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IZA DP No. 18231

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ABSTRACT

First-Generation Graduates in OECD Countries

This paper examines earnings differences between first-generation and continuing generation college graduates across 24 OECD countries using data from the OECD Survey of Adult Skills (PIAAC). In all but two of the countries analysed, first-generation graduates earn less than their peers from college-educated families, with an average gap across all countries of approximately 8%. We investigate potential mechanisms behind this result and find that first-generation graduates are less likely to pursue postgraduate education, more likely to hold vocational degrees, and tend to have lower cognitive skills. These findings highlight the need for policy interventions to enhance educational mobility and promote equality of opportunity.

JEL Classification: I23, I24, J62
Keywords: inequality, tertiary education, intergenerational mobility

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1. Introduction

A large body of research highlights the significant differences in socioeconomic outcomes between college graduates and non-graduates (Case and Deaton, 2022; Autor et al., 2020, 2008; Autor, 2014). These studies consistently show that college education is a powerful driver of both individual and societal welfare. Similarly, extensive work on intergenerational mobility demonstrates that children of college-educated parents are far more likely to attend college than those whose parents lack a college degree Hu and Qian, 2023; Chetty et al., 2014b,a, 2020; OECD, 2018.

These findings suggest that empirical evidence on the outcomes of first-generation and continuing-generation graduates is crucial to improving our understanding of inequalities and mobility patterns. However, such evidence remains surprisingly scarce.

In our extensive review (see Appendix B), we found a few interesting academic papers and policy reports, most of which are focused on the US or the UK (Adamecz-Volgyi et al., 2023; Manzoni and Streib, 2019; Thomas and Zhang, 2005; Emmons et al., 2019; Fry, Richard, 2021). These studies consistently find that first-generation graduates face worse economic outcomes – primarily lower earnings – compared to their peers.

In this paper, we analyse the differences in earnings between individuals with at least one college-educated parent, referred to as *continuing-generation graduates*, and individuals whose parents lack a college education, referred to as *first-generation graduates*.[1] We use data from the most recent OECD Survey of Adult Skills of the Programme for the International Assessment of Adult Competencies (PIAAC), which consists of representative samples of the adult population in the 24 participating countries, collected in 2022-2023. With sample sizes ranging from about 3,000 to 5,000 observations per country, this data allows us to produce comparable estimates across multiple OECD countries and investigate potential mechanisms underlying the differences we detect. To the best of our knowledge, this study is the most comprehensive cross-country analysis of first- and continuing-generation graduates to date.

In all but two countries in our dataset, first-generation graduates earn less than continuing-generation graduates, with differences that are often large and statistically significant. On average, across the 24 countries analysed, first-generation graduates earn about $350 less per month – roughly 8% less – than their continuing-generation peers.[2]

We further show that higher education only partially helps narrow the earnings gap associated with parental background. Among non-graduates, individuals without college-educated parents earn, on average, 88% of the earnings of those with college-educated parents. The earnings ratio increases by a few percentage points, to 92%, among college graduates.

[1] Our results are robust to variations in the definitions of first- and continuing-generation graduates.

[2] We report earnings in 2022 US dollars.

These findings are somewhat surprising if one expects first-generation graduates to be more positively selected on ability than continuing-generation graduates. Children of college-educated parents generally have better access to financial resources and information about higher education opportunities, making it easier for them to pursue tertiary education. Children of non-college-educated parents who attend college are likely to be more motivated and possibly more capable, as they have overcome greater barriers to access tertiary education. Our evidence supports this view: we show that in countries with more selective university systems (lower overall shares of graduates), the proportion of graduates among children of non-college-educated parents is significantly smaller.

In the last part of the paper, we investigate potential mechanisms underlying our findings, and we identify two main factors. First, the types of degrees obtained by first-generation graduates differ from those of continuing-generation graduates. While differences in fields of study are limited, first-generation graduates are less likely to obtain postgraduate degrees (Master's and doctoral degrees) and, in the countries where these are available, they are also more likely to hold professional or vocational tertiary degrees (Stansbury and Schultz, 2023; Torche, 2018). Second, by exploiting the unique feature of the PIAAC data, which includes competence scores in basic literacy, numeracy, and problem solving, we show that first-generation graduates perform significantly worse in these basic skills than continuing-generation graduates. We interpret this as suggestive evidence of the lasting consequences of lower human capital accumulation at home (Maré and Stillman, 2010).

Our analysis is descriptive and does not aim to identify causal effects in any of the empirical exercises presented in this paper. Given the paucity of empirical evidence on the topic, we believe that documenting the facts is, at this stage, the most valuable contribution we can offer. Hopefully, our analysis will spark new research on the determinants of the differences in outcomes between first- and continuing-generation graduates.

We believe that our findings are important not only for advancing our understanding of the nature of inequalities in society but also for informing policy interventions. For instance, vocational tertiary education may unintentionally divert promising students, particularly first-generation graduates, away from postgraduate studies, potentially deepening inequalities. While addressing disparities in human capital accumulation within families is challenging, recent evidence suggests that targeted interventions, such as home visits involving children and parents, can improve outcomes for children from less advantaged backgrounds (Conti and Gupta, 2024; Winston LeCroy et al., 2024).

2. The OECD Survey of Adult Skills

For our empirical exercise, we use the most recent *OECD Survey of Adult Skills* from the *Programme for the International Assessment of Adult Compe-*

tencies (PIAAC).[3] For simplicity, we refer to this dataset as the PIAAC data.

The database is a collection of representative samples of the population aged 16-65 years old in each of the participating countries. A total of 31 countries participated in the most recent PIAAC cycle. [4] We focus the analysis on OECD countries, and we exclude Denmark, Finland, Netherlands, Slovak Republic, and Switzerland since we do not have information on labour market earnings for these countries. Further, note that data from the UK refer to England only, and data from Belgium refer only to the Flemish region.

The data collection took place between September 2022 and August 2023, with some variation across participating countries. To ensure cross-country comparability, the sampling procedures were defined by the OECD and implemented locally with minimal variations, and the questionnaires were the same in all the countries, merely translated into the local languages. Sample sizes range between 3,000 and 5,000 respondents in most countries.

For the purpose of our analysis, the PIAAC data features two crucial advantages. First, all respondents are asked to report not only their education (in the form of their highest achieved qualifications) but also the education of their parents, which is crucial to identifying first-generation graduates. Information about the education of parents exists in some specific surveys in various countries or can be retrieved from administrative data; however, the PIAAC database is unique in the country coverage and the degree of comparability that it offers. Second, beyond answering the questionnaire, all respondents are also administered assessment tests of their competence in the basic skills of literacy, numeracy, and problem-solving. This is a unique feature of the PIAAC project, and we use it to investigate the potential sources of differences in outcomes between first- and continuing-generation graduates.

In our analysis, we want to focus on the labour market returns to college education; hence, we exclude respondents younger than 25, who might not have completed their education yet, and also those aged above 55, who might receive income from retirement programs.

About half of the countries in the PIAAC dataset (13 out of 24), earnings are reported only by deciles. Of course, deciles are also available in the countries that provide actual monetary amounts. Hence, to obtain comparable earnings measures across all the countries, we use complementary OECD data that provide the monetary values of earnings deciles in each country. This allows us to construct earnings intervals and apply interval regression to produce our main results. This approach also allows us to include respondents who are not employed by assigning them zero earnings. We adopt this approach because we want to use a synthetic measure of labour market success, however, in Appendix A we also report results for employment and earnings conditional on employ-

[3] The data are freely available from the OECD website at `www.oecd.org/en/data/datasets/piaac-2nd-cycle-database.html`.

[4] Of the total 31 countries, 29 are part of OECD and 2 are non-OECD countries (Croatia and Singapore).

ment separately (see Figures A.3 and A.4). The earnings measure we use is the monthly total remuneration from market work, thus including bonuses and self-employment earnings. [5]

Skills are assessed through a standardised set of tasks evaluating literacy, numeracy, and problem-solving. Each domain is measured using performance-based items designed to reflect real-world challenges. The data are analysed using item response theory (IRT) to generate proficiency scales, ensuring robust and cross-culturally comparable skill estimates. Competency scores are reported on a scale from 0 to 500 (OECD, 2024b).

In Section 5.2 we also use information about occupations, industry and firm size. Occupations are classified according to the 1-digit ISCO classification (ISCO 2008), while industries follow the 1-digit ISIC classification (ISIC Rev. 4). Firm size is categorised into six groups: 1–10 employees, 11–49 employees, 50–249 employees, 250–499 employees, 500–999 employees, and 1,000 or more employees. For employed respondents, we use their current occupation, industry, and firm size. For those not employed at the time of the interview, we rely on information from their last job.

We classify respondents based on two criteria: their own educational attainment and that of their parents. College graduates are defined as individuals who self-report a tertiary degree as their highest qualification in the baseline questionnaire. [6] Parental education is also self-reported, and respondents are classified as having college-educated parents if at least one parent holds a college degree or higher. Using these two dimensions, we classify respondents into four categories:[7]

- those who do not have a college degree and whose parents (neither of them) also do not have a college education (we identify this group with the dummy variable $[NoCollege\&NoCollegeParent]_i$);
- those who do not have a college degree and at least one parent with a college education (we identify this group with the dummy variable $[NoCollege\&CollegeParent]_i$);
- first-generation graduates, those with a college degree and whose parents (both of them) lack college education (we identify this group with the dummy variable $[College\&NoCollegeParent]_i$);
- continuing-generation graduates, those with a college degree and whose parents (at least one of them) also have college education (we identify this group with the dummy variable $[College\&CollegeParent]_i$).

[5] For Japan we use hourly earnings deciles since monthly data are not available.

[6] According to the international ISCED classification, tertiary degrees are those belonging to ISCED 5B (professional degrees), ISCED 5A (bachelor degrees), and ISCED 6 (master/research degrees).

[7] We have experimented with alternative definitions of first-generation, such as having both parents with a college education, and results are robust to these variations.

Table A.1 in Appendix A reports the distribution of respondents into these four groups in each country, together with gender and the size of the samples. All the results in the paper, including the descriptive statistics of Table A.1, are produced following the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country and the variability in the estimated proficiency scores (Avvisati and Keslair, 2024; OECD, 2025).

3. Methods

Our main results about earnings are produced using the following interval regression model, which allows us to circumvent the interpretation issues highlighted by Chen and Roth (2024). Let y_i^* be the (unobserved) monthly earnings of respondent i and $d_1 < d_2 < \ldots < d_9$ be the deciles of y_i^* that are reported in PIAAC. Define y_i as the indicator of the decile in which y_i^* falls:

$$y_i = \begin{cases} 0 & \text{if} \quad y_i^* = 0 \\ 1 & \text{if} \quad 0 < y_i^* \leq d_1 \\ 2 & \text{if} \quad d_1 < y_i^* \leq d_2 \\ ... & ... \\ 10 & \text{if} \quad y_i^* > d_9 \end{cases} \tag{1}$$

Assume that $y_i^* = X_i\boldsymbol{\beta} + u_i$, where X_i is a set of explanatory variables and $\boldsymbol{\beta}$ is the corresponding vector of coefficients. Further assume that $u_i|X \sim N(0, \sigma^2)$. Abstracting from weighting, the parameters $\boldsymbol{\beta}$ and σ^2 can be estimated by maximum likelihood as follows:

$$\{\widehat{\boldsymbol{\beta}}, \widehat{\sigma}^2\} = argmax_{\{\boldsymbol{\beta},\sigma^2\}} \sum_{i=1}^{N} l_i(\boldsymbol{\beta}, \sigma^2; X_i) \tag{2}$$

where N is the size of the sample, and the individual (log) likelihood contributions are:

$$\begin{aligned} l_i(\boldsymbol{\beta}, \sigma^2; X_i) = & \mathbb{1}[y_i = 0] log\{\Phi[(X_i\boldsymbol{\beta})/\sigma^2]\} + \\ & \mathbb{1}[y_i = 1] log\{\Phi[(d_1 - X_i\boldsymbol{\beta})/\sigma^2]\} + \\ & \mathbb{1}[y_i = 2] log\{\Phi[(d_2 - X_i\boldsymbol{\beta})/\sigma^2 - \Phi(d_1 - X_i\boldsymbol{\beta})/\sigma^2]\} + \\ & ... + [y_i = 10] log\{1 - \Phi[(d_9 - X_i\boldsymbol{\beta})/\sigma^2]\} \end{aligned} \tag{3}$$

This is a slightly modified version of the standard interval regression model that includes observations with zero earnings for respondents who are not employed at the time of the interview.[8]

[8] The assumption is that observed earnings are zero when $y^* \leq 0$, which is consistent with the interpretation of y^* as potential earnings or an accepted wage offer that is higher than the reservation wage.

We estimate one such model for each country, and we use the estimated coefficients to compute the ratios reported in Figures 1 and 2. More precisely, the set of controls that we use includes the following:

$$\begin{aligned} X_i\boldsymbol{\beta} =& \beta_0 + \beta_1[NoCollege\&CollegeParent]_i + \\ & \beta_2[College\&NoCollegeParent]_i + \beta_3[College\&CollegeParent]_i \\ & + \gamma male_i + \sum_{a=1}^{2} \alpha_a \mathbb{1}[age_i = a] \end{aligned} \tag{4}$$

where the group indicators $[NoCollege\&CollegeParent]_i$, $[College\&NoCollegeParent]_i$, $[College\&CollegeParent]_i$ have the meaning described in the previous section ($[NoCollege\&NoCollegeParent]_i$ is the residual category). $male_i$ is a dummy that takes value one if the respondent is a woman, and age_i is a discrete indicator of the age category of the respondent: 25-34, 35-44, 45-54. One age group is omitted as the reference category.[9]

Our results are constructed using the predicted earnings obtained from the estimates of the interval regression model, which we compute as follows:

- predicted earnings of non-graduates with non-college educated parents: $\widehat{y}^{00} = \widehat{\beta}_0 + \widehat{\gamma}\overline{male} + \sum_{a=1}^{2} \widehat{\alpha}_a \overline{age_a}$;
- predicted earnings of non-graduates with college educated parents: $\widehat{y}^{01} = \widehat{\beta}_0 + \widehat{\beta}_1 + \widehat{\gamma}\overline{male} + \sum_{a=1}^{2} \widehat{\alpha}_a \overline{age_a}$;
- predicted earnings of first-generation graduates: $\widehat{y}^{10} = \widehat{\beta}_0 + \widehat{\beta}_2 + \widehat{\gamma}\overline{male} + \sum_{a=1}^{2} \widehat{\alpha}_a \overline{age_a}$;
- predicted earnings of continuing-generation graduates: $\widehat{y}^{11} = \widehat{\beta}_0 + \widehat{\beta}_3 + \widehat{\gamma}\overline{male} + \sum_{a=1}^{2} \widehat{\alpha}_a \overline{age_a}$;

where $\overline{male}$ is the sample average of $male_i$ and $\overline{age_a}$ is the sample average of $\mathbb{1}[age_i = a]$.[10]

The relative earnings ratios of Figure 1 are computed as $\widehat{y}_i^{10}/\widehat{y}_i^{11}$ and Figure 2 compares these ratios, which are reported on the vertical axis, with $\widehat{y}_i^{00}/\widehat{y}_i^{01}$, reported on the horizontal axis.

In Section 5.2, we produce estimates of relative earnings by augmenting the set of control variables to include the occupational, industry and firm size dummies (the red estimates in Figure 4). In Section 5.4, we compare the numeracy skills of first- and continuing-generation graduates using an approach similar to the one we use for earnings (Figure 6). However, contrary to earnings, numeracy is available as individual scores rather than in intervals and we can thus estimate parameters using simple OLS. In other words, we estimate the following model:

$$n_i = X_i\boldsymbol{\delta} + e_i \tag{5}$$

[9] Table A.4 reports the estimated coefficients.

[10] The predicted earnings $\widehat{y}^{00}, \widehat{y}^{01}, \widehat{y}^{10}, \widehat{y}^{11}$ are reported in Table A.2.

where n_i is the numeracy score of respondent i, X_i is the same set of explanatory variables as above, $\boldsymbol{\delta}$ is the vector of coefficients to be estimated and e_i is a residual. Once we obtain OLS estimates of the coefficients $\boldsymbol{\delta}$, we compute relative numeracy by comparing predicted numeracy of first- and second-generation graduates in the same way as we did to compute relative earnings.[11]

In Section A-3 in Appendix A, we explored differences between genders and found no major deviations. So, we decided to report in the main text results that pool men and women together.

4. Earnings of first- and continuing-generation graduates

Figure 1 contains our main results. The figure shows the ratios of monthly earnings between first-generation and continuing-generation college graduates across all countries in our dataset. Given the cross-sectional nature of the PIAAC data and the significant changes in graduation rates across cohorts and genders, we compute average earnings conditional on age and gender (see Section 3 for details). A ratio below one indicates that first-generation graduates earn less than their continuing-generation peers – a pattern observed in all but two countries (Austria and the Czech Republic). The highest ratio is found in the Czech Republic (1.03), while the lowest is in Chile (0.82). On average, first-generation graduates earn 92% of what continuing-generation graduates make. In the majority of countries (14 out of 24) the ratios of earnings are statistically different from one at the 95% confidence level. Interestingly, these earnings differences seem to be mostly associated with differences in pay rather than employment or hours of work.[12]

No clear cross-country pattern emerges from these results. For instance, in the United States, first-generation graduates earn 0.83 of what continuing-generation graduates earn. However, in Canada and the United Kingdom – countries comparable to the US in many institutional aspects – first-generation graduates fare substantially better, with relative earnings at 0.88 and 0.93, respectively.

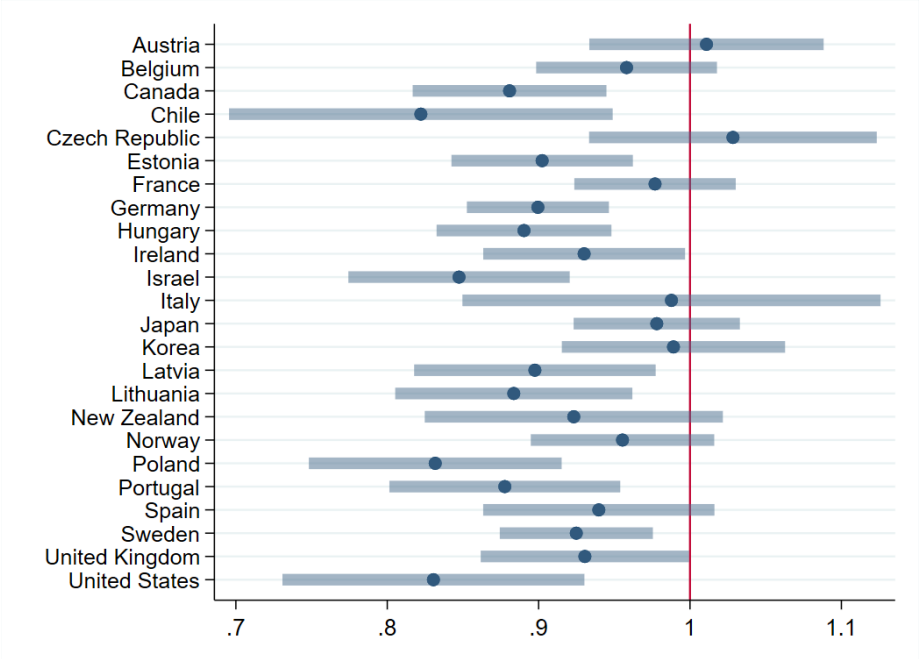
The equality of opportunity literature often regards college education as one of the primary tools to overcome differences associated with family background (Chetty et al., 2020; Torche, 2018, 2011). To shed more light on this issue, Figure 2 compares the relative earnings of first- and continuing-generation graduates (the same ratios of Figure 1) with those of non-graduates with and without college-educated parents.[13] The relative earnings of graduates are reported on the vertical axis, and those of non-graduates are reported on the horizontal axis. The dotted line represents the 45-degree line. As expected, in most countries and for both groups, these ratios are below one, indicating that individuals

[11] The predicted numeracy scores $\widehat{n}^{00}, \widehat{n}^{01}, \widehat{n}^{10}, \widehat{n}^{11}$ are reported in Table A.3.

[12] See Figures A.2, A.3 and A.4.

[13] As in Figure 1, earnings averages are computed conditional on age and gender.

Figure 1: Relative Earnings of first- and continuing-generation graduates



Note: The figure shows the ratios of the earnings of first- over continuing-generation graduates (conditional on age and gender). A number smaller than one indicates that first-generation graduates earn less than continuing-generation graduates. The shaded bars represent 95% confidence intervals. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

from non-college-educated parents earn less than those from college-educated families.[14]

The majority of countries in Figure 2 lie above the 45-degree line, indicating that the earnings gap associated with parental education is smaller among graduates than non-graduates. However, the differences are modest and never statistically significant. On average, among non-graduates, individuals from non-college-educated parents earn 88% of what those with college-educated parents make. This ratio increases only slightly, to 92%, among college graduates. Moreover, in one-third of the countries (8 out of 24), the parental earnings gap is actually larger among graduates than non-graduates, and the average difference between the two gaps is approximately 0.038.

Taken together, the evidence in Figures 1 and 2 suggests that parental education plays a significant role in shaping earnings inequalities and that college education does relatively little to mitigate them.

5. Explaining differences between first- and continuing-generation graduates

In this section, we explore some potential mechanisms underlying the differences in earnings between first- and continuing-generation graduates documented in the previous section. We focus on four mechanisms: selection, access to good jobs, types of tertiary education and basic skills.

5.1. Selection into higher education

Perhaps the most natural explanation for the lower earnings of first-generation graduates is differential selection. Within each parental background group, those who attend college are likely to be more capable than those who do not. However, this selection effect may be stronger among children of college-educated parents than among those from non-college-educated backgrounds. In Figure 3 we show evidence against this hypothesis and suggesting, instead, that first-generation graduates are more, rather than less, positively selected than continuing-generation graduates. The figure plots the overall share of graduates in each country on the horizontal axis and the share of graduates by parental education on the vertical axis.

In all the countries we analyse, children of college-educated parents are significantly more likely to graduate from college than those from non-college-educated families. However, the size of this gap varies considerably depending on the overall share of graduates in a country (horizontal axis), which serves as a proxy for the selectivity of the tertiary education system. In countries where earning a college degree is more difficult, due to high costs or other informal barriers, the graduation gap between the two groups is particularly wide. Specifically, in countries with lower overall graduation rates (toward the left of the

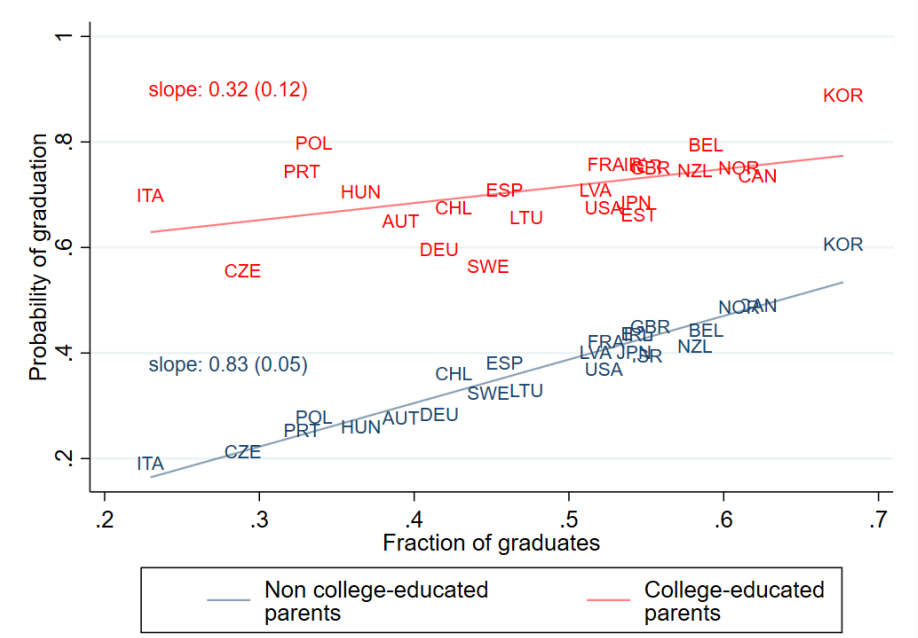
[14] Norway is a notable exception that may warrant further investigation.

Figure 2: Parental earnings premium for college and non-college graduates

Note: The figure shows on the vertical axis the ratio between the average earnings of first- and continuing-generation graduates and on the horizontal axis the ratio between the average earnings of non-graduates whose parents are not college-educated and the earnings of non-graduates with college-educated parents. All averages are computed conditional on age and gender. The dashed line is the 45-degree line. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025). Countries are identified by standard ISO alpha-3 codes (`www.iso.org/iso-3166-country-codes.html`).

figure), the share of graduates among children of college-educated parents exceeds that of first-generation graduates by 40–50 percentage points. In contrast, in countries where higher education is more accessible (toward the right), this gap narrows to around 20-25 percentage points. The steeper slope of the blue line, representing first-generation graduates, suggests a stronger selection effect for this group. This is consistent with the idea that children of non-college-educated parents face greater barriers to accessing higher education. This is not surprising, as these students are more likely to struggle with financial constraints, lack access to useful information about application processes, and may have less guidance when choosing a college or field of study.

Figure 3: Selection into college



Note: The figure shows on the horizontal axis the total share of graduates in the country (among the population aged 25 to 55) and on the vertical axis the share of graduates (in the same age group) by parental background: in red for individuals with college-educated parents and in blue for those with non-college-educated parents. The solid lines are linear best-fit functions. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

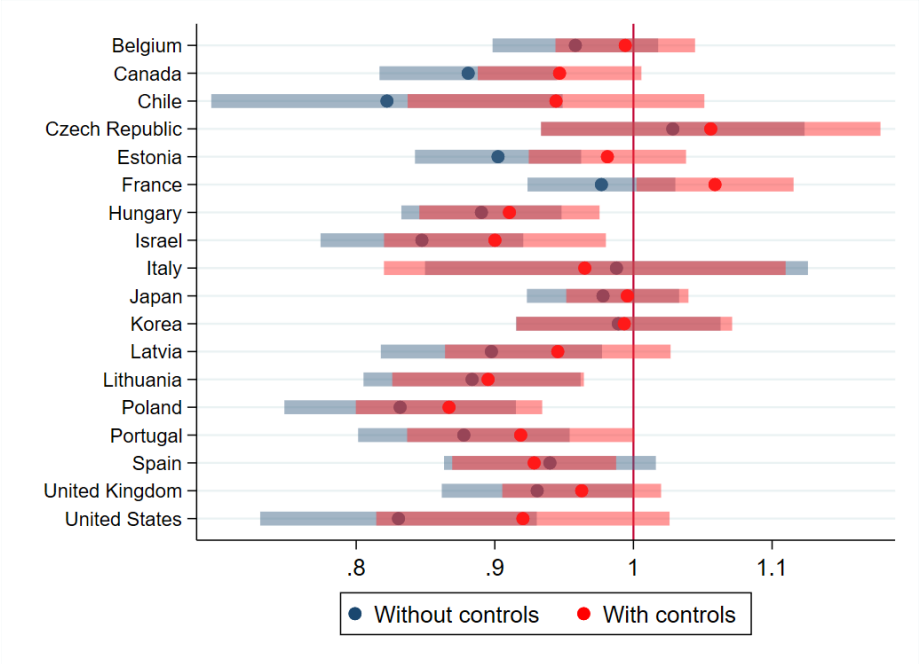
The stronger positive selection of first-generation graduates would be consistent with higher earnings for this group, which is opposite to what we find in our analysis. Hence, we need to search for some other factors to rationalise our main findings.

5.2. Different jobs

Another possible explanation for the worse performance of first-generation graduates in the labour market is that college-educated parents provide their children with advantages in accessing better-paying jobs and navigating career paths. In contrast, first-generation graduates may face greater challenges in securing high-paying positions and advancing in their careers.

We explore this hypothesis in Figure 4, where we compare the relative earnings from Figure 1 with the same statistics computed after accounting for job characteristics. Specifically, we compute the relative earnings using the same methodology described in Section 3 but augmenting the set of control variables with dummies for occupation (9 categories), industry (19 categories), and firm size (6 classes). Since these variables are not available in all countries, we restrict this analysis to a smaller subset of 18 countries.

Figure 4: Relative Earnings with and without job controls



Note: The figure displays the ratios of the earnings for first-generation graduates relative to continuing-generation graduates. The blue ratios are computed conditional only on age and gender (as in Figure 1). The red ratios are computed conditionally based on age and gender and, additionally, on occupation, industry, and firm size. A ratio below one indicates that first-generation graduates' earnings are smaller than that of continuing-generation graduates. The shaded bars represent 95% confidence intervals. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

Industry, occupation and firm size classes are admittedly imperfect measures of job quality. However, if differences in job types explained the gap in earnings

between first- and continuing-generation graduates, we would expect the ratios to move closer to one when accounting for these factors. The results indicate that this occurs to some extent. In most countries (16 out of 18), the conditional ratios (in red) are larger than the unconditional ones (in blue). However, the differences are often small and the confidence intervals of the two measures always overlap. On average, the relative earnings increase by approximately 4.6 points (from 0.91 to 0.95).[15]

5.3. Different types of education

In this section, we examine whether differences in earnings between first- and continuing-generation graduates are linked to the types of degrees they pursue. For clarity, Figure 5 presents results aggregated across all countries.[16]

The PIAAC questionnaire asks respondents to report their highest educational qualification. In our previous analyses, we classified as graduates those whose highest qualification corresponds to a tertiary education degree (ISCED code 5 or higher). However, tertiary education encompasses different types of degrees. To account for this, we further categorise them into professional degrees (e.g., those awarded by 2-year vocational colleges in the US or Fachhochschulen in Germany, ISCED code 5B), bachelor's degrees (ISCED code 5A), and postgraduate degrees, including master's and doctoral degrees (ISCED codes 5A/6).

Panel (a) of Figure 5 presents the distribution of degree types among first- and continuing-generation graduates and some important differences emerge. First-generation graduates are significantly more likely to hold professional tertiary degrees and less likely to obtain postgraduate degrees, with gaps of around 10–15 percentage points. Additionally, our data show that average monthly earnings vary by degree type: graduates with professional degrees earn approximately 4,000 USD, those with bachelor's degrees 4,900 USD, and those with postgraduate degrees 6,500 USD. As a result, when comparing first- and continuing-generation graduates within the same degree category, earnings disparities shrink by more than 50%. Specifically, no significant earnings gap exists among those with professional degrees, while for bachelor's and postgraduate degree holders, differences persist at around 4%.[17]

Panel (b) of Figure 5 examines another key aspect of graduate degrees: the field of study. The PIAAC data classifies fields according to the International Standard Classification of Education (ISCED 2013) and, for convenience of exposition, we have regrouped them into the categories shown int he figure.[18]

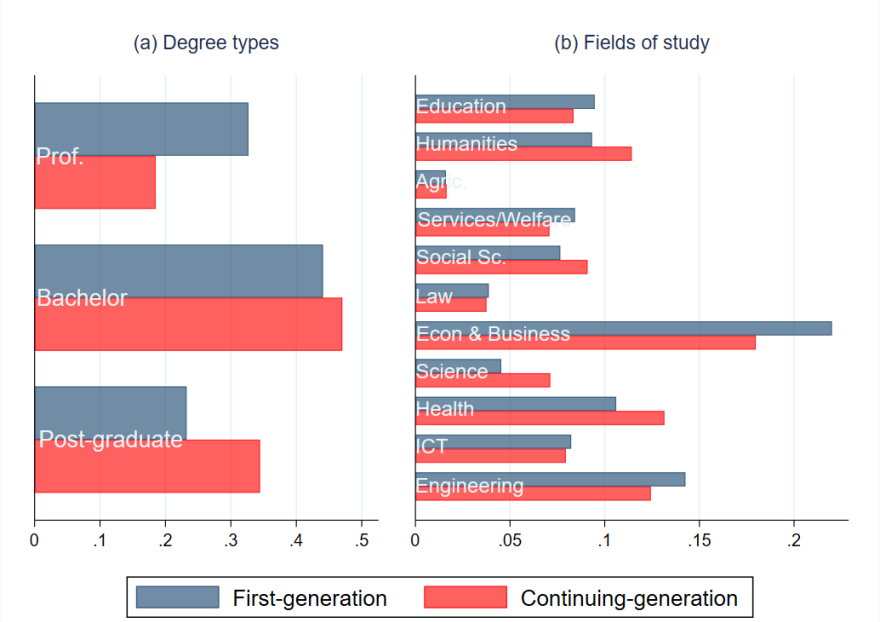
[15] Figure A.7 shows the distributions of first- and continuing-generation graduates across occupations and classes of firm size. First-generation graduates are indeed under-represented in high-ranked occupations, such as managers and professionals, and they also tend to work in slightly smaller firms.

[16] Country-specific analyses are available upon request.

[17] Figure A.5 shows relative earnings ratios computed holding the type of degree fixed.

[18] The exact grouping of ISCED codes that we adopt is the following: ISCED 4-12-13 = Services and Welfare; ISCED 15 = Humanities; ISCED 11 = Agriculture, Forestry, Fisheries and Environmental Studies; ISCED 14 = Education and Teacher Training; ISCED 4-5-6 =

Figure 5: Degree types and fields



Note: The figure shows the distribution of graduates (conditional on age, gender and country fixed effects) by type of degree (panel (a)) and fields of study (panel (b)) separately for first- and continuing-generation graduates. The groups of degree types are based on the official ISCED classification as follows: 5B=professional degrees, 5A=bachelor degrees, 5A master/6=post-graduate degrees. The classification of fields of study is based on the authors' recoding of the official ISCED-2013 (see text for details). Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

Similar to panel (a), panel (b) displays the distribution of fields of study for first- and continuing-generation graduates, ranked by average earnings, with the least remunerative fields at the top and the most remunerative at the bottom. While some differences exist, they are not systematically concentrated in the highest- or lowest-paying fields. For instance, first-generation graduates are more likely to major in Education, the least remunerative field, but they are also more likely than continuing-generation graduates to hold degrees in Engineering[19]. Consequently, differences in the field of study play a limited role in explaining the earnings gap between first- and continuing-generation graduates.

5.4. Differences in basic skills

A distinctive advantage of the PIAAC data is that they include individual measures of basic skills, such as numeracy, literacy and problem-solving. We leverage this unique feature to investigate differences in such basic skills between first and continuing-generation graduates. We restrict our analysis to numeracy, as results for literacy and problem-solving are very similar.[20]

Panel (a) of Figure 6 presents the ratio of average numeracy scores between first- and continuing-generation graduates. The results indicate that first-generation graduates consistently exhibit lower numeracy skills. In 23 out of 24 countries, their average scores are lower, with ratios ranging from 0.90 to 0.98. These differences are statistically significant in all but four cases. Spain is the only exception where first-generation graduates slightly outperform continuing-generation graduates, though the ratio is not statistically different from one at conventional significance levels.

The OECD estimates that an increase of one standard deviation in numeracy proficiency is associated with a 9% increase in wages (OECD, 2024a). Based on this estimate, we calculate that, on average across all the countries that we consider, the difference in numeracy between first- and continuing-generation graduates is approximately one-third of a standard deviation, hence the numeracy gap between these two groups can account for approximately 40% of the gap in earnings.

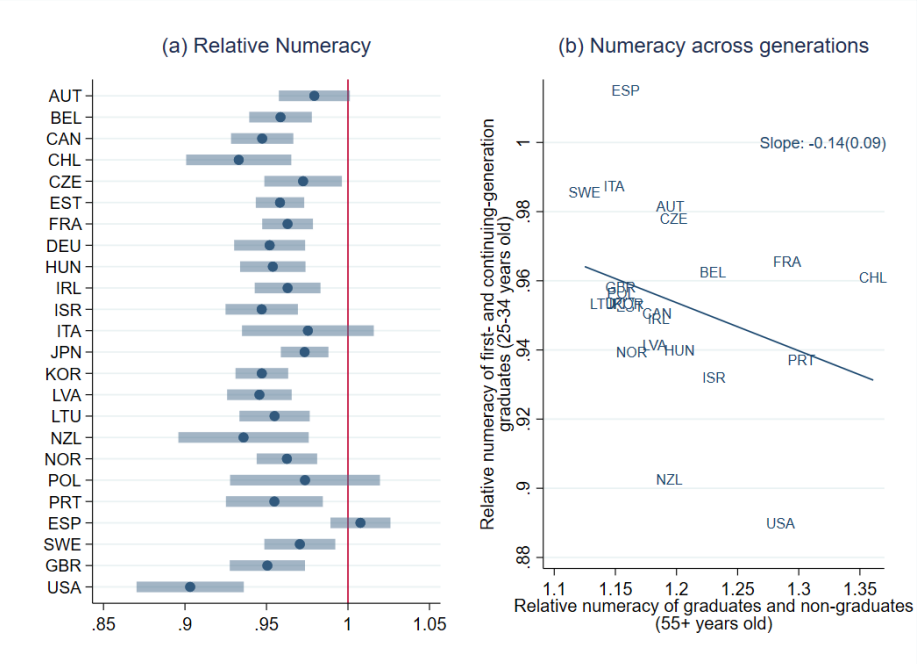
The numeracy competence assessed in PIAAC reflects basic knowledge that is more likely to be developed in early life than in college. In panel (b) of Figure 6, we explore whether the numeracy gap between first- and continuing-generation graduates can be linked to the numeracy competence of the generation of their parents. The horizontal axis plots the ratio of average numeracy scores between graduates and non-graduates among PIAAC respondents aged 55+, while the vertical axis replicates the numeracy gap between first- and

Social sciences; ISCED 3 = Health; ISCED 1 = Economics, Business and Administration; ISCED 8 = Natural Sciences, Mathematics and Statistics; ISCED 9-10 = Engineering, Manufacturing and Construction; ISCED 2 = Law; ISCED 7 = Information and Communication Technologies (ICT).

[19] Figure A.9 presents results by gender, confirming the absence of a clear pattern.

[20] Figure A.6 in Appendix A replicates results for literacy and problem-solving.

Figure 6: Competence in numeracy of first- and continuing-generation graduates



Note: panel (a) of the figure shows the ratio between the numeracy score for first-generation graduates and continuing-generation graduates (conditional on age and gender). A number smaller than one indicates that the numeracy score of the first group is smaller than that of the latter. The shaded bars represent 95% confidence intervals. Panel (b) of the figure shows the correlation between the ratio between the numeracy score for first-generation graduates and continuing-generation graduates (conditional on age and gender) computed on young respondents (25-34 years old) and the ratio between the numeracy score for graduates and non-graduates (conditional on age and gender) computed on old respondents (55+ years old). Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country and the variability in the estimated proficiency score (Avvisati and Keslair, 2024; OECD, 2025).

continuing-generation graduates (as shown in panel (a)) for respondents aged 25-34. Given that generations are conventionally spaced about 25-30 years apart, we interpret the statistics on the horizontal axis as referring to the parental generation and those on the vertical axis to the children's generation.

The figure shows a remarkably strong correlation. In countries where the numeracy gap between graduates and non-graduates is largest among the older generation, first-generation graduates exhibit the lowest relative numeracy. This evidence suggests that the process of human capital transmission at home is likely to play an important role in explaining the lower performance of first-generation graduates compared to continuing-generation graduates.

6. Discussion

We have examined selection into tertiary education, access to high-paying jobs, differences in types of tertiary education, and disparities in basic skills as potential explanations for the earnings gap between first- and second-generation graduates. Our findings indicate that multiple factors contribute to this gap. However, disentangling and quantifying their precise effects is challenging, as these factors are interrelated and jointly determined. For instance, numeracy competence may influence earnings both directly and indirectly by shaping the likelihood of attending college or selecting into a particular type of degree, such as a professional or postgraduate qualification. Further research is needed to move beyond our descriptive analysis and provide a more precise assessment of these mechanisms.

Nevertheless, our findings highlight several areas where policy interventions could enhance the role of tertiary education in promoting equality of opportunity. Expanding access to high-quality jobs and reducing reliance on informal networks seem to be important. While professional and vocational tertiary education is often seen as a pathway for students from disadvantaged backgrounds, our results suggest that it may also steer some students away from programs with higher labour market returns.[21] Perhaps the most critical – but also the most challenging – area for intervention lies in the accumulation and transmission of human capital at home. The transfer of parental knowledge plays a fundamental role in shaping educational and economic outcomes, yet addressing disparities in this domain is particularly complex. Recent studies have begun exploring targeted interventions, such as structured home visits, to support early skill development. We see this emerging research as especially promising, with the potential to yield impactful policy insights (Conti and Gupta, 2024; Winston LeCroy et al., 2024).

[21] Mountjoy (2022) provides an insightful methodology for identifying the effects of tertiary education expansion on different subpopulations.

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During the preparation of this work the authors used ChatGPT and Microsoft Copilot in order to improve the readability of the text and the format of tables and figures. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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Appendix A. Additional results

A-1. Descriptive statistics

Table A.1: Summary Statistics

	[1=male]	*[NoCollege& NoCollegeParent]*	*[NoCollege& CollegeParent]*	*[College& NoCollegeParent]*	*[College& CollegeParent]*	observations
AUT	0.50	0.50	0.11	0.19	0.20	2251
BEL	0.51	0.33	0.08	0.26	0.33	1884
CAN	0.50	0.24	0.14	0.23	0.39	5770
CHL	0.51	0.51	0.07	0.29	0.14	2331
CZE	0.51	0.61	0.10	0.17	0.12	2802
EST	0.51	0.29	0.16	0.23	0.32	3260
FRA	0.50	0.40	0.07	0.30	0.23	2977
DEU	0.50	0.41	0.17	0.17	0.25	2409
HUN	0.51	0.57	0.07	0.20	0.17	2620
IRL	0.50	0.37	0.08	0.29	0.26	2243
ISR	0.49	0.34	0.11	0.23	0.32	3042
ITA	0.50	0.75	0.02	0.18	0.05	2348
JPN	0.51	0.30	0.15	0.21	0.34	3058
KOR	0.52	0.30	0.03	0.46	0.22	3594
LVA	0.52	0.37	0.11	0.25	0.27	2933
LTU	0.50	0.38	0.15	0.19	0.29	2890
NZL	0.51	0.29	0.13	0.21	0.38	1987
NOR	0.47	0.28	0.12	0.26	0.35	2029
POL	0.50	0.64	0.02	0.25	0.09	2861
PRT	0.48	0.63	0.04	0.22	0.11	1723
ESP	0.50	0.47	0.07	0.29	0.16	3116
SWE	0.53	0.33	0.22	0.16	0.29	1678
GBR	0.50	0.36	0.08	0.30	0.25	2376
USA	0.50	0.32	0.16	0.19	0.34	1738

Note: The table reports the means of the indicated variables in the samples used in our main analysis. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

Table A.2: Average earnings

	NoCollege NoCollegeParent	NoCollege CollegeParent	College NoCollegeParent	College CollegeParent
AUT	3568	3929	5488	5428
BEL	3912	4452	6198	6469
CAN	3310	3919	4842	5498
CHL	1135	1117	2127	2587
CZE	2273	2545	3227	3138
DEU	3296	4067	5876	6532
ESP	1902	2375	3576	3805
EST	2332	2835	3579	3966
FRA	2366	2768	4163	4261
GBR	2748	3087	4684	5034
HUN	1891	2113	3222	3619
IRL	2844	2824	5581	6000
ISR	1819	2612	3750	4425
ITA	1945	2561	3514	3558
JPN	13	15	18	18
KOR	3307	3587	4272	4320
LTU	2137	2142	3327	3765
LVA	1691	2131	3075	3426
NOR	3845	3271	6610	6919
NZL	2902	3434	4509	4884
POL	1860	2063	2752	3309
PRT	1674	2055	3195	3640
SWE	3702	3974	4897	5294
USA	2788	3287	5567	6703

Note: the table reports the average predicted earnings for each of the indicated population groups in each country. These are the quantities that we describe in Section 3 as $\widehat{y}^{00}, \widehat{y}^{01}, \widehat{y}^{10}, \widehat{y}^{11}$. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

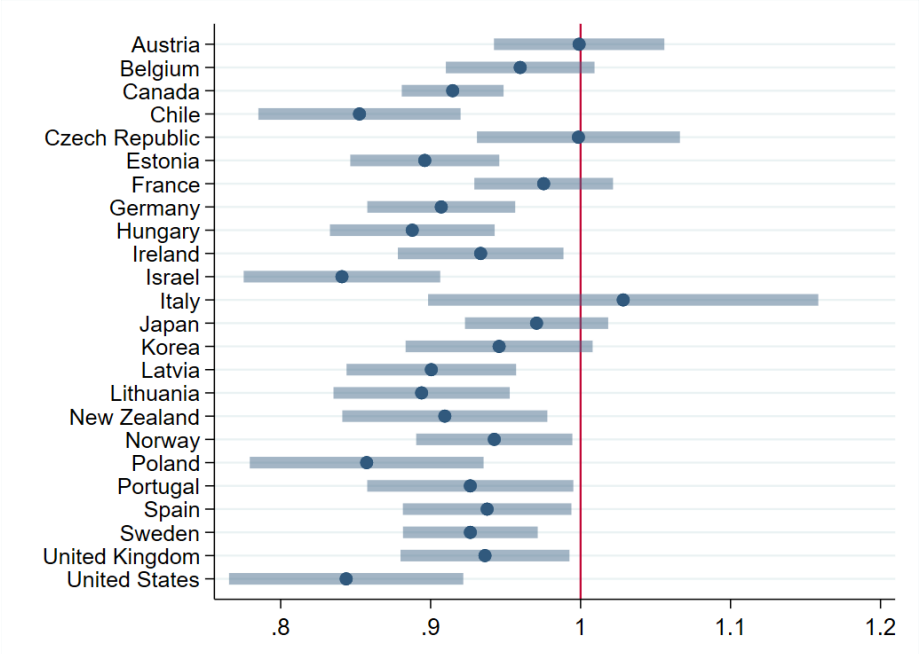
Table A.3: Average numeracy score

	NoCollege NoCollegeParent	NoCollege CollegeParent	College NoCollegeParent	College CollegeParent
AUT	251	269	305	311
BEL	253	275	307	320
CAN	248	269	285	301
CHL	197	210	246	263
CZE	262	280	306	314
DEU	249	280	304	319
ESP	233	249	281	278
EST	262	283	303	317
FRA	237	256	291	302
GBR	251	269	288	303
HUN	235	262	288	302
IRL	235	252	278	288
ISR	216	239	266	281
ITA	237	253	272	279
JPN	271	281	310	318
KOR	238	257	267	282
LTU	230	243	263	276
LVA	246	271	281	298
NOR	267	280	303	315
NZL	233	262	276	295
POL	232	248	260	267
PRT	228	256	284	297
SWE	273	287	310	320
USA	214	239	271	300

Note: The table reports the average predicted numeracy scores for each of the indicated population groups in each country. These are the quantities that we describe in Section 3 as $\widehat{n}^{00}, \widehat{n}^{01}, \widehat{n}^{10}, \widehat{n}^{11}$. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country and the variability in the estimated proficiency score (Avvisati and Keslair, 2024; OECD, 2025).

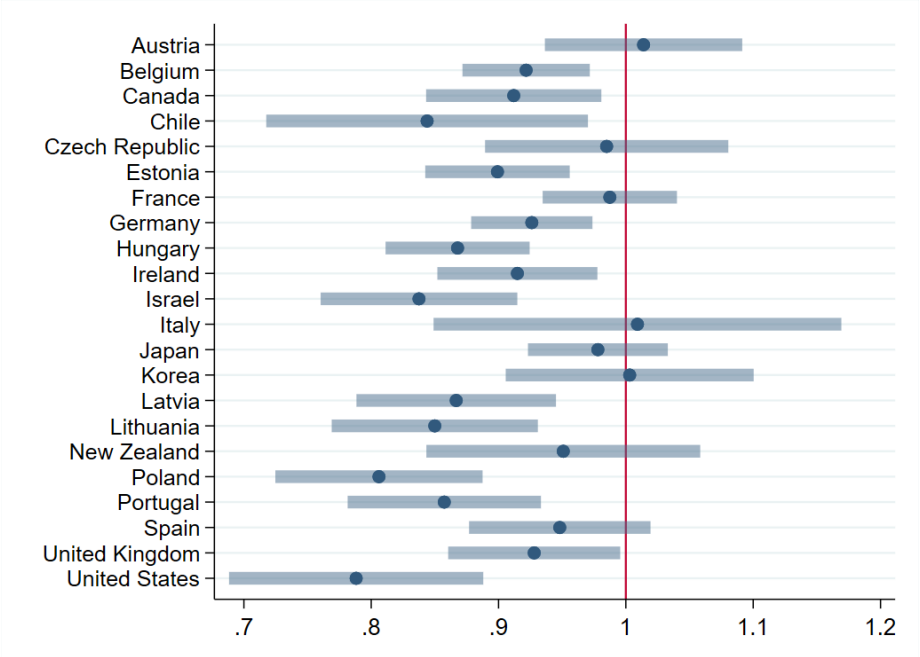
A-2. Robustness checks

Figure A.1: Relative Earnings - Unweighted Regressions



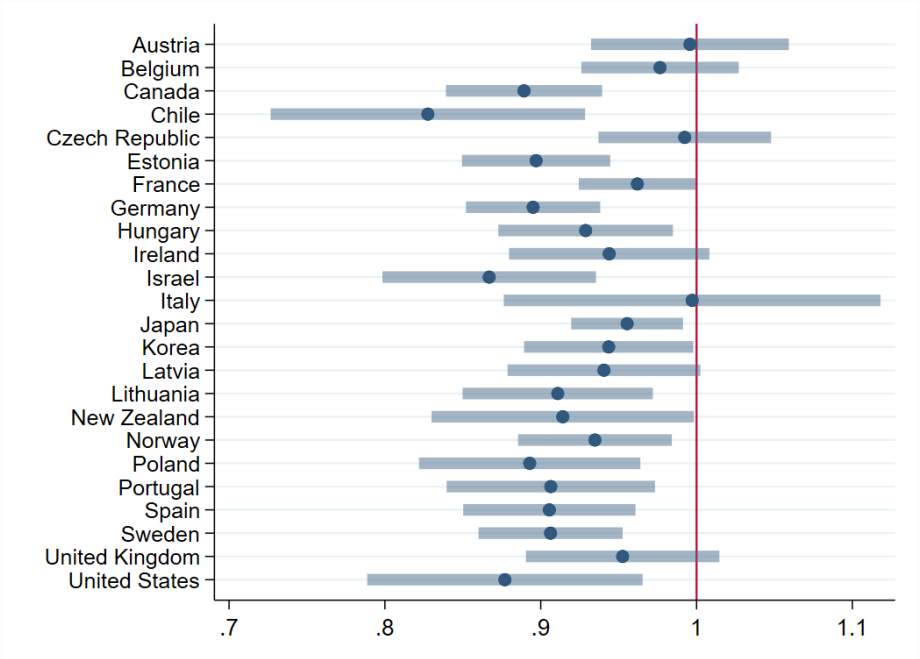
Note: The figure shows the ratios of the monthly wages of first- over continuing-generation graduates (conditional on age and gender). A number smaller than one indicates that first-generation graduates earn less than continuing-generation graduates. The shaded bars represent 95% confidence intervals.

Figure A.2: Relative Earnings in hourly wages



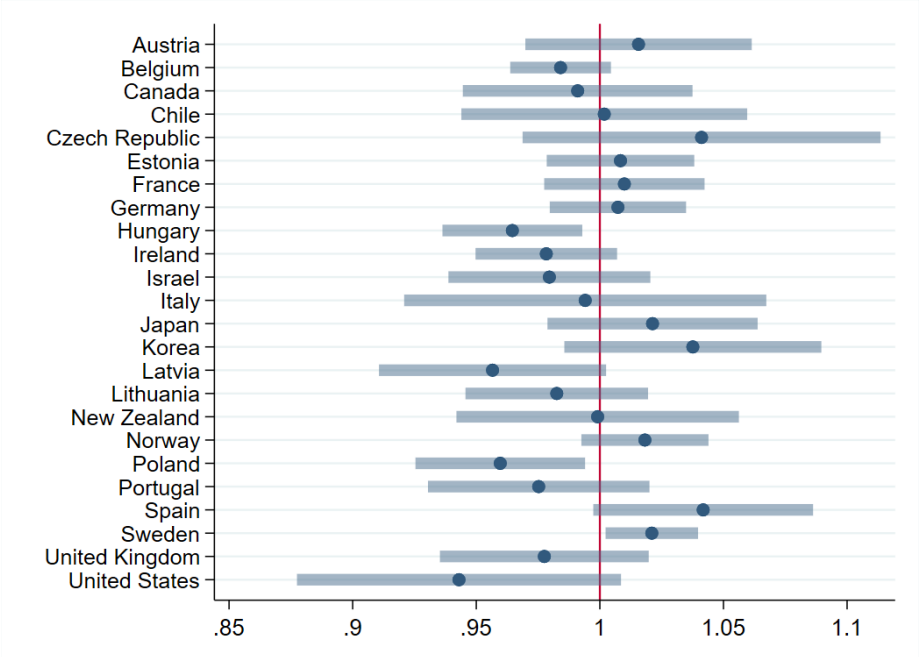
Note: The figure shows the ratios of the hourly wages of first- over continuing-generation graduates (conditional on age and gender). A number smaller than one indicates that first-generation graduates earn less than continuing-generation graduates. The shaded bars represent 95% confidence intervals. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

Figure A.3: Relative Earnings Conditional on Employment



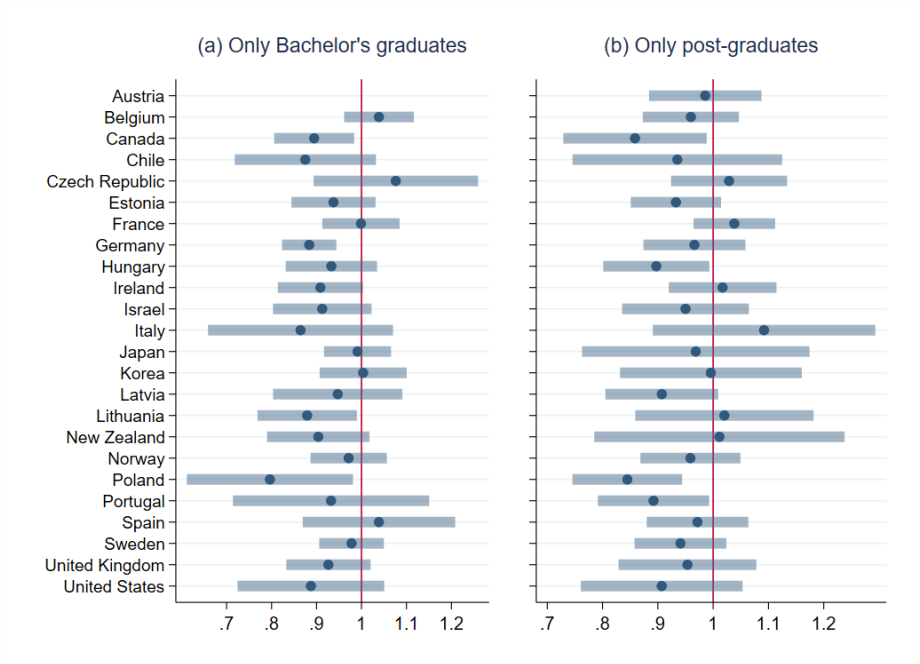
Note: The figure shows the ratios of the monthly earnings of first- over continuing-generation graduates (conditional on age and gender) excluding the non-employed. A number smaller than one indicates that first-generation graduates earn less than continuing-generation graduates. The shaded bars represent 95% confidence intervals. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

Figure A.4: Relative Employment



Note: The figure shows the ratios of the employment probabilities of first- over continuing-generation graduates (conditional on age and gender). A number smaller than one indicates that first-generation graduates are less likely to be employed than continuing-generation graduates. The shaded bars represent 95% confidence intervals. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

Figure A.5: Relative Earnings for graduates with the same type of degree

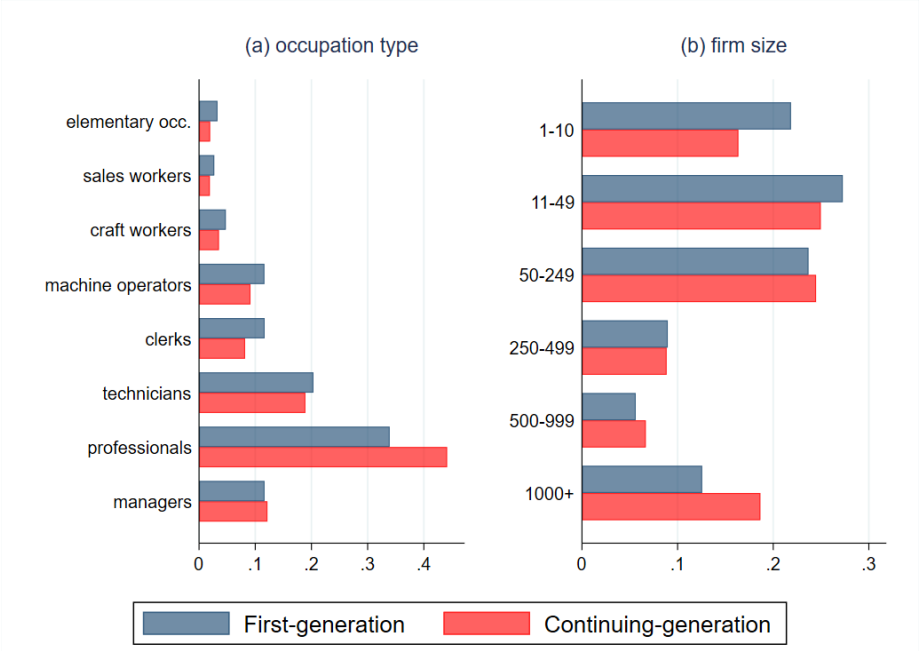


Note: The figure displays the earnings ratios for first-generation graduates relative to continuing-generation graduates. A ratio below one indicates that first-generation graduates' earnings are smaller than that of continuing-generation graduates. The shaded bars represent 95% confidence intervals. Austria is an outlier: the earnings ratio for those with only a bachelor is 1.26 (not displayed to ease readability). Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

Figure A.6: Competence in literacy and problem solving of first- and continuing-generation graduates

Note: panel (a) and (b) of the figure show respectively the ratio between the literacy and problem solving scores for first-generation graduates and continuing-generation graduates (conditional on age and gender). A number smaller than one indicates that the numeracy score of the first group is smaller than that of the latter. The shaded bars represent 95% confidence intervals. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country and the variability in the estimated proficiency score (Avvisati and Keslair, 2024; OECD, 2025).

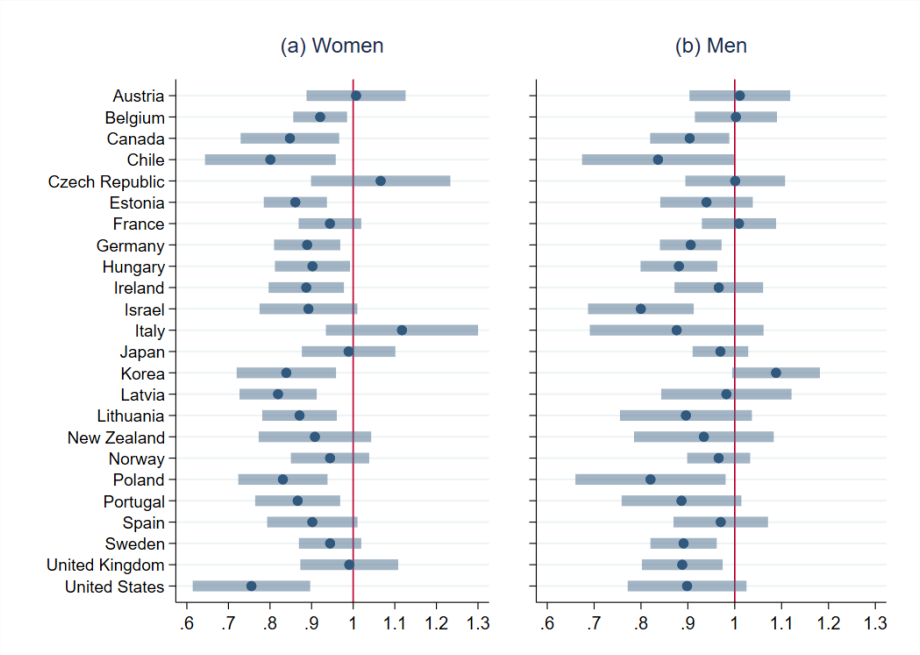
Figure A.7: Occupation types and firm size



Note: The figure shows the distribution of graduates (conditional on age, gender and country fixed effects) by type of occupation (panel (a) and firm size (panel (b)) separately for first- and continuing-generation graduates. The classification of occupation types is based on the authors' recoding of the official ISCO-2008. The categories for firm size are taken from PIAAC. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

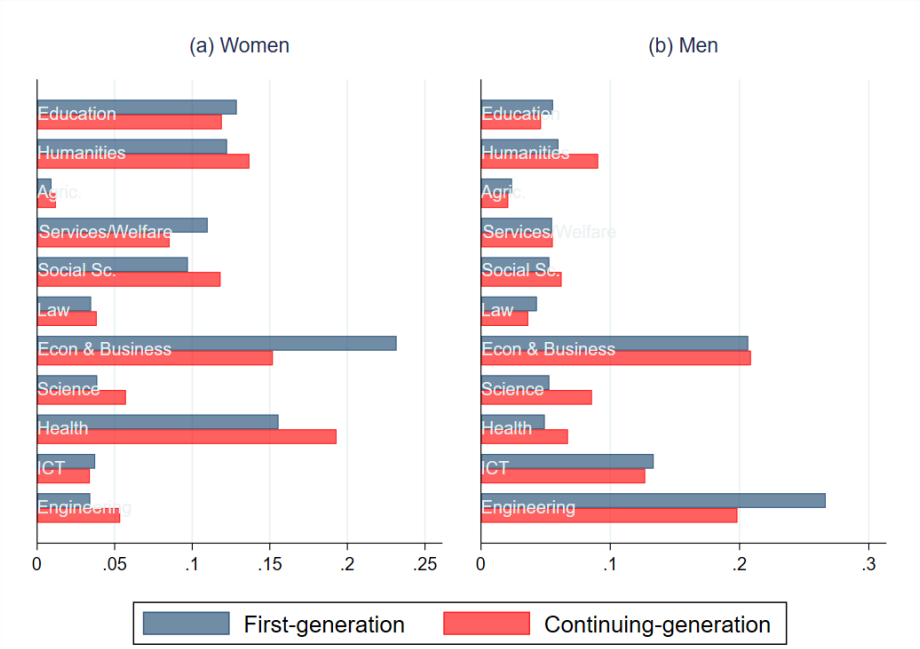
A-3. Results by gender

Figure A.8: Relative Earnings of first- and continuing-generation graduates by gender



Note: The figure shows the ratios of the monthly wages of first- over continuing-generation graduates (conditional on age and gender) by gender. A number smaller than one indicates that first-generation graduates earn less than continuing-generation graduates. The shaded bars represent 95% confidence intervals. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

Figure A.9: Fields of study by gender



Note: The figure shows the distribution of graduates (conditional on age and country fixed effects) by fields of study for women (panel a) and men (panel b), separately for first- and continuing-generation graduates. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

A-4. Detailed regression results

Table A.4: Regression results by country

	AUT	BEL	CAN	CHL	CZE	EST	FRA	DEU	HUN	IRL	ISR	ITA
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
NoCollege&CollegeParent	345	550	541	-17	267	501	404	774	221	-7	757	612
	(194)	(259)	(210)	(175)	(120)	(107)	(129)	(181)	(128)	(287)	(250)	(394)
College&NoCollegeParent	1,949	2,283	1,496	988	938	1,234	1,810	2,598	1,330	2,780	1,886	1,549
	(161)	(176)	(150)	(89)	(105)	(106)	(77)	(166)	(86)	(201)	(136)	(150)
College&CollegeParent	1,869	2,553	2,088	1,446	854	1,612	1,906	3,268	1,728	3,196	2,532	1,593
	(184)	(194)	(139)	(126)	(114)	(90)	(90)	(162)	(89)	(237)	(142)	(191)
1=male	2,011	1,440	1,613	814	1,415	1,297	1,064	2,009	843	1,887	1,489	1,470
	(105)	(136)	(117)	(89)	(67)	(79)	(71)	(121)	(59)	(184)	(134)	(106)
1=age_35–44	189	644	603	370	321	105	426	230	104	540	253	326
	(142)	(155)	(168)	(88)	(77)	(97)	(92)	(112)	(82)	(173)	(137)	(126)
1=age_45–54	767	1,013	763	293	357	-98	759	543	259	614	487	510
	(139)	(165)	(175)	(80)	(79)	(101)	(86)	(139)	(66)	(191)	(159)	(103)
Observations	2,094	1,765	5,585	2,061	2,607	2,942	2,738	2,310	2,354	2,080	2,586	1,997

Table A.5: Table A.4: (continued)

	JPN	KOR	LVA	LTU	NZL	NOR	POL	PRT	ESP	SWE	GBR	USA
	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se	b/se
NoCollege&CollegeParent	2	278	440	19	529	-563	207	373	467	275	336	506
	(1)	(341)	(160)	(151)	(238)	(358)	(259)	(284)	(148)	(179)	(208)	(307)
College&NoCollegeParent	5	944	1,356	1,172	1,571	2,794	881	1,553	1,669	1,223	1,945	2,763
	(1)	(140)	(116)	(134)	(243)	(234)	(77)	(100)	(95)	(155)	(154)	(324)
College&CollegeParent	6	1,006	1,687	1,589	1,875	3,123	1,400	2,006	1,888	1,628	2,289	3,887
	(1)	(179)	(132)	(109)	(247)	(251)	(131)	(141)	(145)	(146)	(195)	(287)
1=male	9	2,127	1,086	980	1,607	2,894	892	697	980	990	1,678	1,667
	(0)	(117)	(94)	(89)	(175)	(165)	(63)	(77)	(79)	(98)	(145)	(148)
1=age_35–44	2	603	225	71	746	949	147	279	659	315	297	745
	(0)	(146)	(121)	(116)	(158)	(190)	(78)	(81)	(98)	(127)	(148)	(287)
1=age_45–54	4	849	-190	-44	848	1,496	194	466	750	569	363	865
	(1)	(158)	(129)	(101)	(193)	(184)	(71)	(124)	(102)	(136)	(172)	(268)
Observations	2,847	3,508	2,572	2,539	1,846	1,171	2,055	1,551	2,749	1,408	2,262	1,637

The table reports the estimated coefficients and standard errors (in parentheses) of the interval regression models described in Section 3 (equations (2), (3) and (4)). The last row reports sample sizes. Results are produced using the weighting procedures recommended by the OECD to take into account the different sampling frames used by each country (Avvisati and Keslair, 2024; OECD, 2025).

Appendix B. Literature Review

While extensive research has been conducted on the undergraduate experiences of first-generation college students, their labour market outcomes post-graduation remain largely unexplored. The existing literature predominantly focuses on the United States (Manzoni and Streib, 2019; Thomas and Zhang, 2005; Emmons et al., 2019; Fry, Richard, 2021) and England (Adamecz-Volgyi et al., 2023), leaving a gap in our understanding of first-generation graduates in other countries. Additionally, most of this evidence is derived from cohort studies, which may not reflect experiences broadly applicable across different cohorts and can be challenging to generalise. Furthermore, existing studies typically examine labour market outcomes within a narrow timeframe of 1 to 10 years after graduation, an interval too brief to fully encompass the peculiar career trajectories of first-generation graduates.

The first available evidence on first-generation graduates' outcomes comes from (Thomas and Zhang, 2005). Analysing the outcomes of those who completed their bachelor's degrees in 1992/1993 in the US, they find a small and insignificant wage penalty for first-generation graduates one year after graduation, which, however, increases to 4% and becomes significant at the end of the fourth year in the labour market. Larger gaps of 11% and 9%, respectively, for men and women are found by (Manzoni and Streib, 2019) for the same cohort 10 years after graduation. The gap, especially for men, is well explained by first-generation graduates' different labour market choices (industry, occupation, hours worked, and location), which suggests that labour market factors, rather than educational ones, largely contribute to this gap.

In England, the only existing evidence on the labour market outcomes of first-generation graduates comes from (Adamecz-Volgyi et al., 2023). Analysing data of the cohort born in 1989/1990, they find a 7.4% wage penalty for first-generation female graduates at age 25/26, but not for men. Two-thirds of the wage penalty for first-generation women is accounted for by factors like lower pre-university educational attainment, not attending elite universities, choosing degree courses with lower expected earnings, working in smaller firms, employment in non-degree-requiring jobs, and motherhood. First-generation men are different from continuing-generation men in their characteristics (working in jobs that do not require their degree and working in smaller firms), but they have higher returns on those characteristics. This could be because men are generally less likely to graduate, hence first-generation male graduates might be a more select group.

While not focusing explicitly on first-generation graduates, another strand of literature in sociology studies intergenerational mobility as a function of education in the US. This literature focuses on whether a college degree can be considered as "the great equalizer", erasing the effect of parental background (Mann, Horace, 1957). While the issue has generated a rich debate in the sociological literature, with analyses operationalising parental background in different ways and looking at different outcomes of interest such as social class, socioeconomic index, and occupational prestige, here we try to limit ourselves

to only the most important contributions specifically considering parental education and individual earnings. Since the seminal work of Hout (1988, 1984) on occupational persistence, the consensus has been for long that the influence of parental background is much weaker among college graduates than among those with less schooling. Torche (2011) finds a U-shaped pattern for intergenerational association based on educational level. Intergenerational correlation is high among those with low educational attainment; it weakens among bachelor's degree holders but reemerges among those with advanced degrees. The finding is confirmed by Oh and Kim (2020), who highlight the role of expensive and financially rewarding advanced degrees from prestigious institutions in re-opening the gap. Contrary to the thesis of "the great equalizer", Witteveen and Attewell (2020) find that parental education is associated with substantially higher post-college incomes, also for individuals with only a bachelor's degree. Lastly, some studies focus on the earnings premium associated with college as a function of parental background. Cheng et al. (2021) show growing college premiums for men as a function of mother's education, while the opposite stands for women, with the relation being stronger for older individuals.

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