Recognizing inequalities in the Chilean academia: A longitudinal analysis of how Gender, Social Class, and Geographic Origins affects Scientific Careers

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1. Introduction

One of the central promises of scientific institutions lies in their supposed meritocratic character: a reward system where scientific outcomes are evaluated based mainly on intellectual merit. Yet this ideal has been widely contested. Throughout the 20th and 21st centuries, research has shown that the social stratification present in broader society permeates the organization and prestige hierarchies (references). As a result, academic and scientific institutions not only reflect existing inequalities but often actively reproduce them.

Among these, gender has been the most extensively studied societal structure for understanding how stratification and inequality are (re)produced through both institutionalized and informal mechanisms within academic and scientific institutions (xxxx). Hundreds of scholarly works have examined how gender structures—often conceptualized in binary terms—constrain women's access to and advancement within academia across different contexts and roles (xxxx). In many countries, women's representation has increased at the undergraduate level, including in math-intensive fields historically dominated by men. However, their presence declines sharply at senior ranks, echoing what has been widely described as the "leaky pipeline."

While gender remains central to understanding inequality in scientific careers, we argue for widening the analytical lens to include other persistent structures—particularly social class and geographic origin—that have shaped the educational trajectories of those who are, or will become, the next

generation of scientists. These factors have been widely analyzed in the broad social stratification literature (xxxxxx), particularly for their impact on access to prestigious educational institutions. Yet they remain largely overlooked in studies of scientific careers; perhaps due to the difficulty of accessing these data and/or the assumption that class and geographic origin become imperceptible at the light of their scientific productivity (xxxx).

This article addresses that gap by analyzing three cohorts of Chilean researchers (N = 2,436) who received a competitive government-funded doctoral fellowship between 2014 and 2016. Chile was selected as the national case for three key reasons. First, the country significantly expanded its doctoral fellowship programs after 2008, offering funding for studies both within Chile and abroad. Second, Chile exhibits high levels of social class and geographic inequality—patterns that characterize the higher education systems of many countries across Latin America. Third, it offers access to a unique longitudinal dataset that includes researchers' high school and regional background, enabling us to examine the effects of gender, class, and geographic origin across three key academic milestones: (1) the selection and unequal chances of entering a prestigious undergraduate institution, (2) the pursuit of doctoral studies, and (3) scientific productivity in the six years following the fellowship award. Using this dataset, we applied a path model analysis to estimate the direct and indirect effects of gender, social class, and geographic origin across these three moments.

While gendered patterns of scientific productivity align with existing literature, our findings complicate linear models of stratification. Researchers from working-class backgrounds produce research outputs at rates statistically similar to those of their upper-class peers. Even more unexpectedly, researchers who grew up in less economically and culturally developed regions outperform those from the wealthier, metropolitan center. These findings suggest that commonly held assumptions about advantage and academic performance do not fully account for the lived realities—and possible exceptional adaptations—of those who enter academia from structurally marginalized positions.

2. Conceptual framework: stratification on sciences.

2.1. Geographical disparities in academic trayectories

2.2. Socioeconomic status

2.3. Disciplinary differences in scientific production

2.4. Gender and scientific production

2.5. Scolarship selection process

3. Method

3.1. Data and sample

The database is a longitudinal reconstruction of the academic trajectories of three cohorts of Chilean researchers (N = 2436) who received a doctoral scholarship between 2014 and 2016. It includes information on the socioeconomic level of the high school they attended, the region of the institution, the accreditation level of their undergraduate program, the prestige of the doctoral university, the postgraduate area, and the number of publications produced up to six years after the scholarship was awarded.

3.2. Variables

Table 1 shows the variables used in the analysis. These summarize the researchers' trajectory from secondary education to scientific productivity after the doctorate. The analysis employed three sociodemographic variables: sex, socioeconomic status, and region. To measure socioeconomic status, the socioeconomic classification of each researcher's high school served as a proxy, while geographic origin was determined by the educational institution's region.

Undergraduate prestige was measured through the accreditation level of the researcher's university as determined by the National Education Commission. For doctoral prestige, we calculated the average between the scores in the Shanghai and QS international rankings, expressed as a Z-score.

Finally, scientific productivity was measured through the number of publications, standardized based on the average publications in the researcher's area.

Tabla 1: Table 1. Descriptive Statistics

Category	Statistic
Gender	
Femenino	1010 (41.5 %)
Masculino	1426 (58.5 %)
Socio-economic Status	
Alto	849 (34.9 %)
Bajo	473 (19.4 %)
Medio	663 (27.2 %)
Medio alto	451 (18.5 %)
Region	
Otra región	720 (29.6 %)
Región Metropolitana	1190 (48.9 %)
Valparaiso o Concepción	525 (21.6 %)
Undergraduate Prestige	
Acreditacion 4	188 (7.7 %)
Acreditacion 5	373 (15.3 %)
Baja acreditacion o no acreditada	106 (4.4 %)
Excelencia	812 (33.3 %)
Investigacion	957 (39.3 %)
Publication before PhD	
Sin publicaciones	1742 (71.5 %)
Tiene publicaciones	694 (28.5 %)
PhD Prestige (Z)	
Max.	4.2
Mean	0.04
Min.	-1.35
SD	0.96

National PhD	
Chile	1523 (62.5 %)
Extranjero	913 (37.5 %)
Publications after PhD (Z)	
Max.	28.46
Mean	0
Min.	-0.84
SD	1

3.3. Analytic Strategy

In accordance with the research objectives and the hypotheses proposed, we opted to use path analysis. This technique uses regression models to represent theories of causal relationships. In statistical terms, it consists of a series of ordered regressions within the chosen analytical "path". The main advantage of this method is that it allows to make explicit the relationships between the selected variables. Additionally, it enables the decomposition of direct and indirect effects (Agresti, 2018, p. 506).

4. Finding

In accordance with the hypotheses proposed, social class has a substantial effect on the quality of undergraduate education to which researchers gain access. Compared to the high socioeconomic group, the upper-middle and middle groups decrease the quality of undergraduate education (-0.388 and -0.366, respectively), while the low group has a strong negative effect on undergraduate quality (-0.741). Moreover, the region of origin shows a statistically significant effect. Compared to other regions, completing secondary education in Santiago, Valparaíso, and Concepción has a positive and moderate effect on undergraduate quality (0.367). Finally, gender does not present a statistically significant effect.

Regarding prior publications, neither socioeconomic group nor undergraduate quality have a statistically significant effect. Being female and coming from the metropolitan, Valparaíso, and Concepción

regions have a small negative effect (-0.038 and -0.041).

The effects on doctoral prestige are also revealing. Compared to the high socioeconomic group, the other groups decrease doctoral prestige. The upper-middle group has a small negative effect (-0.127), the middle group has a moderate effect (-0.205), and the low group has a moderate to strong effect (-0.331).

Concerning region, coming from the main urban centers increases doctoral prestige (0.134). Undergraduate accreditation has a small but positive effect (0.091). In line with expectations, completing the doctorate in Chile has a negative effect on doctoral prestige (-1.073). Gender and the number of prior publications do not have statistically significant effects on doctoral prestige.

Finally, with respect to publications after the doctorate, socioeconomic group, region, and gender have important effects on scientific productivity. Compared to men, being female presents a moderate negative effect (-0.120). Similarly, compared to the high socioeconomic group, the middle group has a statistically significant negative effect (-0.106) on scientific productivity. However, the low group does not present a statistically significant effect.

On the other hand, coming from the main urban centers has a small but negative effect on scientific productivity (-0.141). Additionally, doctoral prestige presents a small negative effect (-0.053), as does having completed the doctorate in Chile (-0.131). Undergraduate accreditation does not have a statistically significant effect.

5. Conclusions

5.1. Referencias