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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 account 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.

JEL classification: J62, I21, I29, D13

Keywords: Educational Economics, Intergenerational Mobility, Europe, Birth Cohorts, Family

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1. Introduction

The existence of a 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 face extremely restricted life chances and will have difficulty achieving their complete economic potential. Even so, the optimal level of intergenerational mobility may not be the highest one — i.e. zero intergenerational correlation — because, from the efficiency perspective, this could imply a wrong allocation of individuals' talent in the economy. In fact, in a well-working market

economy, a given level of intergenerational persistence in income or education could be owed simply to positive return to human capital and/or to the genetic transmission of cognitive ability (Black & Devereux, 2010).

According to Piketty (2000), however, the degree of intergenerational persistence observed in the real world is in general higher than the efficient or the desired one, because of the presence of several types of market failures. Indeed, credit or liquidity constraints may prevent less advantaged families from realising the optimal investment in children's human capital, implying that able but poor children may face a ceiling in the development of their economic potential. This represents the main rationale for public policies to equalise educational opportunities through the provision and financing of education. Often, however, educational institutions fail to accomplish the objective of equalising educational opportunities, for example maintaining a stratified school design with early tracking decisions.[1] Finally, an excessive level of persistence could also be caused by other institutional inefficiencies, territorial segregation (through neighbourhood and peer effects), as well as by more complicated mechanisms of social interactions (i.e. social and/or cultural constraints).

The empirical research on intergenerational mobility has significantly expanded since the 1980s; a lot of effort has been dedicated to quantifying intergenerational persistence and to explaining its causes in positive terms but, to the best of our knowledge, there is no research that is concerned with the optimal level of persistence in a normative sense. 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.[2] On the other hand, the majority of the economic literature has usually been concerned with intergenerational persistence in earnings or income (Solon 1999, 2002, Corak 2004, Blanden 2009 and Black and Devereux 2010 provide extensive reviews about these topics). The economic literature, however, contains a small (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

[1] The empirical evidence suggests that early track separation reinforces the existing link between family background and child's final education attainment (see Hanushek & Wöβmann, 2006; Brunello & Checchi, 2007), and it has a detrimental effect on educational mobility (Bauer & Riphahn ,2006; Checchi & Flabbi, 2007).

[2] 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.

intergenerational socio-economic persistence (in income, but also in occupation, poverty and other outcomes).

The principal issue that has been considered in this literature is the extent to which intergenerational persistence in educational attainment is determined by genetic transmission. Quantifying the extent to which educational persistence is genetic represents an important empirical question which might be useful for the implementation (or even the suppression) of mobility-enhancing public policies. For this reason, many authors have tried to obtain an estimate of the intergenerational elasticity of years of schooling, uncontaminated by 'nature' or genetic effects (see inter alia Behrman & Rosenzweig, 2002; Sacerdote, 2002; Plug, 2004).[3] The evidences obtained in these studies are mixed, and the peculiarity of the surveys used means that the results cannot be easily generalised to other realities. This means that the relevance of genetic transmission is still an open question, and there is a need for additional work in this area. Even so, unfortunately, our data do not allow controlling for genetic effects; this implies that we are not able to present causal evidence on educational persistence. If, however, we assume that genetic effects are the same between countries and across time, we can reasonably consider that genetics is not a real problem for our comparative approach; that is, the measure of educational mobility that we present might still be valid (albeit with a descriptive interpretation).

In fact, other studies (like this one) are explicitly focused on the 'measurement' of educational mobility in a descriptive sense. 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

[3] The special feature of these studies is the use of special samples (twin parents or adoptees) that can rule out the effect of genetic ability. The other usual technique s consists in exploiting the exogenous variations in parental schooling produced by educational reforms (see Chevalier, 2004; Oreopoulus et al, 2006).

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 work by Checchi et al (2008), in which they analyse educational persistence across cohorts in Italy; they find that, although 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 between the measures of mobility considered. Even so, they suggest that northern European countries display the lowest persistence, whereas the records of greatest persistence are those of Latin American countries.

Given the research background on educational mobility, our contribution to the existing literature is threefold.[4] 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 variance of years of schooling[5] between parents' and children's generations (more specifically, the R-squared of the intergenerational regression). Note that the necessity for joint consideration of these two components in order to obtain a clear picture of mobility (especially for comparison purposes) has been observed by Hertz et al (2008) and Checchi et al (2008).

Second, we believe that the intergenerational transmission of education is a process that simultaneously involves both parents, albeit 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'

[4] The reader should consider in advance that we are only intending to provide additional positive evidence about the degree of educational mobility and its changes over time and place, without any concrete attempt to express normative judgments.

[5] We consider educational mobility in terms of the 'imputed' years of education, derived from the information on the highest completed level of education in terms of ISCED levels (Unesco, 1997); we will return to this point later.

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 gap in European evidence on intergenerational mobility from a comparative perspective (in particular for Central and Southern countries). In fact, we apply our methodology to twelve European countries[6] with homogeneous data from the 2005 wave of EU-SILC, which contain retrospective information about parental education and family characteristics at the age of fourteen. Moreover, by computing our standardised measure of intergenerational mobility separately for different birth cohorts (eight five-year birth cohorts), we are able to analyse consistently the temporal patterns of educational mobility in several European countries over a long time period (that is, for individuals born between 1940 and 1980).

Indeed, the analysis of time patterns has already captured the attention of many researchers on intergenerational socio-economic mobility (see, for example, Ermisch and Francesconi 2004, Mayer and Loopo 2005, Nicoletti and Ermisch 2007, and Lee and Solon 2009). This is because examining temporal changes and their comparison across countries enables the contemplation of how institutional changes affect intergenerational mobility. There are different institutions that may simultaneously affect intergenerational mobility (in income, but also in education). For example, the labour market, by determining in a broad sense 'the return to education', influences the incentives to invest more or less in a child's human capital. Moreover, the educational system can affect the cost of this investment by modifying the general availability and the quantity of educational resources.

The labour market and the educational system, however, are not the only institutions that may affect intergenerational mobility. As noted by many authors (for example, Esping-Andersen, 2004; Nicoletti & Ermisch, 2007), the family represents the other

[6] Namely: Denmark, Finland, Norway and Sweden (Nordic countries); Austria, Belgium, France and the Netherlands (Continental countries); Greece, Italy, Portugal and Spain (Southern countries). We found serious anomalies in the original EU-SILC data referring to parental level of education in the cases of Germany and the United Kingdom that prevented us from using them in our analyses. After we sought information about these anomalies from EUROSTAT, it was clear that the anomalies arose from problems in the original data gathering and codification and hence could not be solved subsequently. On the one hand, EU-SILC German data on parental level of education are affected by lack of homogeneity between the classifications used in East and West Germany. This causes an overrepresentation of the ISCED5 level, which may be verified by comparing original EU-SILC German data with European Social Survey data (2006 wave) and also with data drawn from the German Socio-Economic Panel (2003), as shown by Heineck and Riphahn (2007). On the other hand, data referring to the United Kingdom present a serious problem of severe overrepresentation of cases coded as ISCED0; this overrepresentation may be confirmed through a comparison with European Social Survey data (2006 wave).

important institution that exerts important effects on socio-economic persistence. Following to this intuition, 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. With a logic similar to that of the methodology in Blanden et al (2007),[7] we consider family characteristics as 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. For family characteristics, we use all the relevant information contained in the 2005 wave of the EU-SILC: namely (a) the number of siblings, (b) family structure, (c) the frequency of financial problems in the family and (d) parental labour status and familial socio-economic status (clearly related to parental education). Moreover, as explained in the next section, we implicitly consider as family characteristics (e) the potential parental assortative mating according to education. This means that we will be able to quantify the contribution of parental assortative mating (as for other family characteristics) on observed educational mobility. Therefore, in the next section, we first define our intergenerational mobility index, emphasising its descriptive properties. Later, we proceed to illustrate how this index enables the linking of family characteristics with intergenerational mobility.

With these purposes in mind, for the rest of the paper we proceed as follows: in section 2, we review relevant elements of previous research, highlighting how we complement the existing evidence with the present contribution. Section 3 is dedicated to the definition of the mobility index, an intuitive description of its properties, and the methodology for obtaining a linkage between family characteristics and educational mobility (which are fully detailed in the Methodological Annex). Section 4 contains the empirical results from

[7] The logic is similar but the idea behind it is different: they consider how education, ability, non-cognitive skills and labour market experience affect the intergenerational income transmission mechanism. They suggest that the association between these factors, parental income and individual earnings explain a significant part of intergenerational transmission; moreover, the temporal change of these relationships accounts for 80% of the decline in intergenerational mobility in the UK.

the baseline index and its temporal patterns (4.1) as well as from the simulation, which allows accounting for the effect of family characteristics (4.2). In section 5, we discuss the results, and section 6 concludes.

2. Empirical Methodology

Traditionally, much of the empirical research on socio-economic mobility has been centred on measuring the 'degree' of the intergenerational transmission of socio-economic status; focusing on education mobility, one may describe the statistical association between parental education and child outcomes by using probabilistic measures such as transition matrices (or derived indices) described in Checchi (2006) and adopted by Comi (2003), Chevalier et al (2007), and Heineck and Riphnahn (2009). A common alternative consists of the use of regression coefficients between the child's and the parents' years of completed schooling or correlation coefficients, which respectively represent a relative and an absolute or standardised measure of intergenerational educational persistence. In fact, as suggested by Hertz et al (2007) and Checchi et al (2008), the regression coefficient contains the ratio between the variances of the offspring's years of education and the parents' years of education; this means that an increase in the variance of parental education (relative to the variance of child's education) may distort the measure of mobility expressed in terms of intergenerational elasticity. That is, an increase (decrease) of the estimated intergenerational elasticity may only be the result of an increase (decrease) of the dispersion of children's schooling relative to the dispersion of parents' schooling. Indeed, the correlation coefficient represents an absolute or standardised measure of mobility because it is normalised with respect to relative changes in inequalities in education for the children's and the parents' generations.[8]

Nevertheless, as also noted by Checchi et al (2008), these measures of intergenerational mobility neglect the potential effect of parental 'assortative mating' on human capital. As mentioned above, a higher degree of parental matching according to education may strengthen the degree of educational transmission through the quality-quantity trade-off channels (better-educated parents have fewer children but invest more resources in their

[8] Moreover, Checchi et al (2008) propose an intuitive decomposition of the correlation coefficient, whose results are very appealing for the analysis of temporal changes because they might account for changes in composition effects and thus provide a more 'correct measure for analysing intergenerational transmission of education' (the marginal probability of child's education, conditional on that of the parents).

human capital). Regression or correlation coefficients (but also the transition matrices) are usually estimated, however, with respect to a single proxy of parental education (father's education, higher completed parental education, mean parental education, etc.), disregarding that (i) both parents 'transmit' education to the child, and (ii) the relation between paternal and maternal education may strengthen the degree of global persistence in educational attainment.

From the methodological perspective, we contribute to the intergenerational mobility literature by suggesting a new mobility index that takes three steps forward in the measurement of intergenerational mobility. First, we define the global degree of intergenerational mobility as the weighted sum of the degree of mobility computed with respect to the two parents separately. Second, our measure of intergenerational mobility simultaneously combines the absolute and the relative components of the intergenerational transmission process. Third, the proposed index enables us to examine the role of family characteristics as mediating factors in the intergenerational transmission process.

Specifically, the measure of intergenerational mobility proposed here consists in a generalisation of 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[9]

$$I = \frac{\hat{\sigma}^2_{(c-f)} + \hat{\sigma}^2_{(c-m)}}{\left(\hat{\sigma}^2_c + \hat{\sigma}^2_f\right) + \left(\hat{\sigma}^2_c + \hat{\sigma}^2_m\right)} = \underbrace{\frac{\hat{\sigma}^2_{(c-f)}}{\left(\hat{\sigma}^2_c + \hat{\sigma}^2_f\right)}}_{\text{child vs. father mobility}} \cdot \lambda_f + \underbrace{\frac{\hat{\sigma}^2_{(c-m)}}{\left(\hat{\sigma}^2_c + \hat{\sigma}^2_m\right)}}_{\text{child vs. mother mobility}} \cdot \lambda_m . \qquad (1)$$

According to the index proposed, in cases of perfect immobility ($I=0$), where the education of the father (mother) is completely transmitted to the child (i.e. the child replicates his/her parents), it follows that $\hat{\sigma}^2_{(c-f)} = \hat{\sigma}^2_c + \hat{\sigma}^2_f - 2\hat{\sigma}_{cf} = 0$ ($\hat{\sigma}^2_{(c-m)} = \hat{\sigma}^2_c + \hat{\sigma}^2_m - 2\hat{\sigma}_{cm} = 0$). In the opposite situation, if the statistical relationship between father's (mother's) and child's years of schooling is zero (i.e. the outcome of the child is not related to that of his/her parents), we obtain the case of perfect mobility ($I=1$), as it results that $\hat{\sigma}^2_{(c-f)} = \hat{\sigma}^2_c + \hat{\sigma}^2_f$ ($\hat{\sigma}^2_{(c-m)} = \hat{\sigma}^2_c + \hat{\sigma}^2_m$). That is, the mobility index proposed always takes a value between zero (perfect immobility) and one

[9] The exact derivation of this mobility index is detailed in the Methodological Annex.

(perfect mobility), respectively. Moreover, this mobility index allows decomposition of the global observed mobility between mobility with respect to paternal education, mobility with respect to maternal education, and their respective weights (λ_f and λ_m).

This additive 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. In extreme (and somewhat unrealistic) cases, children's education might be attached only to one parent's schooling; in any case, we could also capture this unusual situation by reporting each of the elements of the mobility index separately. Moreover, as explained later, defining mobility with respect to both parents offers the appealing possibility of capturing assortative mating in the parents' generation. Following Piketty (2000: p.48), if children's schooling is a function of the years of education of the two parents, the fact that fathers and mothers with similar levels of schooling tend to mate makes intergenerational (educational) mobility lower than it would be under random parental matching. That is, the stronger parental matching according to education the lower the degree of intergenerational mobility. In this context, with this mobility index we are offering a way to avoid computing the degree of intergenerational mobility only with respect to a single indicator of parental education background, and therefore neglecting the presence of parental assortative mating (which may imply an overestimation of intergenerational persistence).

Additionally, 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 dispersion (i.e. the variances) of educational attainment in both child's and parents' generations. As explained in detail in the Methodological Annex, the mobility index proposed here can be equivalently expressed as,

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

where $\hat{\beta}_f$ and $\hat{\beta}_m$ represent the intergenerational elasticity parameters obtained from two bivariate regressions that relate the logarithm of child's years of education with the logarithm of paternal and maternal years of education respectively, whereas R^2_f and R^2_m are the two R-squared obtained from each intergenerational regression and ω_u, ω_f and ω_m represent the weight of each component. In other words, this last reparameterisation allows

expression of 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 in terms of the intergenerational mobility of education: this would be especially true if the purpose of the analysis was cross-country comparison of temporal changes. Moreover, as also suggested by Black and Devereux (2010), both absolute and relative elements are informative about the 'size' of intergenerational mobility. With this measure, we try to reconcile and simultaneously combine these two elements in order to obtain a global (and more informative) measure of intergenerational mobility, which we consider an appealing property for comparative purposes. In fact, our mobility index would indicate a higher level of mobility when the explanatory power of paternal and/or maternal education decreases and when the intergenerational elasticity with respect to father's and/or mother's education decreases (with the respective weights that may also change over time and place).

Finally, apart from measuring intergenerational educational mobility and its different components, the index proposed here holds another interesting property that represents a further methodological contribution to the existing literature. In general, the degree to which the socio-economic status of a given generation is inherited from the previous one may be related to a wide set of elements, many of them observable. Among these observable elements, we can consider on the one hand 'institutional factors' (in a broad sense, i.e. the educational system and the labour market), and on the other, 'educational circumstances', mainly located within the other relevant institution: the family.[10] Focusing on the latter element, 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 a set of family characteristics during

[10] Unfortunately, we cannot analyse the effect of school-level educational circumstances, school quality, educational resources, neighbourhood and peer effects. This is because, in general, there are no retrospective data that also cover school variables; moreover, the information about where the individuals were living at the age of fourteen is not available in the EU-SILC database.

childhood (which act as determinants of individual schooling),[11] we can exploit the mobility index to assess the effect of family characteristics as mediating factors in the intergenerational transmission of education. Let us suppose that the data generation process for completed years of schooling can be represented by an Extended Measurement Model, which includes father's and mother's education as well as a vector *R* composed by *k* family characteristic during childhood; after the OLS estimation, this model takes the form

$$c_i = \tilde{\beta}_f \cdot f_i + \tilde{\beta}_m \cdot m_i + \tilde{\delta}' R_i + \tilde{u}_i . \qquad (3)$$

As we illustrate more specifically in the Annex, the mobility index in (1)-(2) can also be reformulated in terms of the parameters of the Extended Measurement Model, that is:

$$I = \left[\frac{(1-R_f^2)+(1-R_m^2)}{2} \right] \cdot \omega_1 + \left[1 - \tilde{\beta}_f - \tilde{\beta}_m \cdot \frac{\sum f_i \cdot m_i}{\sum f_i^2} - \tilde{\delta}' \cdot \left(\frac{\sum f_i \cdot R_i}{\sum f_i^2} \right) \right]^2 \omega_2 + \\ + \left[1 - \tilde{\beta}_m - \tilde{\beta}_f \cdot \frac{\sum f_i \cdot m_i}{\sum m_i^2} - \tilde{\delta}' \cdot \left(\frac{\sum m_i \cdot R_i}{\sum m_i^2} \right) \right]^2 \omega_3 \qquad (4)$$

Note that this specification of the mobility index allows us to explore how the link between parental education and the other family characteristics included in the Extended Model may potentially affect the observed educational persistence. We operationalise this methodology for the analysis of education mobility by formulating the following question: what would the degree of educational mobility have been in the hypothetical case of breaking the statistical association between parental education and the complete set of educational circumstances at the family level? This kind of empirical ceiling of the intergenerational mobility of schooling might be obtained by computing a simulated mobility index, where the components that capture the covariance between paternal and maternal education with family characteristics (the terms $\sum f_i \cdot R_i$ and $\sum m_i \cdot R_i$ respectively) are forced to be zero. In general, what we expect is a higher degree of mobility, as in some way the relationship between parental education family characteristics could reinforce the connection between parental background 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.

[11] Namely (a) family composition, (b) frequency of financial problems during childhood, (c) parental labour situation and occupation, and implicitly (d) educational assortative mating; see section 2.2 and Table 2 of the Appendix for details.

Even cutting the statistical connection between educational persistence and family characteristics (via parental education), however, we still expect some degree of intergenerational educational persistence; this is because the strength of the association between parental and child's schooling is also determined by important institutional elements (Solon, 2004; Hassler et al, 2007). In this sense, cross-country differences in this 'residual' persistence may arise from the extent of comprehensiveness of the educational system, from the age of initial tracking into different types of education (academic, vocational, etc.), or from other relevant features of the educational system. Nevertheless, changes in residual persistence may also be the result of differences in the labour market, related to the returns on human capital (i.e. the degree of skill bias in the productive technology, labour market regulation, segmentation, etc.). In a broad sense, we might interpret the residual persistence as the (net) institutional effects on educational mobility (also net of the potential interaction between institutional effects and family characteristics).[12]

Moreover, we can also check the extent to which each component of educational circumstances (significantly) contributes to the observed degree of educational persistence across generations. By removing separately each of the covariance components from the formula (4), it would be possible to analyse the impact of every element of family characteristics (contained in matrix *R*) on the observed educational mobility. In other words, we can check whether and how each element of family characteristics modifies the estimates of intergenerational persistence in the years of education. Note also that, according to the definition of the mobility index, educational assortative mating is implicitly considered among family characteristics, given that the term $\sum m_i \cdot f_i$ represents the statistical relationship between father's and mother's log years of schooling. This would mean that removing this element from (4), that is, supposing that there is no statistical association between parents' years of completed schooling, we should quantify the contribution of educational assortative mating to the observed degree of intergenerational persistence in educational attainment (an issue that, to the best of our knowledge, has only been considered by Güell et al 2007).

[12] Note that the estimated residual mobility could also be the result of unmeasured family characteristics and/or other elements acting as determinants of educational attainment; as in the case of genetic ability, if we assume that such elements are the same between countries and across time, the interpretation of the results might still be valid.

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 twelve 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 Southern countries. As noted above, we consider the 2005 wave because it contains retrospective information about family characteristics and parental background when the individual was fourteen years old, which is considered the crucial age for a child's educational process. This particular wave of the European Survey also allows splitting of the sample into eight sub-samples of five-year birth cohorts for each country.[13] 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 as for parents, consistently with the normal (country-specific) expected length of each ISCED level.[14]

3.1 Baseline Mobility Index: Levels, Temporal Patterns and the Role of Father and Mother

The analysis of the baseline mobility index, computed separately for each birth cohort[15] and for each country, can give us an impression of (i) the global degree of educational

[13] 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 observations 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 (maternal education in the first two cohorts is fixed for all observations to ISCED2); we preferred to exclude these two initial cohorts from the analysis rather than compute mobility only with respect to parental education.

[14] In Table 2, we report the detailed information about the conversion of ISCED levels into equivalent years of education; 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 aim 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 reasons of brevity, we neglect gender differences, which will be a subject of future research on this topic.

[15] As in Nicoletti and Ermisch (2007) and in Mayer and Loopo (2005) we have also tested a rolling specification, by progressively adding one year to each five-year birth cohort (1940-45, 1942-46 and so on); however, this specification does not modify the general results, nor does it affect the temporal patterns of the mobility index (it only artificially increases the number of points in which the mobility index is calculated).

persistence in Europe and (ii) how educational mobility has evolved over 40 years (that is, for individuals born between 1940 and 1980). Figure 1a-c represents the temporal evolution of the mobility index with the empirical 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 (apart from a slight decrease around the 1970s), which is probably because of 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 when compared with Nordic countries (apart from Greece, which shows rather 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 twelve European countries analysed. As also noted by Chevalier et al (2009), however, 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. As confirmation of this indication, the same happens with France (with initial mobility close to 0.8), and to a lesser extent Austria (starting with values around 0.7), where the evolution of educational mobility is roughly constant over the entire time span.[16] 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 at the beginning of the period.[17] Among the Nordic countries,

[16] Note that in the case of France we observe a moderate decrease in educational mobility from the 1956-60 cohort, but it increases again from 1966 to 1970, reaching its high initial levels. Moreover, in Austria there is a pronounced inflection between the 1940-45 cohort and the 1955-60 cohort, which is probably owed to a WWII effect on educational mobility; however, educational mobility is essentially stable up to the end of the period.

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

this common behaviour is only absent in the Norwegian case, where the initial mobility was 0.66 (lower than in the rest of the 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.[18] Focusing now on the Southern countries, we can see 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 and the Dutch cases (0.02 per cohort excluding the last one). The increase of educational mobility is not, however, so pronounced in the rest of the Southern countries; indeed, Portugal exhibits the lowest general degree of educational mobility, with a very reduced tendency towards 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 owed 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 paternal 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, the 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 than with respect to the mother, with an important exception in the case of Austria (where child's education is

[18] 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 simply be the result of the exclusion from the sample of those individuals who were still studying in the year of the survey (2005). In all likelihood, these individuals are enrolled in higher education, and dropping them from the sample may reduce the observed degree of mobility in this cohort; in fact, in order to avoid distorting the results, the mean rate of increase of 0.02 has been computed with respect to the first seven cohorts.

highly associated with maternal education). For many countries, however, 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 fall within the confidence interval of the mobility index: this is the case with Nordic countries (with the exception of Finland[19]), 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 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 owed 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 the child's education is more attached to paternal education that maternal education during the entire period; for Portugal, it seems that only at the end of the period does maternal education matter more than paternal education.

Having analysed the general results from the analysis of educational mobility and its temporal evolution, we now move to examining the effect of family characteristics on educational mobility. The results from the simulations described in section 3 (and detailed in the Methodological Annex) allow us to understand which part of the observed degree of educational mobility is accounted for by other family characteristics. In other words, we want to check to what extent family characteristics act as a mediating factor in the statistical relationship between parental and child education.

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

3.2 Simulation Results: Intergenerational Mobility and Family Characteristics

In this section, we examine the temporal patterns of the 'residual' persistence (the complement to one of the mobility simulated index I^* in the Annex, without any family characteristic), and 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 fourteen years old), which is contained in the Intergenerational Transmission of Poverty Module of the 2005 wave of EU-SILC. Specifically, apart from paternal and maternal (log) years of education, the explanatory variables included in the extended model are:

- 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)
- two indicators that take the value of one if the father/mother was not working
- the family socio-economic status index (ISEI).[20]

Detailed information about the variables included in the vector of family characteristics is contained in Table 3. Table 4 contains the baseline mobility index for each country and birth cohort and five versions of the simulated index:[21] namely, in index (A) we eliminate all the covariance components $\sum f_i \cdot R_i$ and $\sum m_i \cdot R_i$, 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 most influential elements of family characteristics (i.e. the simulated index I^{**} in the Annex): 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 fourteen years old; or (C) removing the statistical

[20] The (international) socio-economic 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, information about the frequency of financial problems during childhood is not provided. For these countries, we specify the Extended Measurement Model with the rest of the variables; therefore, because of this data limitation, the simulation results for Sweden, Greece and Portugal must be treated with caution.

[21] The results from the estimation of the EMM are not shown for reasons of brevity; nor are the results from the auxiliary regression used to compute the covariance components in (4); this is because actually we have (8 cohorts)×(12 countries) = 96 regressions for eq. (3) and 2×7×8×12 = 1344 bivariate regressions to compute the covariance components. Reporting this huge number of results is unfeasible, but they are available upon request from the authors.

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 paternal and maternal education (in other words, the potential educational assortative mating, or I^{***} in the Annex).[22] In what follows, we also describe the (relative) contribution of each of these elements to the total effect of family characteristics. The same information can also be inspected in the graphic representation in Figure 2a-c for the three groups of European countries, respectively.

The analysis of residual educational persistence (the complement to one of the simulated mobility index (A)) represents the degree of intergenerational persistence once accounting for the total contribution of family characteristics. This indicates, in a broad sense, the net effect of the labour market and educational institutions in generating persistence in educational attainment. Such effects appear to be increasing in the case of Denmark and Finland, indicating that in these two Nordic countries, the (independent) role of institutions seems to increase with the passage of time. For the rest of the countries, it decreases (with the exception of France and Italy, which show more stable values) but it never approaches the value of zero, suggesting that institutions always play a role in intergenerational persistence in some way. In fact, residual mobility decreases to the value of 0.1 for Norway, Sweden, Austria, Belgium, France, and, to a lesser extent, for Greece. Nevertheless, it remains higher for Italy, Portugal and Spain. Note that residual mobility is also higher for the Netherlands, suggesting that this country is highly mobile, but this result is mainly guaranteed by the role of institutions.

As an initial step in describing the role of the family in educational mobility, we compute the global impact of family characteristics on educational persistence;[23] the results obtained provide a general picture describing the total contribution of family characteristics to 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

[22] The first simulation allows for comparing changes in the degree of 'residual mobility' across countries and cohorts. Moreover, we only report the results from selected simulations because financial problems, siblings, socio-economic status and assortative mating are the only factors that significantly affect educational mobility (that is, we found zero effect of the indicators for gender and parental working activity). Nevertheless, detailed decompositions and estimation results are not reported here but are available upon request from the authors.

[23] 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).

last cohorts) and is almost stable for Denmark and Sweden (0.1 for the former and 0.08 for the latter). On the other hand, 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: specifically, it accounts for something under 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 higher in Belgium (between 0.15 and 0.25) than in the rest of Continental countries. In addition, it is very low in the Netherlands (always less than 0.15); this confirms that, in terms of educational attainment, the latter country appears to be more similar to Nordic countries in terms of educational opportunities (i.e. high mobility rate, and low impact of family characteristics). The statistical association between parental education and family characteristics also makes 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 other hand, for the rest of the 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 Figure 2a-c 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% 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, 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[24] 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 with other family characteristics (with the exception of Norway in the first four cohorts). For Continental countries, the presence of siblings also represents a very small contribution for Belgium and for the Netherlands; 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 to 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% 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 father's and mother's education and socio-economic status has been removed, exhibits higher levels of educational mobility. This means that an important component of the intergenerational persistence of educational attainment is related to the socio-economic status of the family. With respect to our countries' grouping (Nordic, Continental and Southern), however, 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 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 half of the effect of family characteristics (apart from the case of Austria). The relative effect of family socio-economic status in educational persistence (with respect to overall family characteristics) is lower for Southern countries, however; in these countries, the statistical association between parental education and socio-economic status shows a proportion between 20 and 45% of the total effect of family characteristics.

[24] 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.

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. Owing to the mechanics 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.[25]

4. Discussion of the Results

In this section, we try to analyse the obtained results concerning the degree of intergenerational mobility in educational attainment and its evolution across eight birth cohorts (1940-1980) in the selected European countries. Confirming the previous findings, we find that Nordic European countries display higher levels of mobility than the other countries (as found, in general, by Chevalier et al 2009 and by Hertz et al 2008). Unexpectedly, our study also reports very high levels of educational mobility for France, especially at the beginning of the period.[26] Moreover, the remaining Continental countries

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

[26] Comi (2003) ranked France in an intermediate position in terms of educational mobility. The difference with respect to our results might be owed to (i) difference in the measure of intergenerational mobility (she used two mobility indexes derived from the transition matrix) or to (ii*)* difference in sample selection (ECHP 1994-1998, using the sub-sample of individuals whose parents are in the sample as well). We believe that, in all likelihood, the sample selected by Comi reflects the cohorts where the degree of educational mobility tends to decrease in our study (i.e. individuals born around 1970).

are situated in an intermediate position, although within this group Belgium exhibits somewhat lower levels of mobility than Austria and the Netherlands. Finally, as commonly found in the literature, Southern countries have the highest level of persistence in educational attainment.

We claim that this heterogeneous picture of educational mobility in Europe is principally the product of differences in the educational systems and the amount of public expenditure on education. Indeed, we show that Southern countries have a lower level of mobility, which is probably the result of the delayed implementation of compulsory school reforms, compared with Continental and Nordic countries (see Fort 2006 for a good review of educational reforms in Europe). Moreover, historically, the former countries invested substantially fewer public resources in education, which may also have constrained the degree of intergenerational mobility in educational attainment. Additionally, Nordic countries might display the highest level of mobility, as these countries were pioneers in introducing a comprehensive structure of secondary education; in fact, comprehensive secondary education considerably reduces the statistical association between child's schooling and parental background (that is, a ceteris paribus increase in educational mobility). In order to explain fully the higher level of mobility in Nordic countries, however, as suggested by Hassler et al (2007), we might also consider the higher level of wage compression and labour market flexibility in these countries with respect to Southern and (to a lesser extent) Continental countries, which may translate into higher educational mobility.

With respect to temporal patterns, we report a general increase of educational mobility during the 40 years considered: nevertheless, the tendency is not homogeneous and mainly depends on the starting-point (that is, the degree of mobility reported for the first cohort). Indeed, the rate of increase of educational mobility is higher for those countries with the lowest level of mobility in the first birth cohort (1940-1945); furthermore, it remains almost stable over time for those countries with very high initial mobility (Nordic countries, except Norway, and France).

The most important message of the evidence on the temporal patterns is that there is a sort of ceiling of educational mobility; that is, in countries where the degree of educational mobility was already very high at the beginning of the period, mobility remains stable or even decreases. This means that, to some extent, educational attainment is always related to parental background, regardless of the design of the educational system or the amount of public expenditure on education. We must also emphasise the significant improvements in

educational mobility experienced by many Southern and Continental countries during the period analysed. For the latter, we observe a clear tendency of convergence to the levels of mobility of the Nordic countries. For Southern countries, however, the complete convergence is still very distant and it is not completely achieved even at the end of the period. Even so, we believe that by using data referring to a more recent period we may have observed a further reduction of the distance between Southern and Nordic countries in terms of educational mobility.[27]

Regarding the separate contributions of fathers and mothers, we observe that for Nordic countries, Belgium and Greece, there is no statistical distinction between the two. On the contrary, for the rest of the countries, individual education is more attached to paternal education than to maternal education, with the exception of Austria, where we find the opposite result. We obtain very interesting evidence, however, that at a given point in time (depending on the country) the degree of educational mobility with respect to each parent converges to the same level. Even so, the general message is that considering only the intergenerational elasticity with respect to the father (common practice in the empirical literature) may distort, to some extent, conclusions about the degree of intergenerational persistence of socio-economic status.

This result may be in part related to the reduction in the gender gap in educational attainment in the parents' generation but we also observe a convergence between the degree of mobility with respect to fathers and mothers in countries where the mean gap in educational attainment between the two parents persists (namely France, the Netherlands, Portugal and Spain).[28] Therefore, to explain the convergence of fathers and mothers in the contribution to total mobility, we might search for other explanations: an interesting possibility is the changing role of mothers in the family and in the cognitive development of the child, which is also related to the increasing participation of women in the labour market. Note, however, that we carried out the analysis neglecting gender differences; that is, we computed the mobility index for the overall sample, including both males and females. Perhaps by considering males and females in a separate fashion, we would find more evidence on the role of fathers and mothers in educational mobility (an interesting issue for future research, not investigated here for reasons of space).

[27] Nevertheless, we must also stress the fact that for Italy and Portugal we find that the temporal patterns of educational mobility are roughly stable (especially in Italy at the end of the period).
[28] The results are not shown here but are available upon request from the authors.

Finally, we find substantial effects of family characteristics on the degree of intergenerational persistence in educational attainment; however, this effect is not the same for all the countries, with lower effects recorded for Nordic countries, France and the Netherlands. Between the components of family characteristics, which exert some effect, we find that the effect of financial problems is generally low (perhaps owing to the subjective nature of the variable); moreover, the effect of the number of siblings on educational mobility also seems to be small. Nevertheless, our results suggest that family socio-economic status and parental assortative mating according to education have significant effects on educational mobility, which are also likely to remain constant over time. As is usual when OLS is applied, the interpretation of these results in causal terms requires the independence of the explanatory variables of the Extended Measurement Model (eq. 3) and the random disturbances. If this hypothesis is not accomplished biased estimations will be obtained.[29] In any case, if we assume that the role of the unobservable is constant over time and/or among countries, our results are still informative at least in a descriptive sense.

In general, the obtained evidence indicates that understanding the role of family characteristics in 'mediating' the relationship between parental education and children's schooling is crucial for the analysis of educational mobility. This is because (i) parental education is statistically associated with other family characteristics and (ii) those family characteristics operate (even if not in a causal sense) as a determinant of children's educational attainment. Therefore, especially in countries with stratified educational systems, family characteristics represent 'educational circumstances', or, more specifically, elements that influence educational attainment but are out of the control (or responsibility) of the individuals (children). This means that policies aimed at reducing the degree of intergenerational persistence of education, in order to achieve equality of opportunity, may also be directed at cutting the link between family characteristics and educational attainment. Once again, we believe that the most effective way of reaching a significant increase in educational mobility is through the introduction of a comprehensive secondary education system that is compulsory until the age of eighteen. Indeed, this kind of educational policy has been implemented in some European countries and is part of the educational policy agendas in many others.

[29] The EU-SILC database does not contain any valid instrument to apply IV methods to correct the potential endogeneity bias, nor are we allowed to use panel structure of the survey in order to deal with unobserved heterogeneity, given that the variables used in the analysis (those contained in the Intergenerational Transmission of Poverty Module) do not vary between waves.

5. Conclusions

This paper adds some new evidence to the literature of intergenerational mobility; specifically, we explored the degree of educational mobility in twelve 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 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 schooling.

In sum, we showed 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, with the unexpectedly good performance of France. 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 is 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 in part be owed 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 when educational transmission for males and females is considered separately.

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 mate according to education, and this contributes to reinforcing the intergenerational correlation of socio-economic status; that is, parental assortative mating acts as a family characteristic, mediating the relationship between parents' 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.

METHODOLIGICAL ANNEX

Definition of the mobility index

The index is defined in the following way:

$$(1)\quad I = \frac{\hat{\sigma}^2_{(c-f)} + \hat{\sigma}^2_{(c-m)}}{(\hat{\sigma}^2_c + \hat{\sigma}^2_f) + (\hat{\sigma}^2_c + \hat{\sigma}^2_m)} = \lambda_1 \cdot \frac{\hat{\sigma}^2_{(c-f)}}{(\hat{\sigma}^2_c + \hat{\sigma}^2_f)} + \lambda_2 \cdot \frac{\hat{\sigma}^2_{(c-m)}}{(\hat{\sigma}^2_c + \hat{\sigma}^2_m)} =$$

$$= \lambda_1 \cdot (\textit{Child vs father mobility index}) + \lambda_2 \cdot (\textit{Child vs mother mobility index})$$

$$(2)\quad \lambda_1 = \left(\frac{\hat{\sigma}^2_c + \hat{\sigma}^2_f}{2 \cdot \hat{\sigma}^2_c + \hat{\sigma}^2_f + \hat{\sigma}^2_m} \right)$$

$$(3)\quad \lambda_2 = \left(\frac{\hat{\sigma}^2_c + \hat{\sigma}^2_m}{2 \cdot \hat{\sigma}^2_c + \hat{\sigma}^2_f + \hat{\sigma}^2_m} \right)$$

$$(4)\quad \lambda_1 + \lambda_2 = 1$$

where:

$$(5)\quad \hat{\sigma}^2_c = \frac{1}{N-1} \sum c_i^2$$

$$(6)\quad \hat{\sigma}^2_f = \frac{1}{N-1} \sum f_i^2$$

$$(7)\quad \hat{\sigma}^2_m = \frac{1}{N-1} \sum m_i^2$$

$$(8)\quad \hat{\sigma}^2_{(c-f)} = \frac{1}{N-1} \sum (c_i - f_i)^2$$

$$(9)\quad \hat{\sigma}^2_{(c-m)} = \frac{1}{N-1} \sum (c_i - m_i)^2$$

and c, f, m represent the log years of schooling of child, father and mother; for convenience, all the variables are expressed in deviations from the population mean.

Note that the mobility index *I* can be represented in an equivalent form, that is:

$$I = \frac{\sum (c_i - f_i)^2 + \sum (c_i - m_i)^2}{\sum c_i^2 + \sum f_i^2 + \sum c_i^2 + \sum m_i^2}$$

This alternative specification enables us to prove that the intergenerational mobility index *I* will be always included in the interval (0, 1). First, let us suppose that the father and the mother share the same educational level: if the child replicates the educational level of the parents, the value of the index is zero, which is the case of perfect immobility. In fact, in this case we have:

$$I = \frac{\sum (c_i - f_i)^2 + \sum (c_i - m_i)^2}{\sum c_i^2 + \sum f_i^2 + \sum c_i^2 + \sum m_i^2} = 0$$

because, by definition, both elements of the numerator are equal to zero. Second, on the opposite side, the maximum value that *I* can reach is one, which represents the situation of perfect mobility. This happens because, with simple algebra, the numerator of the index can also be expressed:

$$I = \frac{\sum (c_i - f_i)^2 + \sum (c_i - m_i)^2}{\sum c_i^2 + \sum f_i^2 + \sum c_i^2 + \sum m_i^2} = \frac{\sum c_i^2 + \sum f_i^2 - 2\sum c_i f_i + \sum c_i^2 + \sum m_i^2 - 2\sum c_i m_i}{\sum c_i^2 + \sum f_i^2 + \sum c_i^2 + \sum m_i^2}$$

Indeed, if the covariance between child's and parents' years of education is zero (i.e. the outcome of the children is independent from that of his/her parents), the index takes the value of one, because in this case we have $\sum c_i f_i = 0$ and $\sum c_i m_i = 0$; therefore, the mobility index is equal to:

$$I = \frac{\sum (c_i - f_i)^2 + \sum (c_i - m_i)^2}{\sum c_i^2 + \sum f_i^2 + \sum c_i^2 + \sum m_i^2} = \frac{\sum c_i^2 + \sum f_i^2 + \sum c_i^2 + \sum m_i^2}{\sum c_i^2 + \sum f_i^2 + \sum c_i^2 + \sum m_i^2} = 1.$$

Note also that the proposed index expresses intergenerational mobility as a weighted mean of the degree mobility with respect to each parent. This means that, given the additive decomposability of the expression in (1), the proposed index also enables the analysis of intergenerational mobility with respect to the two parents separately; we can therefore examine (1) if individual's schooling is more (or only)

attached to the educational background of the father or to that of the mother, and (2) whether the contribution of each parent to intergenerational mobility changes according to time and place.

Reparameterisation of the mobility index

The mobility index *I* can also be represented in terms of the parameters of the two intergenerational persistence regression models, which link the child's log years of schooling[30] to the log years of schooling of the two parents, that is

$c_i = \hat{\beta}_f \cdot f_i + \hat{\varepsilon}_{fi}$: children vs. father intergenerational regression

$c_i = \hat{\beta}_m \cdot m_i + \hat{\varepsilon}_{mi}$: children vs. mother intergenerational regression

Using algebra, the mobility index *I* can be expressed in the following way:

$$(10) \quad I = \left[\frac{(1-R_f^2)+(1-R_m^2)}{2} \right] \cdot \omega_1 + (1-\hat{\beta}_f)^2 \cdot \omega_2 + (1-\hat{\beta}_m)^2 \cdot \omega_3$$

$$(11) \quad \omega_1 = \frac{2 \cdot \hat{\sigma}_c^2}{(\hat{\sigma}_c^2 + \hat{\sigma}_f^2) + (\hat{\sigma}_c^2 + \hat{\sigma}_m^2)}$$

$$(12) \quad \omega_2 = \frac{\hat{\sigma}_f^2}{(\hat{\sigma}_c^2 + \hat{\sigma}_f^2) + (\hat{\sigma}_c^2 + \hat{\sigma}_m^2)}$$

$$(13) \quad \omega_3 = \frac{\hat{\sigma}_m^2}{(\hat{\sigma}_c^2 + \hat{\sigma}_f^2) + (\hat{\sigma}_c^2 + \hat{\sigma}_m^2)}$$

$$(14) \quad \omega_1 + \omega_2 + \omega_3 = 1$$

where

$$(15) \quad R_f^2 \text{ is the } R^2 \text{ of the OLS regression} : c_i = \hat{\beta}_f \cdot f_i + \hat{\varepsilon}_{fi}$$

$$(16) \quad R_m^2 \text{ is the } R^2 \text{ of the OLS regression} : c_i = \hat{\beta}_m \cdot m_i + \hat{\varepsilon}_{mi}$$

This reparameterisation shows that the underlying definition of intergenerational mobility expressed by *I* captures both relative and absolute changes in intergenerational persistence, that is, the intergenerational elasticity parameters (the betas) and the R-squared from the two intergenerational regressions respectively. As equation (10) shows, the mobility index increases

[30] Note that the betas obtained from these regressions, where the dependent as well as the explanatory variables are expressed in terms of deviation from the respective means, are exactly the same as those that can be obtained from the OLS regressions with the original level variables plus an intercept term.

when the explanatory power paternal education R_f^2 and/or maternal education R_m^2 in the bivariate intergenerational regressions decrease. Also, the mobility index increases when the elasticity between father's education and child's education $\hat{\beta}_f$ decreases and/or when the elasticity between mother's education and children's education $\hat{\beta}_m$ decreases. Finally, note also that the contribution of relative and absolute mobility to the value of the proposed index depends on the weight attached to each component.

Intergenerational mobility and family characteristics

Another appealing property of our mobility index is that it enables us to link the degree of intergenerational mobility to other determinants of individuals' schooling — i.e. family characteristics other than parental education. Let us consider an Extended Measurement Model (EMM) for the log individual's schooling that includes both father's and mother's education as explanatory variables, as well as a vector of other family characteristics (*R*) composed of *k* elements; that is:

(17) $c_i = \tilde{\beta}_f \cdot f_i + \tilde{\beta}_m \cdot m_i + \tilde{\delta}' R_i + \tilde{u}_i$

Multiplying (17) by f_i, dividing by f_i^2 and summing over the *i* we obtain[31]:

(18) $$\frac{\sum f_i \cdot c_i}{\sum f_i^2} = \tilde{\beta}_f + \tilde{\beta}_m \cdot \frac{\sum f_i \cdot m_i}{\sum f_i^2} + \tilde{\delta}' \left\{ \frac{\sum f_i \cdot R_i}{\sum f_i^2} \right\}$$

It should be noted that $\hat{\beta}_f$ in equation (15) is the left-hand side of equation (18), so:

(19) $$\hat{\beta}_f = \tilde{\beta}_f + \tilde{\beta}_m \cdot \frac{\sum f_i \cdot m_i}{\sum f_i^2} + \tilde{\delta}' \left\{ \frac{\sum f_i \cdot R_i}{\sum f_i^2} \right\}$$

In a similar way we can obtain:

(20) $$\hat{\beta}_m = \tilde{\beta}_m + \tilde{\beta}_f \cdot \frac{\sum f_i \cdot m_i}{\sum m_i^2} + \tilde{\delta}' \left\{ \frac{\sum m_i \cdot R_i}{\sum m_i^2} \right\}$$

Finally, substituting (19) and (20) in (10) the mobility index *I* can be expressed as:

[31] The last term $\sum f_i \tilde{u}_i / \sum f_i^2$ cancels out from (18), given the mechanical orthogonality between the OLS residuals and the explanatory variables included in the model.

$$(21)\quad I=\left[\frac{(1-R_f^2)+(1-R_m^2)}{2}\right]\cdot\omega_1+\left[1-\tilde{\beta}_f-\tilde{\beta}_m\cdot\frac{\sum f_i\cdot m_i}{\sum f_i^2}-\tilde{\delta}'\left(\frac{\sum f_i\cdot R_i}{\sum f_i^2}\right)\right]^2\omega_2+$$

$$+\left[1-\tilde{\beta}_m-\tilde{\beta}_f\cdot\frac{\sum f_i\cdot m_i}{\sum m_i^2}-\tilde{\delta}'\left(\frac{\sum m_i\cdot R_i}{\sum m_i^2}\right)\right]^2\omega_3=$$

$$=\left[\frac{(1-R_f^2)+(1-R_m^2)}{2}\right]\cdot\omega_1+$$

$$+\left[1-\tilde{\beta}_f-\tilde{\beta}_m\cdot\frac{\sum f_i\cdot m_i}{\sum f_i^2}-\left(\tilde{\delta}_1\cdot\frac{\sum f_i\cdot R_{1i}}{\sum f_i^2}+\cdots+\tilde{\delta}_k\cdot\frac{\sum f_i\cdot R_{ki}}{\sum f_i^2}\right)\right]^2\omega_2+$$

$$+\left[1-\tilde{\beta}_m-\tilde{\beta}_f\cdot\frac{\sum f_i\cdot m_i}{\sum m_i^2}-\left(\tilde{\delta}_1\cdot\frac{\sum m_i\cdot R_{1i}}{\sum m_i^2}+\cdots+\tilde{\delta}_k\cdot\frac{\sum m_i\cdot R_{ki}}{\sum m_i^2}\right)\right]\omega_3$$

The last expression enables us to establish a direct link between the degree of intergenerational mobility estimated by *I* with the existing statistical relationship between parental education and other family characteristics. In other words, we are able to analyse the role of family characteristics as mediating factors in the intergenerational transmission process. In fact, if the estimated coefficient vector $\tilde{\delta}$ is positive, the degree of observed mobility increases with the covariance between paternal and maternal education with the variables included in the vector *R* (which are captured by the terms $\sum f_i\cdot R_i$ and $\sum m_i\cdot R_i$ respectively) and vice versa. Moreover, the degree of intergenerational mobility also depends negatively on parental educational assortative mating ($\sum m_i\cdot f_i$), which means that the intergenerational persistence moves in the same direction as the association between the educational background of the two parents.

This result implies that we can construct a counterfactual mobility index, obtained by forcing the covariance between parental education and other family characteristics to be zero. This can be done by suppressing from the expression (21) the relevant component of the covariance matrixes $\sum f_i\cdot R_i$ and $\sum m_i\cdot R_i$ — e.g. zero statistical association between parental education and family characteristics. More specifically, the impact of the correlation between paternal and maternal education with the whole set of family characteristics (i.e. the global effect of

family characteristics on observed mobility) is represented by the difference between the baseline index and the following simulated mobility index

$$(22)\quad I^{*}=\left[\frac{(1-R_f^2)+(1-R_m^2)}{2}\right]\cdot\omega_1+\left[1-\tilde{\beta}_f-\tilde{\beta}_m\cdot\frac{\sum f_i\cdot m_i}{\sum f_i^{\,2}}\right]^2\omega_2+$$
$$+\left[1-\tilde{\beta}_m-\tilde{\beta}_f\cdot\frac{\sum f_i\cdot m_i}{\sum m_i^2}\right]^2\cdot\omega_3 \quad ,$$

where the covariance between family characteristics and father's and mother's education is forced to be zero.

In the same fashion, the mobility index proposed here also enables the analysis of each component of family characteristics separately. For example, if we are interested in quantifying the impact of the *j* element of the vector of family characteristic *R*, we simply have to compute the counterfactual mobility index in which the covariance between R_j and paternal and maternal (respectively) education is equal to zero:

$$(23)\quad I^{**}=\left[\frac{(1-R_f^2)+(1-R_m^2)}{2}\right]\cdot\omega_1+$$
$$+\left[1-\tilde{\beta}_f-\tilde{\beta}_m\cdot\frac{\sum f_i\cdot m_i}{\sum f_i^{\,2}}-\left(\tilde{\delta}_1\cdot\frac{\sum f_i\cdot R_{1i}}{\sum f_i^{\,2}}+\cdots+\tilde{\delta}_{j-1}\cdot\frac{\sum f_i\cdot R_{j-1i}}{\sum f_i^{\,2}}+\tilde{\delta}_{j+1}\cdot\frac{\sum f_i\cdot R_{j+1i}}{\sum f_i^{\,2}}+\cdots+\tilde{\delta}_k\cdot\frac{\sum f_i\cdot R_{ki}}{\sum f_i^{\,2}}\right)\right]^2\omega_2+$$
$$+\left[1-\tilde{\beta}_m-\tilde{\beta}_f\cdot\frac{\sum f_i\cdot m_i}{\sum m_i^2}-\left(\tilde{\delta}_1\cdot\frac{\sum m_i\cdot R_i}{\sum m_i^2}+\cdots+\tilde{\delta}_{j-1}\cdot\frac{\sum m_i\cdot R_{j-1i}}{\sum m_i^2}+\tilde{\delta}_{j+1}\cdot\frac{\sum m_i\cdot R_{j+1i}}{\sum m_i^2}+\cdots+\tilde{\delta}_k\cdot\frac{\sum m_i\cdot R_{ki}}{\sum m_i^2}\right)\right]\omega_3$$

.

Finally, it is possible to analyse the degree of intergenerational mobility in the hypothetical situation of no relationship between father's and mother's schooling, that is, without parental assortative mating. In some way, the mechanics of our mobility index imply that the correlation between father's and mother's education can be taken as another intervening element in the intergenerational transmission process; therefore, the impact of parental assortative mating can be obtained by computing

$$(24)\quad I^{***} = \left[\frac{(1-R_f^2)+(1-R_m^2)}{2}\right]\cdot\omega_1 + \left[1-\tilde{\beta}_f - \tilde{\delta}'\left(\frac{\sum f_i \cdot R_i}{\sum f_i^{\,2}}\right)\right]^2 \omega_2 + \left[1-\tilde{\beta}_m - \tilde{\delta}'\left(\frac{\sum m_i \cdot R_i}{\sum m_i^2}\right)\right]^2 \cdot\omega_3 ,$$

which corresponds to the baseline index expressed as in (21), except that the covariance term between the years of schooling completed by the two parents is equal to zero. In a nutshell, the proposed mobility index allows investigation of the role of family characteristics and parental assortative mating as mediating factors in the intergenerational transmission of educational attainments.

Distributional considerations

Given the mobility index as defined in equation (1), previously detailed,

$$I = \frac{\hat{\sigma}^2_{(c-f)} + \hat{\sigma}^2_{(c-m)}}{(\hat{\sigma}^2_c + \hat{\sigma}^2_f) + (\hat{\sigma}^2_c + \hat{\sigma}^2_m)},$$

and given that the statistics $\frac{\hat{\sigma}^2_{(c-f)}}{\sigma^2_{(c-f)}}$, $\frac{\hat{\sigma}^2_{(c-m)}}{\sigma^2_{(c-m)}}$, $\frac{\hat{\sigma}^2_c}{\sigma^2_c}$ and $\frac{\hat{\sigma}^2_f}{\sigma^2_f}$ follow χ^2 distributions divided by the corresponding number of degree of freedom, the proposed index holds a well-defined empirical distribution. In the present application, the empirical distributions of the mobility index for each country and each cohort were computed by generating 20,000 replication of each element of the mobility index. Reporting these results, however, was not feasible because of the excess of information. One way to summarise this huge amount of information is to build empirical confidence intervals, recognising that the amplitude of those intervals depends on the selected confidence level. The selection of the confidence level is always arbitrary and less informative than showing all the distribution, but in any case this approach is a standard way to facilitate the presentation. In our case, following the recommendation of certain authors, a confidence interval of 70% has been selected. As the confidence level increases, the amplitude of the interval also increases but the informative content of the interval decreases — i.e. there is a kind of trade-off between exactness and relevance. Obtaining one correct answer out of three (this is

what a confidence interval of 70% implies) was the criterion selected to resolve the trade-off between accuracy and relevance.

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APPENDIX

TABLE 1: DEFINITION AND SAMPLE SIZE OF BIRTH COHORTS

BIRTH COHORT	**NORDIC COUNTRIES**				**CONTINENTAL COUNTRIES**				**SOUTHERN COUNTRIES**			
	Denmark	*Finland*	*Norway*	*Sweden*	*Austria*	*Belgium*	*France*	*Netherlands*	*Greece*	*Italy*	*Portugal*	*Spain*
1940-45	313	816	403	491	504	567	986	543	788	3358	712	2092
1945-50	282	985	421	432	474	648	1193	585	804	3506	688	1987
1950-55	269	879	409	383	491	669	1185	533	889	3181	704	1997
1955-60	396	799	437	355	567	705	1213	558	886	3413	761	2313
1960-65	479	733	434	400	556	730	1298	677	870	3781	754	2455
1965-70	461	621	429	390	533	663	1215	669	915	3582	663	2174
1970-75	380	493	362	374	377	546	1129	511	824	3302	581	2035
1975-80	184	393	209	257	217	390	667	257	604	2032	419	1409
TOTAL	2764	5719	3104	3082	3719	4918	8886	4333	6580	26155	5282	16462

TABLE 2: CONVERSION OF ISCED LEVELS INTO EQUIVALENT YEARS OF EDUCATION

COMPLETED EDUCATION—ISCED	***ISCED 0***	***ISCED 1***	***ISCED 2***	***ISCED 3***	***ISCED 4***	***ISCED 5-6***
NORDIC COUNTRIES						
Denmark	2	6	9	12	13	15
Finland	2	6	9	12	13	16
Norway	2	6	9	12	13	16
Sweden	2	6	9	12	13	15
CONTINENTAL COUNTRIES						
Austria	2	4	8	12	13	16.5
Belgium	2	6	8	12	13	16.5
France	2	5	9	11	12	15.5
Netherlands	2	6	9	12	13	15
SOUTHERN COUNTRIES						
Greece	2	6	9	12	13	16.5
Italy	2	5	8	13	14	18
Portugal	2	6	9	12	13	16
Spain	2	6	8	12	13	17

Note: the same conversion applies to individuals and parents.

TABLE 3: EXPLANATORY VARIABLES OF THE EXTENDED MEASUREMENT MODEL

VARIABLE	DEFINITION	MAXIMUM	MINIMUM
log(father's years of education)	*logarithm of imputed years of education (father)*	*country specifics*	
log(mother's years of education)	*logarithm of imputed years of education (mother)*		
gender	*dichotomic: 1 if male*	0	1
number of siblings	*number of brothers/sisters when the individual was 14*	0	21
father not working	*dichotomic: 1 if the father was unemployed or inactive when the individual was 14*	0	1
mother not working	*dichotomic: 1 if the mother was unemployed or inactive when the individual was 14*	0	1
intact family	*dichotomic: 1 if the individual was living with both parents when he/she was 14*	0	1
highest parental ISEI	*socio-economic status index (occupation); highest among the two parents*	16	80

FIGURE 1a: MOBILITY INDEX — NORDIC COUNTRIES

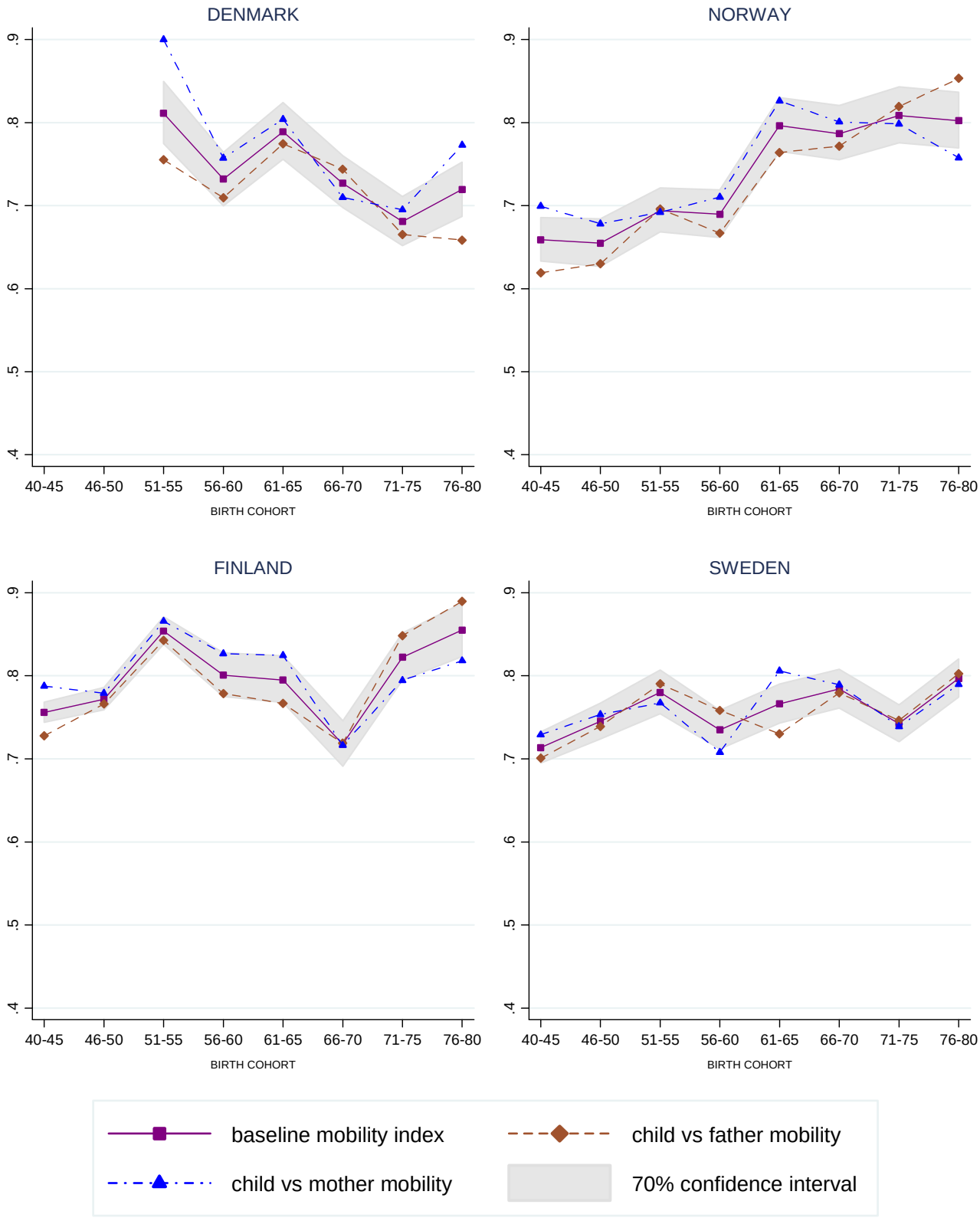


FIGURE 1b: MOBILITY INDEX — CONTINENTAL COUNTRIES

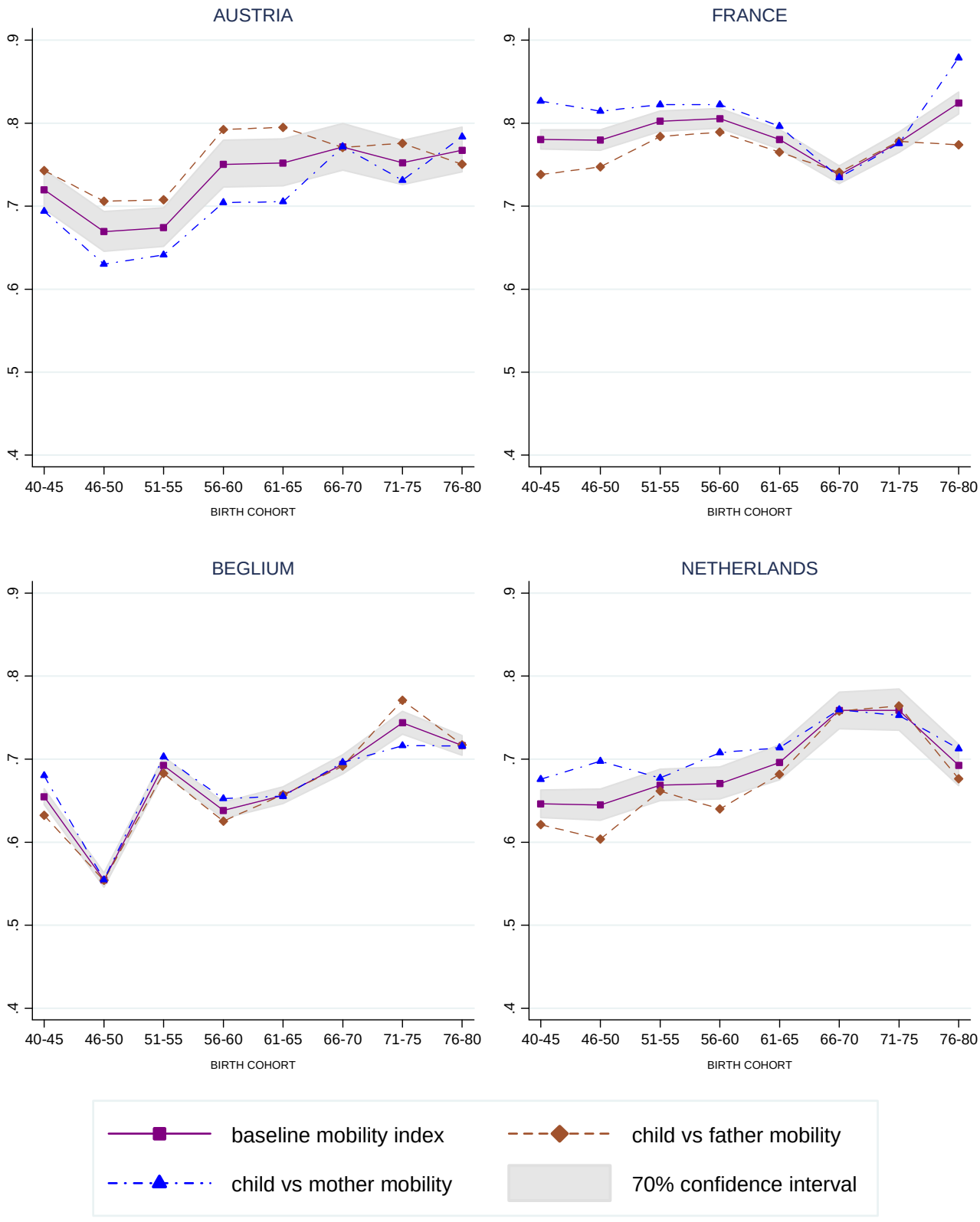


FIGURE 1c: MOBILITY INDEX — SOUTHERN COUNTRIES

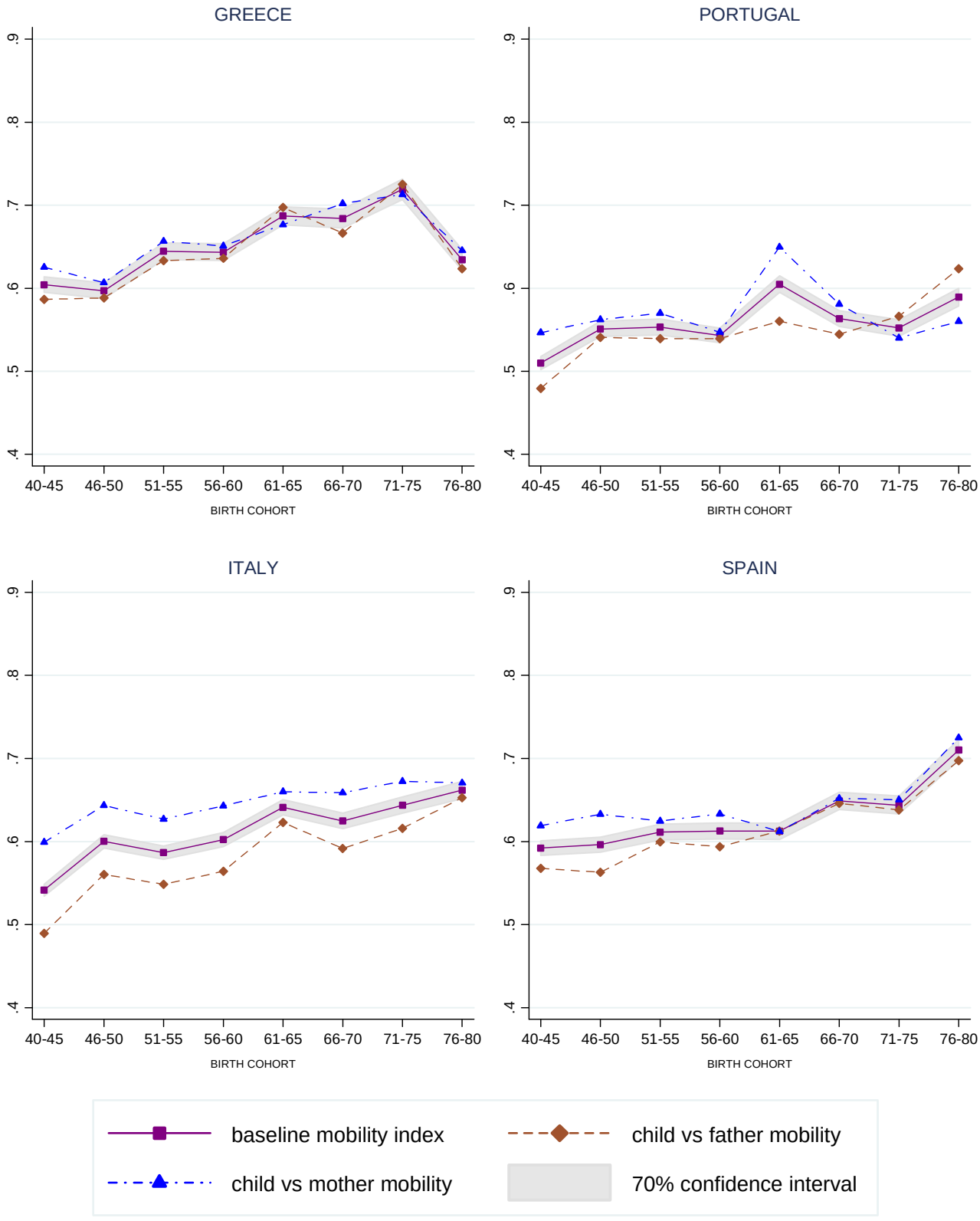
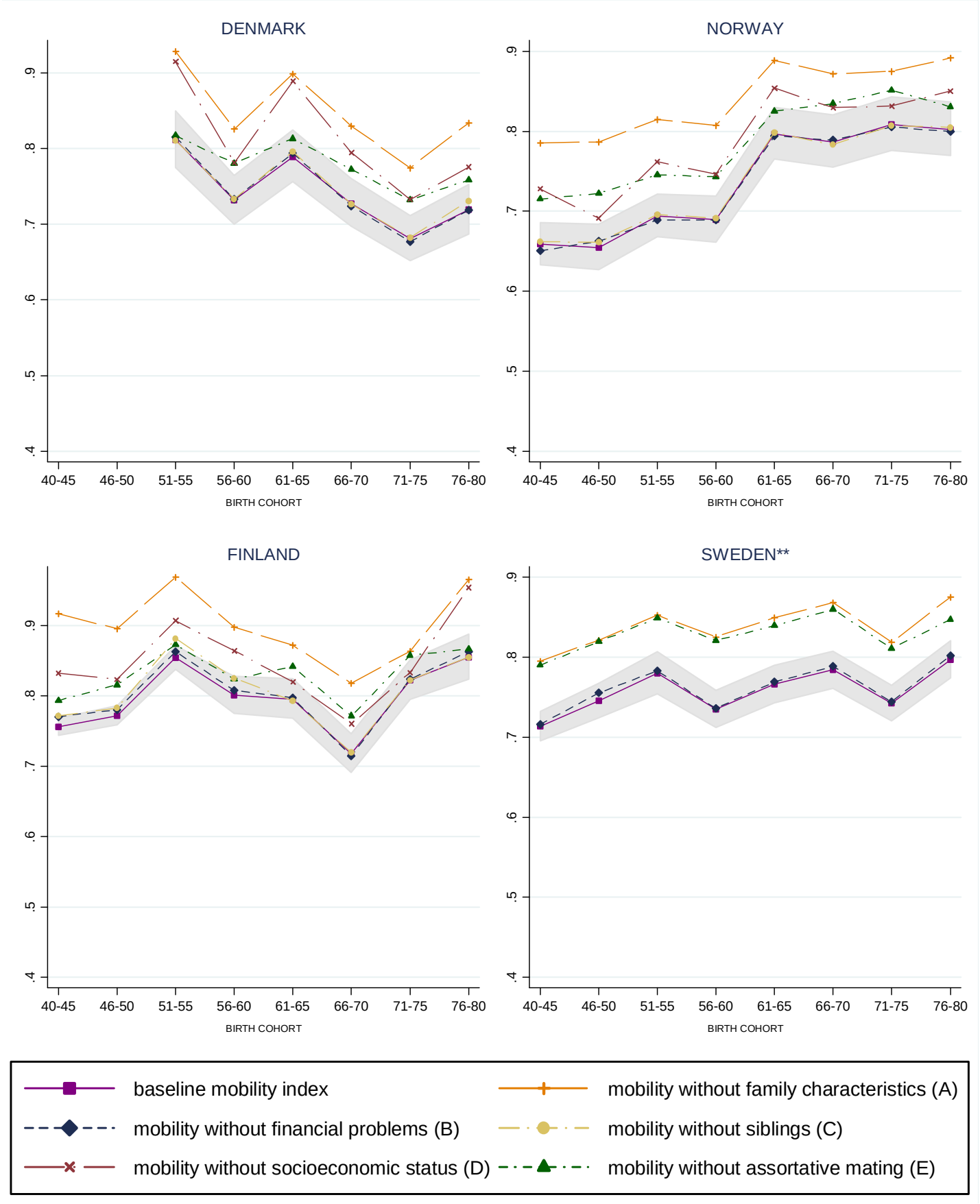
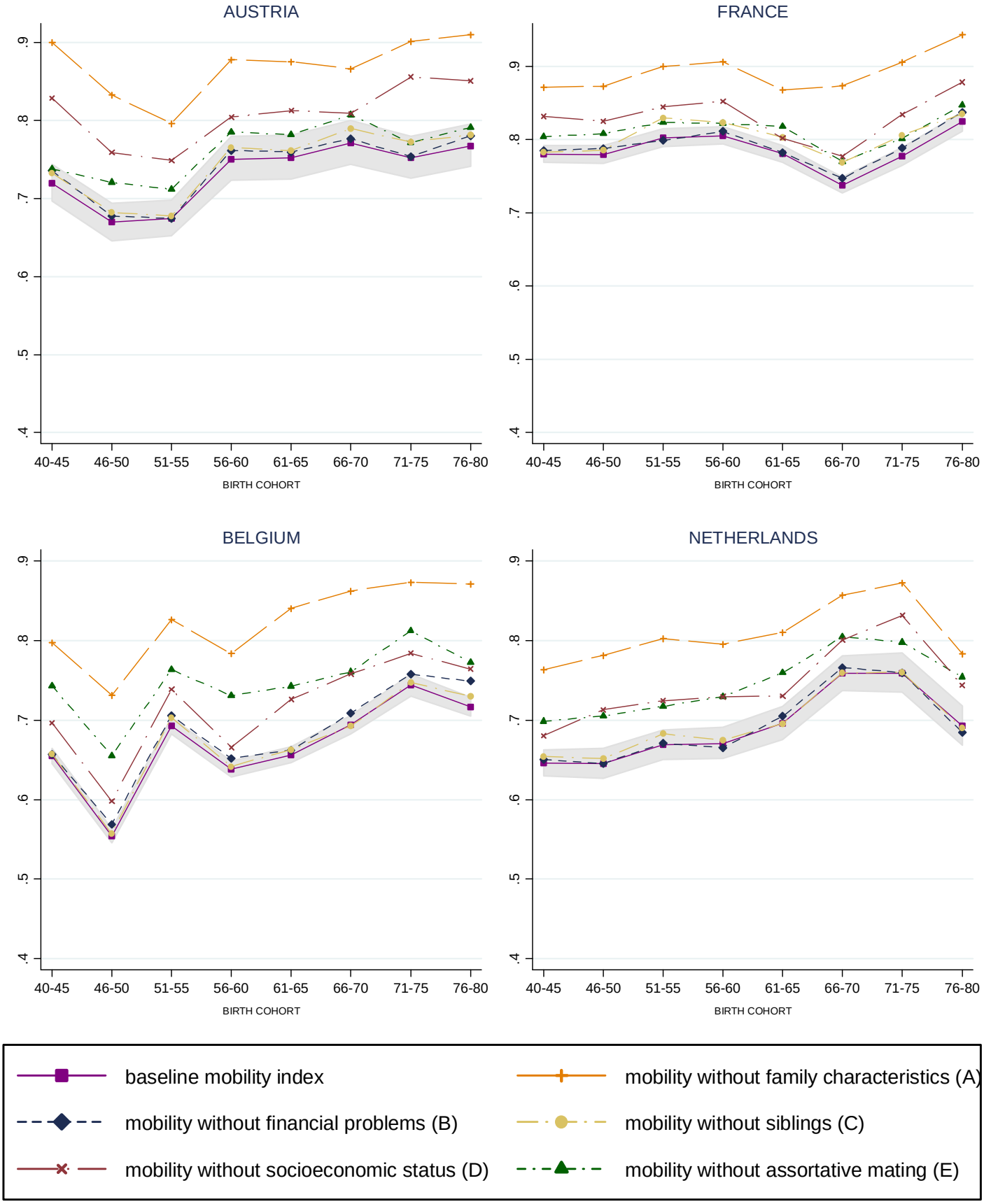


FIGURE 2a: SIMULATED MOBILITY INDEX — NORDIC COUNTRIES



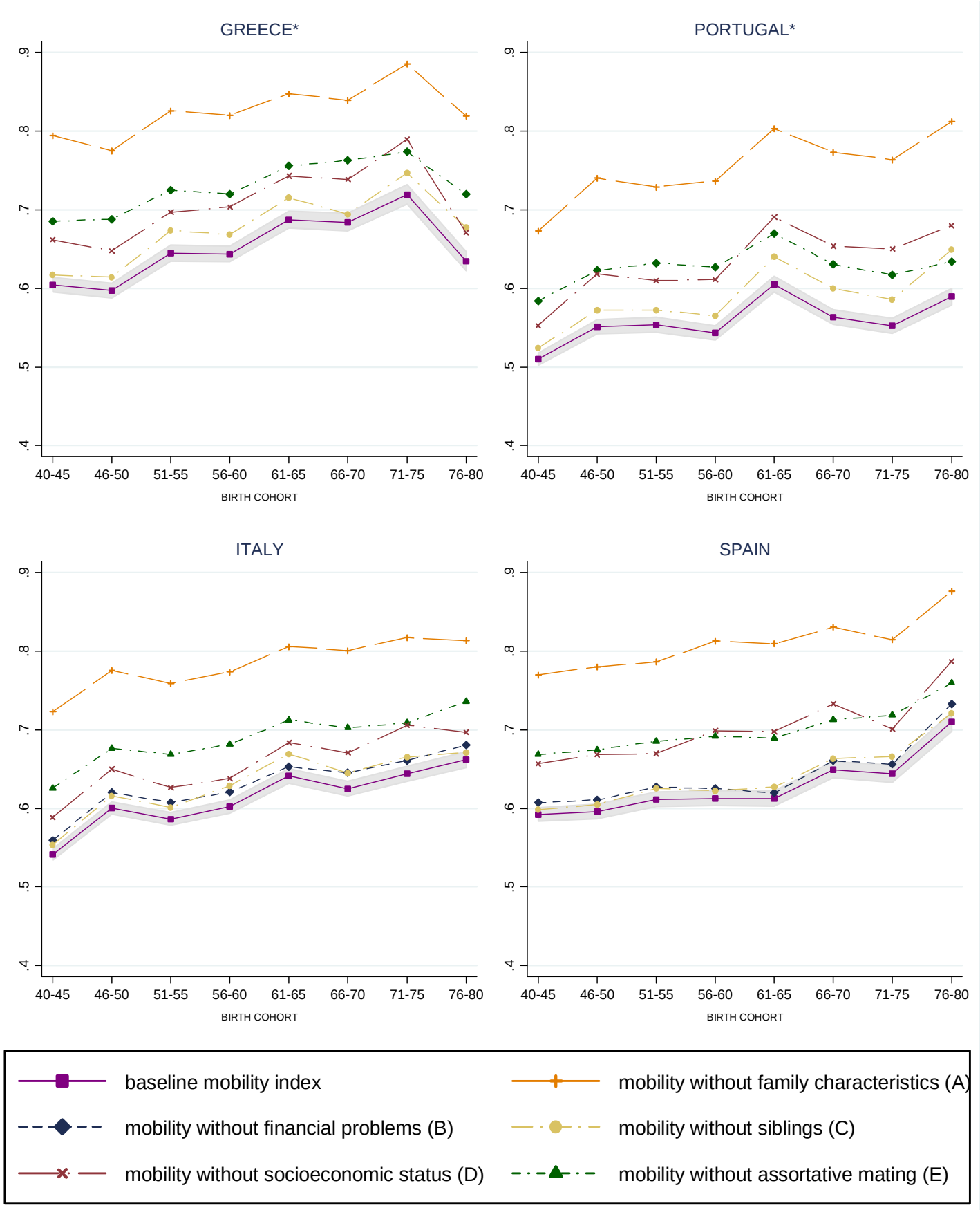
* NO INFORMATION ABOUT THE FREQUENCY OF FINANCIAL PROBLEMS
** NO INFORMATION ABOUT PARENTAL OCCUPATION OR ABOUT THE NUMBER OF SIBLINGS

FIGURE 2b: SIMULATED MOBILITY INDEX — CONTINENTAL COUNTRIES



* NO INFORMATION ABOUT THE FREQUENCY OF FINANCIAL PROBLEMS
** NO INFORMATION ABOUT PARENTAL OCCUPATION OR ABOUT THE NUMBER OF SIBLINGS

FIGURE 2c: SIMULATED MOBILITY INDEX — SOUTHERN COUNTRIES



* NO INFORMATION ABOUT THE FREQUENCY OF FINANCIAL PROBLEMS
** NO INFORMATION ABOUT PARENTAL OCCUPATION OR ABOUT THE NUMBER OF SIBLINGS

TABLE 4: BASELINE MOBILITY INDEX AND SIMULATIONS

	NORDIC COUNTRIES																							
BIRTH	***DENMARK***						***FINLAND***						***NORWAY***						***SWEDEN***					
COHORT	*INDEX*	*A*	*B*	*C*	*D*	*E*	*INDEX*	*A*	*B*	*C*	*D*	*E*	*INDEX*	*A*	*B*	*C*	*D*	*E*	*INDEX*	*A*	*B*	*C*	*D*	*E*
1940-45	.	.	.		.	.	0.756	0.917	0.771	0.772	0.832	0.793	0.659	0.786	0.651	0.662	0.715	0.728	0.714	0.795	0.716	.	0.790	.
1945-50	.	.	.		.	.	0.772	0.895	0.780	0.783	0.824	0.816	0.655	0.787	0.663	0.661	0.722	0.691	0.746	0.821	0.755	.	0.819	.
1950-55	0.811	0.928	0.815	0.811	0.817	0.915	0.854	0.969	0.863	0.882	0.907	0.873	0.694	0.815	0.689	0.696	0.746	0.762	0.780	0.852	0.783	.	0.849	.
1955-60	0.732	0.826	0.733	0.733	0.781	0.781	0.801	0.898	0.808	0.825	0.864	0.824	0.690	0.808	0.689	0.691	0.743	0.746	0.735	0.825	0.736	.	0.821	.
1960-65	0.789	0.898	0.794	0.796	0.813	0.889	0.795	0.872	0.797	0.793	0.820	0.842	0.797	0.889	0.794	0.798	0.825	0.854	0.766	0.849	0.769	.	0.839	.
1965-70	0.727	0.830	0.724	0.727	0.773	0.795	0.718	0.818	0.715	0.720	0.760	0.772	0.787	0.872	0.789	0.783	0.835	0.830	0.784	0.868	0.789	.	0.860	.
1970-75	0.681	0.774	0.677	0.683	0.732	0.733	0.823	0.864	0.824	0.822	0.833	0.858	0.809	0.875	0.805	0.807	0.851	0.831	0.743	0.819	0.744	.	0.811	.
1975-80	0.720	0.834	0.719	0.730	0.758	0.776	0.855	0.965	0.863	0.855	0.954	0.867	0.803	0.892	0.800	0.805	0.831	0.850	0.797	0.875	0.802	.	0.847	.
	CONTINENTAL COUNTRIES																							
BIRTH	***AUSTRIA***						***BELGIUM***						***FRANCE***						***NETHERLANDS***					
COHORT	*INDEX*	*A*	*B*	*C*	*D*	*E*	*INDEX*	*A*	*B*	*C*	*D*	*E*	*INDEX*	*A*	*B*	*C*	*D*	*E*	*INDEX*	*A*	*B*	*C*	*D*	*E*
1940-45	0.720	0.900	0.736	0.733	0.738	0.828	0.655	0.797	0.657	0.658	0.743	0.697	0.780	0.872	0.785	0.783	0.804	0.832	0.646	0.764	0.650	0.654	0.698	0.680
1945-50	0.670	0.833	0.678	0.682	0.721	0.759	0.554	0.731	0.569	0.557	0.655	0.598	0.780	0.873	0.788	0.786	0.808	0.825	0.645	0.781	0.646	0.652	0.705	0.713
1950-55	0.674	0.796	0.674	0.678	0.712	0.749	0.692	0.826	0.705	0.703	0.763	0.739	0.802	0.900	0.799	0.829	0.823	0.845	0.669	0.802	0.671	0.683	0.717	0.724
1955-60	0.750	0.878	0.762	0.765	0.785	0.804	0.638	0.784	0.652	0.642	0.731	0.666	0.805	0.906	0.811	0.823	0.822	0.852	0.671	0.796	0.665	0.675	0.730	0.729
1960-65	0.752	0.875	0.760	0.761	0.782	0.812	0.656	0.840	0.662	0.663	0.743	0.726	0.780	0.868	0.782	0.803	0.818	0.802	0.696	0.810	0.705	0.696	0.760	0.730
1965-70	0.771	0.866	0.776	0.789	0.807	0.809	0.694	0.862	0.709	0.693	0.761	0.758	0.738	0.873	0.747	0.769	0.770	0.777	0.759	0.857	0.766	0.760	0.805	0.801
1970-75	0.752	0.901	0.754	0.772	0.771	0.856	0.744	0.873	0.758	0.747	0.812	0.784	0.777	0.906	0.788	0.806	0.801	0.834	0.759	0.872	0.760	0.760	0.798	0.832
1975-80	0.767	0.910	0.780	0.781	0.791	0.851	0.717	0.871	0.749	0.730	0.773	0.764	0.824	0.943	0.837	0.835	0.847	0.878	0.693	0.783	0.684	0.690	0.754	0.744
	SOUTHERN COUNTRIES																							
BIRTH	***GREECE***						***ITALY***						***PORTUGAL***						***SPAIN***					
COHORT	*INDEX*	*A*	*B*	*C*	*D*	*E*	*INDEX*	*A*	*B*	*C*	*D*	*E*	*INDEX*	*A*	*B*	*C*	*D*	*E*	*INDEX*	*A*	*B*	*C*	*D*	*E*
1940-45	0.604	0.794	.	0.617	0.685	0.662	0.542	0.723	0.559	0.554	0.626	0.589	0.510	0.673	.	0.524	0.584	0.553	0.592	0.770	0.607	0.598	0.669	0.657
1945-50	0.597	0.775	.	0.614	0.688	0.648	0.600	0.775	0.620	0.616	0.676	0.650	0.551	0.740	.	0.572	0.623	0.618	0.596	0.780	0.611	0.605	0.674	0.668
1950-55	0.645	0.826	.	0.674	0.725	0.697	0.587	0.759	0.608	0.601	0.669	0.626	0.553	0.729	.	0.572	0.632	0.610	0.611	0.786	0.627	0.625	0.685	0.670
1955-60	0.643	0.820	.	0.668	0.720	0.704	0.602	0.774	0.621	0.629	0.681	0.638	0.543	0.737	.	0.565	0.627	0.611	0.613	0.813	0.625	0.622	0.692	0.699
1960-65	0.687	0.848	.	0.715	0.755	0.743	0.641	0.806	0.653	0.669	0.712	0.684	0.605	0.803	.	0.640	0.669	0.690	0.612	0.809	0.619	0.627	0.689	0.698
1965-70	0.684	0.839	.	0.694	0.763	0.738	0.625	0.801	0.645	0.645	0.703	0.671	0.563	0.773	.	0.600	0.630	0.654	0.649	0.830	0.661	0.663	0.713	0.733
1970-75	0.719	0.885	.	0.747	0.774	0.789	0.644	0.817	0.661	0.665	0.709	0.706	0.552	0.764	.	0.586	0.617	0.650	0.644	0.815	0.656	0.666	0.718	0.701
1975-80	0.634	0.819	.	0.677	0.719	0.671	0.662	0.813	0.681	0.671	0.736	0.697	0.589	0.812	.	0.649	0.634	0.680	0.710	0.876	0.733	0.721	0.759	0.787

SIMULATIONS:

- A → NO FAMILY CHARACTERISTICS (EDUCATIONAL CIRCUMSTANCES)
- B → NO FINANCIAL PROBLEMS
- C → NO SIBLINGS
- D → NO SOCIO-ECONOMIC STATUS
- E → NO EDUCATIONAL ASSORTATIVE MATING

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