

# Family socioeconomic status and sibling correlations in upper secondary education. An empirical analysis of educational inequalities in Italy

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## Abstract

The study examines the educational inequalities in upper secondary education in Italy, with a focus on the vertical dimension of school enrolment and the horizontal dimension of track and curriculum choice. To measure the importance of family background, we use the estimation of sibling correlations, which has seldom been used in the analysis of track choice in upper secondary education. Using data from the Italian Labor Force Survey 2005–2020 (ILFS), which includes detailed information on household characteristics such as the gender composition of siblings and parental education and occupational status, we find that around half of the variation in the probability of attending upper secondary school in Italy is related to the family of origin. We also show that comparing sibling correlations on binary outcomes should be complemented by additional statistics, such as variances at the individual and family levels and proportions of enrolled sibling pairs. For upper secondary school enrolment, advantaged families have a relatively lower sibling correlation due to minor variations at both individual and family levels. However, in terms of track choice, the sibling correlation is relatively higher for enrolment in the academic track compared to the technical and vocational tracks.

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Additionally, with respect to the attendance of science/technical curricula within each track, the results indicate a lower sibling correlation for the academic track than for the other two tracks, which suggests that individual characteristics have a greater impact than family background when these outcomes are considered.

#### KEYWORDS

educational inequalities, family, school choice, sibling correlation, social inequality, upper secondary education

## 1 | INTRODUCTION

The impact of family background on educational opportunities is a widely studied topic, and the most common approach in this field of research is to analyse differences in economic and educational outcomes between individuals from different families (e.g., Breen et al., 2009). The *intergenerational mobility approach* thus implies the estimation of the association between parents' income, earnings, social class, or education and their children's educational opportunities. An alternative approach to studying inequality of educational opportunities (IEO) is to calculate the fraction of total educational inequality attributed to the factors shared by the siblings in the same family, known as sibling correlation (SC). This method provides a comprehensive measure of the role of family background and community effects, capturing unobserved characteristics shared by the children belonging to the same family, such as parental motivation, parenting style, and sibling interactions (Björklund & Jantti, 2020).

This research uses the latter approach and examines SC in upper secondary education in Italy, considering both vertical and horizontal dimensions of inequality of educational opportunities (IEO). It extends the literature in three ways. First, it employs the SC approach to investigate IEO in upper secondary school enrolment and track selection, examining an educational transition that has received limited attention in the literature. Prior research based on SC has mainly focused on continuous educational outcomes, such as years of education, school grades, and cognitive skills (e.g., Grätz, 2018; Grätz et al., 2021; Hällsten & Thaning, 2018), and has largely overlooked this important educational dimension, which has far-reaching implications for inequalities in tertiary education and the labor market, especially in the Italian context (Ballarino & Panichella, 2016). Second, the study explores the heterogeneity of SC by the social background of origin, an aspect that previous studies have rarely considered but which can provide further insights into important topics central to social stratification research, such as compensatory mechanisms (Bernardi, 2014). Moreover, the available evidence is mixed: while some studies show the existence of differences in SC by social origin (e.g., Conley et al., 2007; Conley & Glauber, 2008; Grätz et al., 2021), others find no substantial heterogeneity among students from different backgrounds (e.g., Duta et al., 2021; Grätz, 2018). Lastly, the empirical analyses are based on a high-quality database, providing a detailed measure of educational paths in upper secondary school and allowing for a fine-grained analysis of social inequality in terms of school choice. Unlike previous studies on IEO in upper secondary education, this work focuses not only on the 'classical' distinction between the academic, technical and vocational tracks, but also on the differentiation between scientific/technical- and general/service-oriented schools within each track. This approach reveals a previously unexplored dimension of stratification in the Italian educational system that has implications for access to STEM university fields and future job prospects (Ballarino & Panichella, 2016).

## 2 | DATA AND METHODS

The empirical analyses presented in this research note utilize pooled quarterly data from the Italian Labour Force Survey (ILFS) covering the years 2005 to 2020. The ILFS is a nationally representative survey conducted by ISTAT,

TABLE 1 Descriptive statistics.

	By gender		By parental education			Total
	Male	Female	Lower secondary or less	Upper secondary	Tertiary	
<b>1. Upper secondary school enrolment</b>						
Enrolled	81.2	85.6	71.1	89.4	95.4	83.3
Not enrolled	18.8	14.4	28.9	10.6	4.6	16.7
N of observations	13,581	12,761	10,210	11,708	4424	26,342
<b>2. Choice of track (conditional on upper secondary school enrolment)</b>						
Academic	39.4	62.4	29.6	52.4	83.4	50.9
Technical	40.4	21.5	40.0	32.2	12.6	31.0
Vocational	20.2	16.1	30.4	15.4	4.0	18.1
N of observations	10,974	10,876	7214	10,427	4209	21,850
<b>3. Choice of the curriculum within each track (conditional on upper secondary school enrolment)</b>						
<b>3.1. Academic track</b>						
Scientific curriculum	67.4	35.7	36.8	48.2	54.7	48.1
Classic lyceum and other humanistic curricula	32.6	64.3	63.2	51.8	45.3	52.0
N of observations	4327	6784	2138	5463	3510	11,111
<b>3.2. Technical track</b>						
Technical/industry-oriented curricula	68.9	22.1	49.2	46.8	39.6	47.3
Service-oriented curricula	31.1	77.9	50.8	53.2	60.5	52.7
N of observations	4433	2343	2886	3359	531	6776
<b>3.3. Vocational track</b>						
Technical/industry-oriented curricula	34.7	9.6	24.3	22.9	20.8	23.6
Service-oriented curricula	65.3	90.5	75.7	77.1	79.2	76.4
N of observations	2214	1749	2190	1605	168	3963

which is mandatory for all household members aged 15 and above. This dataset provides a comprehensive picture of upper-secondary school choices, as well as rich and detailed information on household structure, educational attainment, and occupational status of its members. The analytical sample consists of 13,171 households with two children aged 15–17 years, resulting in 26,342 observations in the sibling sample. Table 1 shows the descriptive statistics of the sample.

The analysis includes three sets of dependent variables. The first is a dummy variable indicating whether a child is enrolled in a 5-year upper secondary school rather than not being enrolled, including those who dropped out or enrolled in vocational schools. The second set of variables estimates the probability of enrolment in one of three five-year tracks (academic, technical, or vocational), conditioned on upper secondary school enrolment. The third set is related to the choice between scientific/technical- and general/service-oriented schools within each track. With respect to the academic track, the dummy equal to one corresponds to enrolment in a science lyceum (*liceo scientifico*), while the dummy equal to zero corresponds to enrolment in a classical lyceum (*liceo classico*) or humanistic schools (e.g., *liceo linguistico*, *liceo delle scienze umane*). For the technical and vocational tracks, the dummy equal to one relates to technical/industry-oriented schools, whereas the dummy equal to zero stands for service-oriented schools.

Sibling similarities in educational outcomes of interest are estimated through the intraclass correlation coefficients (ICCs) obtained from restricted maximum likelihood (REML) multilevel models (Björklund & Jäntti, 2012) in which individuals ( $i$ ) are nested within the families ( $j$ ). The model is expressed as:

$$Y_{ij} = X_{ij}\beta + \varepsilon_{ij}, \quad (1)$$

where  $Y_{ij}$  is the educational outcome of interest,  $X_{ij}$  is gender, and  $\varepsilon_{ij}$  is the error term that can be decomposed into family-specific ( $\alpha_i$ ) and individual-specific ( $\delta_{ij}$ ) components under the assumption that the covariance between these two parts is 0:

$$\varepsilon_{ij} = \alpha_i + \delta_{ij} \quad (2)$$

The intraclass correlation coefficient obtained from this model is computed as follows:

$$\text{ICC} = \sigma_{\alpha}^2 / (\sigma_{\alpha}^2 + \sigma_{\delta}^2), \quad (3)$$

where  $\sigma_{\alpha}^2$  is the variance between the families and  $\sigma_{\delta}^2$  is the variance within the families. ICC, thus, shows how much of the total variance ( $\sigma_{\alpha}^2 + \sigma_{\delta}^2$ ) is shared by the siblings. The linear probability model in the case of this study is preferable to the logistic model, as it provides a non-parametric estimate of the ICC (Breen & Ermisch, 2021). We investigate the heterogeneity of SCs by socioeconomic background by estimating separate models on subgroups defined by parental education levels. As the response variables are binary, we also consider additional measures suggested by Breen and Ermisch (2021), such as the proportion of families where all siblings have the same outcome, the proportion of families where all siblings have the outcome equal to 1 among those where siblings have the same outcome, as well as family-level and individual-level variance.

### 3 | EMPIRICAL EVIDENCE

Table 2 reports SC on upper secondary school enrolment, as well as its heterogeneity by parental education.

The ICC on upper secondary school enrolment indicates that 51% of the variation in the probability of this outcome is attributed to the family background. This result is in line with the SCs on years of education reported in previous studies that range from 0.4 to 0.6 (see above).<sup>1</sup> As for the heterogeneity by parental education, the correlation is relatively lower among the most advantaged families (0.33) not because of larger inequalities within these families but due to the less variance at both individual (0.015) and family levels (0.029). Additional statistics for this

**TABLE 2** Sibling correlation on upper secondary school enrolment and its heterogeneity by parental education (standard errors in parenthesis).

Statistic	Upper-secondary school enrolment	By parental education		
		Lower secondary or less	Upper secondary	Tertiary
ICC	0.51 (0.006)	0.52 (0.010)	0.43 (0.011)	0.33 (0.019)
Level 1 (family) variance	0.071 (0.001)	0.094 (0.003)	0.040 (0.001)	0.015 (0.001)
Level 2 (individual) variance	0.067 (0.001)	0.094 (0.002)	0.054 (0.001)	0.029 (0.001)
Proportion of the families in which children have the same outcome	0.86 (0.002)	0.80 (0.004)	0.89 (0.003)	0.94 (0.004)
Proportion of enrolled siblings among those who have the same outcome	0.89 (0.002)	0.76 (0.005)	0.94 (0.002)	0.98 (0.002)
Number of observations	26,342	10,210	11,708	4424

group reveal that the proportion of families where children have the same outcome is the highest (94%), and almost all of these siblings are similar on the positive outcome (98%), that is, both are enrolled in upper secondary school.

Table 3 reports SCs on the enrolment in academic, technical, or vocational tracks, as well as their variation by parental education. Family background has a relatively higher impact on enrolment in the academic track (0.47) compared to the technical (0.35) and vocational tracks (0.41). Indeed, previous studies show that children from advantaged families are more likely to attend academic schools, which grant greater chances of further university enrolment, while children from lower socioeconomic backgrounds often attend technical and vocational schools, perceiving them as a fast track to enter the labor market and acquire valuable job-specific skills (Panichella & Triventi, 2014). Moreover, the heterogeneity of sibling correlations by parental education reveals that, within the academic track, sibling similarity is relatively higher for children whose parents are tertiary educated, with 89% of sibling pairs having the same outcome of being enrolled in this track. Conversely, when enrolment in the vocational track is considered, relatively higher sibling correlations are found among children with the least educated parents.

Table 4 reports SCs on the choice of a science/technical curriculum within each of the three tracks, conditional on upper secondary school enrolment. The results indicate that the weight of family background in the choice of a science/technical curriculum is the lowest in the case of those who attend the academic track, with only 34% of the variation in the probability of choosing this path attributed to the family. Conversely, in the case of the technical and vocational tracks, family-level variation constitutes 42% and 52% of the total variation, respectively.

Hence, in the case of the curriculum choice within the academic track, there is more variation within the families due to individual characteristics than between the families: the individual-level variance (0.149) is almost twice larger than the family-level variance (0.077). At the same time, with respect to this track, the proportion of both siblings enrolled in a science/technical curriculum among the siblings with the same outcome is 38%, while in the case of technical and vocational tracks, these proportions are 29% and 8% respectively. Therefore, there is more sibling similarity within the technical track and vocational tracks than the academic track in terms of the science/technical programs enrolment, although this higher similarity is based on a greater proportion of families where both siblings are not enrolled in the considered programs.

As for the heterogeneity by parental education, the SCs for the families with upper secondary (0.32) and tertiary educated parents (0.33) are relatively lower compared to the families with the least educated parents when enrolment in the science/technical curriculum of the academic track is considered. This result can be explained by the greater similarity among the least advantaged families on the negative outcome: 80% ( $100\% - 20\% = 80\%$ ) of the sibling pairs with the same outcome are similar in terms of not being enrolled in the science/technical curriculum. In contrast, greater variation of sibling correlations on the attendance of science/technical programs is shown for the technical and vocational tracks. In case of the enrolment in science/technical programs of the technical track, relatively higher SCs are revealed for children having tertiary-educated parents (0.55). For this group, the weight of the family background (0.114) is greater compared to the role of individual characteristics (0.093). This result might be related to the fact that science/technical paths within the technical track include not only programs linked to blue-collar occupations but also programs for preparing surveyors (*geometra*) or information technology specialists (*informatica*), which might be considered attractive paths for the children from better-off families choosing the technical track.

## 4 | CONCLUSIONS

This research note presents compelling empirical evidence on how family background influences the educational paths of Italian students in upper secondary schools, utilizing the sibling correlation approach. The results show that family background explains approximately half (51%) of the variation in the likelihood of attending upper secondary education, in line with previous studies on various educational outcomes. Furthermore, the study highlights the importance of additional statistical measures beyond simple sibling correlations to fully understand the intricacies of intergenerational educational inequality, as evidenced by the variation in sibling similarity among families with different levels of parental education (Breen & Ermisch, 2021).

TABLE 3 Sibling correlations on the choice of academic/technical/vocational track, conditional on upper secondary school enrolment (standard errors in parenthesis).

Statistic	Academic track			Technical track			Vocational track					
	By parental education			By parental education			By parental education					
	Lower secondary or less	Upper secondary	Tertiary	Overall	Lower secondary or less	Upper secondary	Tertiary	Overall	Lower secondary or less	Upper secondary	Tertiary	
ICC	0.47 (0.008)	0.39 (0.015)	0.36 (0.012)	0.42 (0.019)	0.35 (0.009)	0.36 (0.016)	0.28 (0.013)	0.36 (0.020)	0.41 (0.009)	0.40 (0.015)	0.34 (0.013)	0.26 (0.022)
Level 1 (family) variance	0.110 (0.003)	0.075 (0.004)	0.085 (0.003)	0.057 (0.003)	0.073 (0.002)	0.082 (0.004)	0.059 (0.003)	0.039 (0.003)	0.061 (0.002)	0.084 (0.004)	0.044 (0.002)	0.010 (0.001)
Level 2 (individual) variance	0.125 (0.002)	0.116 (0.003)	0.149 (0.002)	0.078 (0.002)	0.133 (0.002)	0.148 (0.004)	0.148 (0.003)	0.069 (0.002)	0.088 (0.001)	0.128 (0.003)	0.086 (0.002)	0.028 (0.001)
Proportion of the families in which children have the same outcome	0.72 (0.003)	0.74 (0.005)	0.67 (0.005)	0.82 (0.006)	0.71 (0.003)	0.67 (0.006)	0.67 (0.005)	0.85 (0.005)	0.82 (0.003)	0.73 (0.005)	0.83 (0.004)	0.94 (0.004)
Proportion of enrolled siblings among those who have the same outcome	0.49 (0.004)	0.21 (0.006)	0.52 (0.006)	0.89 (0.005)	0.21 (0.003)	0.31 (0.007)	0.22 (0.005)	0.06 (0.004)	0.09 (0.002)	0.19 (0.005)	0.07 (0.003)	0.01 (0.002)
Number of observations	21,850	7214	10,427	4209	21,850	7214	10,427	4209	21,850	7214	10,427	4209

**TABLE 4** Sibling correlations on the choice of science/technical curricula within each track, conditional on upper secondary school enrolment (standard errors in parenthesis).

Statistic	Science/technical curriculum within the academic track			Science/technical curriculum within the technical track			Science/technical curriculum within the vocational track					
	By parental education			By parental education			By parental education					
	Overall	Lower secondary or less	Upper secondary	Tertiary	Overall	Lower secondary or less	Upper secondary	Tertiary	Overall	Lower secondary or less	Upper secondary	Tertiary
ICC	0.34 (0.014)	0.41 (0.033)	0.32 (0.021)	0.33 (0.022)	0.42 (0.020)	0.44 (0.029)	0.38 (0.030)	0.55 (0.065)	0.52 (0.024)	0.47 (0.033)	0.59 (0.033)	0.48 (0.137)
Level 1 (family) variance	0.077 (0.004)	0.087 (0.008)	0.071 (0.005)	0.076 (0.006)	0.084 (0.005)	0.086 (0.007)	0.077 (0.007)	0.114 (0.017)	0.085 (0.005)	0.080 (0.007)	0.095 (0.007)	0.071 (0.023)
Level 2 (individual) variance	0.149 (0.003)	0.125 (0.007)	0.153 (0.005)	0.153 (0.005)	0.116 (0.004)	0.108 (0.005)	0.127 (0.006)	0.093 (0.013)	0.080 (0.004)	0.089 (0.005)	0.066 (0.005)	0.076 (0.020)
Proportion of the families in which children have the same outcome	0.65 (0.005)	0.69 (0.010)	0.64 (0.007)	0.65 (0.008)	0.56 (0.006)	0.60 (0.009)	0.54 (0.009)	0.51 (0.022)	0.79 (0.007)	0.77 (0.009)	0.81 (0.010)	0.82 (0.030)
Proportion of enrolled siblings among those who have the same outcome	0.38 (0.006)	0.20 (0.010)	0.36 (0.008)	0.53 (0.010)	0.29 (0.007)	0.30 (0.011)	0.27 (0.010)	0.31 (0.028)	0.08 (0.005)	0.08 (0.007)	0.08 (0.007)	0.06 (0.020)
Number of observations	11,111	2138	5463	3510	6776	2886	3359	531	3963	2190	1605	168

The findings on the enrolment in upper secondary education are worth further investigation, as they suggest that there is less similarity among siblings in families where parents have tertiary education compared to those with less education. This result warrants further analysis, as it may indicate greater diversity in educational choices among children from advantaged families, contrary to the idea that compensatory behaviors lead to greater homogeneity in educational outcomes among higher-class families (Conley, 2008). Additionally, the study suggests that family background has a stronger influence on enrolment in the academic track compared to the technical and vocational tracks, highlighting the crucial role of family-related factors such as socialization and economic resources in shaping educational trajectories. This finding underscores the significance of parenting style and socio-economic resources in determining students' choices to pursue the most prestigious and challenging track within the Italian educational system. This research note also investigated the association between track choice and enrolment in science/technical programs using unique data on Italian students' track selection. The findings show that the academic track has lower sibling correlations in science/technical programs than the other two tracks, implying that individual factors, such as personal ambition and intelligence, may have a stronger influence than family background on enrolment in these programs.

Overall, this study shed light on how interrelated mechanisms involving family background, individual characteristics, and contextual factors shape intergenerational educational outcomes in track choices among Italian students. The findings demonstrate that the weight of family background varies depending on the chosen track and that there is heterogeneity within the traditional academic, technical, and vocational tracks, which provides insight for future research on horizontal IEOs in upper secondary education. Furthermore, this research note highlights the importance of considering other dimensions of horizontal stratification in future research, such as the distinction among schools with different teaching programmes, e.g., scientific and general-oriented schools. While previous research has primarily focused on the hierarchy among academic, technical, and vocational tracks (see Ballarino & Panichella, 2021; Panichella & Triventi, 2014), the expansion of upper secondary education in Western Europe—where participation at this level has become nearly universal—emphasizes the importance of new and unexplored dimensions of horizontal stratification. Specifically, concerning the Italian case, this research note reveals heterogeneity within the three traditional tracks (academic, technical, and vocational) that has not been considered by previous studies. This highlights the need for further analysis of educational inequalities to better understand the complex mechanisms that shape IEOs in Italy.

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All co-authors have seen and agree with the contents of the manuscript and there is no financial interest to report. We certify that the submission is original work and is not under review at any other publication.

## CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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## ENDNOTE

<sup>1</sup> When comparing our results to previous studies that used SC on continuous outcomes, it should be noted that binary outcome variables usually diminish overall fit in linear prediction and tend to bias intra-class correlations downwards (Lahtinen et al., 2019).



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