a growing public focus on environmental issues might make careers in oil and gas exploration less appealing.

Proportion of Oil Related Education Completion

Dependent Variables:	Completed Tertiary Education		Completed University	Completed Tech Program
Model:	(1)	(2)	(3)	(4)
Variables				
Oil Production Shock	-0.0020	-0.0020	-0.0022**	-0.0010
	(0.0102)	(0.0101)	(0.0011)	(0.0105)
Covariates	No	Yes	No	No
Fixed-effects				
School	Yes	Yes	Yes	Yes
Oil Field	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Fit statistics				
Observations	1,248	1,246	1,248	1,248
R^2	0.38385	0.38609	0.30507	0.42052
Within R^2	0.00023	0.00396	0.00074	8.42×10^{-5}

Clustered (ID_SCHOOL) standard-errors in parentheses

*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

6 Conclusions

(PENDIENTE)

References

Buchholz, Peter. 2022. Germany's transition from coal to renewable energy: The role of geography and institutions. *Energy, sustainability and society.*

Castañeda, Brigitte, Intriago, Luis Fernández, Heffron, Raphael J., & Hyun, Minwoo. 2024 (January). *A global and inclusive just labor transition: Challenges and opportunities in developing and developed countries.* Tech. rept. Universidad de Los Andes, Environmental Defense Fund, Universite de Pau et des Pays de l'Adour, University of California, Santa Barbara.

CESORE. 2021. *Diversificación productiva para el post-carbon en el cesar.*

Dept., International Monetary Fund. Research. 2022. *World economic outlook, april 2022: War sets back the global recovery.* USA: International Monetary Fund.

Hafstead, Marc, & Dunlap, Lauren. 2020 (May). *Carbon pricing 106: Effects on employment.* Part of RFF's Carbon Pricing Explainer Series.

Hafstead, Marc A. C., & Williams, Roberton C. 2020. Jobs and environmental regulation. *Environmental and energy policy and the economy*, **1**, 192–240.

WBG, World Bank Group. 2018. *Effect of climate policies on labor markets in developing countries: Review of the evidence and directions for future research.*

WBG, World Bank Group. 2023. *Colombia's ndc mitigation target and employment impacts.*

Yamazaki, Akio. 2017. Jobs and climate policy: Evidence from British Columbia's revenue-neutral carbon tax. *Journal of environmental economics and management*, **83**, 197–216.