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The role of graduate education in the intergenerational reproduction of inequality in Chile

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ABSTRACT

Following the massification of higher education and its extension into graduate studies, a key question in social mobility research focuses on the role of graduate education in relation to social inequality. This study provides empirical evidence for this debate by analyzing the extent to which graduate attainment mediates the relationship between social origin and wages among Chilean undergraduates. Drawing on survey data from 922 recent undergraduates of 17 Chilean universities, a structural equation model was estimated to assess the mediating role of graduate education in shaping labor-market outcomes. The results show that graduate studies play only a marginal role in this process, despite substantial wage gaps by social background. At the same time, the selectivity of the undergraduate institution accounts for approximately 30% of the relationship between background and earnings, while the field of study explains less than 10%. Although educational pathways are socially stratified at both the undergraduate and graduate levels, more than 60% of the wage gap operates directly. These findings suggest that the mediating role of graduate education is not universal, and that in contexts such as Chile, social reproduction appears to rely more on direct mechanisms linked to social closure and the mobilization of social and cultural capital.

1. Introduction

Since the mid-twentieth century, the role of education in the intergenerational reproduction of inequality has been a central concern in sociological debates. There are, however, different conceptualizations of the role of education within this process. On the one side, some authors argue that, as education expands, the system increasingly allows individuals' destinations to depend less on their origins and more on their abilities and individual merit (Blau & Duncan, 1967; Torche, 2018). By contrast, authors such as Bourdieu (1979) introduced a critical perspective, emphasizing the influence of family origin on both educational attainment and destination. From this perspective, educational institutions recognize the cultural dispositions of the dominant classes as "merit", converting inherited advantages into individual achievement. By naturalizing inequality as personal ability, they reproduce and legitimize existing social hierarchies (Bourdieu & Passeron, 1964, 1970; Reay, 2017).

In recent years, this debate has increasingly focused on higher education, given its global expansion and its central role in determining labor market outcomes (Bhuller et al., 2017; Reay, 2022). Evidence indicates that the relationship between higher education and intergenerational persistence of inequality is complex, as it can simultaneously expand opportunities for upward mobility while also reproducing existing advantages (Costa-Ribeiro, 2023; Solis & Dalle, 2019; Salgado

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et al., 2025; Chetty et al., 2026; Barrios-Fernández et al., 2024). On the one hand, several studies show that earnings gaps by social origin tend to disappear among undergraduates (Torche, 2018; Manzoni, 2021). For instance, Chetty et al. (2020) show that much of the earnings gap between undergraduates is explained by the institution they attended rather than by their social background. However, this same institutional segmentation enables a reproducing role, through the sorting of individuals from different socioeconomic backgrounds into institutional pathways that confer unequal value (Witteveen & Attewell, 2017). After massification of enrolment, evidence shows that students from higher socioeconomic backgrounds have become increasingly concentrated in the most selective and prestigious institutions and undergraduate programs, which translates into better labor market outcomes (Czarnecki, 2018; Marginson, 2016).

More recently, there has been growing interest in graduate studies (Ailei & Wengin, 2022; Pyne & Grodsky, 2020; Wakeling & Laurison, 2017). Globally, enrolments in graduate programs rose by 17% between 2012 and 2023, reaching nearly 29 million students in master's programs and almost four million in doctoral programs. However, this growth has been uneven across regions. In OECD countries, enrolments grew by 16% during this period, compared to just 9% in North America. By contrast, regions such as East Asia and the Pacific, have experienced much stronger expansion, with graduate enrolments increasing by nearly 50% between 2012 and 2023 (UNESCO, 2024). During this period, enrolments in Latin America grew by 48% at the master's level and 66% at the doctoral level (UNESCO, 2024). However, both undergraduate and graduate expansion have unfolded within highly unequal contexts, shaping the features of higher education systems across the region.

These trends are evident in Chile, whose higher education system has been described as a paradigmatic case of massification driven by the deregulation of the private sector in the region (Chiroleu & Marquina, 2017). Over the past three decades, total enrolments have increased sixfold, and system coverage for individuals aged 18–24 rose from 12.7% to 41.1% between 1990 and 2022 (Ministerio de Desarrollo Social, 2022). As a result, the number of people with higher education has also expanded. Recent national figures indicate that between 2006 and 2022, the share of adults aged over 18 with tertiary education doubled, increasing from 12.4% to 26.1% (Ministerio de Desarrollo Social, 2023). In this context, undergraduate degrees have become less effective for labor market differentiation (Collins, 1979). Simultaneously, graduate studies have expanded significantly in the last fifteen years, reflecting a growing demand for advanced qualifications. Between 2010 and 2025, the number of programs almost doubled from 1231 to 2656, while enrolments grew from 33,398 to over 54,696 students (Subsecretaría de Educación Superior, 2025a, 2025b).

In light of this expansion of graduates studies, recent research has increasingly analyzed social inequality at this higher tier, examining whether the mechanism observed in undergraduate education persist, weakens or reconfigures. On the one hand, studies in the United States (Pyne & Grodsky, 2020), Europe (Neugebauer et al., 2016; Triventi, 2013; Zamfir et al., 2021) and Australia (Department of Education Australia, 2019) have found persistent disparities on access to graduate programs by social background. On the other hand, research also has examined the labor market returns of graduate degrees, finding that wage gaps based on social origin remain among those who have completed these studies (In & Breen, 2023; Oh & Kim, 2020). Graduate education, therefore, has been described as a new frontier of social mobility (Wakeling & Laurison, 2017).

Nevertheless, most of this research has addressed access and labor outcomes separately, or has focused on wage gaps among those who hold a graduate degree (Falcon & Bataille, 2018; In & Breen, 2023; Lee et al., 2020; Mateos-González & Wakeling, 2022). As a result, the existing literature provides fragmented insights into how graduate education relates to broader patterns of social inequality. Although prior research has shown that undergraduate studies can both reduce origin-based differences and simultaneously reproduce advantage (Witteveen & Attewell, 2017; Chetty et al., 2026), it remains unclear whether graduate education reinforces or potentially mitigates these mechanisms. Moreover, most of the existing evidence comes from Europe (Triventi, 2013; Neugebauer et al., 2016; Ortiz-Gervasi, 2023) and the United States (Oh & Kim, 2020; Pyne & Grodsky, 2020; Torche, 2018), which raises the question of how these processes unfold in contexts of the Global South.

This study addresses these gaps by analyzing the role of graduate education in reproducing or reducing social inequality among university undergraduates in Chile. Specifically, it examines whether graduate studies mediate the relationship between social background and labor market outcomes. Focusing on Chile's massified and highly privatized higher education system, this study seeks to extend existing stratification debates, mainly shaped by European and North American cases. In doing so, the findings aim not only to fill an empirical gap but also to raise a broader theoretical question. Is the upward shift in the boundaries of inequality to higher levels of education a global trend, or is it conditioned by contextual factors such as the degree of elite closure and homogeneity, as well as the segmentation of the higher education system?

2. Theoretical background

2.1. Theoretical approaches to education and social inequality

Despite major transformations in education systems worldwide, the role of education in shaping inequality and social mobility remains a pressing concern (Reay, 2017, 2022). As higher education systems have expanded in recent decades, scholars sought to understand whether broader participation would reduce the influence of social origin on individuals' socioeconomic destinations. Classical mobility research, particularly the status attainment model of Blau and Duncan (1967), conceptualized education as the primary mechanism through which the effects of social origin were transmitted. This perspective was formalized in the Origin–Education–Destination (OED) framework, which models how family background (O) shapes individuals' educational attainment (E), and how these, in turn, influence occupational and income destinations (D) (Bukodi & Goldthorpe, 2022). Under this perspective, educational expansion was expected to erode the direct link between origin and destination (OD) and the relationship between origin and educational attainment (OE), while strengthening the association between education and destination (ED).

Indeed, evidence shows that higher education can promote upward social mobility (Costa Ribeiro, 2023). Some studies suggest that wage gaps among undergraduate degree holders by social background are minimal (Torche, 2018; Fiel, 2020). Other studies, however, point to the limits of higher education in overcoming origin-based inequalities. For example, in Italy, Giangregorio and Menés (2025) identify wage premiums associated with social origin in specific fields of study, including Economics and Business and Engineering. Similarly, evidence from the United States indicates that while no significant origin-based wage gaps are observed among female undergraduates, such differences persist among men (Manzoni, 2021). Moreover, although higher education contributes to social mobility in countries such as Argentina, Mexico, and Chile, its capacity to substantially reduce the effects of social origin remains limited (Solís & Dalle, 2019).

These mixed findings have led scholars to rethink the relationship between education and the persistence of intergenerational inequality. One strand of theory, has explained this phenomenon grounded in rational choice perspectives. In particular, the theories of Maximally Maintained Inequality (MMI) (Raftery & Hout, 1993) and Effectively Maintained Inequality (EMI) (Lucas, 2001) describe how social groups compete for educational advantages. MMI posits that, in the context of educational expansion, privileged groups maintain their access advantage until a given level of education has been fully saturated. Only then

do opportunities expand to other social groups (Raftery & Hout, 1993). EMI, in turn, argues that even when vertical differences diminish, privileged groups preserve their advantages through horizontal differentiation, seeking to secure access to more selective or prestigious programs (Lucas, 2001).

Pierre Bourdieu's work approaches the issue from a different angle, offering conceptual tools for critically examining the role of education in the reproduction of inequality. Through the notions of habitus, cultural capital, and field, Bourdieu and Passeron, (1964), (1970) argued that educational institutions are not neutral spaces but sites where social hierarchies are symbolically reproduced and legitimized. From this perspective, social structures are internalized as embodied dispositions, or habitus, that shape how individuals perceive, evaluate, and respond to their environment. In schools and universities, these dispositions interact with institutional expectations that implicitly and explicitly reward forms of cultural knowledge and ways of being that are more commonly held by upper-class students. These include familiarity with dominant academic codes, confidence in formal interactions, and participation in culturally valued activities (Weininger & Lareau, 2018). As a result, students from privileged backgrounds feel more at ease within educational institutions and, consequently, achieve higher grades, stronger academic records and more valued educational credentials. By presenting these outcomes as the product of individual merit, the education system masks inherited advantages and legitimizes structural inequalities, since these credentials operate as institutionalized cultural capital whose perceived value is recognized and rewarded in the labor market (Reay, 2022; Spence, 1973).

2.2. Beyond undergraduate studies: graduate education and social inequality

In the context of mass higher education, this perspective is reflected in the differentiated pathways students follow according to their background (Weininger & Lareau, 2018). Through their habitus, an embodied system of dispositions shaped by family and school socialization, students perceive distinct educational horizons and develop unequal expectations about the types of institutions and programs to which they can aspire (Crozier et al., 2019). These expectations interact with prior academic performance, which tends also to favor those from more privileged backgrounds, resulting in differentiated trajectories within the higher education system (Marginson, 2016). Although empirical evidence shows that much of the wage gap among undergraduates is explained by their institution, studies highlight that students from privileged backgrounds are overrepresented in the most selective and prestigious universities and programs (Chetty et al., 2020, 2026; Czarnecki, 2018). Since these institutions provide smoother transitions into the labor market and higher salaries, prestige, and selectivity constitute key mechanisms in the intergenerational reproduction of inequality (Laurison & Friedman, 2016, 2024).

Although Bourdieu did not systematically address graduate education, his framework could be extended to this level (Posselt & Grodsky, 2017). Graduate studies introduce a new stage at which prior advantages may be converted into further forms of institutionalized cultural capital. By allowing symbolic differentiation among those who have already achieved an undergraduate degree, graduate education may consolidate previously acquired advantages, reinforcing the position of upper-class undergraduates. Indeed, available evidence shows that access to graduate programs is stratified by social background, favoring undergraduates with greater volumes of capital and whose dispositions are recognized within the academic field (Mateos-González & Wakeling, 2022; Neugebauer et al., 2016; Posselt & Grodsky, 2017; Triventi, 2013; Zamfir et al., 2021). In France, Falcon and Bataille (2018) traced the influence of social origin across the twentieth century, finding that family background remains decisive for both access to and completion of graduate studies. In the United Kingdom, the weight of class background in graduate participation has increased, with working-class undergraduates currently being about 30% less likely to progress to graduate studies than those from more privileged families (Wakeling & Laurison, 2017).

These inequalities may arise from how social background shapes both institutional selection processes and students' educational decisions. Admission criteria, such as minimum GPA, letters of recommendation, exam scores, research experience, and the reputational hierarchy of undergraduate institutions, operate as institutional filters that tend to favor students from privileged backgrounds (Mikkelsen et al., 2021; Woo et al., 2022). At the same time, graduate programs are often limited to those with sufficient economic capital due to their costs and duration. For instance, a study across four English universities showed that financial constraints significantly restricted first-generation undergraduates' access to graduate studies (Marvell, 2022). The same research found that these undergraduates often perceive universities, especially prestigious ones, as elitist, which creates feelings of non-belonging and discourages their applications. Similarly, consistent with the notion of habitus, horizons of possibility after graduation vary by social background, with aspirations to pursue graduate education differing according to parental education and occupation (Ortiz-Gervasi, 2023).

To assess whether graduate education functions as a mechanism of social differentiation, however, it is necessary to analyze labor outcomes. The existing evidence is mixed. On the one side, in the United States and the United Kingdom, Lindley and Machin (2016) found a graduate wage premium. The authors attributed this positive effect to graduates being concentrated in more specialized, less routine jobs than undergraduates. On the contrary, Lee et al. (2020) reported that in South Korea, master's graduates earned lower wages than undergraduates, reflecting a labor market that sometimes values work experience over academic credentials.

Moreover, not all graduates achieve similar labor outcomes. Wage gaps by social background persist even among those who attain a graduate degree (Wakeling & Laurison, 2017). Research indicates that part of this disparity is due to the stratification of graduate programs themselves. Students from privileged backgrounds tend to enroll in the most prestigious institutions, which leads to higher labor market returns (Oh and Kim, 2020; Torche, 2018). Similarly, In and Breen (2023) found that wage differences among graduates in the United Kingdom are mediated by undergraduate trajectories, with those completing highly valued graduate programs disproportionately coming from elite undergraduate institutions.

2.3. Conceptual model, expectations and research question

The literature shows that higher education plays a dual role in relation to social inequality at the undergraduate level (Torche, 2018; Fiel, 2020; Chetty et al., 2020; Witteveen & Attewell, 2017). At the graduate level, existing research indicates that both access and the economic returns are stratified by social origin (Oh & Kim, 2020; Wakeling & Laurison, 2017). Following Bourdieu's framework, graduate education can be expected to contribute to the reproduction of inequality by enabling symbolic distinction among those who have already gained access to higher education. However, empirical evidence on how these dynamics unfold remains fragmented. In this regard, the research question guiding this study is the following: To what extent does graduate education mediate the association between social origin and earnings among undergraduates?

To operationalize this research question, the OED framework offers a useful analytical tool. Although traditionally associated with the status-attainment tradition (Blau & Duncan; 1967), the OED model has increasingly been used in critical research to examine how education contributes to the reproduction of inequality (Solis & Dalle, 2019). In this study, the model presented in Fig. 1 draws on the OED framework to estimate the direct and indirect effects of social origin on labor market outcomes, explicitly incorporating graduate study as a potential

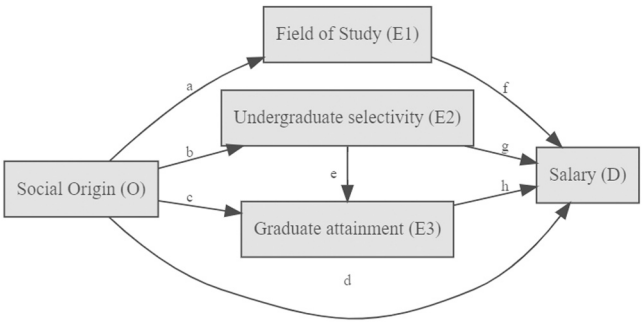

Fig. 1. Extension of the OED triangle to the graduate level.
Source: Authors' elaboration based in the OED triangle.

mediating mechanism. Therefore, the educational dimension is divided into three components: the field of study (E1), and the selectivity of the university (E2) attended at the undergraduate level, and the highest level of education attained (E3). This strategy allows for the simultaneous analysis of both the direct and indirect effects of social origin on earnings, while also identifying whether graduate studies reinforce or attenuate pre-existing inequalities.

3. The Chilean context

The current features of Chile's higher education system stem from the neoliberal reforms implemented by the military dictatorship (1973–1990) in the 1980s. These reforms enabled the deregulated creation of new private universities, adding to the set of pre-existing "traditional private universities" and public universities (Salazar & Leihy, 2017). As a result, higher education underwent an explosive process of massification and privatization. While university enrolment stood at around 130,000 students in 1990 (Rolando et al., 2010), by 2025 it had increased to over 730,000 (Subsecretaría de Educación Superior, 2025a). Today, the university system comprises 51 institutions, with a strong private-sector presence that enrolls more than 70% of all students. The system is also characterized by relatively long undergraduate programs, which typically last around five years (Subsecretaría de Educación Superior, 2025c).

This expansion broadened access across all social groups (Ministerio de Desarrollo Social, 2023). As a result, university education has promoted absolute upward mobility, improving the occupational status of those who enter the system. However, the impact on relative mobility has been more limited, as occupational gains tend to benefit individuals across the social spectrum without weakening the persistence of inequalities by social origin (Salgado et al., 2025). This picture becomes even more complex when considering that the system has become highly differentiated by institutional prestige, selectivity, and quality, with a small group of elite universities. Graduates from these universities tend to earn higher salaries and are more likely to attain leadership positions (Bordón & Braga, 2020; Zimmerman, 2019), a pattern reinforced by the structure of the Chilean professional labor market. With the exception of a limited number of regulated professions, most occupations are not legally tied to specific credentials (Subsecretaría de Educación Superior, 2022). Instead, employers typically define a set of acceptable professional degrees and rank candidates according to institutional prestige and selectivity, as well as through practices that may involve discriminatory criteria (Undurraga, 2019).

As in other contexts, access to these elite universities is highly stratified by social background. Students from privileged families in Chile are disproportionately concentrated in the most prestigious and selective universities and programs, while students from lower socio-economic backgrounds are more likely to attend less selective institutions (Kuzmanic et al., 2021; Villalobos et al., 2020). A substantial part of this stratification is explained by the selection mechanisms used by the 45 selective universities in the country, which admit students through a centralized system based on standardized admission test scores. Evidence shows that performance on these tests is strongly associated with students' socio-economic background and the characteristics of their secondary schooling (Rodríguez et al., 2022).

In this way, institutional differentiation at the undergraduate level enables, at least partly, the reproduction of advantages among students from more privileged backgrounds. At the same time, this process does not operate in a purely exclusionary manner. Evidence shows that students from lower socio-economic backgrounds who manage to enter elite universities experience significant upward mobility (Barrios-Fernández et al., 2024). Nevertheless, other studies highlight the ambivalence of these dynamics, suggesting that students from privileged backgrounds may be better positioned to fully capitalize on elite higher education, due to their greater access to complementary resources, networks, and forms of cultural capital (Zimmerman, 2019).

Within this context, there has been a growing interest in graduate programs, given their expansion in the last decade. This includes master's and doctoral degrees, which confer an academic qualification in a specific field and typically last between two and four years, with average durations of 2.4 and 5.3 years, respectively (Subsecretaría de Educación Superior, 2025c). In recent years, a second type of program has also gained relevance: *Diplomados* (Certificate Programs). Unlike graduate degrees, these programs do not confer a qualification beyond the bachelor's degree but provide specialized training in a specific subject. Their duration is short, averaging approximately 0.5 years.

The growing importance of graduate and certificate programs is evident in their expanding provision, enrolments, and number of graduates. Over the past 15 years (2010–2025), the provision of these programs has increased substantially, led by certificate programs (up 397%), followed by doctoral (135%) and master's (119%) programs (Subsecretaría de Educación Superior, 2025b). Enrolment has risen accordingly: while certificate enrolments grew from 14,000 in 2010–70, 000 students in 2025, graduate enrolments (master's and doctoral programs) increased from 33,000 to over 54,000 in the same period (Subsecretaría de Educación Superior, 2025a). Despite the growing importance of graduate education in Chile, evidence on access remains scarce. One recent study suggests that graduate enrolment is stratified by socio-economic background, as first-generation and low-income graduates were less likely to enroll (Espinoza et al., 2024).

4. Methodology

4.1. Data

The data analyzed come from an online survey of undergraduates from Chilean universities. The survey aimed to examine their educational and labor trajectories, as well as the higher education system's contribution to reducing social inequality. Unlike available administrative data in Chile, this survey integrates detailed information on social origin, complete higher education trajectories, and labor market outcomes within a single source.

The sample was constructed in two steps. First, 17 universities were selected from the institutions participating in Chile's centralized admissions system (45 selective universities). The 17 universities were chosen through intentional sampling to ensure they broadly represent the Chilean university system (Cohen et al., 2017). Selection criteria included geographical location (north, center, south), level of selectivity based on admission scores (low, high, elite), and type of institution (traditional private, new private, state). Table 1 compares the 17 participating universities with the Chilean selective university system, showing that the two groups display similar distributions in gender, graduation year, and field of study (differences below 2%). Some variation is observed in regional distribution and institutional selectivity. Overall, the participating universities provide a reasonable approximation of the broader system.

Table 1
Descriptive statistics for the survey sample, the population of undergraduates from the participating 17 universities, and the Chilean selective university system (cohorts 2015–2017).

Variable	Survey respondents (%)	Undergraduate Population: 17 participating universities (%)	|Standardized Mean Differences| (|SMD|)	Chilean selective university system (%)
Male	41.0	42.6	0.03	43.0
Graduation year				
2015	32.0	32.6	0.02	32.8
2016	33.4	33.0		32.6
2017	34.6	34.4		34.6
Field of study				
Business & Adm.	8.4	9.9	0.14	11.3
Agriculture	5.4	4.2		3.1
Arts & Humanities	6.3	6.8		5.2
Social Science	14.9	12.2		11.4
Law	5.7	4.4		4.9
Education	17.9	18.4		18.1
Health	23.9	24.5		25.2
STEM	17.6	19.7		20.8
Region				
North	13.1	13.3	0.02	8.7
Central	37.4	36.9		33.6
Metropolitan	34.7	35.4		45.1
South	14.8	14.4		12.6
Selectivity				
Low	66.4	64.0	0.07	59.7
High	21.9	22.8		29.9
Elite	11.7	13.3		10.4
	Mean (SD)	Mean (SD)	SMD	Mean (SD)
University GPA	5.53 (0.51)	5.50 (0.50)	0.06	-
N	922	56,168	-	184,740

Note: Standardized mean differences (SMD) were computed by comparing survey respondents with the undergraduate population of the 17 participating universities.
Source: Authors' elaboration based on data provided by the 17 participating universities and national administrative records from the Subsecretaría de Educación Superior (2025c).

The 17 universities provided lists of graduates from the 2015, 2016, and 2017 cohorts. This information was used to construct the sampling frame (N = 56,168), from which a random sample of 1057 cases was drawn (3% margin of error, 95% confidence level). The sample was proportionally distributed across universities according to their size. Graduates were contacted by email between May and November 2023. Each week, non-respondents were randomly replaced within the same university until the established sample size for each institution was completed.[6]

The final analytical sample consisted of 922 graduates who were working at the time of the survey and had complete information. 18 cases with missing values were excluded from the sample, as well as 117 unemployed graduates, for whom salary data were not available. While this strategy enables regression models to be estimated, it may introduce some selection bias if the probability of being employed is correlated with individual or institutional characteristics. To assess this, employed and unemployed respondents were compared across observed covariates. Bivariate χ^2 tests showed no significant differences by gender ($p = 0.73$), family income ($p = 0.40$), parental education ($p = 1.00$), university selectivity ($p = 0.39$), field of study ($p = 0.09$), or graduation year ($p = 0.35$). A *t*-test for university GPA indicated no significant difference between groups ($p = 0.41$).

Table 1 presents descriptive statistics for the survey sample and for the population of undergraduates from the 17 participating universities. Standardized mean differences (SMD) were computed, showing that the only variable exceeding the 0.10 threshold is the undergraduate field of study (|SMD| = 0.14). However, SMD values tends to be inflated for variables with many categories. In fact, the differences between survey respondents and the population at the 17 universities are small, only 2.7% for social science and 2.1% for STEM. Taken together, these patterns indicate that the sample can be considered representative of the undergraduate population of the 17 universities.

4.2. Variables and analytical strategy

To estimate the conceptual model presented in Fig. 1, social origin was constructed using latent class analysis, which allows for the identification of qualitatively distinct groups based on observable characteristics (Lazarsfeld & Henry, 1968; Weller et al., 2020). Four indicators were used to capture undergraduates' families economic, social, and cultural capital (Bourdieu, 1997). Economic capital was measured using the family income reported by graduates at the time of entry into undergraduate education. This variable was grouped into four categories, following the Chilean context (Instituto Nacional de Estadísticas, 2024): Low (<470 USD), Middle (471–1042 USD), High (1043–1667 USD), and Very High (>1667 USD).

Social and cultural capital were assessed through two variables, parental education and parental occupation. Parental education was coded as a binary indicator showing whether at least one parent had ever attended higher education. Parental occupation was measured using the highest-status occupation between mother and father, classified into three levels: non-professional, professional, and managerial. Finally, because school socialization also contributes to the development of habitus (Palma-Amestoy, 2022), a fourth variable capturing the type of secondary school attended (private, private subsidized, or public), was included.

Based on these indicators, the model with the best fit, showing the lowest AIC and BIC, was the four-class solution. The results reveal four groups ordered from the lowest to the highest levels of economic, social, and cultural capital: i) Class 1 (low levels of capital, 46%), comprising

[6] The overall response rate was 8%. Appendix A presents some characteristics of respondents and non-respondents. No major differences were found regarding gender, year of graduation, or university GPA. However, there was a higher proportion of graduates from low-selectivity private universities among the non-respondents. The potential implications of this difference are discussed later in the study's limitations.

students from public and subsidized schools, first-generation entrants to higher education, whose parents held non-professional occupations and had low or middle incomes; ii) Class 2 (moderate levels of capital, 29%), mainly composed of students from subsidized schools, whose parents had some higher education experience and displayed a balanced distribution between professional and non-professional occupations, together with middle family incomes; iii) Class 3 (high levels of capital, 17%), characterized by a higher concentration of students from private schools, with parents who had attended higher education, held professional occupations, and had high family incomes; and iv) Class 4 (very high levels of capital, 8%), predominantly educated in private schools, with parents who had assisted higher education, held professional or managerial occupations, and reported very high family incomes.

Labor market destination was operationalized as the monthly salary reported at the time of the survey. While self-reported income may be subject to measurement error, prior studies have shown it to be reasonably reliable (Carnevale et al., 2011; Friedman & Laurison, 2019). In addition, since income distributions tend to be highly skewed, the natural logarithm was applied. Educational trajectories were captured through three dimensions, two referring to undergraduate level and one indicating whether the undergraduate continued into graduate education. Regarding undergraduate studies, field of study (E1) and the selectivity of the university attended (E2) were used. The latter was operationalized as an ordinal variable with three categories based on institution's average admission test scores: low, high, and elite. Finally, the highest educational level attained (E3) was coded as an ordinal variable with three categories: undergraduate only, certificate program (Diplomado), and graduate (master or doctoral). In addition to the main variables, several controls were included, such as gender, secondary school GPA, and current job characteristics. Further details on the specific equations estimated can be found in Appendix D.

Table 2 shows the distribution of the variables used to describe social origin, educational trajectories, and labor market outcomes. In addition to reporting categories and distributions, the table provides a national benchmark whenever data was available. Regarding earnings, the salaries reported by survey respondents closely resemble the national average for individuals with more than 17 years of education (Ministerio de Desarrollo Social, 2023). In contrast, some distortions emerge in the distribution of university type (E2), as well for parental education and highest qualification attained (E3) (Subsecretaría de Educación Superior, 2025c; Ministry of Social Development, 2017; SIES, 2025). The discrepancies are substantially larger for this last two variables, which may be related to participation patterns in the survey, particularly higher participation among undergraduates with more favorable academic trajectories and more advantaged family backgrounds. The implications of this potential bias are discussed in the conclusion. To partially address these distortions, weights were constructed based on institutional selectivity and the highest qualification attained, which were used as robustness checks in the estimated models (M2 in Appendix C).

To empirically test the model presented in Fig. 1, a Structural Equation Model (SEM) was estimated (Danner et al., 2015). SEM allows simultaneous estimation of multiple relationships between observed and latent variables. In this study, only observed variables were used; hence, only structural relationships were estimated. One advantage of SEM is that it enables the analysis of mediation effects by estimating both direct and indirect paths, providing a more comprehensive framework than traditional regression analysis. Because the model includes categorical (family income) and ordinal variables (university type, educational attainment), the Weighted Least Squares Mean and Variance adjusted (WLSMV) estimator was employed. This method adjusts for non-normality and allows estimation with non-continuous variables (Li, 2016).

In addition, it was necessary to account for the hierarchical structure of the data, in which undergraduates are nested within their universities. The sample size and the number of universities did not allow for a stable estimation of a multilevel SEM with random effects. Therefore, as a robustness check, the same conceptual model was estimated using multilevel linear regressions, which allowed modelling the potential dependence among undergraduates from the same institution (M3 in Appendix C).

Analyses were conducted in RStudio using the *lavaan* package (Rosseel, 2012), while latent classes were constructed with the poLCA package (Linzer & Lewis, 2011). Moreover, robustness checks were performed with packages lme4 (Bates et al., 2015), and survey (Lumley, 2024).

Table 2
Distribution of origin, education, and destination variables.

Variable	Categories	Distribution (%)	National distribution
Family Income (In 2025 USD)	Low (<470)	242 (26%)	Not available
	Medium (470–1042)	389 (42%)	
	High (1.042–1.667)	171 (19%)	
	Very High (>1.667)	120 (13%)	
Parental education	First Generation (FG: no parent attended HE)	405 (44%)	83%
	At least one parent attended HE	517 (56%)	17%
Parental occupation	Non-professional	556 (60%)	Not available
	Professional	332 (36%)	
	Managerial	34 (4%)	
Secondary school type	Public	310 (34%)	Not available
	Subsidized private	475 (52%)	
	Private	137 (15%)	
Selectivity at the undergraduate Level (E2)	Low	612 (66%)	60%
	High	202 (22%)	30%
	Elite	108 (12%)	10%
Highest qualification attained (E3)	Undergraduate only	417 (45%)	80%
	Certificate (Diplomado)	339 (37%)	12%
	Graduate	166 (18%)	7%
	Mean (USD)	Standard Deviation (USD)	Mean (USD)
Salary	1.683	1.181	1.586

Note: The field of study (E1) is not included in this table, as it was already presented in Table 1.
Source: Authors' elaboration based on national data from SIES (2025) for the highest degree attained (graduates from the 2015, 2016 and 2017 cohorts who completed a certificate or graduate program between 2016 and 2022); Ministry of Social Development (2022) for salary estimates (calculated as a weighted average based on the observed distribution among the survey sample); Ministry of Social Development (2017) for parental education; and administrative records from the Subsecretaría de Educación Superior (2025c) for the selectivity of the university.

5. Results

To assess whether graduate education mediates the relationship between social origin and labor market destination, the model described in Fig. 1 was estimated. Full parameter estimates and fit statistics are reported in Appendix B. As expected for a large WLSMV-estimated model with numerous categorical indicators and multiple pathways, global fit indices are low across metrics (CFI, TLI, RMSEA and SRMR) (Shi et al., 2019; Xia & Yang, 2019). Given these limitations, and consistent with applications focused on mediation mechanisms rather than on strict global fit, the analysis focuses on theoretically grounded direct and indirect effects, which remain interpretable and substantively meaningful. The results first show a positive association between social origin and selectivity at the undergraduate level, particularly, for undergraduates from Class 3 (high-capital group) ($\beta = 0.760$, $p < 0.001$) and Class 4 (very-high capital group) ($\beta = 1.257$, $p < 0.001$) compared to those from Class 1 (low-capital group). Second, social origin was associated with a higher probability of pursuing further studies after

Table 3
Direct and indirect effects of origin on undergraduates' salaries.

	Direct	Indirect (Undergraduate)	Indirect (Field)	Indirect (Highest level)	Total
Absolute					
Class 2 (Moderate capital)	-0.006	0.015	0.029*	0.005	0.044
Class 3 (High capital)	0.165**	0.087***	0.016	0.013	0.281***
Class 4 (Very high capital)	0.270**	0.144***	0.041	0.001	0.455***
Percentage					
Class 2 (Moderate capital)	-13.6%	34.1%	65.9%	11.4%	100.0%
Class 3 (High capital)	58.7%	31.0%	5.7%	4.6%	100.0%
Class 4 (Very high capital)	59.3%	31.6%	9.0%	0.2%	100.0%

Note: Standard errors and p-values for indirect effects were computed using the delta method applied to the robust WLSMV variance–covariance matrix of model parameters. Absolute effects were computed directly from the model coefficients and can be interpreted as percentage changes in salary by exponentiating them. Indirect effects were obtained by multiplying the coefficients of their respective paths, while total effects were calculated as the sum of direct and indirect components. Percentage effects represent the proportion of the total effect accounted for by each direct or indirect pathway.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$
Authors' elaboration based on model results.

graduation only among undergraduates from Class 3. There is also evidence of a relationship between undergraduate selectivity and progression to Certificate or Graduates programs.

Regarding salary outcomes, all four variables (social origin, university selectivity, field of study, and highest qualification attained) are associated with earnings (Appendix B). Since salary is modelled in logarithmic form, the estimated coefficients can be exponentiated, allowing them to be interpreted as approximate percentage changes in salary. Undergraduates from Class 3 earn, on average, 18% more than those from Class 1 ($e^{0.165} = 1.18$, $p < 0.01$), while the wage gap between them and those from Class 4 is nearly 31% ($e^{0.270} = 1.31$, $p < 0.001$). In terms of educational trajectories, higher levels of university selectivity are associated with higher earnings, while individuals holding credentials beyond the bachelor degree earn higher wages than those with only an undergraduate degree. Regarding fields of study, undergraduates from Humanities and Education earn lower salaries than those in business (reference category), whereas undergraduates from STEM and Law fields obtain higher earnings.

Based on these results (see Appendix B), direct and indirect relationships were calculated and summarized in Table 3. The table reports both absolute and percentage effects, showing virtually no wage differences between undergraduates from Class 1 (low-capital group) and 2 (moderate-capital group). In contrast, significant gaps appear for undergraduates from Class 3 (high-capital group) and 4 (very high-capital group). However, most of these differences are expressed directly. For instance, undergraduates from Class 3 earn, on average, 32% more than those from Class 1 ($e^{0.281} = 1.32$, $p < 0.001$). Of this total, 60% corresponds to a direct effect, about 30% is explained by the selectivity of the university attended, nearly 6% is mediated by the field of study, and only 5% by the highest educational level attained. The wage gap is even larger when comparing individuals from Class 4, who earn, on average, 60% more than those from Class 1 ($e^{0.455} = 1.58$, $p < 0.001$), of which virtually none is mediated by the highest degree obtained (Table 3).

Finally, four additional linear regressions were estimated as robustness checks, with results reported in Appendix C using the same format as Table 3. Overall, the total effect across these robustness checks closely resemble those from the SEM (Table 3), except for M3. This difference arises because, once nesting is modelled, the analysis captures variation within universities rather than between them, substantially reducing the component associated with institutional selectivity. Even so, the overall structure of the results remains stable, as most of the differences continue to be expressed directly, rising slightly above 60% in M2 and approaching 70% in M1 and M4. In M3, the direct component increases further due to reduced mediation via undergraduate selectivity. Likewise, the mediation attributable to graduate education remains small across all specifications, around 5% for Class 3 and nearly zero for Class 4.

6. Discussion

Following the massification of higher education, a central question in social mobility research has been whether broader educational participation weakens or reinforces the reproduction of social inequality. At the undergraduate level, existing evidence indicates that higher education can simultaneously create new opportunities for social mobility while reproducing advantages (Torche, 2018; Witteveen & Attewell, 2017; Costa Ribeiro, 2023; Solis & Dalle, 2019). However, less is known about whether similar dynamics operate at the graduate level, despite its sustained growth and its potential to generate new forms of symbolic differentiation among undergraduates. In the Chilean case, this study's findings suggest that graduate education plays only a marginal role in explaining the differences in earnings by social origin. Nevertheless, this limited mediating role does not imply that undergraduates from different backgrounds experience similar outcomes. On the contrary, substantial wage gaps persist, reflecting the enduring influence of social origin on labor trajectories.

The analysis allowed for the disentangling of the different pathways through which inequality is reproduced within the educational system. As reported in other contexts, the educational trajectories at both the undergraduate and graduate levels are strongly conditioned by undergraduates' social background (Brighouse, 2025; Czarnecki, 2018; Thompson, 2019; Villalobos et al., 2020). These results confirm that, in a mass higher education system, educational pathways are socially stratified through qualitative characteristics, such as undergraduate field of study and institutional selectivity, and quantitative dimensions linked to graduate attainment (Lucas, 2001; Reay, 2022; Weininger & Lareau, 2018). Furthermore, in line with In and Breen (2023), a dependency between undergraduate and graduate trajectories is observed. Attending more selective undergraduate institutions increases the likelihood of enrolling in graduate programs, suggesting a cumulative process within higher education, in which advantages obtained at the undergraduate level are reinforced through the accumulation of graduate-level credentials (Oh & Kim, 2020; Torche, 2018).

In addition, in line with previous national and international research (Bordón & Braga, 2020; Zimmerman, 2019; Chetty et al., 2020),

undergraduate characteristics and graduate attainment are associated with earnings. Their mediating role, however, represents only a relatively small share of the total origin-destination relationship, particularly for graduate studies. This contrasts with findings from the Global North, where higher education has been theorized as a central channel mediating the relationship between social origin and destination (Blau & Duncan, 1967; Bourdieu & Passeron, 1964, 1970), and where graduate education has been framed as a new frontier of social mobility (Wakeling & Laurison, 2017). In the Chilean context, the present findings indicate that although educational trajectories are clearly segmented, their mediating role is relatively limited, consistent with previous evidence (Solis & Dalle, 2019).

The greater relevance of the direct link between social origin and labor market outcomes, which according to our results accounts for nearly 60% of the wage gap, can be interpreted in light of structural features of Chilean society, particularly the high degree of elite homogeneity and social closure (Torche, 2005; Cortés-Orihuela et al., 2024). This closure has been shown to shape access to specific labor market opportunities in ways that are only partially mediated by formal educational credentials. In this context, prior research indicates that status recognition in Chile often relies on symbolic markers such as skin color or surname, which operate alongside, and sometimes independently of educational attainment (Rodríguez & Archer, 2022; Torres et al., 2019; United Nations Development Program [UNDP], 2017). Moreover, forms of capital beyond academic credentials, including social capital expressed in exclusive networks, and cultural capital manifested in behavioral codes or styles of dress, have been shown to influence recruitment processes and career advancement in ways that favor undergraduates from privileged backgrounds (Undurraga, 2019; Zimmerman, 2019; Espinoza et al., 2021). Overall, the results from this study suggest a context in which education contributes to individual mobility, but where the reproduction of inequality is largely driven by labor-market and social dynamics that extend beyond formal credentials.

7. Conclusion

After decades of higher education massification, the process of expansion has progressively extended from undergraduate to graduate studies. This has raised questions about the role of graduate education in relation to social inequality, given its potential to generate distinctions among university undergraduates. This study examined the extent to which graduate attainment mediates the relationship between social origin and the wages of Chilean university undergraduates. In doing so, it sought to provide empirical evidence from a context outside the Global North on the extent to which education operates as a mediating channel at the graduate level. The methodology employed allowed us to quantify and contrast the different pathways shaping this process, offering empirical insights into a level of education rarely incorporated in studies of social reproduction.

The results show that higher education trajectories play only a limited mediating role, particularly in the case of graduate studies, despite the existence of substantial wage gaps by social origin. While the findings suggest inequalities in access to graduate education and positive wage returns associated with this level, their contribution to social reproduction is limited compared to the direct mechanisms linked to economic, social, and cultural capital at origin. In contexts such as Chile, these findings call for more cautious expectations regarding graduate education as a mechanism of differentiation that reinforces or reduces social inequality. They suggest that the role of educational credentials in social mobility is not universal but depends on the specific ways social reproduction occurs in each context. In Chile, the high homogeneity and cohesion of the elite may help explain why educational credentials play a more limited mediating role, configuring direct mechanisms of reproduction that contrast with European and North American contexts, where credentialism has played a more central role.

Nevertheless, the results should be interpreted in light of certain limitations related to sample composition and non-response. In particular, response rates were lower among undergraduates from low-selectivity private universities, who are more likely to experience weaker labor-market outcomes. This pattern suggests a degree of positive selection among respondents from these institutions, potentially leading to an upward bias in wages. This positive selection is further reinforced by the overrepresentation in the sample of undergraduates that attained graduate education and those whose parents had prior experience in higher education. Since both graduate attainment and parental education are associated with more favorable labor outcomes, their overrepresentation implies that the analyzed sample is skewed towards individuals with more advantaged origins and trajectories. Taken together, these patterns suggest that the estimated wage gaps by institutional selectivity and educational trajectory may be even larger, and that inequalities linked to social origin could be even more pronounced.

Finally, further research is needed to deepen our understanding of the role of the education system in the reproduction of inequality. First, it is necessary to investigate the mechanisms that explain why most of the relationship between origin and destination operates directly. To what extent can this be attributed to undergraduates' social and cultural capital, or discriminatory practices in the Chilean labor market? In addition, although inequalities between graduates by social background are considerable, it is important to examine to what extent higher education has enabled those undergraduates from less privileged backgrounds to improve their situation. Lastly, international comparisons should be broadened to include countries with stratification patterns similar to Chile's. This would facilitate assessment of whether the limited relevance of graduate credentials found here is replicated in other Global South contexts.

CRediT authorship contribution statement

Oscar Espinoza: Writing – review & editing, Project administration, Funding acquisition. **Bruno Corradi:** Writing – original draft, Methodology, Formal analysis, Conceptualization. **Catalina Miranda:** Writing – review & editing. **Noel McGinn:** Writing – review & editing. **Luis Sandoval:** Writing – review & editing.

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Declaration of Competing Interest

The authors declare that they have no conflict of interest.

Appendix

Appendix A
Descriptive statistics for respondents and non-respondents

Variable	Respondents	Non-respondents
Gender		
Feminine	58.8	57.2
Masculine	41.2	42.8
Year of Graduation		
2015	32.5	32.4
2016	32.8	33.9
2017	34.7	33.7
Field of Study		
Admin. & Business	7.9	9.8
Agriculture	5.6	3.6
Art & Humanities	6.8	6.8
Social Sciences	14.8	10.6
Law	5.6	3.1
Education	17.7	20.2
Health	23.3	31.6
STEM	18.3	14.3
Type of univ.		
Private Low Selectivity	26.4	46.4
Traditional Low Selectivity	40.0	29.4
Private High Selectivity	8.0	6.6
Traditional High Selectivity	13.4	6.8
Elite	12.1	10.8
	Mean	Mean
University GPA	5.52	5.49
N	1057	12,213

Source: Authors' elaboration.

Appendix B
Results and fit of the structural equation model

Model	Coefficients	Standard Error	P value
Selectivity			
Class 2	0.133	0.106	0.211
Class 3	0.760	0.121	0.000
Class 4	1.257	0.171	0.000
Secondary GPA	0.501	0.058	0.000
Male	0.400	0.089	0.000
Highest level			
Class 2	0.097	0.093	0.298
Class 3	0.240	0.113	0.033
Class 4	0.014	0.151	0.926
Selectivity	0.107	0.042	0.011
Univ. GPA	0.278	0.075	0.000
Field Agriculture			
Class 2	-0.003	0.021	0.873
Class 3	-0.013	0.024	0.573
Class 4	-0.029	0.034	0.402
Secondary GPA	0.000	0.011	0.986
Male	0.014	0.018	0.439
Field Arts & Hum.			
Class 2	0.014	0.025	0.561
Class 3	0.087	0.023	0.000
Class 4	0.102	0.028	0.000
Secondary GPA	-0.021	0.011	0.047
Male	0.020	0.017	0.244
Field STEM			
Class 2	-0.006	0.028	0.843
Class 3	-0.054	0.033	0.103
Class 4	-0.101	0.054	0.064
Secondary GPA	0.037	0.014	0.011
Male	0.180	0.029	0.000
Field Social Science			
Class 2	0.004	0.029	0.882
Class 3	0.055	0.031	0.079
Class 4	0.036	0.044	0.415
Secondary GPA	-0.047	0.016	0.002
Male	-0.048	0.025	0.054
Field Law			
Class 2	0.019	0.019	0.320

(*continued on next page*)

Appendix B (*continued*)

Model	Coefficients	Standard Error	P value
Class 3	0.025	0.024	0.293
Class 4	0.117	0.024	0.000
Secondary GPA	0.027	0.011	0.011
Male	0.003	0.018	0.883
Field Education			
Class 2	-0.084	0.028	0.003
Class 3	-0.135	0.040	0.001
Class 4	-0.187	0.079	0.018
Secondary GPA	-0.083	0.016	0.000
Male	-0.087	0.026	0.001
Field Health			
Class 2	0.044	0.033	0.178
Class 3	0.028	0.038	0.457
Class 4	-0.065	0.069	0.349
Secondary GPA	0.065	0.019	0.000
Male	-0.092	0.032	0.004
Salary			
Class 2	-0.006	0.040	0.883
Class 3	0.165	0.049	0.001
Class 4	0.270	0.078	0.001
Selectivity	0.114	0.019	0.000
Highest level	0.056	0.017	0.001
Male	0.132	0.036	0.000
Univ. GPA	-0.067	0.034	0.050
Working hours	-0.030	0.017	0.088
Supervisory Resp.	0.037	0.012	0.003
Sector Employer	-0.042	0.081	0.607
Sector Private	-0.067	0.074	0.361
Sector Public	0.055	0.081	0.497
Contract Fee	0.224	0.079	0.004
Contract Fixed	0.334	0.061	0.000
Contract Indefinite	0.476	0.055	0.000
Field Agriculture	0.011	0.058	0.850
Field Art & Humanities	-0.221	0.062	0.000
Field STEM	0.180	0.044	0.000
Field Social Science	-0.077	0.049	0.116
Field Law	0.284	0.056	0.000
Field Education	-0.298	0.043	0.000
Field Health	0.074	0.040	0.066
Fit			
Estimator	DWLS	N	922
χ^2 (df = 118)	3948, $p < .001$	Scale χ^2 (df = 118)	2468, $p < .001$
CFI	0.072	TLI	0.646
RMSEA	0.147 (IC90% [0.142, 0.152])	SRMR	0.283

Source: Authors' elaboration.

Appendix C

Direct and indirect effects of origin on graduates' salaries using linear regression (robustness checks)

	Direct	Indirect (Undergraduate)	Indirect (Field)	Indirect (Highest level)	Total
M1: single level, unweighted model					
Absolute					
Class 2	-0.007	0.011	0.016	0.004	0.024
Class 3	0.196	0.066	-0.008	0.012	0.266
Class 4	0.323	0.133	0.019	-0.004	0.471
Percentage					
Class 2	29.2%	45.8%	66.7%	16.7%	100%
Class 3	73.7%	24.8%	-3.0%	4.5%	100%
Class 4	68.6%	28.2%	4.0%	-0.8%	100%
M2: single level, weighted model					
Absolute					
Class 2	-0.010	-0.002	0.017	0.005	0.010
Class 3	0.179	0.091	-0.003	0.009	0.276
Class 4	0.286	0.147	0.029	-0.005	0.457
Percentage					
Class 2	-100.0%	-20.0%	170.0%	50.0%	100%
Class 3	64.9%	33.0%	-1.1%	3.3%	100%
Class 4	62.6%	32.2%	6.3%	-1.1%	100%
M3: multilevel, unweighted model					
Absolute					
Class 2	-0.013	0.000	0.015	0.005	0.007
Class 3	0.152	0.004	-0.012	0.015	0.159
Class 4	0.278	0.011	0.014	0.002	0.305
Percentage					

(*continued on next page*)

Appendix C (*continued*)

	Direct	Indirect (Undergraduate)	Indirect (Field)	Indirect (Highest level)	Total
Class 2	-185.7%	0.0%	214.3%	71.4%	100%
Class 3	95.6%	2.5%	-7.5%	9.4%	100%
Class 4	91.1%	3.6%	4.6%	0.7%	100%
M4: model with winsorized income					
Absolute					
Class 2	-0.006	0.011	0.016	0.004	0.025
Class 3	0.182	0.064	-0.007	0.012	0.251
Class 4	0.320	0.129	0.019	-0.003	0.465
Percentage					
Class 2	-24.0%	44.0%	64.0%	16.0%	100.0%
Class 3	72.5%	25.5%	-2.8%	4.8%	100.0%
Class 4	68.8%	27.7%	4.1%	-0.6%	100.0%

Note: Absolute effects were computed directly from the model coefficients. The total effect corresponds to the coefficient estimated in the model without mediators. Mediators were then introduced sequentially in the following order: undergraduate selectivity, field of study, and graduate attainment. Indirect effects were computed based on changes in the coefficients associated with social origin between the model excluding the relevant mediator and the model including it. Finally, the direct effect corresponds to the coefficient estimated in the model including all mediators simultaneously. Percentage effects represent the proportion of the total effect accounted for by each direct or indirect pathway.
*p < 0.05, **p < 0.01, ***p < 0.001

Appendix D. Technical Specifications of the SEM (Fig. 1)

D.1. Model specification and identifying assumptions

This study estimates a Structural Equation Model (SEM) to examine how social origin is related to labor-market outcomes through multiple dimensions of the higher education trajectory (Fig. 1). The identification of the model rests on a set of theoretically grounded assumptions. Social origin is assumed to precede educational trajectories and labor-market outcomes. Undergraduate selectivity, field of study, and progression into graduate education are modelled as parallel dimensions of educational stratification, with selectivity additionally influencing the likelihood of pursuing graduate studies. The model further assumes conditional exogeneity, such that, conditional on observed academic performance, gender and labor-market controls, the error terms are uncorrelated with the explanatory variables in each equation. Finally, relationships are assumed to be approximately linear and additive on the latent scale underlying the ordinal variables, consistent with the use of the WLSMV estimator. These assumptions allow for an interpretable decomposition of direct and indirect effects without implying strong causal identification.

D.2. Structural equations

$$Selectivity_i = \alpha_1 + \beta_1 Origin_i^{Class\ 2} + \beta_2 Origin_i^{Class\ 3} + \beta_3 Origin_i^{Class\ 4} + \beta_4 Sec.\ GPA_i + \beta_5 Male_i + \varepsilon_{1i}$$

$$Highest\ Lvl_i = \alpha_2 + \beta_6 Origin_i^{Class\ 2} + \beta_7 Origin_i^{Class\ 3} + \beta_8 Origin_i^{Class\ 4} + \beta_9 Selectivity_i + \beta_{10} Univ.\ GPA_i + \varepsilon_{2i}$$

$$Field_{ik} = \alpha_{3k} + \beta_{k2} Origin_i^{Class\ 2} + \beta_{k3} Origin_i^{Class\ 3} + \beta_{k4} Origin_i^{Class\ 4} + \beta_{ks} Sec.\ GPA_i + \beta_{kM} Male_i + \in_{3ik}$$

$$k \in \{Agriculture,\ Art\&Humanities,\ STEM,\ Social\ Science,\ Law,\ Education,\ Health\}$$

$$\begin{aligned}\ln(Earning_i) = {} & \alpha_4 + \beta_{11} Origin_i^{Class\ 2} + \beta_{12} Origin_i^{Class\ 3} + \beta_{13} Origin_i^{Class\ 4} + \beta_{14} Selectivity_i + \beta_{15} Highest\ Lvl_i + \beta_{16} Univ.\ GPA_i + \beta_{17} Male_i \\ & + \beta_{18} Working\ Hours_i + \beta_{19} Supervisory\ Status_i + \beta_{20} Sctr.\ Employer_i + \beta_{21} Sctr.\ Private_i + \beta_{22} Sctr.\ Public_i \\ & + \beta_{23} Contr.\ Fee_i + \beta_{24} Contr.\ Fixed_i + \beta_{25} Contr.\ Indefinite_i + \gamma_1 Agriculture_i + \gamma_2 Art\&Hum._i + \gamma_3 STEM_i + \gamma_4 Soc.\ Science_i \\ & + \gamma_5 Law_i + \gamma_6 Education_i + \gamma_7 Health_i + \in_{4i}\end{aligned}$$

D.3. Direct, indirect, and total effects

For Class 2:

$$Direct = b_{11}$$

$$Indirect_{Selectivity} = b_1 * \ b_{14}$$

$$Indirect_{Highest\ Lvl} = b_6 * \ b_{15}$$

$$Indirect_{Field} = \sum_k \beta_{k2} \ * \ \gamma_k$$

$$Total = Direct + \ \sum Indirect\ effects$$

For Class 3:

$$Direct = b_{12}$$

$$Indirect_{Selectivity} = b_2 * \ b_{14}$$

$$Indirect_{Highest\ Lvl} = b_7 * \ b_{15}$$

$$Indirect_{Field} = \sum_k \beta_{k3} \ * \ \gamma_k$$

$$Total = Direct + \sum Indirect\ effects$$

For Class 4:

$$Direct = b_{13}$$

$$Indirect_{Selectivity} = b_3 * \quad b_{14}$$

$$Indirect_{Highest\ Lvl} = b_8 * \quad b_{15}$$

$$Indirect_{Field} = \sum_k \beta_{k4} \quad * \quad \gamma_k$$

$$Total = Direct + \sum Indirect\ effects$$

D.4. Treatment of ordinal and categorical variables

Several variables in the model are ordinal, including undergraduate selectivity, highest level attained, working hours, and supervisory status. These variables are treated as ordered categorical indicators and are estimated using the WLSMV estimator. Nominal categorical variables, such as social origin, gender, field of study, sector, and type of contract, are included via dummy coding, with one category omitted as the reference group.

Appendix E. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.rssm.2026.101147.

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