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Should I stay or should I go? The role of national geographic mobility, gender, age, institutional research profiles, and labor market on the career performance of the scientific workforce in Colombia

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Abstract
Academic mobility is a central concern in science policy, yet research has focused largely on international mobility or migration, leaving national mobility in middle-income countries underexplored. This study examines how national geographic mobility between cities and municipalities is associated with the career performance of Colombian researchers classified under the national evaluation system of the Ministry of Science, Technology, and Innovation (MinCiencias). Drawing on open administrative data from six assessment calls conducted between 2013 and 2021, the analysis covers 40,485 researcher-call observations. An ordinal logistic regression model estimates the association between researcher rank (Junior, Associate, Senior) and a set of lagged individual, institutional, and contextual covariates, including a binary indicator of inter-city relocation. Because the proportional odds assumption is rejected, an unrestricted specification is adopted to capture heterogeneous effects across rank thresholds. Inter-city mobility is uncommon, affecting 2.7% of observations, and is concentrated among early-career researchers. Mobility is not associated with accelerated promotion; instead, it correlates with rank instability, particularly for Junior and Associate researchers. Institutional concentration of academic capital emerges as a strong correlate of rank progression, consistent with cumulative advantage. However, mobility is associated with rank instability mainly when researchers relocate to smaller cities, whereas moves toward larger urban centers show no comparable penalty.

Keywords Academic mobility · Geographic mobility · Research performance · Science policy · Colombia

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Introduction

Academic mobility is a key factor in science policy, promoting intellectual collaboration, innovative knowledge production and transfer, and the internationalization of national science systems (Cavalli & Teichler, 2015; Gureyev et al., 2020; Ito et al., 2025; Momeni et al., 2022; Morano-Foadi, 2005; Soete et al., 2021; Sugimoto et al., 2017). It has also become a prominent subject in metascience and quantitative science studies, where the most relevant topics include the development of methodological approaches, the flows of academic migration, the impact of academic mobility, factors driving academic mobility, and historical perspectives (Gureyev et al., 2020). Despite this, most research has been directed toward international mobility, highlighting a limited understanding of the dynamics of national scientific workforce mobility in middle- and low-income countries (Liu et al., 2024).

To clarify, migration and mobility, though related, differ primarily in their permanence. According to Teichler (2015), migration implies a permanent relocation, domestic or abroad, such as a scientist moving from one country of citizenship to another to take up a permanent research position. In contrast, mobility refers to non-permanent or repeated movements without a permanent change in residence, such as a scientist participating in an international research exchange for a few months (Teichler, 2015).

Regarding exceptional studies on national mobility, evidence from the United States indicates that professors are more likely to move to institutions with higher research intensity and from rural to urban areas. Notably, women professors are more frequently relocating within the same geographic region than their men counterparts (Yan et al., 2020). At Washington State University, researchers showed high mobility rates, with domestic movers demonstrating greater citation impacts than international movers (Payumo et al., 2018). In Italy, the centralized and non-competitive university system results in lower post-mobility performance, particularly for less productive researchers (Abramo et al., 2022). Faculty members at Turkish public universities, particularly women, older individuals, and those in major cities or well-established institutions, are less likely to relocate nationally (Yuret, 2023).

Tuning the attention to Latin America, the signing of the North American Free Trade Agreement (NAFTA) increased the flow of Mexican inventors to multinational companies, exacerbating the brain drain, while regional disparities in mobility persist, with Mexico City as a key destination (Aboites & Díaz, 2018). Over time, migration intensity has decreased, but the diversity and density of migration networks across Mexican states have increased (Miranda-González et al., 2020).

Research objectives and research question

This study focuses on the scientific workforce mobility in Colombia, a sizable country with an area of 1.1 million square kilometers, a territory sufficient to encompass the combined areas of Germany, Italy, the United Kingdom, and Romania. Beyond its significant territorial size, Colombia presents several characteristics relevant to this analysis, such as a scientific system that shows measurable efficiency in research output despite scarce financial resources, and a protracted history of intense forced internal displacement stemming from an armed conflict started in the 1960 s (Cortés & Ramírez Cajiao, 2024; SCImago, 2020; UNHCR, 2023).

This national context is reflected in the concentration of human capital, as researchers in Colombia originate from over 866 distinct municipalities; however, the majority are ultimately employed in the three largest cities: Bogotá, Medellín, and Cali (MinCiencias, 2022). This scenario provides a pertinent case study for advancing the research agenda on the internal mobility of researchers and the structural factors that influence their career progression.

This study aims to contribute to the understanding of national academic mobility factors by analyzing the association between researchers' mobility patterns and subsequent changes in their research career performance. We access open governmental data maintained by the Ministry of Science, Technology, and Innovation (MinCiencias) rather than relying solely on canonical bibliographic sources like WoS or Scopus. In particular, we try to answer the following research question:

> *RQ: How is geographic mobility between cities and covariates, such as individual characteristics, institutional research profiles, and local labor market conditions associated with Colombian researchers' performance within the MinCiencias ranking system?*

Following this introduction, the study's structure transitions into the methodology section. This section will include a detailed description of the open-access data repository from MinCiencias, derived from the national research groups assessment, and an explanation of the analytical methods to be applied. Subsequently, we present the results and then discuss them in relation to the existing literature. The final section, the conclusions, will address the study's limitations and outline the agenda for future research. A previous draft of this manuscript was published in the Proceedings of the 20th International Society of Scientometrics and Informetrics Conference (ISSI 2025) (Godoy et al., 2025).

Methodology

Data

We used open-access datasets curated and issued by MinCiencias. These datasets provide information from national assessments conducted in 2013, 2014, 2015, 2017, 2019, and 2021. There were no national assessments conducted by MinCiencias in 2016, 2018, and 2020. Our analysis draws on socioeconomic data and academic career data for Colombian researchers. This analysis incorporates two specific datasets: one detailing research groups and another detailing researchers. The links to both datasets are shared below:

- National Groups Assessments, 21 columns, ~30,000 rows[1]
- National Researchers Assessment, 30 columns, ~77,000 rows[2]

MinCiencias (2023) launched a dashboard titled 'La Ciencia en Cifras' (Science in Numbers)[3] to explore the raw data contained in the dataset displayed above, among other

[1] https://www.datos.gov.co/d/hrhc-c4wu, last accessed on December 24, 2025.
[2] https://www.datos.gov.co/d/bqtm-4y2h, last accessed on December 24, 2025.
[3] https://minciencias.gov.co/la-ciencia-en-cifras, last accessed on December 24, 2025.

subjects. Colombian researchers are evaluated as units within the national evaluation system, categorized into Junior, Associate, Senior, or Emeritus ranks based on criteria such as academic output, leadership, and mentoring. Researchers update their portfolios on the national platform (CvLAC), detailing their disciplinary expertise and research outputs, with oversight from institutional and research group leadership. It must be noted that academic rank progression does not influence salary or career advancement within their employing institutions (Vasen et al., 2023). We also used the national statistics of the labor market issued by the Colombian National Statistical Office (DANE) (DANE 2025). The national household survey (GEIH) is a continuous, national, probabilistic, multi-stage, and stratified household survey designed to generate official statistics on the labor market, household income, monetary poverty, and the socio-demographic characteristics of the resident population. The methodology utilizes concepts adapted from the International Labour Organization (ILO) standards, particularly the resolutions of the International Conference of Labour Statisticians (CIET), providing key indicators such as the Global Participation Rate, the Unemployment Rate, and measures of sub-utilization of the labor force. Operating with an annual sample of approximately 315,000 households, the most recent iteration is the GEIH Framework 2018, which incorporated a revised sampling design based on the 2018 National Population and Housing Census (CNPV) and introduced enhancements for the identification and measurement of population groups such as the *campesino*, LGBTI, and disabled populations. The justification for the inclusion of this data set will be detailed in the following subsection.

Method and variables

Table 1 reports variable categories and descriptions. We implemented an ordinal logistic regression model due to the ordered nature of the dependent variable (researcher rank: Junior, Associate, Senior). The underlying assumption is the existence of a latent continuous variable that represents the unobserved "research recognition" or status of each researcher. This latent variable is modeled as a linear function of three sets of covariates: individual, institutional, and contextual factors, plus a random error term with zero mean and unit variance. Observed performance ranks (Junior, Associate, Senior) arise from this latent variable crossing estimated cutpoints that partition the continuous scale into discrete ordered categories.

Under the proportional odds specification, the cumulative probabilities of being at or below a given rank are linked to the covariates through the standard logistic function. In this framework, the odds ratios associated with each predictor are assumed to be constant across the cumulative splits of the ranking (Junior versus Associate or Senior, and Junior or Associate versus Senior). The initial model is estimated under the assumption of proportional odds.

The explanatory variables are systematically organized into three analytical domains, i.e., individual, institutional, and contextual, to capture the multifaceted factors influencing academic mobility.

Individual-level variables: standard controls for human capital and professional standing immediately preceding the observed mobility event. These include:

- Gender, introduced to test for systematic differences in mobility patterns and their outcomes across genders, is a critical consideration in national academic labor markets and career advancements (Sugimoto & Larivière, 2023). The gender is auto-reported

Table 1 Variable categories and description

Category	Variable	Description
Dependent	researcher_rank	Ordered academic rank of the researcher (Junior, Associate, Senior); modeled as the observed outcome of a latent recognition variable
Central explanatory	moved	Binary indicator equal to 1 if the researcher changed city between two consecutive assessment calls; interpreted as conditional association, not causal effect
Individual	gender	Self-reported gender from the researcher's individual profile; no algorithmic inference applied
	age18	Age operationalized as years past the age of majority in Colombia, used as a centered measure of experience and career stage
	n_affiliations	Number of institutional affiliations; proxy for the size and density of the researcher's collaboration and institutional network
	previous_rank.L	Linear component of the previous researcher rank; captures baseline effect of prior academic standing on mobility
	previous_rank.Q	Quadratic component of the previous researcher rank; tests for non-linear (accumulated advantage) effects across the rank distribution
	research_area	Disciplinary field classified into six OECD Fields of Science categories (Medical and Health Science, Natural Sciences, Engineering and Technology, Social Sciences, Humanities, Agricultural Sciences)
Institutional	researcher_area_hhi_mean_l1	Lagged Herfindahl–Hirschman Index of research areas within the institution; measures disciplinary concentration of institutional activity
	researcher_rank_hhi_mean_l1	Lagged Herfindahl–Hirschman Index of researcher ranks within the institution; proxies concentration of academic capital and prestige or bottleneck effects
Contextual	unemployment_rate_l1	Lagged local unemployment rate at the city level; captures regional labor market pressure and economic constraints preceding the mobility decision

by each researcher in their individual profile; there is no algorithm implementation to infer this individual characteristic.

- Age is operationalized as years past the age of majority in Colombia (age18), providing a centered metric for accumulated experience and career stage relevant to the local context (Cortés et al., 2024a, 2024b).
- The number of institutional affiliations functions as a proxy for the size and density of the researcher's collaboration and institutional network, where a broader network is hypothesized to increase the potential for external job opportunities and subsequent mobility (Azoulay et al., 2017; Newman, 2001, 2004).
- The previous researcher rank is included with both linear and quadratic components (.L and.Q) to rigorously test for potential non-linear effects of initial academic standing on mobility propensity (*accumulated advantages*), acknowledging that both very junior and highly established researchers may exhibit distinct mobility behaviors compared to intermediate ranks (Merton, 1968, 1988). And finally,
- Research area, categorized into six distinct disciplinary fields, controls for heterogeneity in field-specific labor market dynamics and mobility norms. The classification of research groups and their affiliated researcher into grand disciplinary areas and disciplines is based on the Organisation for Economic Co-operation and Development (OECD) Fields of Science (FOS) framework (OECD, 2015). This framework collectively comprises 219 disciplines. The distribution of disciplines across these areas is as follows: Medical and Health Sciences (60), Natural Sciences (48), Engineering and Technology (46), Social Sciences (29), Humanities (22), and Agricultural Sciences (14). This assignment addresses, for example, the difficulties in associating authors with a specific discipline that are observed in other co-authorship approaches, as authors do not typically declare their discipline in publications (Wagner et al., 2011).

All individual variables, except for gender and research area, are measured from the ranking call immediately before any observed city move, a lagging strategy employed to mitigate endogeneity and establish the temporal sequence of conditions preceding the mobility decision.

The Institutional variables capture the organizational context and academic capital of the researcher's previous affiliated institution. These include:

- The concentration of research activity by field is measured by an index of specialization (*researcher_area_hhi_mean_l1*), calculated as the Herfindahl–Hirschman Index (HHI) (Herfindahl, 1950) of research areas within the institution. This variable assesses the extent to which institutional focus influences a researcher's decision to relocate for disciplinary alignment or diversification.
- The concentration of academic capital is proxied by the distribution of researcher ranks within the institution (*researcher_rank_hhi_mean_l1*), where higher values signify a greater share of high-ranking researchers. This index tests for the presence of institutional "bottleneck" effects or prestige effects, which may respectively act as a push or a pull factor for geographic movement. These institutional metrics are lagged to reflect the organizational environment before the mobility observation (Cortés & Andrade, 2022; Larivière et al., 2010).

Contextual variables integrate external labor market pressure into the model. The local unemployment rate (unemployment_rate_l1) at the city level is included as a measure of local job market pressure and economic constraints. This variable captures regional

economic conditions that may influence the decision to pursue mobility, such as limited local career opportunities or the comparative attractiveness of potential destination cities (Bettencourt et al., 2007, 2010; Verginer & Riccaboni, 2021). By lagging this variable, the model ensures that the observed economic environment reflects conditions in effect at the time the researcher considered the mobility transition, thereby maintaining the established temporal precedence required for robust causal inference in this econometric specification. Our administrative records identify mobility events but do not capture the contractual or motivational conditions of each move —particularly Junior researchers who made ~ 48% of the sample—so we cannot directly distinguish involuntary departures (e.g., non-renewals, restructuring) from strategic relocations toward better opportunities. To partially mitigate this concern, we can leverage the employment rate of the origin and destination cities as a contextual proxy for local labor market conditions. Incorporating this variable as a control, or interacting it with the mobility indicator, allows us to test whether the negative association between mobility and rank progression is concentrated among researchers leaving weaker labor markets, which would be consistent with a selection interpretation.

The central variable of interest is a binary indicator for scientific mobility, defined as a change of city between two consecutive assessment calls (i.e., moved). We explicitly frame this variable as a measure of conditional association rather than a causal driver of performance. We acknowledge that mobility decisions are likely endogenous: researchers who relocate may differ systematically from those who remain in place in ways that are not fully captured by the available covariates, including career opportunities, institutional pressures, match quality with prospective employers, family considerations, or unobserved differences in productivity trajectories. Because mobility is not randomly assigned, the estimated coefficient for moved may therefore reflect both the association of relocation with subsequent rank outcomes and selection into mobility. In substantive terms, a negative association could overstate the disruptive effect of moving if researchers relocate in response to already adverse career conditions, while a positive association could partly capture the fact that more promising researchers are better positioned to secure opportunities elsewhere. To mitigate this concern, all individual, institutional, and contextual covariates are measured before the observed move, so the estimates compare movers and non-movers conditional on pre-move characteristics.

Even so, the limitations of the available administrative data, specifically the lack of valid instrumental variables, exogenous shocks, or richer information on contractual and motivational conditions, preclude a credible causal identification strategy. Consequently, our model estimates adjusted performance differences associated with mobility, and the resulting coefficient should be interpreted as an adjusted association with rank progression rather than as a treatment effect isolated from selection processes.

Results

Descriptive statistics

Descriptive statistics for all variables included in the model are summarized in Table 2. In sum, the dataset contains 40,723 observations corresponding to researcher–call instances. Mobile researchers are a minority of the sample, accounting for 2.7% (n = 1,081) of the total sample. The distribution of researcher rank is significantly associated with the movement event. Junior researchers, who constitute 48.6% of

Table 2 Descriptive statistics of the ordinal logistic regression variables

Variable	Total	Moved = 0	Moved = 1	Sig. test
No. of observations	40,723	39,642 (97.3%)	1,081 (2.7%)	
researcher_rank				*** C
Junior	19,780 (48.6%)	19,052 (48.1%)	728 (67.3%)	
Associate	12,874 (31.6%)	12,635 (31.9%)	239 (22.1%)	
Senior	8,069 (19.8%)	7,955 (20.1%)	114 (10.5%)	
gender (= man)	25,891 (63.6%)	25,192 (63.5%)	699 (64.7%)	F
age18_l1	26.626 (9.546)	26.788 (9.535)	20.689 (7.898)	*** K
research_area				*** C
agricultural sciences	1,970 (4.8%)	1,888 (4.8%)	82 (7.6%)	
engineering and technology	8,242 (20.2%)	8,003 (20.2%)	239 (22.1%)	
humanities	2,607 (6.4%)	2,531 (6.4%)	76 (7.0%)	
medical and health sciences	6,756 (16.6%)	6,644 (16.8%)	112 (10.4%)	
natural sciences	9,997 (24.5%)	9,700 (24.5%)	297 (27.5%)	
social sciences	11,151 (27.4%)	10,876 (27.4%)	275 (25.4%)	
moved (= 1)	1,081 (2.7%)	0 (0.0%)	1,081 (100.0%)	*** F
research_area_hhi_mean_l1	0.295 (0.115)	0.295 (0.115)	0.296 (0.092)	*** K
researcher_rank_hhi_mean_l1	0.461 (0.088)	0.461 (0.088)	0.469 (0.088)	*** K
unemployment_rate_l1	9.628 (1.776)	9.630 (1.770)	9.561 (1.984)	K

K Kruskal–Wallis, *F* Fisher's exact test, *C* Chi-Square test

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

the overall sample, represent a high 67.3% of the individuals in the moving cohort, indicating a substantial tendency toward mobility among early-career researchers.

Senior researchers exhibit lower geographic mobility compared to their early-career counterparts. Although this group constitutes 19.8% of the total population, they represent only 10.5% of the mobile cohort. Statistical analysis confirms that age is a decisive factor in these migration patterns (Kruskal–Wallis, $p < 0.001$). The mean age of the moving group is 20.7 years (standard deviation = 7.8), significantly lower than the mean age of 26.8 years (standard deviation = 9.5) observed in the non-moving group.

Furthermore, a significant association exists between the primary research area and researcher movement. Research fields such as Natural Sciences (27.5%) and Engineering and Technology (22.1%) contribute the largest percentages to the mobile cohort. In contrast, the Medical and Health Sciences area exhibits lower comparative mobility, accounting for 10.4% of the moved group despite comprising 16.6% of the overall sample. Both the research area concentration index and the researcher rank concentration index also show significant differences between the two groups (Kruskal–Wallis, $p < 0.001$). The variables of gender and the unemployment rate, however, do not exhibit a statistically significant difference between the researchers who moved and those who did not.

Figure 1 shows the correspondence between the birth department (jurisdictional equivalent of an estate in the USA) of researchers and residence at the first national call record, 2013, via alluvial visualization. As previously mentioned in the Introduction, Bogotá, D.C. exhibits the highest magnitude of both retention and attraction; while it

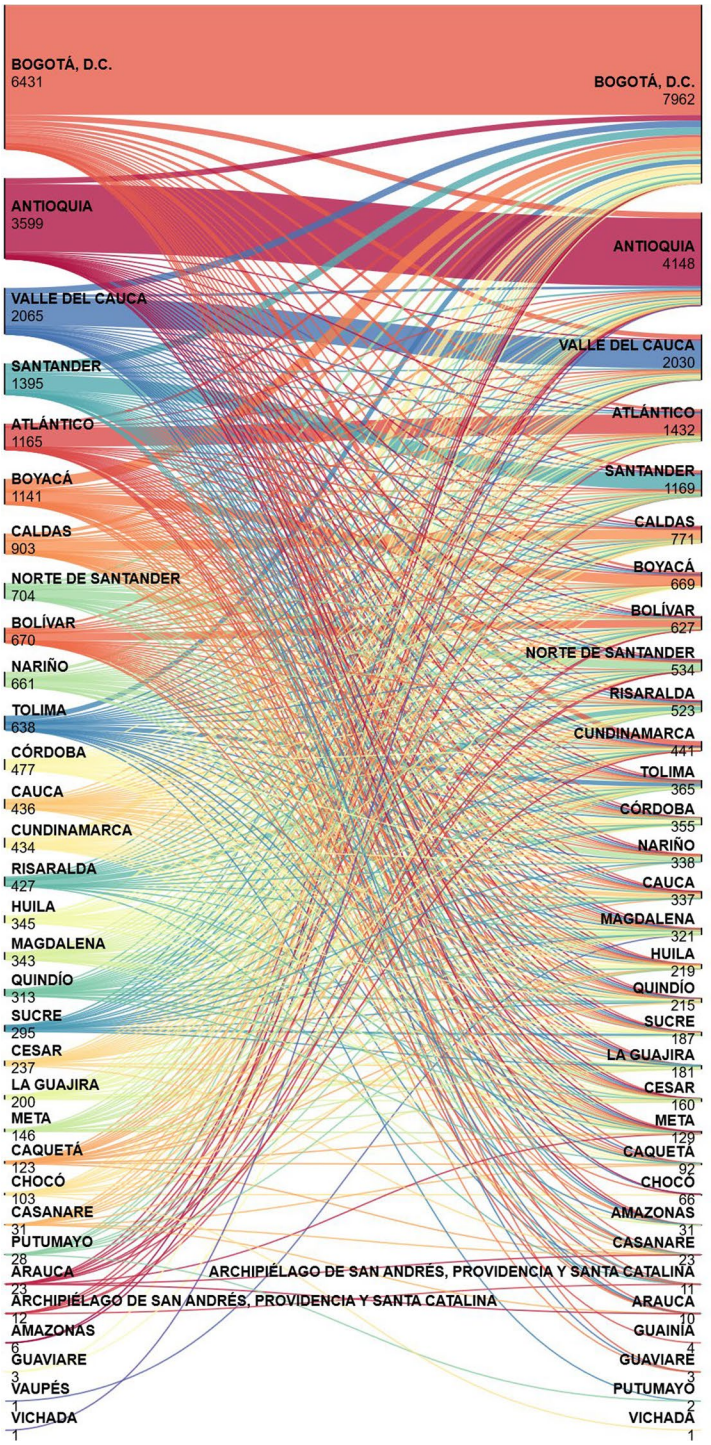


Fig. 1 Correspondence between birth department and residence at the first national call record, 2013

retains a substantial component of its native population, it experiences a net expansion to 7,962 individuals, fueled by substantial inflows from nearly every peripheral department. Antioquia follows a similar trajectory of high internal consistency and positive net growth. In contrast, departments like Boyacá and Caldas show notable emigration patterns, where the narrowing of their destination nodes relative to their origin nodes indicates a scientific workforce labor migration toward the capital and the Valle del Cauca. The intricate "mesh" in the center of the diagram highlights that while large hubs maintain high spatial inertia, smaller departments such as Chocó and Putumayo are characterized by highly dispersed, low-magnitude flows, reflecting a fragmented migratory pattern where residents are pulled toward multiple competing cities and municipalities rather than a single destination.

This visualization has limitations. Given that the median year of birth for the sample is 1975, the researchers reached a median age of 38 years by 2013, suggesting that their department of residence in that year is likely to represent an intermediate stage rather than a primary or final professional location. Despite this temporal constraint, the data shows a clear pattern in the distribution of human capital. While researchers in Colombia originate from more than 866 distinct municipalities, a substantial majority of this population eventually moves or stays within the three largest urban centers: Bogotá, Medellín (the capital of Antioquia), and Cali (the capital of Valle del Cauca).

Econometric estimates

Table 3 reports four econometric specifications of the ranking of researchers in Colombia. The restricted specifications (columns (1) and (3)) are ordinal models in which the proportional odds assumption is imposed, whereas the unrestricted specifications (columns (2a), (2b), (4a) and (4b)) relax this assumption and thus allow for more flexibility in how covariates affect different transitions in the ranking process.

Given that the proportional odds restriction is quite strong for describing researchers' progression through the ranking categories, the first step is to assess econometrically whether this assumption is plausible. Brant test (1990) rejects the proportional odds assumption ($\chi 2 = 1{,}105.69$, $df = 15$, $p < 0.001$), indicating that predictor effects of the explanatory variables are not constant across thresholds and instead vary along the ranking distribution.

In a second step, an unrestricted ordinal logistic model is estimated, allowing the coefficients to differ between the two thresholds Junior|Associate and Associate|Senior. A subsequent likelihood-ratio test ($LR = 911$, $df = 13$, $p < 0.001$), together with the comparison of AIC, BIC, and log-likelihood values, confirms that the unrestricted model offers a substantially better fit to the data than the restricted specification. Consequently, the substantive conclusions are drawn from this more flexible specification.

We extended the model by adding a dummy variable for each call year, excluding the first year (to avoid perfect multicollinearity), in both the restricted and unrestricted specifications, as reported in Table 4. This strategy absorbs common temporal shocks and policy adjustments shared by all researchers within a given call, allowing the remaining covariates to be interpreted net of year-specific variation.

Before presenting the detailed results by variable category, we offer two remarks. First, it is worth noting in advance the reversal in the sign of the coefficients for certain variables across models. This pattern, observed when moving from the restricted to the unrestricted specification in Table 3, is consistent with Simpson's paradox (Samuels, 1993; Wagner,

Table 3 Restricted and unrestricted ordinal logistic model results

	Restricted model	Unrestricted model		Restricted model	Unrestricted model	
	(1)	Junior|Associated (2a)	Associated|Senior (2b)	(3)	Junior|Associated (4a)	Associated|Senior (4b)
gender:man	0.17 (0.02)***	−0.14 (0.03)***	−0.30 (0.04)***	0.17 (0.02)***	−0.13 (0.03)***	−0.29 (0.04)***
age18_l1	0.01 (0.00)***	0.01 (0.00)***		0.01 (0.00)***	0.01 (0.00)***	
n_affiliations_l1	0.16 (0.02)***	−0.18 (0.02)***	−0.18 (0.03)***	0.16 (0.02)***	−0.18 (0.02)***	−0.18 (0.03)***
researcher_rank_l1.L	3.97 (0.04)***	−3.12 (0.06)***	−3.59 (0.04)***	3.99 (0.04)***	−3.14 (0.06)***	−3.61 (0.04)***
researcher_rank_l1.Q	0.41 (0.02)***	0.22 (0.04)***	−0.73 (0.03)***	0.43 (0.02)***	0.21 (0.04)***	−0.75 (0.03)***
research_area:engineering and technology	0.38 (0.06)***	−0.43 (0.06)***	−0.25 (0.09)**	0.39 (0.06)***	−0.44 (0.06)***	−0.25 (0.09)**
research_area:humanities	−0.26 (0.07)***	0.14 (0.08)	0.91 (0.13)***	−0.26 (0.07)***	0.14 (0.08)	0.91 (0.13)***
research_area:medical and health sciences	0.21 (0.06)***	−0.15 (0.07)*	−0.35 (0.09)***	0.21 (0.06)***	−0.16 (0.07)*	−0.35 (0.09)***
research_area:natural sciences	0.11 (0.06)	−0.05 (0.06)	−0.22 (0.09)*	0.11 (0.06)	−0.05 (0.06)	−0.21 (0.09)*
research_area:social sciences	0.03 (0.06)***	−0.14 (0.06)*	0.39 (0.09)***	0.03 (0.06)***	−0.15 (0.06)*	0.39 (0.09)***
moved	−0.38 (0.08)***	0.43 (0.08)***	0.19 (0.14)	−0.38 (0.08)***	0.43 (0.08)***	0.18 (0.14)
research_area_hhi_mean_l1	−0.23 (0.10)*	0.04 (0.12)	0.88 (0.18)***	−0.17 (0.11)	−0.03 (0.12)	0.82 (0.18)***
researcher_rank_hhi_mean_l1	−1.09 (0.14)***	0.87 (0.15)***	2.79 (0.27)***	−1.31 (0.15)***	1.09 (0.16)***	3.06 (0.28)***
unemployment_rate_l1	−0.02 (0.01)**	0.03 (0.01)***	−0.01 (0.01)	−0.00 (0.01)	0.02 (0.01)*	−0.03 (0.01)**
Investigador Junior|Investigador Asociado	−1.62 (0.11)***			−1.73 (0.12)***		
Investigador Associado|Investigador Sénior	1.05 (0.11)***			0.95 (0.12)***		
Intercept		−1.22 (0.12)***	0.31 (0.18)		−1.31 (0.14)***	0.22 (0.19)
Year dummies	No	No	No	Yes	Yes	Yes
AIC	56.744,95	55.849,47		56.532,61	55.634,69	
BIC	56.882,68	56.109,12		56.704,79	55.918,77	
Log Likelihood	−28.356,47	−27.900,74		−28.246,31	−27.784,34	
Num. Obs	40.485	40.485		40.485	40.485	

The suffixes _l1 in each variable refer to the observed values of the variable in the call immediately preceding the one in which the researcher's city transfer was identified. The dependent variable is the researcher's ranking on a given date. *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 4 Extended model with national assessment years as dummy variables

	Restricted model	Unrestricted model		Restricted model	Unrestricted model	
		Junior|Associated	Associated|Senior		Junior|Associated	Associated|Senior
year:2015				−0.26 (0.04)***	−0.26 (0.05)***	
year:2017				−0.03 (0.04)	−0.02 (0.04)	
year:2019				0.09 (0.04)*	0.10 (0.04)*	
year:2021				−0.32 (0.04)***	−0.33 (0.04)***	
LR test				220	230	
df				4	4	
P-Value				< 0.001	< 0.001	

1982). The restricted model, which imposes proportional odds assumption, yields a single averaged estimate that summarizes the association between each covariate and rank progression across the full sample. The unrestricted model, by contrast, relaxes this constraint and estimates separate coefficients for each cumulative category transition (Junior versus Associate or Senior, and Junior or Associate versus Senior), allowing the direction and magnitude of the effects to vary across the rank distribution. A non-zero correlation between the aggregate error term and the explanatory variables can produce sign reversals once the function is disaggregated, meaning that the pooled coefficient may mask heterogeneous and even opposing effects operating at different points of the ordinal scale. Second, the discrepancy between the number of observations reported in Table 2 (40,723) and Table 3 (40,485) arises from 238 researcher records with missing values in the lagged unemployment rate variable reported by DANE.

Years of national assessment

Although an ANOVA test indicates statistical significance of the year fixed effects reported in Table 4, the extended model does not show substantial changes in the magnitude or significance of the coefficients, except for the unemployment variable, which became significant in the AssociatelSenior thresholds.

Individual factors

At the individual level, age (*age18_l1*) is positively but weakly associated with upward movement in the ranking. The estimated coefficient for age in the unrestricted model is small but statistically significant, indicating that professional longevity contributes marginally to career progression.

About gender, the restricted model indicates that men present an odds ratio 1.19 times higher than women of being in the upper categories of the ranking relative to the lower ones. Under the proportional odds assumption of the restricted model, this coefficient implies that being a man shifts the underlying level of scientific status, or recognition within the ranking, uniformly upward across all thresholds. However, once the proportionality constraint is relaxed in the unrestricted model, the gender coefficients turn negative, revealing partial effects opposite to those observed in the aggregated sample. This clear manifestation of Simpson's paradox admits several explanations related to contextual variables or changes in the structure of incentives. We argue that the contrast between the restricted and unrestricted specifications reveals a non-monotonic patter of gender inequality: when a constant effect is imposed, men appear to enjoy an overall advantage, but once the effect is allowed to vary across segments of the hierarchy, the men advantage becomes concentrated in the early career transitions, while a possible'late stage' women advantage emerges in the transition to Senior, consistent with selection and screening mechanism operating along the scientific career.

The number of affiliations (*n_affiliations_l1*) has a negative association with advancement. Although more affiliations could be interpreted as a larger personal network, the results indicate that, in the Colombian evaluation system, having multiple affiliations tends to reduce the likelihood of moving to a higher rank. A higher number of institutional affiliations in is also associated with researchers holding multiple employment ties as a strategy to supplement their personal income. From this perspective, a larger number of affiliations implies a greater dispersion of efforts and reduced concentration on high-impact research

activities, which in turn translates into lower scores in the national rankings along the dimension of high-impact research output.

The introduction of linear (.L) and quadratic (.Q) terms for previous rank reveals nonlinear effects of initial conditions. For the Junior|Associate threshold, the negative coefficient on the linear term and the positive coefficient on the quadratic term suggest that modest improvements in previous rank do not translate straightforwardly into higher probabilities of reaching the Senior category. The system appears to penalize researchers who demonstrate incremental gains but fail to surpass critical thresholds of productivity or quality. As the previous rank increases, the positive quadratic component gradually offsets the negative linear effect, creating a pattern of inertia toward the extremes: researchers tend to remain either in the lower or upper ranks rather than stabilizing in intermediate positions.

For the Associate|Senior threshold, both the linear and quadratic components of the previous rank are negative. This pattern is consistent with a reduced probability of remaining in the Associate category over time. Instead, the evaluation system appears to discourage researchers from achieving the intermediate rank, in a context where outcomes depend not only on absolute production but also on relative positioning within a competitive field.

Differences are also observed across research areas. Compared with the reference category, some fields, such as engineering and technology or medical and health sciences, exhibit positive associations with higher ranks at certain thresholds, whereas humanities and social sciences display patterns that sometimes favor and sometimes hinder advancement, depending on the specific transition considered. These heterogeneous effects suggest that the evaluation criteria interact with field-specific publication practices, collaboration patterns, and recognition mechanisms.

Institutional factors

Institutional characteristics play a central role in shaping researchers' performance trajectories. The concentration of research activity in specific areas, as measured by the specialization index (research_area_hhi_mean_l1), tends to be positively associated with higher ranks, although the strength of this association varies by threshold and is not always statistically robust. More consistent patterns emerge for the concentration of academic capital (researcher_rank_hhi_mean_l1). The index capturing the internal distribution of ranks within institutions shows large and statistically significant coefficients, especially for the Associate threshold. A higher concentration of senior researchers within an institution increases the chances that an individual researcher will occupy a higher rank.

This result can be interpreted as evidence of cumulative advantage within institutional contexts. Being embedded in institutions with a high density of recognized researchers may facilitate access to resources, collaboration networks, and mentoring that enhance individual performance and visibility in the evaluation system. At the same time, it may indicate that MinCiencias' classification process itself reinforces existing institutional hierarchies, granting more recognition to researchers affiliated with already prestigious institutions.

Contextual labor market conditions

The city-level unemployment rate (unemployment_rate_l1) is used to approximate the pressure exerted by the broader labor market on academic careers. The results indicate that higher unemployment rates are associated with changes in the probabilities of moving across ranks, which differ by career stage. For Junior researchers, higher unemployment

appears to favor upward mobility, which may reflect a stronger effort to consolidate an academic position when alternative employment opportunities are scarce. Junior researchers in more adverse labor markets may increase their productivity or prioritize activities that more directly align with evaluation criteria to secure or stabilize their positions within universities.

For researchers in higher ranks, the relationship between unemployment and academic mobility appears to operate in the opposite direction. Higher city-level unemployment rates are associated with a lower probability of moving upward in the ranking and, in some specifications, with a greater likelihood of remaining at the same level or even moving down. This pattern may reflect the fact that Senior and more established researchers already occupy relatively secure and prestigious positions, so adverse labor market conditions reduce the incentives to undertake risky strategies—such as changing institutions—that could potentially enhance their recognition but also expose them to uncertainty. In addition, in regions with weaker labor markets, universities may face more binding budget constraints, limiting the availability lof promotion slots or performance-based incentives, which can dampen the returns to additional effort at the top of the hierarchy and slow down advancement for already well-positioned researchers.

Scientific mobility and researcher ranking

The primary focus of the study is the relationship between geographic mobility and researchers' rankings. The unrestricted model introduces a mobility indicator that distinguishes researchers who changed cities between two assessment calls from those who remained in the same location. The estimated coefficients for the mobility variable are positive at both thresholds, but only statistically significant for the transition from Junior to Associate. This suggests that, on average, relocating to another city is associated with differences in the likelihood of occupying specific ranks; however, these differences do not uniformly correspond to promotions.

To interpret these patterns, predicted probabilities shown in Fig. 2 were computed as average marginal predictions from the ordinal logistic model, evaluating each observation at its own covariate values and then averaging across the sample, rather than fixing covariates at their means or reference categories.

The first panel (left) examines researchers previously classified as Junior. The probability of remaining in the Junior category is generally high, and this likelihood is observed to be even higher when a Junior researcher relocates to another city. Thus, geographic mobility appears linked to a consolidation of the initial position rather than characterizing a rapid pathway to Associate or Senior ranks. For researchers who were already Associates, the baseline probability of being reclassified as Junior is relatively low (around one-fifth), but this probability corresponds to a higher value following a city move. For Senior researchers, the probability of falling into the Junior category is minimal and varies little with mobility status. Taken together, the evidence suggests that mobility is not associated with early promotion; instead, it correlates with retention in entry-level ranks and a higher likelihood of downgrading for those in intermediate positions.

The second panel (center) focuses on the probability of being categorized as an Associate. For Junior researchers, moving to another city coincides with a significantly lower probability of being classified as Associate or Senior in the subsequent call. For Associate researchers, mobility is also linked to a lower probability of maintaining the Associate category. When considered alongside the results from the first panel, it becomes clear that

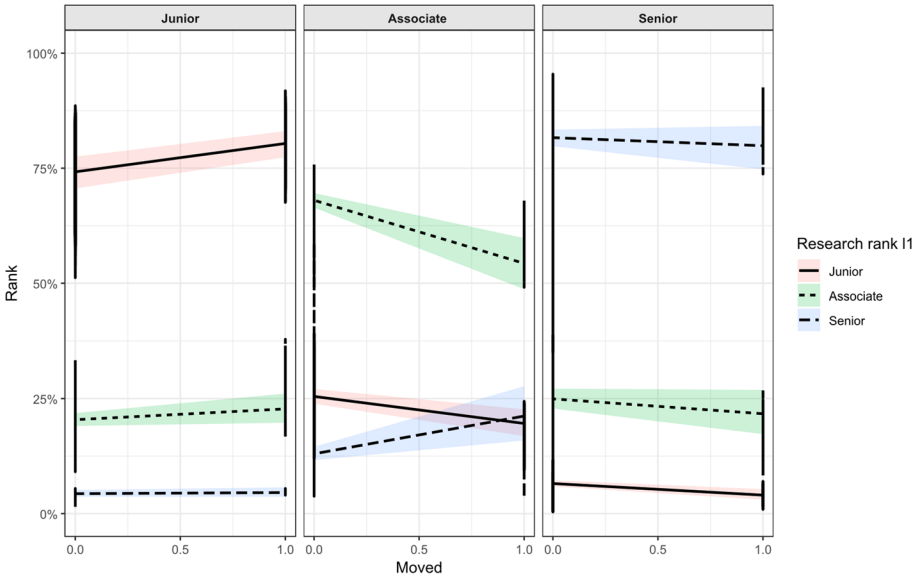


Fig. 2 Predicted probabilities of researcher rank at t + 1, by current rank and mobility status. Panels reports researcher's rank at time t (Junior, Associate, Senior). The three lines show the predicted probability of being classified at t + 1 as Junior (red, solid), Associate (green, dotted), or Senior (blue, dashed). The x-axis indicates mobility status between t and t + 1 (0 = stayer, 1 = mover). Shaded areas and vertical bars denote 95% confidence intervals

moving to a different city is associated with a higher likelihood that Associate researchers will be reclassified as Junior rather than promoted to Senior. For Senior researchers, the association between mobility and the probability of becoming an Associate is small but positive, indicating a slight difference in the likelihood of a downgrade to the intermediate rank. Overall, mobility in the middle stage of the career appears to coincide with instability: researchers who move exhibit a greater likelihood of downward movement in the ranking, accompanied by only modest differences in the probability of reaching or remaining in the top category.

Separating moves toward larger cities (moved_sl) from moves toward smaller cities (moved_ls) reveals a marked asymmetry in the estimated effects. Moves toward smaller cities closely track the pooled mobility estimates reported in Table 3. The coefficient is large and statistically significant in the restricted model and at the Junior|Associate threshold of the unrestricted model, and statistically insignificant at the Associate|Senior threshold. Moves toward larger cities, by contrast, are negligible and statistically insignificant across all specifications. The estimated penalty is therefore not a general property of geographic mobility but is specific to the direction of the move. The pooled effect of relocation is driven almost entirely by moves toward smaller, plausibly less resource-rich environments, while moves toward larger urban centers carry no comparable penalty. This pattern is consistent with the institutional and infrastructure mechanisms discussed above: smaller cities tend to offer thinner research ecosystems, fewer senior peers, and weaker institutional support, all of which can depress measured output under national evaluation criteria. The relevant concern is not mobility per se but the uneven territorial distribution of research infrastructure, institutional support, and career opportunities, which conditions whether a given move advances or hinders subsequent recognition.

We adjusted the specification of both the restricted and unrestricted models to include a random intercept intended to capture unobserved individual heterogeneity that remains stable over time as robustness testing. Results are available as Supplementary material. The estimates reported no substantial changes in the coefficients or their statistical significance in the restricted model, and the BIC suggests that the specification without a random intercept (the more parsimonious model) may be preferable. We also adjusted the standard errors of the restricted model using a sandwich estimator clustered by researcher_id, with no substantial changes in the magnitude or significance of the coefficients supporting the main conclusions of the model.

Discussion

This study contributes to the growing body of research on academic mobility by shifting attention from international moves, dominant in the literature, to the within-country mobility of researchers in a middle-income setting, using open administrative data from MinCiencias. By modelling rank outcomes in the Colombian evaluation system (Junior → Associate → Senior) as a function of mobility and a set of lagged individual, institutional, and contextual covariates, the analysis provides evidence on how geographic relocation across Colombian cities is correlated with subsequent career performance in a policy-relevant classification framework.

A first descriptive finding is the limited prevalence of inter-city mobility: only 2.7% of researcher–call observations involve a city change between consecutive assessment calls. This low rate is consistent with the idea that national academic labor markets can exhibit substantial "spatial inertia," especially when research capacity and employment opportunities are concentrated in a few large hubs. Mobility is strongly age- and career-stage graded: Junior researchers are overrepresented among movers (67.3% of movers vs 48.6% overall), while Seniors are underrepresented (10.5% of movers vs 19.8% overall). This pattern aligns with theories of cumulative advantage and the "settling" of scientists as they accumulate location-specific capital (networks, supervisory roles, labs, and reputational assets), which increases the opportunity cost of relocation later in the career.

The core substantive result concerns the association between geographic mobility and subsequent rank. The proportional odds assumption does not hold, motivating the use of an unrestricted ordinal specification that allows heterogeneous effects across thresholds. The unrestricted model provides a better fit than the restricted proportional odds model.

While coefficient patterns for moved differ across thresholds in the unrestricted model, the marginal probability analysis clarifies the substantive direction: mobility is not associated with sped up promotion, and instead correlates with rank instability, particularly at the bottom and middle of the distribution. Among researchers previously classified as Junior, movers display an even higher probability of remaining Junior; among those previously classified as Associate, mobility is associated with a higher likelihood of being reclassified as Junior rather than promoted to Senior.

This finding contrasts with evidence from some high-income settings where movers (especially those moving to more research-intensive environments) often experience citation or productivity gains. It is, however, consistent with the idea that mobility can be disruptive when it is directed toward less resource-rich destinations, or when moves are driven by precarious employment, short-term contracts, or necessity rather than strategic career investment. In the Colombian case, geographic relocation may reflect constrained

local opportunities, institutional turnover, or mismatches between researcher specialization and the local research ecosystem, mechanisms that can reduce short-run output and weaken the continuity needed to satisfy evaluation criteria. The fact that MinCiencias rank progression does not directly translate into salary or institutional career advancement may further reduce incentives for institutions to protect research time and resources during a relocation, potentially amplifying short-term performance costs.

A second plausible mechanism is timing: MinCiencias assessments occur in discrete calls (2013, 2014, 2015, 2017, 2019, 2021). If relocation imposes a temporary productivity dip or delays in documenting outputs within CvLAC, the next assessment may capture disruption more readily than longer-term gains, especially if the benefits of a new environment (new collaborations, lab access, funding) accrue with a lag. The observed association may reflect the short-to-medium-term consequences of moving rather than the longer-run returns.

Institutional context emerges as one of the strongest correlations of rank outcomes. The concentration of academic capital (rank concentration within the prior institution) shows large and statistically significant effects in the unrestricted model. This pattern is consistent with cumulative advantage at the organizational level: researchers embedded in environments with a higher density of senior peers may gain access to mentoring, co-authorship opportunities, infrastructure, and reputational spillovers that facilitate success under national evaluation criteria.

At the same time, this finding raises a policy-relevant interpretation: evaluation systems may inadvertently reinforce institutional hierarchies if recognized researchers and recognized institutions mutually amplify each other's status. The descriptive evidence of strong attraction toward major hubs (e.g., Bogotá and Antioquia (i.e., Medellín) further suggest the potential for a self-reinforcing geography of scientific capital, where mobility primarily reallocates talent toward already dominant centers rather than diffusing capacity across the territory.

The contextual unemployment rate is included as a proxy for city-level labor market pressure. Results indicate that unemployment is associated with rank transitions in a career-stage-dependent manner: for Juniors, higher unemployment appears to be linked to upward movement, plausibly reflecting intensified efforts to secure academic standing when outside options are scarce. For higher ranks, associations are weaker and less systematic. These patterns underscore that "mobility and performance" are embedded in broader local opportunity structures, and that early-career researchers may be particularly sensitive to non-academic labor market conditions.

Taken together, the findings suggest that simply encouraging geographic mobility is unlikely to be sufficient, and may even be counterproductive for some groups, unless moves are accompanied by institutional supports that prevent short-run disruption from translating into evaluation penalties.

Policy implications that follow directly from the evidence include: (i) Targeted support during transitions, since if mobility is associated with retention in Junior ranks and downgrading for Associates, then relocation packages, bridge funding, and protected research time could be prioritized for movers to reduce transition costs; (ii) Attention to mid-career vulnerability, since the instability among Associate movers suggests a "risk zone" in which relocation may not be rewarded and may even be penalized; (iii) Monitoring institutional concentration dynamics, since strong institutional effects and hub concentration call for policy instruments that build research capacity outside dominant cities; otherwise, mobility may deepen regional inequalities in scientific production and recognition; (iv) Evaluation timing and lag structures, because mobility-related benefits may take time to materialize,

evaluation frameworks could consider mechanisms to avoid penalizing short-term output disruption following a move (e.g., allowing a transition window or emphasizing multi-year output trajectories).

Conclusion

This paper examined how within-country geographic mobility between Colombian cities is associated with subsequent research performance in the MinCiencias ranking system. Using a large administrative dataset that spans multiple national assessment calls, we find that inter-city mobility is relatively uncommon and concentrated among early-career researchers. The main empirical takeaway is that mobility is not associated with a generalized promotion premium. Instead, the predicted probabilities indicate that Junior movers are more likely to remain Junior and that Associate movers face a higher risk of downward reclassification than of promotion to Senior, pointing to rank instability rather than accelerated advancement.

These results have practical implications for science policy and university management. If mobility entails short-run disruption, policies that simply encourage relocation are unlikely to be sufficient. Transition support, such as bridge funding, protected research time, mentoring, and integration support in the destination institution, may be especially important for Junior and Associate researchers. More broadly, the strong role of institutional academic capital suggests that mobility policies should be coordinated with efforts to reduce territorial concentration in the research system, so that movement does not merely reinforce the advantage of already dominant hubs.

This study has several limitations. First, mobility is observed as a change of city or municipality between assessment calls, so the data cannot identify interim moves, commuting arrangements, temporary placements, or the exact timing of relocation within the interval. Second, the analysis is associative rather than causal: mobility decisions are likely endogenous, and movers may differ from stayers in unobserved ways, such as career opportunities, institutional pressures, contractual instability, or underlying productivity trends, that also affect rank outcomes. As a result, the estimated mobility coefficient may partly reflect selection into moving rather than the causal effect of relocation itself. Third, the dependent variable is an administrative ranking shaped by reporting practices and system-specific incentives, and it does not map one-to-one onto conventional bibliometric indicators. Fourth, the data do not capture the contractual or motivational conditions surrounding each move, preventing us from distinguishing involuntary departures from strategic relocations.

Future research should extend the analysis by incorporating destination characteristics, distance, and institutional changes associated with the move; by following researchers over longer horizons to test whether the benefits of relocation emerge with delay; by linking administrative records with publication and citation data; and by exploiting richer contractual or survey information to better distinguish voluntary from constrained mobility. Where feasible, quasi-experimental designs could also help address selection into mobility. Overall, the evidence suggests that, in the Colombian research evaluation context, geographic mobility is best understood as a career event whose consequences depend on career stage, institutional stratification, and local opportunity structures.

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Data availability We used open-access datasets curated and issued by MinCiencias. These datasets provide information from national assessments conducted in 2013, 2014, 2015, 2017, 2019, and 2021. There were no national assessments conducted by MinCiencias in 2016, 2018, and 2020. Our analysis draws on socioeconomic data and academic career data for Colombian researchers. This analysis incorporates two specific datasets: one detailing research groups and another detailing researchers. The links to both datasets are shared below: •National Groups Assessments, 21 columns, ~ 30,000 rows: https://www.datos.gov.co/d/hrhc-c4wu •National Researchers Assessment, 30 columns, ~ 77,000 rows: https://www.datos.gov.co/d/bqtm-4y2h

Declarations

Competing interests The authors declare no competing interests.

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References

Aboites, J., & Díaz, C. (2018). Inventors' mobility in Mexico in the context of globalization. *Scientometrics, 115*(3), 1443–1461. https://doi.org/10.1007/s11192-018-2645-6

Abramo, G., D'Angelo, C. A., & Costa, F. D. (2022). The effect of academic mobility on research performance: The case of Italy. *Quantitative Science Studies, 3*(2), 345–362. https://doi.org/10.1162/qss_a_00192

Azoulay, P., Ganguli, I., & Graff Zivin, J. (2017). The mobility of elite life scientists: Professional and personal determinants. *Research Policy, 46*(3), 573–590. https://doi.org/10.1016/j.respol.2017.01.002

Bettencourt, L. M. A., Lobo, J., Helbing, D., Kühnert, C., & West, G. B. (2007). Growth, innovation, scaling, and the pace of life in cities. *Proceedings of the National Academy of Sciences of the United States of America, 104*(17), 7301–7306. https://doi.org/10.1073/pnas.0610172104

Bettencourt, L. M. A., Lobo, J., Strumsky, D., & West, G. B. (2010). Urban scaling and its deviations: Revealing the structure of wealth, innovation and crime across cities. *PLoS ONE, 5*(11), 1–9. https://doi.org/10.1371/journal.pone.0013541

Brant, R. (1990). Assessing proportionality in the proportional odds model for ordinal logistic regression. *Biometrics, 46*(4), 1171. https://doi.org/10.2307/2532457

Cavalli, A., & Teichler, U. (2015). Preface - issue on mobility and migration in science. *European Review, 23*(S1), 1–5. https://doi.org/10.1017/S1062798714000751

Cortés, J. D., & Andrade, D. A. (2022). The Colombian scientific elite—science mapping and a comparison with Nobel Prize laureates using a composite citation indicator. *PLoS ONE, 17*(5), Article e0269116. https://doi.org/10.1371/journal.pone.0269116

Cortés, J. D., & Ramírez Cajiao, M. C. (2024). The policy is dead, long live the policy—Revealing science, technology, and innovation policy priorities and government transitions via network analysis. *Quantitative Science Studies, 5*(2), 317–331. https://doi.org/10.1162/qss_a_00295

Cortés, J. D., Robinson-García, N., Chinchilla-Rodríguez, Z., & Ramírez-Cajiao, M. C. (2024a). Academic age standards underestimate global South career stages and research capacity building — An outlook of the scientific workforce of Colombia. *28th International Conference on Science, Technology and Innovation Indicators (Acronym: STI2024)*.

Cortés, J. D., Robinson-García, N., Chinchilla-Rodríguez, Z., & Ramírez-Cajiao, M. C. (2024b). The Scholarly age—beyond the academic age using techno-scientific, Knowledge appropriation and mentoring outputs. In l. Sserwanga et al. (Ed.), *Wisdom, Well-Being, Win-Win. iConference 2024. Lecture Notes in Computer Science* (Vol. 14596, pp. 321–330). Springer, Cham. https://doi.org/10.1007/978-3-031-57850-2_24

DANE. (2025). Empleo y desempleo. https://www.dane.gov.co/index.php/estadisticas-por-tema/mercado-laboral/empleo-y-desempleo#registro-estadistico-de-relaciones-laborales-relab

Godoy, J. M., Wang, Y., & Cortés, J. (2025). National Mobility and Career Performance of the Scientific Workforce in Colombia. In S. Sargsyan, W. Glänzel, & G. Abramo (Eds.), *20th International Conference on Scientometrics and Informetrics, vol. 2* (pp. 2251–2258). ISSI. https://doi.org/10.51408/issi2025_145

Gureyev, V. N., Mazov, N. A., Kosyakov, D. V., & Guskov, A. E. (2020). Review and analysis of publications on scientific mobility: Assessment of influence, motivation, and trends. *Scientometrics, 124*(2), 1599–1630. https://doi.org/10.1007/s11192-020-03515-4

Herfindahl, O. (1950). *Concentration in the U.S. Steel Industry*. Columbia University.

Ito, R., Chavarro, D., Ciarli, T., Cowan, R., & Visentin, F. (2025). From drains to bridges: The role of internationally mobile PhD students in linking non-mobile with foreign scientists. *Journal of Development Economics, 177*, Article 103577. https://doi.org/10.1016/j.jdeveco.2025.103577

Larivière, V., Macaluso, B., Archambault, É., & Gingras, Y. (2010). Which scientific elites? On the concentration of research funds, publications and citations. *Research Evaluation, 19*(1), 45–53. https://doi.org/10.3152/095820210X492495

Liu, T., Pei, T., Fang, Z., Wu, M., Liu, X., Yan, X., Song, C., Jiang, J., Jiang, L., & Chen, J. (2024). Spatiotemporal mobility network of global scientists, 1970–2020. *International Journal of Geographical Information Science, 38*(10), 1991–2018. https://doi.org/10.1080/13658816.2024.2369540

Merton, R. (1968). The matthew effect in science. *Science, 159*(3810), 56–62. https://doi.org/10.1126/science.159.3810.56

Merton, R. K. (1988). The Matthew effect in science, II: Cumulative advantage and the symbolism of intellectual property. *Isis, 79*(4), 606–623. https://doi.org/10.1086/354848

MinCiencias. (2022, September 25). *Investigadores Reconocidos por convocatoria*. Datos Abiertos Colombia. https://bit.ly/3MKGgyE

MinCiencias. (2023). *La Ciencia en Cifras*. https://minciencias.gov.co/la-ciencia-en-cifras

Miranda-González, A., Aref, S., Theile, T., & Zagheni, E. (2020). Scholarly migration within Mexico: Analyzing internal migration among researchers using Scopus longitudinal bibliometric data. *EPJ Data Science, 9*(1), 34. https://doi.org/10.1140/EPJDS/S13688-020-00252-9

Momeni, F., Karimi, F., Mayr, P., Peters, I., & Dietze, S. (2022). The many facets of academic mobility and its impact on scholars' career. *Journal of Informetrics, 16*(2), 101280. https://doi.org/10.1016/j.joi.2022.101280

Morano-Foadi, S. (2005). Scientific mobility, career progression, and excellence in the European research Area1. *International Migration, 43*(5), 133–162. https://doi.org/10.1111/j.1468-2435.2005.00344.x

Newman, M. E. (2004). Coauthorship networks and patterns of scientific collaboration. *Proceedings of the National Academy of Sciences*. https://doi.org/10.1073/pnas.0307545100

Newman, M. E. J. (2001). The structure of scientific collaboration networks. *Proceedings of the National Academy of Sciences, 98*(2), 404–409. https://doi.org/10.1073/pnas.98.2.404

OECD. (2015). *Frascati Manual 2015: Guidelines for Collecting and Reporting Data on Research and Experimental Development* (The Measurement of Scientific, Technological and Innovation Activities). OECD. https://doi.org/10.1787/9789264239012-EN10.1787/9789264239012-EN

Payumo, J. G., Lan, G., & Arasu, P. (2018). Researcher mobility at a US research-intensive university: Implications for research and internationalization strategies. *Research Evaluation, 27*(1), 28–35. https://doi.org/10.1093/reseval/rvx038

Samuels, M. L. (1993). Simpson's Paradox and related phenomena. *Journal of the American Statistical Association, 88*(421), 81–88. https://doi.org/10.1080/01621459.1993.10594297

SCImago. (2020). *SJR - International Science Ranking*. https://bit.ly/3Ih0qMa

Soete, L., Schwaag, S., Stierna, J., & Hollanders, H. (2021). European Union. In UNESCO Science Report 2021 (Ed.), *UNESCO Science Report 2021* (pp. 254–289). United Nations. https://doi.org/10.18356/9789210058575

Sugimoto, C. R., & Larivière, V. (2023). *Equity for women in science: Dismantling systemic barriers to advancement*. Harvard University Press.

Sugimoto, C. R., Robinson-Garcia, N., Murray, D. S., Yegros-Yegros, A., Costas, R., & Larivière, V. (2017). Scientists have most impact when they're free to move. *Nature, 550*(7674), 29–31. https://doi.org/10.1038/550029a

Teichler, U. (2015). Academic mobility and migration: What we know and what we do not know. *European Review, 23*(S1), S6–S37. https://doi.org/10.1017/S1062798714000787

UNHCR. (2023). *Colombia situation*. https://reporting.unhcr.org/operational/situations/colombia-situation

Vasen, F., Sarthou, N. F., Romano, S. A., Gutiérrez, B. D., & Pintos, M. (2023). Turning academics into researchers: The development of national researcher categorization systems in Latin America. *Research Evaluation, 32*(2), 244–255. https://doi.org/10.1093/reseval/rvad021

Verginer, L., & Riccaboni, M. (2021). Talent goes to global cities: The world network of scientists' mobility. *Research Policy*, *50*(1). https://doi.org/10.1016/j.respol.2020.104127

Wagner, C. H. (1982). Simpson's paradox in real life. *The American Statistician, 36*(1), 46–48. https://doi.org/10.1080/00031305.1982.10482778

Wagner, C. S., Roessner, J. D., Bobb, K., Klein, J. T., Boyack, K. W., Keyton, J., Rafols, I., & Börner, K. (2011). Approaches to understanding and measuring interdisciplinary scientific research (IDR): A review of the literature. *Journal of Informetrics, 5*(1), 14–26. https://doi.org/10.1016/J.JOI.2010.06.004

Yan, E., Zhu, Y., & He, J. (2020). Analyzing academic mobility of US professors based on ORCID data and the Carnegie classification. *Quantitative Science Studies, 1*(4), 1451–1467. https://doi.org/10.1162/qss_a_00088

Yuret, T. (2023). Predicting mobility and research performance of the faculty members in the economics departments at Turkish public universities. *Quantitative Science Studies, 4*(1), 167–185. https://doi.org/10.1162/qss_a_00238

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