EXPLORING EDUCATIONAL MOBILITY IN EUROPE

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Abstract

This paper is concerned with the investigation of the intergenerational mobility of education in several European countries and its changes across birth cohorts (1940-1980), using a new mobility index that considers the total degree of mobility as the weighted sum of mobility with respect to both parents. Moreover, this mobility index enables the analysis of the role of family characteristics as mediating factors in the statistical association between individual and parental education. We find that Nordic countries display lower levels of educational persistence, but that the degree of mobility increases over time only in those countries with low initial levels. Moreover, the results suggest that the degree of mobility with respect to fathers and mothers converges to the same level and that family characteristics accounts for an important part of the statistical association between parental education and children's schooling; a particular finding is that the most important elements of family characteristics are the family's socio-economic status and educational assortative mating of the parents.

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1. Introduction

The existence of some statistical association between individual outcomes and parental socio-economic position is considered a violation of a broad principle of the equality of opportunities. A high level of association indicates low mobility and implies that individuals from poor social origins would face extremely restricted life chances and that they would have difficulty achieving their complete economic potential. The empirical research on intergenerational mobility has significantly expanded in recent decades. An important number of contributions can be found in the sociological literature; traditionally, sociologists are prevalently concerned about

intergenerational association in occupation or social class[1]. On the contrary, the majority of the economic literature has usually been concerned about intergenerational persistence in earnings or in income (Solon 1999, 2002; Corak 2004 and Blanden 2009 provide extensive reviews about these topics). However, the economic literature contains a few (but growing) number of contributions concerned with the analysis of educational mobility from an intergenerational perspective. From a theoretical perspective, following Solon (2004), a strong relationship between individual and parental education is one of the most important mechanisms behind intergenerational socio-economic persistence (in income, but also in occupation, poverty or other outcomes).

Several studies (as this one) are explicitly focused on the "measurement" of educational mobility. The first important contribution concerning this concrete topic is from Checchi et al. (1999), in which the authors compare educational mobility (and income inequality) in Italy and in the US, concluding that Italy has lower levels of mobility than the US despite having lower levels of inequality. Comi (2003) compares earnings and educational mobility in Europe, using the data from the young sample of the ECHP (that is, she only considers individuals who are still living with their parents, which provokes serious problems of sample selection); she reports low levels of mobility for countries in southern Europe, France and Ireland, high levels for Nordic countries, the Netherlands and Austria and an intermediate position for Belgium and Germany. Another study from Chevalier et al. (2009) compares educational mobility within European countries using data from the International Adult Literacy Survey (IALS); his general results suggest that educational mobility is negatively correlated with educational inequality and that the degree of mobility has increased over time. Moreover, he also finds that Nordic countries are the most mobile ones and that the less mobile are Germany, Italy, Ireland and Poland. There is also a recent contribution of Checchi et al. (2008), in which they analyse educational persistence across cohorts in Italy; they find that, even if mobility has increased over time, the relative disadvantage of individuals from poor backgrounds persists up to the end of the period considered. Finally, Hertz et al. (2008) compare the temporal patterns of the intergenerational persistence of education for 42 different countries, considering different measures of mobility (namely, the intergenerational regression coefficient and the parent-child correlation in educational attainment); their results show a significant heterogeneity between countries but also with respect to the

[1] The reader can consult Erikson and Goldthorpe (2002), Esping-Andersen (2004), and Goldthorpe and Mills (2005) for a comprehensive review of the sociological literature on intergenerational mobility.

measure of mobility considered. Even so, they suggest that northern European countries display the lowest persistence, while the highest records of persistence are those of Latin America countries.

Given the research background on educational mobility, our contribution to the existing literature is threefold. First, we propose a new index for measuring intergenerational mobility, which considers both absolute and relative changes in the intergenerational association of educational attainment. That is, as we explain below, our measure of mobility takes into account changes in intergenerational persistence (the beta coefficient, or the relative measure of mobility) and the relative variances of years of schooling between parents' and children's generations (more specifically, the R-squared of the intergenerational regression). Note that the necessity of jointly considering these two components, in order to obtain a clear picture of mobility (especially for comparison purposes), has been considered by Hertz et al. (2008) and by Checchi et al. (2008).

Second, we believe that the intergenerational transmission of education is a process that simultaneously involves both parents, even if to different extents; however, educational mobility has generally been computed with respect to a single measure of parental education (father's education, the highest level between the two parents, the mean level, etc.). We are able to compute the mobility index as a weighted mean of mobility with respect to the father and mobility with respect to the mother. In this way, we take into account the potential parental assortative mating with respect to education (i.e., parents match in the marriage market according to human capital), which can reinforce the degree of educational transmission, as we explain below. Moreover, we are also able to obtain the separate contribution of both parents and check whether and when (in terms of time) educational persistence with respect to the two parents converges to the same level.

Third, with this study, we try to fill the lack of European evidence on intergenerational mobility in a comparative perspective (in particular for Central and Southern countries). In fact, we apply our methodology to 12 European countries[2] with homogeneous data from the 2005 wave of EU-SILC, which contains retrospective information about parental education and family characteristics at the age of 14. Moreover, by computing our standardised measure of intergenerational mobility separately for different birth cohorts (eight five-year birth cohorts), we are able to analyse in a consistent way the temporal patterns of educational mobility in several

[2] Namely: Denmark, Finland, Norway and Sweden (Nordic Countries); Austria, Belgium, France and the Netherlands (Continental Countries); Greece, Italy, Portugal and Spain (Southern Countries).

European countries over a long time period (that is, for individuals born between 1940 and 1980).

In addition, another important innovation of this contribution is that we explicitly model the effect of family characteristics on the degree of observed mobility in years of schooling. We consider family characteristics mediating variables in the intergenerational persistence of educational attainment. Specifically, we analyse the extent to which the statistical association between parental education and family characteristics modifies the intergenerational transmission process; in other words, we determine how educational persistence (the estimated intergenerational elasticity parameter) is affected by the relationship between family characteristics and parental education. We argue that the relationship between parental educational background and family characteristics reinforces the link between parental education and child's education; in other words, if family characteristics were not associated with parental education, intergenerational mobility would be higher.

With these purposes in mind, for the rest of the paper, we proceed as follows Section 2 is dedicated to the definition of the mobility index, to the description of its properties, and to the methodology for obtaining a linkage between family characteristics and educational mobility. Section 3 contains the empirical results from the baseline index and its temporal patterns, as well as from the simulation, which allows accounting for the effect of family characteristics. Finally, section 4 concludes.

2. Empirical Methodology

In order to obtain a measure of education mobility that simultaneously allows for intergenerational transmission with respect to both parents and consistently captures the absolute and the relative components of intergenerational mobility, we generalise the mobility index proposed by Raymond et al. (2009). In particular, defining as c the natural logarithm of child's years of education ($c = ln(S_c)$, where S_c represents the imputed years of education of the child), f represents the natural logarithm of father's years of education ($f = ln(S_f)$) and m represents the natural logarithm of mother's years of education ($m = ln(S_m)$), an index of educational mobility may be defined as[3]

$$I^{EM} = \frac{\sigma^2_{(c-f)} + \sigma^2_{(c-m)}}{\left(\sigma^2_c + \sigma^2_f\right) + \left(\sigma^2_c + \sigma^2_m\right)} \cdot \cdot \qquad (1)$$

[3] Note that the proposed index follows a well-defined empirical distribution, given than each of its elements converges in distribution to a χ^2; therefore, we are also able to report bootstrapped 70% confidence interval for the mobility index.

According to the index proposed, in cases of perfect mobility, where the education of the father (mother) is completely transmitted to the child, it follows that $\sigma^2_{(c\text{-}f)} = \sigma^2_c + \sigma^2_f - 2\sigma_{cf} = 0$ ($\sigma^2_{(c\text{-}m)} = \sigma^2_c + \sigma^2_m - 2\sigma_{cm} = 0$). In the opposite situation, if the correlation between father's (mother's) and child's years of schooling is zero, we obtain the case of perfect mobility, as it results that $\sigma^2_{(c\text{-}f)} = \sigma^2_c + \sigma^2_f$ ($\sigma^2_{(c\text{-}m)} = \sigma^2_c + \sigma^2_m$). That is, the mobility index proposed always takes a value between zero (perfect immobility) and one (perfect mobility), respectively. Moreover, this mobility index allows decomposing the global observed mobility between mobility with respect to parental education, mobility with respect to maternal education, and their respective weights. This is because, with simple algebra, it is possible to specify the index as

$$I^{EM} = \frac{\sigma^2_{(c-f)} + \sigma^2_{(c-m)}}{\left(2\sigma^2_c + \sigma^2_f + \sigma^2_m\right)} = \underbrace{\frac{\sigma^2_{(c-f)}}{\left(\sigma^2_c + \sigma^2_f\right)}}_{\substack{\textit{mobility with}\\ \textit{respect to the}\\ \textit{father}}} \cdot \lambda_f + \underbrace{\frac{\sigma^2_{(c-m)}}{\left(\sigma^2_c + \sigma^2_m\right)}}_{\substack{\textit{mobility with}\\ \textit{respect to the}\\ \textit{mother}}} \cdot \lambda_m , \tag{2}$$

where

$$\lambda_f = \frac{\sigma^2_c + \sigma^2_f}{\left(2\sigma^2_c + \sigma^2_f + \sigma^2_m\right)}; \quad \lambda_m = \frac{\sigma^2_c + \sigma^2_m}{\left(2\sigma^2_c + \sigma^2_f + \sigma^2_m\right)} \tag{2a}$$

and $\lambda_f + \lambda_m = 1$. This decomposition could be very useful if one is interested in the analysis of a cross-country comparison of temporal changes in education mobility (as in the present study). In fact, fathers and mothers may transmit education to their offspring in very different ways, and such differences could change with time and across countries.

Finally, we illustrate why this index accounts for both relative and absolute intergenerational mobility. That is, our mobility index takes into account not only changes of child's and parents', mean years of education but also changes in the inequality (i.e., the variances) of educational attainment in both child's and parents' generations. From the estimation of the following intergenerational equations of educational attainment,

$$\begin{aligned} \ln(S_c) - \overline{\ln(S_c)} &= \hat{\beta}_f \cdot \left(\ln(S_f) - \overline{\ln(S_f)}\right) + \hat{\varepsilon}_f \Rightarrow c = \hat{\beta}_f \cdot f + \hat{\varepsilon}_f \\ \ln(S_c) - \overline{\ln(S_c)} &= \hat{\beta}_m \cdot \left(\ln(S_m) - \overline{\ln(S_m)}\right) + \hat{\varepsilon}_m \Rightarrow c = \hat{\beta}_m \cdot m + \hat{\varepsilon}_m \end{aligned} , \tag{3}$$

which relates the logarithm of child's years of education with the logarithm of parental and maternal years of education, respectively, it is straightforward to express the mobility index as

$$I^{EM} = \frac{\sigma^2_{(c-f)} + \sigma^2_{(c-m)}}{\left(2\sigma^2_c + \sigma^2_f + \sigma^2_m\right)} = \underbrace{\left[\left(1 - R^2_f\right) + \left(1 - R^2_m\right)\right] \cdot \omega_u}_{1} + \underbrace{\left(1 - \hat{\beta}_f\right)^2 \cdot \omega_f + \left(1 - \hat{\beta}_m\right)^2 \cdot \omega_m}_{2}, \quad (4)$$

where the two R-squared are obtained from the respective intergenerational regressions, and

$$\omega_u = \frac{\sigma^2_c}{\left(2\sigma^2_c + \sigma^2_f + \sigma^2_m\right)}; \quad \omega_f = \frac{\sigma^2_f}{\left(2\sigma^2_c + \sigma^2_f + \sigma^2_m\right)}; \quad \omega_m = \frac{\sigma^2_m}{\left(2\sigma^2_c + \sigma^2_f + \sigma^2_m\right)}, \quad (4a)$$

represent the weight of each component, with $\omega_u + \omega_f + \omega_m = 1$. In words, this last reparameterisation allows decomposing total observed mobility as the weighted sum of two components: *1)* the lack of explanatory power of parental education over child's education recovered by the R-squared component (representing the relative variances of parents' and child's years of schooling), and *2)* the lack of intergenerational persistency in educational attainment, namely the relative measure of educational mobility. As documented by Hertz. et al. (2008), these two components may behave very differently. Therefore, considering only one of the two (namely, the persistence component) may provide misleading results on the intergenerational mobility of education: this would be especially true if the purpose of the analysis consisted of a cross-country comparison of temporal changes.

Apart from measuring intergenerational educational mobility and its different components, the proposed index enables the analysis of the extent to which the covariance between parents' and child's education is affected by the statistical association between parental schooling and educational circumstances at the family level. In other words, defining educational circumstances as the set of family characteristics during the childhood (which act as determinants of individual schooling)[4], we can exploit the mobility index for assessing the effect of removing the potential relationship between these elements and the estimated intergenerational persistence parameter (namely, the betas in eq. 4).

Let us suppose that the data generation process for completed years of schooling might be represented by an Extended Measurement Model with *k* covariates, including father's and mother's education. After the OLS estimation, this model takes the form

$$c = \tilde{\beta}^*_f f + \tilde{\beta}^*_m m + \tilde{\delta}' R + \tilde{u} = \tilde{\psi}' W + \tilde{u}\,, \quad (5)$$

[4] Namely, a) family composition, b) frequency of financial problems during the childhood, c) parental labour situation and occupation, and implicitly d) educational assortative mating (see below).

where $\tilde{\psi}'_k = \left(\tilde{\beta}^*_f, \tilde{\beta}^*_m, \tilde{\delta}\right)$ represents the coefficient vector estimates, and $W_{k\times N}=(f, m, R)$, where $k\times N$ is the matrix containing the full set of explanatory variables (specifically, the logarithm of parental years of education and the other family characteristics in R). Therefore, the betas' OLS estimators from the bivariate measurement models in (3) can be written as

$$\begin{aligned}\hat{\beta}_f &= \left(f'f\right)^{-1} f'c = \left(f'f\right)^{-1} f'\left(\tilde{\beta}^*_f f_i + \tilde{\psi}'_f W_f + \tilde{u}\right)\\ \hat{\beta}_m &= \left(m'm\right)^{-1} m'c = \left(m'm\right)^{-1} m'\left(\tilde{\beta}^*_m m_i + \tilde{\psi}'_m W_m + \tilde{u}\right)\end{aligned}, \tag{6}$$

where W_f and W_m represent the matrix W, excluding the elements f and m, respectively (the same applies for the coefficient vector). The mechanical orthogonality between the OLS residuals ($\tilde{u}$) and the regressors of the Extended Model in (5) enables the obtaining of the following representation of the persistence parameter estimates from the bivariate measurement models

$$\begin{aligned}\hat{\beta}_f &= \tilde{\beta}^*_f + \overbrace{\left(f'f\right)^{-1} f'W_f}^{A}\tilde{\psi}'_f\\ \hat{\beta}_m &= \tilde{\beta}^*_m + \underbrace{\left(m'm\right)^{-1} m'W_m}_{B}\tilde{\psi}'_m\end{aligned}. \tag{6a}$$

Note that this represents exactly the classical result from OLS estimation with omitted variables. These equations suggest that the relative degree of (im)mobility, captured by the coefficient estimates from the bivariate measurement models in (3), could be expressed as the sum of two elements: the estimated elasticity with respect to father's (mother's) education from the Extended Model, and another component that represents the link between one parent's education and the rest of the variables included in the matrix W (denoted by A for the father and by B for the mother, respectively). Indeed, from the basic algebraic properties of the OLS estimator, we can retrieve the A and B components (6a), by making use of the coefficient estimates from the following $2\times(k-1)$ auxiliary regressions,

$$\begin{aligned}W_f &= f'\hat{\gamma}_f + \hat{v}_f \Rightarrow \hat{\gamma}_f = \left(f'f\right)^{-1} f'W_f = A\\ W_m &= m'\hat{\gamma}_m + \hat{v}_m \Rightarrow \hat{\gamma}_m = \left(m'm\right)^{-1} m'W_m = B\end{aligned}. \tag{7}$$

This result implies that the coefficient estimates from the simple linear regressions that relates the logarithm of child's years of education to the logarithm of father's and mother's years of education, respectively, should be represented by the sum of the parameters estimates of parental years of schooling ($\tilde{\beta}^*_{f,m}$) from the extended model

and by the cross-product between the estimated coefficients from the *(k-1)* auxiliary regressions ($\hat{\gamma}_{f,m}$) and the rest of estimated parameters from eq. (5) ($\tilde{\psi}_{f,m}$); in formulas,

$$\begin{aligned}\hat{\beta}_f &= \tilde{\beta}_f^* + \overbrace{(f'f)^{-1}}^{A} f'W_f\tilde{\psi}'_f = \tilde{\beta}_f^* + \hat{\gamma}'_f\tilde{\psi}_f \\ \hat{\beta}_m &= \tilde{\beta}_m^* + \underbrace{(m'm)^{-1}}_{B} m'W_m\tilde{\psi}'_m = \tilde{\beta}_m^* + \hat{\gamma}'_m\tilde{\psi}_m\end{aligned} \quad . \tag{8}$$

In order to exploit these results for the analysis of intergenerational mobility, remember that the index can also be defined with respect to the beta coefficients from equation (3). If we replace them with their respective estimations in formula (8), we get

$$I^{EM} = \left[\left(1-R_f^2\right)+\left(1-R_m^2\right)\right]\cdot\omega_u + \left(1-\overbrace{\left(\tilde{\beta}_f^* + \hat{\gamma}_{f1}\tilde{\psi}_{f1}+\cdots+\hat{\gamma}_{fk-1}\tilde{\psi}_{fk-1}\right)}^{\hat{\beta}_f}\right)^2\cdot\omega_f +$$

$$+\left(1-\underbrace{\left(\tilde{\beta}_m^* + \hat{\gamma}_{m1}\tilde{\psi}_{m1}+\cdots+\hat{\gamma}_{mk-1}\tilde{\psi}_{mk-1}\right)}_{\hat{\beta}_m}\right)^2\cdot\omega_m \, .$$

As mentioned above, with this approximation, we can ask which would have been the degree of intergenerational mobility in educational attainment in the hypothetical situation of no systematic relationships between the family characteristic (*j*) (contained in matrix *R*) and parental years of education. The answer may be found in the computation of the simulated mobility index, given by

$$I_*^{EM}=\left[\left(1-R_f^2\right)+\left(1-R_m^2\right)\right]\cdot\omega_u+\left(1-\left(\tilde{\beta}_f^*+\hat{\gamma}_{f1}\tilde{\psi}_{f1}+\cdots+\hat{\gamma}_{fj-1}\tilde{\psi}_{fj-1}+\hat{\gamma}_{fj+1}\tilde{\psi}_{fj+1}+\cdots+\hat{\gamma}_{fk-1}\tilde{\psi}_{fk-1}\right)\right)^2\cdot\omega_f +$$

$$+\left(1-\left(\tilde{\beta}_m^*+\hat{\gamma}_{m1}\tilde{\psi}_{m1}\cdots+\hat{\gamma}_{mj-1}\tilde{\psi}_{mj-1}+\hat{\gamma}_{mj+1}\tilde{\psi}_{mj+1}+\cdots+\hat{\gamma}_{mk-1}\tilde{\psi}_{mk-1}\right)\right)^2\cdot\omega_m;$$

that is, removing the *j*-component of the estimated values of the betas in equations (8) (which is equivalent to supposing that the covariance between parental education and the family characteristic (*j*) is zero).

We operationalise this methodology for the analysis of education mobility by formulating the following question: what would have been the degree of educational mobility in the hypothetical case of breaking the statistical association between absolute education mobility and the complete set of educational circumstances at the family level? This kind of empirical ceiling of the intergenerational mobility of schooling might be computed by removing from the formula of the simulated index all of the *k-1* cross products ($\hat{\gamma}_{f,m}\times\tilde{\psi}_{f,m}$). In general, what we expect is a higher degree of mobility, as in some way, family characteristics could reinforce the connection

between parental education and children's attainment. As explained before, this means that we consider family characteristics to be mediating variables in the statistical association between parents' and child's education[5].

3. Empirical Results

The empirical analysis has been realised with the data from the 2005 wave of EU-SILC (European Survey on Income and Living Conditions) of 12 countries, divided into three groups according to the following standard classification: namely, Denmark, Finland, Norway and Sweden defined as Nordic countries. Austria, Belgium, France and the Netherlands, defined as Continental countries; and Greece, Italy, Portugal and Spain as the group of Southern countries. As commented above, we consider the 2005 wave because it contains retrospective information about family composition and parental background when the individual was 14 years old, which is considered the crucial age for a child's educational process. This particular wave of the European Survey also allows splitting the sample into eight sub-samples of five-year birth cohorts for each country[6]. In order to compute the mobility index as in equations (1)-(2), we impute individuals', fathers' and mothers' years of education from the information about completed education defined according to the ISCED classification; years of completed education are imputed in the same way for individuals than for parents, consistent with the normal (country-specific) expected length of each ISCED level (for the details see Di Paolo et al. 2010)[7].

[5] Note also that, by the definition of the mobility index, educational assortative mating is implicitly considered among family characteristics. This is because the index is defined with respect to (a weighted sum of) mobility with respect of the father and mobility with respect of the mother. This implies that the first component of the matrix W_f (W_m) represents the log of mother's (father's) years of education. Therefore, the first ($\hat{\gamma}_{f,m}$) estimates from the auxiliary regressions in (7) represent a parent's years of education elasticity with respect to his/her spouse's schooling: in other words, they represent the extent of educational assortative mating among the parents. This would mean that removing from the simulated index the first cross-product components (that is, supposing that there is no statistical association between parents' years of completed schooling), we should quantify which is the contribution of educational assortative mating to the observed degree of intergenerational persistence in educational attainment.

[6] Given that the additional questionnaire about family characteristics during childhood in the EU-SILC is only directed at individuals aged between 25 and 65 in 2005, we consider the first birth cohort 1940-45 and the last 1975-80. Table 1 contains the complete definition of birth cohorts, and the number of observation for each cohort for the selected European Countries. In the case of Denmark, we cannot consider the first two birth cohorts (1940-45 and 1945-50), because the information about maternal education is not reliable (namely, maternal education in the first two cohorts is fixed for all observation to ISCED2); we preferred excluding these two initial cohorts from the analysis rather than computing mobility only with respect to parental education.

[7] Note also that we retain observations of native-born individuals who are not still studying in the year of the survey (2005), with valid information about own, paternal and maternal completed education. We use only the sub-sample of native-born individuals because a) we aimed to relate the patterns of educational mobility to institutional changes, and b) we want to avoid including individuals who have been potentially exposed to different institutional environments. For brevity reasons, we neglect gender differences, which will be an issue of future research on this topic.

The analysis of the baseline mobility index, computed separately for each birth cohort and for each country, can give us an impression of *i*) which is the global degree of educational persistence in Europe and *ii*) how educational mobility has evolved over 40 years (that is, for individuals born between 1940 and 1980). Figures 1a-c represent the temporal evolution of the mobility index with the (bootstrapped) confidence interval in solid lines (the same information is also contained in table 4); moreover, the figures also report *iii*) the separate contribution of mobility with respect to the father and mobility with respect to the mother in dashed and dot-dashed lines, respectively.

With respect to the first point, in general we observe that the degree of educational mobility is always higher in Nordic countries than in the rest, with an important exception in the case of France, which shows very high levels of educational mobility over the entire period, which is probably due to its free and very open educational system. The rest of the Continental countries are situated in an intermediate position in our country grouping, although Belgium displays somewhat lower levels of mobility than Austria and the Netherlands. As expected, Southern countries exhibit very low levels of educational mobility, particularly if compared to Nordic countries (apart from the case of Greece, which shows fairly higher levels of mobility than the rest of the group).

Regarding the temporal evolution of educational persistence, we might claim that, in general, educational mobility has increased in the period in the 12 European countries analysed. However, as also noted by Chevalier et al. (2009), the tendency is heterogeneous enough among countries, mainly depending on the starting point (that is, on the degree of educational mobility in the first birth cohort 1940-45). In fact, for countries that exhibit high levels of mobility in the first cohorts (for example, the Nordic countries), educational persistence seems rather stable over the 40 years considered. Confirming this intuition, the same happens for France (with initial mobility close to 0.8), and to a less extent in Austria (starting with values around 0.7), where the evolution of educational mobility is roughly constant over the entire time span[8]. Moreover, in the case of Denmark, the intergenerational persistence of educational attainment increases to some extent in the last cohorts (mobility reduced by approximately 0.1), probably because this country held very high levels of mobility

[8] Note that in Austria there is a pronounced inflection between the 1940-45 cohort and the 1955-60 cohort, which is probably due to a WWII effect on educational mobility; however, educational mobility is essentially stable up to the end of the period.

at the beginning of the period[9]. Among the Nordic countries, this common behaviour is only broken in the Norwegian case, where the initial mobility was of 0.66 (relatively lower than in the rest of high-mobility countries); nevertheless, in this country, mobility substantially increases over time, with an important jump of 0.1 points between 1955-60 and 1960-65, approaching a final value of 0.8 (mean rate of increase of 0.025 per cohort).

Additionally, we observe a moderate and stable increase in educational mobility for Belgium (apart from the fluctuation in the first three cohorts) and for the Netherlands; indeed, these countries exhibit a mean rate of increase of educational mobility of approximately 0.02 points per cohort, rising above the value of 0.7 at the end of the period[10]. Focusing now on the Southern countries, it appears that Greece has also experienced a significant increase in educational mobility during the 40 years analysed; in this country, the average increase of the mobility index over the birth cohorts is very similar to that of the Belgian or of the Dutch case (0.02 per cohort excluding the last one). However, the increase of educational mobility is not so pronounced in the rest of the Southern countries; indeed, Portugal exhibits the lowest general degree of educational mobility, with a very reduced tendency of increase (apart from a discrete jump between 1955-60 and 1965-70). Moreover, Italy and Spain evidently experience an increase in educational mobility (an average increase of 0.014 for each cohort), but both countries maintain considerably lower levels of mobility than other European countries. Moreover, it appears that educational mobility increases in the first half of the period (probably due to the post-war economic recovery and income growth), and then stabilises during the second half for Italy (specifically, from the 1960-65 birth cohort); conversely, for Spain, educational mobility is roughly constant until the 1960-65 birth cohort but rises markedly during the rest of the period considered.

Finally, we can analyse the separate contributions of parental and maternal completed education to the global level of educational mobility and how the role of both parents changes over time. The results suggest that, in general, child's education is strongly attached to paternal education rather than to maternal education. In a nutshell, we observe higher levels of educational persistence with respect to the father

[9] Unfortunately, as commented above, we cannot provide a measure of educational mobility in the first cohorts, due to problems with the information about completed maternal education; however, we suppose that educational mobility at the starting point was significantly high in Denmark.

[10] Note that in both Belgium and the Netherlands but also in Greece, educational mobility seems to decline in the last cohort (1975-80); however, this may just be the result of the exclusion from the sample of those individuals who are still studying in the year of the survey (2005). Reasonably, these individuals are enrolled in higher education, and dropping them from the sample may be apparently reducing the observed degree of mobility in this cohort; in fact, in order to avoid distorting the results, the mean rate of increase of 0.2 has been computed with respect to the first seven cohorts.

than with respect to the mother, with an important exception in the case of Austria (where child's education is highly associated with maternal education). However, for many countries, mobility with respect to the father and mobility with respect to the mother are statistically the same for the greater part of the period, given that both are included within the confidence interval of the mobility index: this is the case of Nordic countries (with a small exception for Finland[11]), but the same happens for Belgium and Greece.

Nevertheless, for other countries, we observe a well-defined temporal convergence of educational mobility with respect to the two parents. That is, in Austria, maternal education is more attached to child education until the 1965-70 birth cohort, but mobility with respect to the mother and mobility with respect to the father are later practically identical. With a reverse role of fathers and mothers, the convergence occurs in the same cohort for France and for the Netherlands, but for Spain, the convergence between educational mobility with respect to the two parents takes place in the previous cohort, 1960-65 (note that it is the same cohort in which educational mobility starts to increase, following the implementation of the compulsory education reform, which took place after 1970). Probably, this general convergence of mobility with respect to fathers and mothers is due to the tendency of equalisation of educational attainment between males and females (in the parents' generation). Conversely, there is no convergence in the case of Italy, where child's education is more attached to parental education that maternal education during the entire period; for Portugal, it seems that only at the end of the period does maternal education matter than paternal education.

We now examine the contribution that educational circumstances at the family level have on the observed degree of educational mobility. First of all, we need to specify the vector of family characteristics (R) included in the Extended Measurement Model (5); we exploit all the relevant information about family characteristics (when the individual was 14 years old), which is contained in the Intergenerational Transmission of Poverty Module of the 2005 wave of EU-SILC. Specifically, apart from parental and maternal (log) years of education, we include in the extended model a gender indicator, the number of siblings, an indicator of intact family (living with both parents), the frequency of financial problems during childhood (categorical, from 1 to 5), and two indicators that take the value of 1 if the father/mother was unemployed or inactive; finally, we also include an index of family socio-economic

[11] In this country, there is a clear switch in the role of the two parents in the 1965-70 cohort: in fact, before, this cohort child's education is more attached to parental education, but maternal education later has the strongest effect until the end of the period.

status (ISEI)[12]. Detailed information about the variables included in the vector of family characteristics could be found in Di Paolo et al. (2010).

Figures 2a-2c illustrate the baseline mobility index for each country and birth cohort and five versions of the simulated index: namely, in the index *A*) we eliminate all the *k-1* cross products ($\hat{\gamma}_{f,m} \times \tilde{\psi}_{f,m}$), which means that we are hypothetically cutting the link between parental education and the entire set of family characteristics. The rest of the simulated indexes (*B*-*E*) enable the analysis of the following hypothetical situations: we consider which would be the degree of educational mobility *B*) with no statistical association between parental education and the frequency of financial problems in the family when the individual was 14 years old; or *C*) removing the statistical association between parental education and the number of siblings. Moreover, we consider *D*) the degree of educational mobility without any relationship between parental education and socio-economic status or, finally, *E*) cutting the potential correlation between parental and maternal education (in other words, the potential educational assortative mating). In what follows, we also describe the (relative) contribution of each of these elements to the total effect of family characteristics.

As an initial step for describing the role of the family in educational mobility, we compute the global impact of family characteristics on educational persistence[13]; the results obtained provide a general picture describing the total contribution of family characteristics on the observed persistence of educational attainment. The effect of removing the statistical association between parental years of schooling and educational circumstances at the family level is especially low in Nordic countries. In particular, the global effect of family characteristics clearly decreases with time for Finland and for Norway (less than 0.1 in the lasts cohorts) and is almost stable for Denmark and Sweden (0.1 for the former and 0.08 for the latter). On the contrary, the total effect of family characteristics is clearly higher for Southern countries, as in these countries, a significant component of the observed intergenerational persistence in educational attainment is represented by the contribution of family characteristics:

[12] The (international) socioeconomic status index (ISEI) is defined in terms of parental occupation, according to Ganzeboom et al. (1992); in order to obtain a proxy of "family" socio-economic status, we take the highest ISEI between the two parents. Note that, unfortunately, the Swedish data do not contain information about parental occupation or about the number of siblings. Moreover, for Greece and Portugal, the information about the frequency of financial problems during the childhood is not provided. For these countries, we specify the Extended Measurement Model with the rest of variables; therefore, because of this data limitation, the simulation results for Sweden, Greece and Portugal must be considered with caution.

[13] The impact of family characteristics on intergenerational persistence in educational attainment is computed as the difference between global observed persistence (1-baseline index) and the simulated persistence without the effect of educational circumstances at the family level (1-simulated index A).

specifically, it accounts for something less than 0.2 points for Greece, Italy and Spain and something more than the same value for Portugal. With respect to this last point, two findings for Continental European countries are somewhat unexpected: the impact of family characteristics on observed mobility is considerably high in Belgium (between 0.15 and 0.25) but is very low in the Netherlands (less than 0.15); this confirms that, in terms of educational attainment, the latter country appears to be a high-mobility country. The statistical association with family characteristics has also a small contribution to observed persistence in France; however, in this country, the effect of family characteristics increases to some extent in the last cohort. Moreover, the contribution of family characteristics to educational mobility tends to decrease over time in Austria (apart from the last two cohorts) and the Netherlands, indicating that in these countries, (as in Finland and in Norway) education transmission is less and less affected by familiar educational circumstances. On the contrary, for the rest of countries, the effect of educational circumstances at the family level remains almost constant over the period analysed (and increases in the case of Portugal).

In order to obtain a better insight into the link between family characteristics and intergenerational mobility, we now move to analysing the most important components of educational circumstances at the family level. First, the graphical results presented in Figures 2a-2c indicate that the frequency of financial problems during childhood (*B*) has no significant impact on educational mobility in Nordic and Continental countries (less than 10 percent of the total effect of family characteristics); however, the simulated mobility index (*B*) with no statistical association between parental education and the frequency of financial problems is slightly out of the confidence interval of the baseline index for Italy and for Spain, accounting for 10% of the estimated relationship among family characteristics and educational mobility. Unfortunately, the information about the frequency of financial problems is not available for Greece and Portugal; we expect that, particularly for these two Southern countries, this weak proxy for liquidity constraints[14] could have an important effect on educational mobility.

Second, the simulated mobility index (*C*) suggests that, in Nordic countries, the association between parental education and the number of siblings has a relatively low impact on educational persistence compared to other family characteristics (with the exception of Norway in the first four cohorts). For Continental countries, the presence

[14] This is a weak proxy because this variable is *i*) subjective, and *ii*) potentially affected by recall problems; indeed, it is often called "subjective financial well-being". Perhaps it is exactly for this reason that its effect on educational mobility is extremely low. In any case, its inclusion in the extended model is still interesting.

of siblings also has a very small contribution for Belgium and for the Netherlands (confirming that the latter country behaves in a similar way to Nordic countries); somewhat higher effects are found in the case of Austria, but for France, the correlation between the number of siblings and parental education represents a very important component of family characteristics (accounting for about 20-30% of the total effect for a relevant part of the analysed period). Moreover, for Southern countries, the effect of siblings seems to increase with time, approaching a proportion of the total effect of family characteristics of about 15 percent in the last cohorts.

Third, family socio-economic status (defined in terms of parental occupation) has a clear significant effect on educational persistence; that is, in general, the simulated mobility index (*D*), in which the existing statistical relationship between parental education and socio-economic status has been removed, exhibits higher levels of educational mobility. This would mean that an important component of the intergenerational persistence of educational attainment is related to the socio-economic status of the family. However, with respect to our countries' grouping (Nordic, Continental and Southern), the relative effect of socio-economic status on educational mobility shows a reverse ranking. Indeed, the relative socio-economic component is higher in Nordic countries because it generally accounts for about the 50% of the statistical association between parental education and family characteristics. An intermediate position is occupied by Continental countries, where socio-economic status represents something less than one half of the effect of family characteristics (apart from the case of Austria). However, the relative effect of family socio-economic status in educational persistence (with respect to overall family characteristics) is lower for Southern countries; in these countries, the statistical association between parental education and socio-economic status shows a proportion between 20 and 45 percent of the total effect of family characteristics.

Finally, from the simulation results, we can claim that a relevant circumstance for educational mobility is the presence of educational assortative mating; as explained above, an important component of the statistical association between parental schooling and children's achievements may be represented by the covariance between paternal and maternal education. Due to the mechanical of the mobility index proposed, the potential statistical relationship between the completed years of education of the two parents is implicitly considered as a family characteristic; this means that parental matching according to completed education could represent a (significant) component of the absolute degree of educational mobility. The evidence that the simulated index (*E*) is, in general, higher than the baseline indicates that *1*)

parental mating is assortative according to education and that *2*) this reinforces the degree of intergenerational persistence in educational attainment. Concretely, about 40% of the family characteristics component of educational persistence can be attributed to the strong correlation in human capital between the parents. Moreover, the relative effect of (parental) educational assortative mating is almost constant over time, with the exception of Denmark and Finland, where the relative contribution of parental matching in educational mobility seems to increase across the cohorts[15].

4. Conclusions

This paper adds some new evidence to the literature of intergenerational mobility; specifically, we explore the degree of educational mobility in 12 European countries and its evolution across eight birth cohorts, covering individuals born between 1940 and 1980. Exploiting the cross-country comparable information about individual and parental educational attainment in the 2005 wave of the EU-SILC, we have tried to fill the gap in comparative studies of intergenerational mobility (especially for southern countries). We used a new index of intergenerational mobility, which accounts for both absolute and relative changes in educational mobility. Moreover, the proposed index enables the consideration of the global degree of mobility as the weighted sum of mobility with respect to the parents; additionally, the statistical properties of the same index permit the analysis of the role of family characteristics on the observed intergenerational persistence of educational attainment. In other words, we treated family characteristics as "mediating factors" in the statistical association between parental and child's schooling.

Summarising the results, we show that educational mobility is higher in Nordic countries and lower in the Southern countries and that the Continental countries are situated in an intermediate position. Furthermore, educational mobility tends to increase in Southern countries and in some Continental countries, but it is almost stable in Nordic countries and in France; this is because the latter countries exhibit a very high level of mobility from the beginning of the period analysed, suggesting that there exists a sort of "ceiling" of intergenerational mobility. We have also found that mobility with respect to the father and mobility with respect to the mother converge to the same level for almost every country (except Italy and Portugal); this may be in part

[15] Note also that in the Swedish case, assortative mating accounts for almost the 100% of family characteristics effects on educational mobility; indeed, this arise from the lack of relevant information about family characteristics in the Sweden data (concretely, parental occupation and the number of siblings).

due to the reduction of the gender gap in educational attainment during the parents' generation, but we believe that the most relevant explanations for that convergence are the changing role of the mother within the family and the cognitive development of the child. Moreover, we expect potentially different results in the case of considering educational transmission for males and females.

Finally, we suggest that family characteristics account for a significant part of the observed educational persistence, mainly represented by the effect of socio-economic status and parental educational assortative mating. The significant correlation between family socio-economic status and parental education exacerbates the degree of intergenerational persistence because socio-economic status matters for the children's education. Moreover, parents are likely to match according to education, and this contributes to reinforce the intergenerational correlation of socio-economic status; that is, parental assortative mating acts as a family characteristic, mediating the relationship between parental and child's completed education. Therefore, gender differences and a more detailed investigation of the channels through which family characteristics affect mobility represent new and interesting topics, which will be the subject of future research on intergenerational mobility

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FIGURE 1a: MOBILITY INDEX — NORDIC COUNTRIES

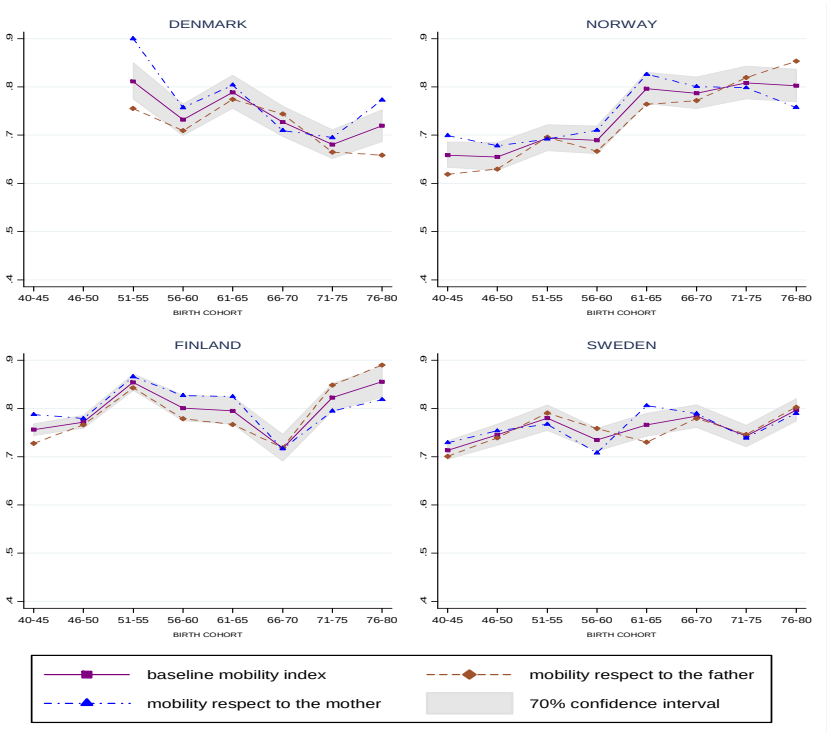

FIGURE 1b: MOBILITY INDEX — CONTINENTAL COUNTRIES

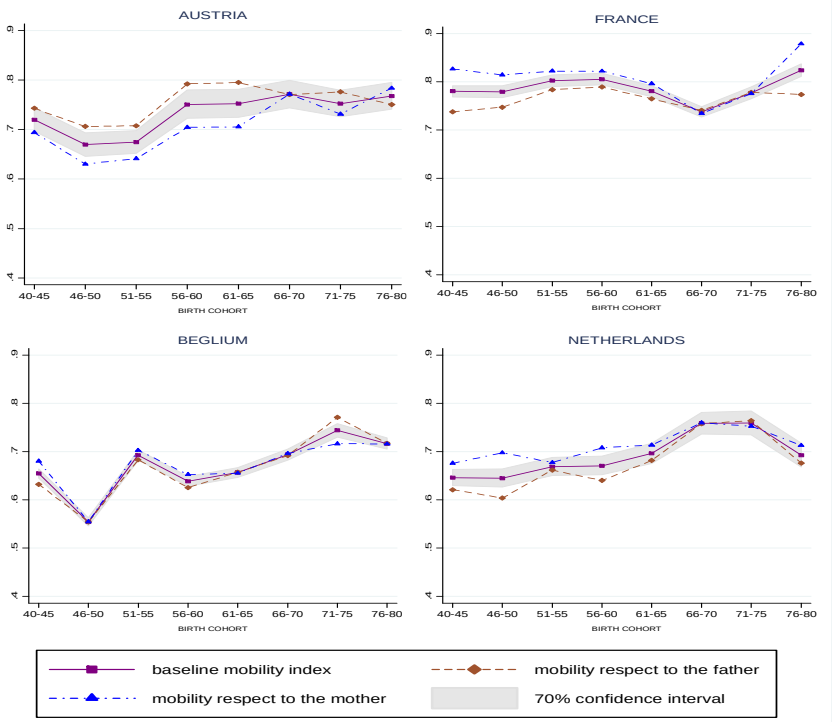

FIGURE 1c: MOBILITY INDEX — SOUTHERN COUNTRIES

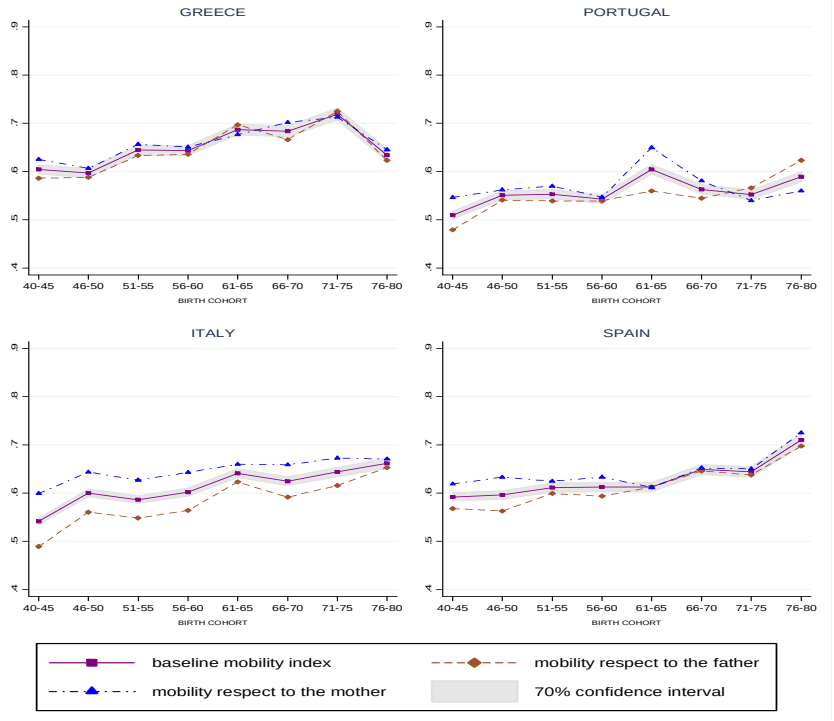

FIGURE 2a: SIMULATED MOBILITY INDEX — NORDIC COUNTRIES

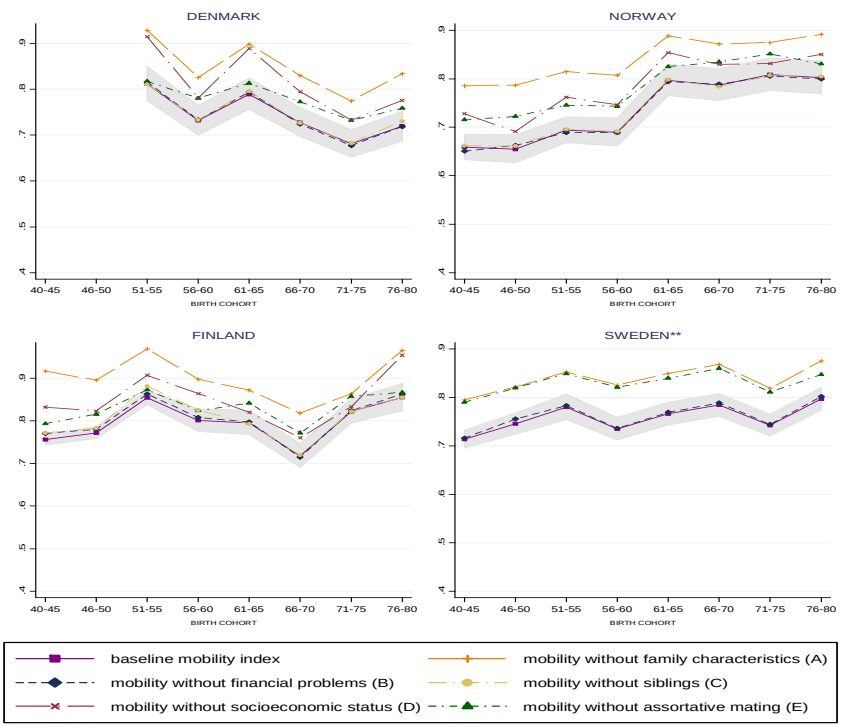

FIGURE 2b: SIMULATED MOBILITY INDEX — CONTINENTAL COUNTRIES

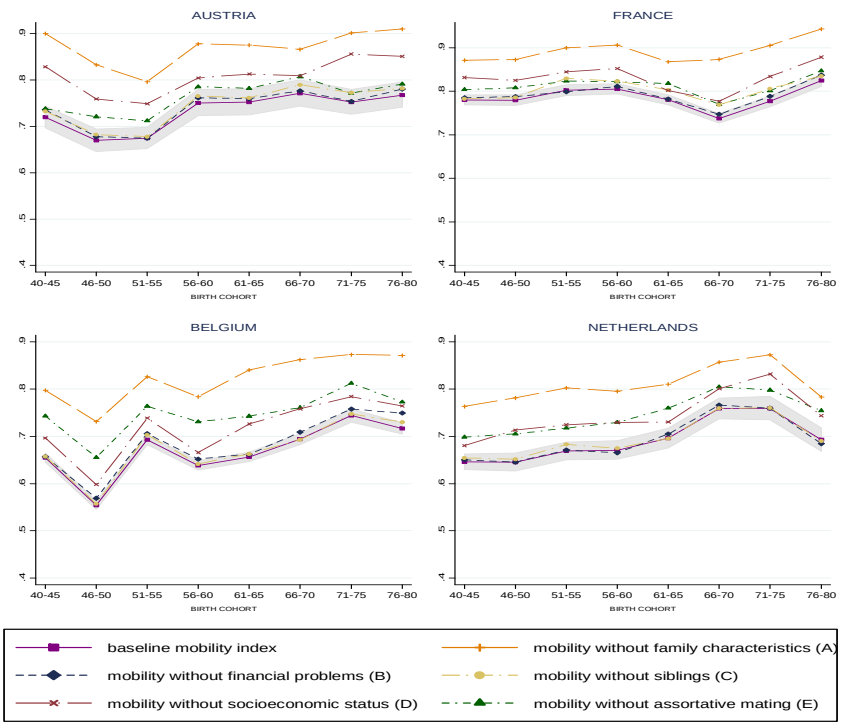

FIGURE 2c: SIMULATED MOBILITY INDEX — SOUTHERN COUNTRIES