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Intergenerational Mobility in Europe: the Role of Mothers and Gender Differences.

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Introduction

In this thesis we study intergenerational mobility in Europe, focusing on the level of persistence in educational attainment. While sociologists have been studying intergenerational transmission of education since the 1960s, this is a rather new topic in the economic literature (Torche, 2014). The importance of assessing intergenerational mobility in the current scenario comes from the high level of inequality in incomes and well-being that is affecting our society. In fact, rising inequality makes initial conditions, such as parental economic and educational background, key drivers of the future outcomes of children more than investment in human capital and "hard work" of the children themselves (OECD, 2018; Corak, 2013). This mechanism operates at the expense of those who find themselves in a lower social class as it would mean that children born in a poor family are less likely to experience upward social mobility. This would imply that the social elevator is broken and deprivation or poverty are likely to always afflict the same people.[1]
Furthermore, intergenerational mobility might not only be an economic and sociologic phenomenon. An emerging body of literature links intergenerational mobility to health consequences/outcomes.[2] An interesting case is the one brought up by Tiikkaja et al. (2009): they discuss the relationship between educational attainment and cardiovascular diseases for Swedish women. They find that child and adult social class explain considerable amounts of risk of cardiovascular diseases. An even more recent strand of literature is focusing on health-related behaviours, a famous example can be found in Gugushvili et al. (2018).

Intergenerational mobility has been studied under many aspects, namely income, social class and educational level. We focus on the latter because education is a good proxy for human capital (Schultz, 1961). We refer to it since higher levels of human capital are associated with higher earnings (Becker, 2009), thus, with a higher socio economic status. Furthermore, considering sociological research, education has been found both as the main avenue for upward social mobility and as the most important factor for intergenerational status reproduction (Hout and DiPrete, 2006).

Not only we have theoretical reasons for using educational attainment as our preferred measure, but we have practical ones as well. First and foremost it is reliable: it encompasses the problems faced when dealing with income, which fluctuates over the many life stages,

[1] However, a society with null intergenerational correlation would not be optimal either, as it would hint that returns to human capital are absent (Black and Devereux, 2010).

[2] Examples are found in Heraclides and Brunner (2009); Houle and Martin (2011).

making it harder to assess permanent income (Schneebaum et al., 2015).
Educational attainment seems to be a better predictor of lifetime earnings both when compared to income observed at one point in time and when averaged over several years (Carneiro and Heckman, 2005) and tends to be stable after a certain age (Nguyen et al., 2005). It is also easier to recall than parental occupation, reducing the so-called recall bias (Black and Devereux, 2010). Furthermore, educational level is less subject to response bias, while people systematically misreport their income (Bielby et al., 1977). Respondents might be less inclined to do so when considering educational attainment because it does not provide an exact measure of their current well-being.
Lastly, results for the US and UK point at the fact that educational background of parents might be more determinant for child education than financial constraints (Cameron and Heckman, 1998; Chevalier and Lanot, 2002).

In the context of our work it is of utmost importance to determine who is negatively affected by intergenerational transmission of inequality, in order to design policies able to address the issue. As we will discuss later, women have been neglected for decades in stratification research,[3] be it for practical and historical reasons (Sørensen, 1994) or "intellectual sexism" (Acker, 1973a). The standard approach in the literature has been to only study father-son intergenerational relations. The main argument brought forward by those opposing the inclusion of women in stratification studies emphasized the difficulty to classify women by social class, as they were usually out of the labour market or their partner had a higher social status (Goldthorpe, 1983).[4]

Because of their past exclusion, in this thesis we focus on the role of women in intergenerational mobility, both as mothers and daughters. We will first discuss the evolution of the literature, analysing how women were included in stratification studies. Thanks to the changes that have occurred in many societies in the last decades, women have increasingly been included in social mobility studies. Successively, we provide our own evidence in favour of the inclusion of women. For this we perform an empirical analysis using data from the Survey on Health, Ageing and Retirement in Europe (SHARE). Not only we find that mothers largely contribute to the process of intergenerational transmission of educational levels, but that they also have a higher influence over their daughters.

[3]The term stratification comes from the sociologic literature. It refers to the different social classes that societies have in place and their relative position, namely, whether they are superior or inferior to one another (Parsons, 1940).

[4]Interestingly, because of the lack of consensus on how to assign a social class to women and lack of data, women have been neglected in studies on the relationship between health issues and social mobility for decades (Vagero, 2000).

It is worth noting that recent research found that women, historically starting from a disadvantaged position as for their educational attainment, are now outperforming men both in Europe (Breen et al., 2009b) and in the US (Buchmann et al., 2008). However, since it is only in the late 1990s that women outnumbered men in tertiary education in Europe (Mischau, 2001), our sample does not address this new trend, as our respondents were born between 1925 and 1964.

One obvious challenge of this area of research is that one has to rely on comparable measures of education across people and across countries. While this issue has been addressed by several international organizations and institutions, hence guaranteeing for a validated measure of educational attainment (Connelly et al., 2016), it is worth recalling that even money measures such as "income" may not be totally comparable across people or countries (Solt, 2009). Therefore we believe that our work has solid foundations.

To study educational intergenerational mobility we created a categorical variable based on the International Standard Classification of Education (ISCED) levels of education. Using this variable instead of years of education allows us to go beyond the usual correlations and elasticities estimated in the literature. The issue with these statistics is clearly explained by Björklund and Jäntti (2002): the association between fathers and sons reasonably varies across the distribution of paternal outcomes. In their article they were referring to income mobility, however the same line of thought can be followed when dealing with educational mobility. Furthermore, dealing with categorical variables when analysing intergenerational mobility has been a priority to sociological studies (Erikson and Goldthorpe, 2002), from which this thesis largely draws.

As specified above, our data comes from the SHARE dataset. To the best of our knowledge, this is the first study on intergenerational educational mobility performed on this data. The survey collects data regarding educational level for around 80000 respondents and their parents in 27 European countries and in Israel. We find high persistence in the upper parts of the educational distribution, where college educated parents strongly influence their children's education. Furthermore, when comparing the main models discussed in the literature, the sex role model seems to hold in our data. However, we should be careful/cautious while interpreting our results in relation to potential public policy interventions. There are many structural differences among countries, thus, a unique type of policy cannot be fitted for all the countries considered. An emblematic example is the Swedish case, where women seem to be way more educated than those in countries such

as Italy and Spain.

This work starts by analysing the level of persistence at the high end of the educational distribution, including mothers and interactions with gender. We then move to the core of the analysis, which relies on a multinomial logistic regression setup, where we study intergenerational mobility across the whole educational distribution. In doing so, we discuss the results obtained when including women in our analysis.

The thesis is organized as follows: in the first chapter we present an overview of both the sociological and economic literature regarding intergenerational mobility, discussing also the main measures and empirical approaches used by scholars. Chapter 2 describes our data and presents some descriptive evidence/analysis performed on it. The third chapter discusses the methodology used, presents the regression analysis and the results we find. Lastly, we conclude discussing our main findings.

I Literature Review

In this chapter we are going to analyse the main findings in both the theoretical and empirical intergenerational mobility literature. Studies on educational attainment across generations constitute a rather new strand of literature. They are strongly related to the literature on the intergenerational transmission of occupation/earnings/social status. Therefore, in what follows we will go through and synthesize several of the main contributions in all these directions. They are important for the purpose of the present thesis because many methods and models developed in these contexts can also be applied when dealing with educational mobility.

1.1 Theoretical Models

The theoretical literature regarding intergenerational mobility is surprisingly narrow, as not many scholars have dedicated their work to this area. The absence of a theoretical framework causes problems that are of a practical nature as well. Without a proper structure, there is no "right" way of interpreting results, leaving important questions unresolved (Hellier and Chusseau, 2012, pg. 251). While intergenerational mobility has been a topic of discussion in the sociologic literature for decades, it is a rather recent topic in the economic one (DiPrete, 2020).

The first economic models of inequality focused on income inequality among different families in the same generation and completely ignored the problem of intergenerational transmission of inequality, as they assumed that it was determined by the distributions of luck and abilities, thus by mere stochastic processes (Roy, 1950; Champernowne, 1953).

The two approaches on inequality (intergenerational mobility and the inequality within the same generation) were first put together in the same model by Becker and Tomes (1979), who developed a new framework that combined the human capital model while taking into account the ties and the social interactions within a family. The former states that inequality may arise from maximizing behaviour (Mincer, 1958; Becker, 1967). The latter considers the individual as a component of a family that lasts several generations, contributing to his family's income and providing care to the children that, eventually, will continue the family line (Becker, 1974; Tomes, 1978). The decision makers in Becker and Tomes (1979) are the families, they are infinitely long-lived and are made of members that are replaced each generation. There may be transfers of capital (human and not). The current generation can increase its consumption at the expense of the next one. However,

it is discouraged to do so as parents altruistically care about their children and leave them a bequest, which is defined in monetary and societal terms.[5] Children's future income is increasing in both investments in human and nonhuman capital and the endowments of their family's genetic and societal characteristics.
However, children also face uncontrollable circumstances such as their endowment and market luck. Thus, the maximization problem faced by parents does not only involve their own consumption, but also the "quantity and quality" of their children (Becker and Tomes, 1979, pg. 1181). The quality of children can be either measured by their adult income or utility. The quantity is instead determined by a trade-off between parental consumption, number of children and each child's income. This trade-off is larger for poor families (Becker and Tomes, 1986) and leads to the consequence that the number of children is negatively related to the earnings of each one of them (Blake, 1981).[6]

As already mentioned, the model leaves room for stochastic processes, recognizing that children's social position results by the interaction of luck and parental maximizing behaviour. Furthermore, equilibrium levels particularly depend on the inheritability of endowments and the propensity to invest in children. Persistence rises when the former parameter is high and the latter is low and family of origin matters the most when both parameters are high. Furthermore, as poor families have limited resources, they tend to invest only in human capital, since its returns are higher at the beginning.[7] The model developed by Becker and Tomes (1979) has been improved by the authors themselves in the following years: Becker and Tomes (1986) consider the role of endogenous fertility in parents and children's consumption and parental utility depends on their offspring's one, instead of their permanent income.

Solon (2004) further develops/builds on the framework proposed by Becker and Tomes (1979), deriving a theoretical model that accommodates log-linear intergenerational income regressions of the form in equation (1), below:[8]

$$ln(Y_{i,t}) = \alpha + \beta ln(Y_{i,t-1}) + \epsilon_i \tag{1}$$

where Y represents permanent income of two different generations t and $t-1$ that belong

[5] As an example, children are endowed with their parents' reputation, reliability and race (Becker and Tomes, 1979).

[6] This is caused by less investment in human capital for each child as parental resources are split between more children.

[7] As Becker (1967) points out, human capital has decreasing marginal returns while non-human capital has constant ones.

[8] The equation we present can be found in Corak (2013).

to the same family i, β is interpreted as the intergenerational income elasticity and ϵ is the error term that captures all the other elements that determine the child's income not related to parental income.[9] This new model has important practical implications: the results indicate that the intergenerational income elasticity increases (and hence intergenerational mobility decreases) (i) with higher earning returns to human capital, (ii) the more productive are human capital investments, and (iii) is positively related to heritability. On the other hand, the more progressive are public investments in human capital the lower the income elasticity. The model predicts lower intergenerational mobility in an era of rising returns to human capital or declining progressivity in public human capital investments (Solon, 2004). Another important merit of this model is that it provides a theoretical framework opening research to the possibility of comparisons across countries and over time, enhancing the analysis in these direction (Corak, 2013). The model allows to explain the cross-country differences in the intergenerational mobility by means of the interactions between family effects, public policy/investments and labour market.

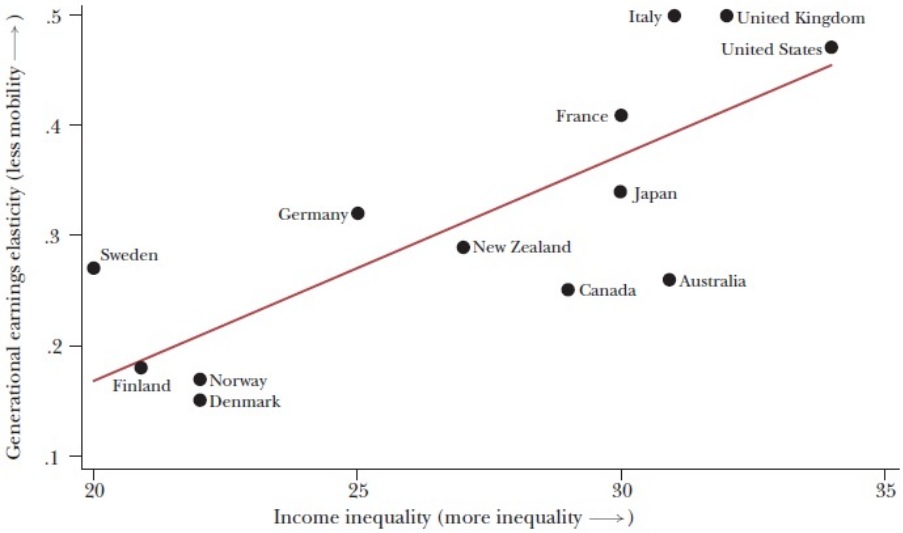
1.2 Descriptive Evidence

Many studies compare elasticities across various developed countries and they all find similar results: Scandinavian countries are the most mobile while the US, UK and Italy are those with stronger persistence levels (Solon, 2002; Jäntti et al., 2006; Corak, 2013; Björklund and Jäntti, 2011; Blanden, 2013). Furthermore, they all find what Krueger (2012) called the "Great Gatsby" curve that was later popularized by Corak (2013): a positive correlation between inequality measures and intergenerational elasticity (IGE). An example of it is found in Figure 1. Even though correlation does not imply causality, this result is still worth of notice, as Corak (2013) himself explains. The value of this curve lies in its many interpretations. One could see the positive slope of it as the effect of heritability between parents and children. If one family is able to pass onto the new generations some specific traits that are valued in the labour market, then intergenerational incomes show a degree of association. Furthermore, as populations are demographically diverse,[10] it is straightforward that the curve must have a positive slope, even when societies are fully meritocratic (Becker, 2013; Roemer, 2012).
Another interpretation of the Great Gatsby curve derives directly from Solon (2004) and his remarks on the role of returns to education. According to him, they can be taken as an index of cross-sectional inequality that is negatively related to social mobility. Corak (2013)

[9] See paragraph 1.3.3 (Income mobility) for a more detailed explanation of the pros and cons of the logarithmic formulation.

[10] Meaning that families transmit different characteristics.

Figure 1: The Great Gatsby Curve: More Inequality is Associated with Less Mobility across the Generations

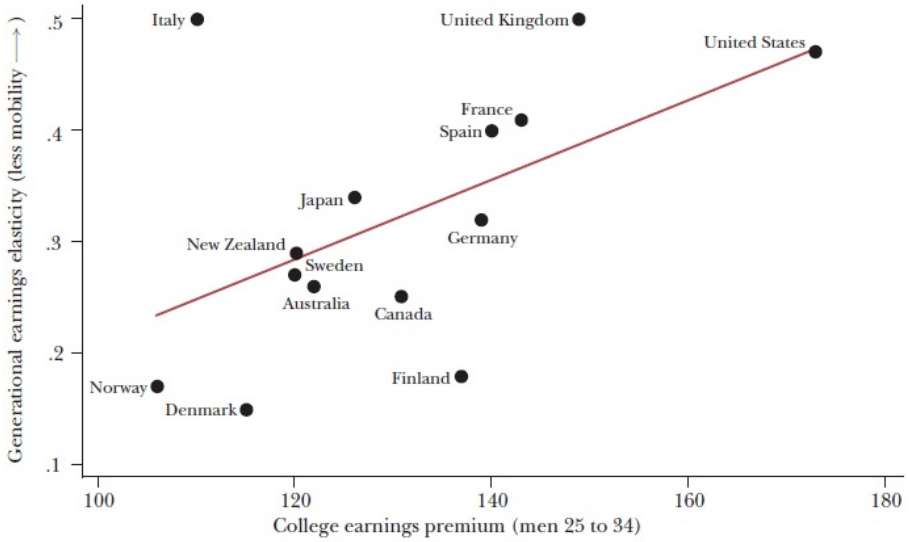


Note: the Gini coefficient is used as a measure on inequality. The results refer to father-son comparisons. Sons were born in the early to mid 1960s and their adult outcomes were measured in the mid to late 1990s.
Source: Corak (2013).

himself brings evidence in support of this interpretation, showing how college earnings premium[11] is positively related to generational earnings elasticity, as represented in Figure 2. Furthermore, this correlation holds over time, as reported in Aaronson and Mazumder (2008) and Mazumder (2012). However, working on the average income leaves us with no information on the distribution of the premium. That is why some scholars have analysed the premium distribution across the income distribution, finding that usually there is a flat IGE among the lower parts of the distribution, but there is a raise at the very end (Bratsberg et al., 2007; Björklund et al., 2012; Corak and Piraino, 2011). Interestingly, this pattern holds true for the Nordic countries and Canada but no conclusive results have been found for the US and UK (Bratsberg et al., 2007), Corak (2013) cites sample size as one possible problem, since the extreme parts of the distribution may not be represented well enough.
Since its ideation, the Great Gatsby curve has been frequently studied in the theoretical and empirical literature. For a review of economic studies we suggest Durlauf et al. (2022),

[11]The premium is calculated as the average employment income of college educated men aged 25 to 34 relative to the average employment income of their counterparts with a high school diploma.

Figure 2: Higher Returns to Schooling are Associated with Lower Intergenerational Earnings Mobility

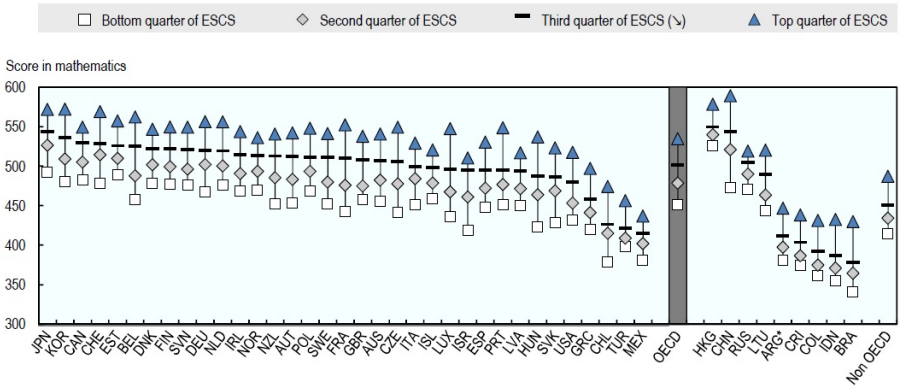


Note: the college earnings premium is calculated as expressed in the text.
Source: Corak (2013).

otherwise, for a more sociological approach, we refer to DiPrete (2020).

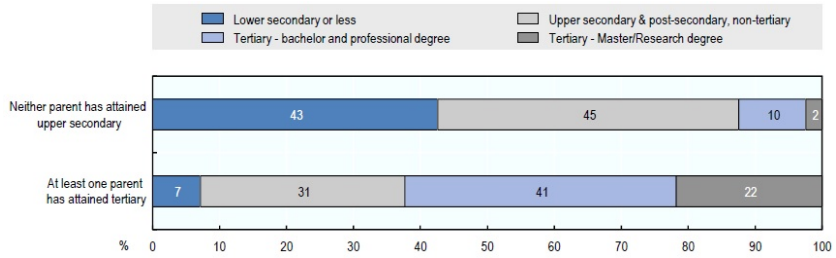
As discussed above, the Great Gatsby curve suggests the presence of a degree of heritability for what regards socio-economic status. However, this relation between parents and children do not only interfere with the earnings of the latter but with the level of education as well. We show in Figure 3 that children born from parents placed at the lower end of the distribution tend to score less in mathematics.
This association between academic performance and parental status is even more problematic when we consider the fact that mobility is not always present. People at the bottom of the distribution, be it of earnings or educational outcomes, tend to stay there. In the literature, this phenomenon is called sticky floors. The converse holds true for people placed at the high end of the distribution. We refer to this as a case of sticky ceilings. An example of this stickiness can be found in Figure 4, where we observe the presence of a strong correlation between parent and child's level of education. When parents do not reach a secondary education level, 43 children out of 100 will not attain secondary education either. Conversely, if at least one parent has a tertiary education level, 63% of children will at least get a bachelor degree.
However, empirical evidence suggests that governments can interfere in the

Figure 3: Score in mathematics by socio-economic status of parents, 2015



Note: ESCS refers to the PISA (Programme for International Student Assessment) index of economic, social and cultural status. *Argentina: Coverage is too small to ensure comparability. *Source*: OECD (2018).

Figure 4: Likelihood of educational attainment by parental education background, OECD average



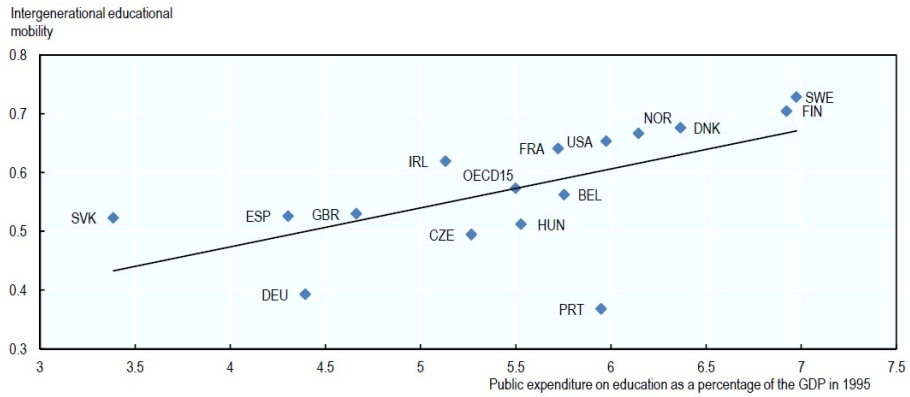
Source: OECD (2018).

intergenerational transmission of inequality. One example is found in the positive relation between public spending on education and educational mobility, as reported in Figure 5.

1.3 Measuring Socio-economic Status and Assessing Mobility

Both economists and sociologists have studied the vast and complex phenomenon of social mobility. However, the sociologic literature has a longer tradition regarding the topic, with its first works being published in the 1960s, while economic scholars have more recently devoted their attention to mobility (Torche, 2014). Furthermore, the two social sciences have adopted different approaches/methodologies to study this phenomenon. Sociologists have devoted their attention to social class and occupational mobility, while economists have focused mainly on earnings and income. In order to have a clearer picture of the

Figure 5: Education mobility in relation to public spending on education



Note: intergenerational educational mobility is measured as 1 minus the intergenerational educational persistence, defined as the regression coefficient between parental and children's years of schooling at age 30-55.
Source: OECD (2018).

academic landscape, we present a brief overview of the methodologies adopted in the literature and their main findings. It should already be mentioned that different methods bring to different conclusions. As an example, Germany is found rather mobile when analysed for its income mobility (Vogel, 2006) but is one of the most persistent countries when studied through the social class lenses (Erikson and Goldthorpe, 1992a; Breen and Luijkx, 2004). These differences can be reconducted to the fact that the distributions of the various measures based on which mobility is assessed might not be perfectly correlated and that their deviations are highly correlated across generations (Björklund and Jäntti, 2002). In what follows we will briefly describe some of the most frequently used measures in the intergenerational mobility literature.

1.3.1 Occupational status

Sociologists usually split occupations into broad categories or they rank them following a one-dimensional hierarchy. Several indices have been proposed over time, each of them presenting advantages and drawbacks. A measure of the socio-economic status that has received positive evaluation is the occupational status, that takes into account both earnings and occupation. It is computed as a weighted average of the mean earnings and educational level of detailed occupations (Torche, 2014). Due to the fact that occupation is easy to recall and less subject to refusal and reliability problems, such a methodology allows the construction of reliable measures from survey data as well (Hauser and Warren,

1997). Moreover, it performs optimally when one needs to build retrospective panels retrieving also information on respondents' previous family generations (e.g. parents).[12] Finally, occupational status remains rather stable over the lifecycle, thus, it reduces any age-related biases (Blanden, 2013; Hauser, 1998).
However, occupational status has its own flaws, mainly related to comparisons between males and females. In this sense, it is worth observing that women receive lower earnings compared to men holding the same job position even when they have the same level of education (Carnevale et al., 2018). This makes comparison between genders problematic (Warren et al., 1998). Furthermore, when comparing countries, it is rather difficult to find comparable measures. An index-based approach has been undertaken in the literature, weighting average education and income within an occupation (Blanden, 2013). This method has extensively been applied by Ganzeboom and Treiman (1996, 2003, 2007). However, it has not delivered a clear picture of cross-country differences yet.
For what regards trend analyses, we distinguish between absolute and relative mobility. Absolute mobility is defined as the "change in average occupational status over time" (Torche, 2014, pg. 39) while relative mobility tends to analyse the level of persistence between parents and their children (Goldthorpe, 2016).[13] The US have recently been the subject of many studies on trend analyses: Hout (2018) finds a decrease in upward absolute mobility and an increase in downward mobility for the cohorts born between the 1970s and 1980s compared to those born in the 1940s and 1950s. However, the only clear results on relative mobility trends are found in Featherman and Hauser (1978) that find rising status mobility until 1972. For the 1970s and 1980s no clear trend is found (Beller and Hout, 2006), neither from 1994 to 2016 (Hout, 2018).

1.3.2 Class analysis

Class has been defined as a way of grouping based on employment relations and consumption opportunities that influence income, health and wealth (Grusky and Weeden, 2006; Jonsson et al., 2007).[14] The most common classification method is the one designed by Erikson, Goldthorpe, and Portocarero (EGP) in Erikson et al. (1979). It requires a two-way contingency table in which one can assess the change of class between generations. Furthermore, classes can be defined more or less broadly, varying from five to seven or even twelve groups (Erikson and Goldthorpe, 1992a; Breen, 2005). The groups are formed according to various criteria. First, it must be taken into account whether the person is

[12] As a matter of fact, SHARE dataset benefits from this feature.
[13] These definitions are quite loose, we will make use of them in other contexts as well.
[14] However, (Wright, 2005, pg. 180), among others, has argued that the practical definition of class depends on the questions one is trying to answer.

an employer, employee or self-employed. Then we look at the skill level, authority in the workplace and, lastly, the sector in which they operate.[15]
Some results at the European level point at a relative class mobility that is rather constant (Goldthorpe and Mills, 2008) and sometimes even increasing for some countries (Breen and Luijkx, 2004). A recent study on the US that uses information on both parents found that relative social mobility, after a slight increase, declined over four decades (Mitnik et al., 2015).

1.3.3 Income mobility

The study on income mobility is rather new when compared to the two aforementioned.
The analysis is based on the concept of permanent income developed by Friedman (1957). According to this theory, consumption choices and economic welfare depend on permanent income levels, and this is why most economists have focused on income/earnings when analysing intergenerational mobility.

Scholars usually refer to a model similar to the one represented in equation (1), calculating the elasticity coefficient of children's permanent income compared to their fathers'. The double-log transformation addresses the earning distribution's right-skewedness (Torche, 2014). However, using equation (1) does not allow to include those who have null earnings, such as housewives and, generally, those without paid employment. To solve this issue, some authors[16] have employed regressions based on the percentile rank in the earning distribution of both fathers and sons instead of permanent income levels.

While allowing a very easy interpretation, the IGE's weakness is that it is sensitive to changes between the distribution of parental and children generational characteristics[17] (Goldthorpe (2013), Black and Devereux (2010)). An alternative measure of income mobility, that accounts for this issue is represented by the correlation of parents' and children's income described by equation (2)[18] where β is the IGE, ρ is the intergenerational correlation (IGC), σ_t and σ_{t-1} are, respectively, the standard deviations of children and parent's characteristics distribution. Schneebaum et al. (2016) shows that the IGC between parents and child's education are lower than the estimates for the IGE, attributing this difference to the increase in the average education of the new generations and to the rising dispersion over time. Generally, studies that use correlations instead of elasticities tend to

[15] Traditionally, the sectors are urban, agricultural and nonmanual, manual (Torche, 2014).
[16] An example is found in Chetty et al. (2014).
[17] These may refer to earnings, educational attainment, class position and others.
[18] The equation is present in Black and Devereux (2010).

report lower estimates (Mitnik et al., 2015; Mazumder, 2016).

$$\beta = \rho \frac{\sigma_t}{\sigma_{t-1}} \tag{2}$$

Using permanent income to measure mobility presents several drawbacks, because it is subject to measurement error. On the one hand, in order to allow for sound intergenerational comparisons, permanent lifetime income would be ideal. Unfortunately, there is hardly available information that allows researchers to construct such a measure for parents and children. Surveys normally provide information on earnings at one (or a few) points in time that reflect earnings at different ages for parents and for children.[19] On the other hand, when collected through surveys, income/earnings are more prone to refusal or recall bias and hence their reliability is questionable.

Measurement error is particularly problematic when it occurs in the independent variable,[20] as it leads to inconsistent and downward-biased estimates of β (Solon, 1992; Zimmerman, 1992; Peters, 1992). Measurement errors may occur because of transitory shocks. This is problematic especially when working with short-term data.[21] To tackle this issue, scholars have averaged income over the years. However, the ages and the time-interval over which one calculates the average matters. As Mazumder (2005a,b) show, an average over two years brings elasticity coefficients of about 0.25, but one over sixteen years produces an estimate of 0.6. The differences in the estimates obtained when the time period over which the income is averaged varies are due to the life-cycle bias. As an example, averaging over the first years of employment would lead us to ignore the early-career gap present between the low and high lifetime earners, thus we would underestimate the wage gap that they will experience later in their working lives (Torche, 2014).[22] This underestimation due to the life-cycle bias is a problem for the dependent variable as well, as shown by Solon (1999) and Haider and Solon (2006). There is rather general consensus over the fact that income should be measured between the early 30s and mid-40s (of age).[23]

[19]Most of the times information on earnings is provided for older parents and younger children which may lead to downward bias of estimates (Haider and Solon, 2006).

[20]In our case it is fathers' permanent income.

[21]As an example, one-year observations were used in the early works and they led to elasticity estimates of about 0.15-0.2 (Behrman and Taubman, 1985; Becker and Tomes, 1986), which are considerably low when compared to 0.4 reported by Solon (1999) in his review on studies that averaged father's income over 3 to 5 years. More recently Chetty et al. (2014) obtained an estimate of 0.34 with data derived from administrative records on about 40 million children, averaging parental income over the years 1996-2000, which are those when the children in their sample are growing up.

[22]We would incur into an underestimation as high lifetime earners experience a steeper earning growth when compared to low ones.

[23]Such results have been obtained for USA, Sweden and Germany (Böhlmark and Lindquist, 2006;

To overcome measurement error, scholars have tried using instrumental variables (IVs).[24] However, it is hard to find a variable correlated with the independent one and that does not independently affect the dependent one. This issue causes an upward bias that leads us to interpret the IV estimates as upper bounds for the true value (Blanden, 2013). For detailed reviews of results and trends obtained with different methodologies we suggest the work of Durlauf et al. (2022); DiPrete (2020); Torche (2014); Blanden (2013).

1.3.4 Education

We have already seen that educational attainment has been used in some of the measures mentioned above, such as occupational status. However, a strand of literature analyses the effects of education alone on intergenerational mobility. After Blau and Duncan (1967), in the literature there is general consensus around the fact that education is both the "main vehicle for intergenerational reproduction and the main avenue for mobility" (Torche, 2014). This claim is made as, according to the model developed by Blau and Duncan (1967), social origins and everything that is independent from social origins contribute to the variation in educational outcomes. Education is the main vehicle for intergenerational reproduction because, from Figure 6, we see that the product ac is greater than b, that represents the direct effects of social origins. Furthermore, education is also the main avenue for mobility because uc is greater than ac. This means that the factors that are independent from social origins contribute more variance to destination than social origins themselves.

Empirically, many approaches have been taken. One of the most common is the one presented in equation 3 taken from Blanden (2013).

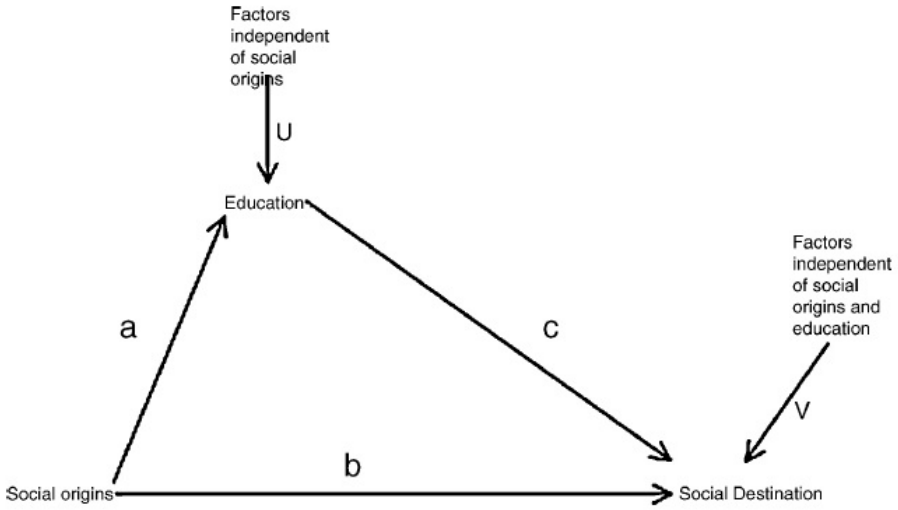
$$YearsEd_i^{children} = \pi + \psi YearsEd_i^{parents} + u_{2i} \tag{3}$$

Where the dependent variable is children's years of education and the independent variable is parental years of education. This approach has been used extensively, a prominent example is found in Hertz et al. (2008), where a study involving 42 countries is conducted. They find a rather stable global average correlation of 0.4 between parent and children's educational attainment and a declining ψ over time. However, the main limitation of this approach is that it considers the effects of parental years of education on their children's educational outcomes linear and monotonic. The linearity assumption might not hold.

Brenner, 2010). However, other studies such as Chetty et al. (2014) find that even the late 20s could be a good period of time.

[24] Björklund and Jäntti (1997) applied this methodology first.

Figure 6: Simplified path diagram of how destination depends on origins and education



Source: Hout and DiPrete (2006).

Hout and DiPrete (2006) suggest that in different schooling systems more years of schooling might not lead to more valuable credentials.[25] Taking into consideration this fact, other authors, such as Chevalier et al. (2009), have worked with indices that signal qualification levels, such as ISCED. Being aware of this nonlinearity issue, this thesis uses the ISCED index as well. Furthermore, Blanden (2013) compares the results from Chevalier et al. (2009) and Hertz et al. (2008). She finds their results to have a correlation of 0.49, which suggests that the two approaches might share some core similarities.

1.4 Empirical Approaches

In stratification research, the main unit of analysis is the family (Sørensen, 1994), as it studies the children's change of class from their family of origin (Ganzeboom et al., 1991). However, measuring a family's social class is not an easy task, considering that there is still no general consensus surrounding it. We are going to present the main views on this issue, highlighting their strengths and faults while trying to present some results as well. Historically, the first methodology for measuring class is the "conventional" (Goldthorpe, 1983) one. According to it, fathers' socioeconomic status can be used as a proxy for their

[25]Dearden et al. (2002) find that in UK, when accounting for the time required in order to get the qualification, the returns per year of study between vocational programs and college education are closer than expected.

family's one. This comes from the assumption that, as part of the family's economic plan, wives are not supposed to work or, when they do work, it is either for a short amount of time (Erikson, 1984) or their husbands have a higher status than theirs (Goldthorpe, 1983). According to this view, since the mother always depends on the father, his education and status are the only determinants of children's education, leaving no place for maternal influence (Korupp et al., 2002). Even if the idea behind this model sounds dated, it is one of the most used and it allows for broader cross-country comparisons (Corak, 2013). In fact, even recent works are still working according to this view (Hout, 2018). However, thanks to the availability of better datasets, results have considerably changed overtime. As an example, (Becker, 1988, pg. 10) found a father-son elasticity of 0.2 in the US, while, almost twenty years later, Corak (2006) argues that the coefficient is more likely to be a value between 0.4 and 0.6.

In 1984, as a response to Goldthorpe (1983), who was defending the "conventional" view, Erikson (1984) develops a new framework, called the Dominance model. The author observes that women are no longer segregated out of the labour market, on the contrary, they are increasingly participating in it, as data from Sweden reported. In order to describe this different scenario, Erikson (1984) proposes a model in which the class of the family is still determined by one parent, however, this time it has not to be the father the one determining the social class, but the one that holds the highest social position. A similar notion could be found in the Power model previously developed by McDonald (1977), who, following the work of Maccoby (1959), analyses the fact that children tend to imitate the parent that is perceived as the one in control of the household's resources.

Even if the Dominance model leaves room for wives when their occupation is higher than their husbands', it still does not take into account both spouses simultaneously and excludes in most cases women, since, historically, they have been the second earners in the household,[26] as even the author of the theory itself claims (Erikson and Goldthorpe, 1992a, pg. 267). Applying this approach with educational attainment, women would be left out of the picture in our sample as well since we see from Figure 12 that, when parents do not have the same educational level, fathers are predominantly the most educated parent.
Garnsey (1978) discusses the importance of the income gained by the second earner as it helps lessen inequality by reducing differences in total household income, especially for those families where the main earner is working in a less-skilled profession. Furthermore, Korupp et al. (2002) argue that children's educational attainment could be viewed as

[26]This still holds true in most contemporary societies, however, there is evidence that the share of women as main earners of their household is increasing (Harkness, 2010).

consumption of parental resources. Thus, the lower status parent must be included in the analysis as he is contributing to the parental resources. Furthermore, Sørensen (1994) finds that estimates concerning intergenerational mobility that exclude the role of women are biased, as the conventional and Dominance models assume that the presence of absence of a housewife has no effect on family status and put in the same class a worker married to a housewife and another to a worker holding the same position (Erikson, 1984; Leiulfsrud and Woodward, 1989; Wright, 1989).

Due to the aforementioned criticisms and thanks to the increasing number of wives being employed, authors started questioning the methodologies employed until then.[27]
New and more radical approaches were developed. The best example is found in the feminist literature: scholars refused to consider the family as the pillar of stratification and class analysis, instead, it was the individual the sole determinant of his class position (Acker, 1973b; Delphy, 1984). This new methodological approach shed light to female problematics that had mostly been overlooked until then, such as women's employment, gender inequality in labour market outcomes, and the mechanisms that hindered women from fully participating to the labour market.[28]
However, the feminist approach cannot account for those phenomena in social stratification where the pooling of resources and the sharing of living conditions are important. In these cases, family should be the preferred unit of analysis (Sørensen, 1994). Furthermore, Erikson and Goldthorpe (1992b) challenge the new methodology as they find the conventional view to have more explanatory power but they suggest that the feminist model might be a better fit in case of a higher female labour participation and "class consciousness" (Erikson and Goldthorpe, 1992b, pg. 95).

Nonetheless, the feminist critique was not left unheard in the works of those who kept family as the unit of analysis. Scholars developed different approaches to include women, the first one being the Individual model, as defined in Korupp et al. (2002).[29] According to it, both parents are included as additive variables. This model was used in studies of status attainment analysing the effects of parental education and occupation on children's occupational and educational attainment (Hayes, 1993; Sewell et al., 1980; Treiman and

[27] An early example can be found in the work of (Svalastoga, 1959, pg. 140).

[28] Examples of this new wave of literature could be found in Bielby and Baron (1986); DiPrete and Grusky (1990); Reskin and Hartmann (1986). For a more comprehensive review, we suggest Sørensen (1994).

[29] Even though the feminist literature spread awareness on the importance of the female role, Crompton (2003), in her review, concludes that the feminist literature and quantitative class analysis had drawn away from each other, instead of benefitting from each other's conclusions.

Terrell, 1975). Korupp et al. (2002) find the Individual model to work best when considering the effects of parental occupation over children's educational level.

However, the Individual model does not account for the interactions that happen between both parents. An early work that tried to assess the value of interaction effects is the one by Graaf and Heath (1992) that analysed voting behaviour of couples. One of the many hypotheses explored is that the voting behaviour is influenced by one's own position and by their partner's as well. This view has then been incorporated into status analysis thanks to the Joined model, which uses the average of parental educational attainment (Korupp, 2000). This approach is based on the idea that, when parents have different status positions or levels of education, children find themselves in the middle of their parents' position (Graetz, 1991). Korupp et al. (2002) find the Joined model to be the best one, among those we propose in this thesis, when accounting for both parents' educational and occupational status effects on children's educational attainment. However, Marks (2007) argues that averaging parental status or educational attainment underestimates the proportions of families at both ends of the socioeconomic measure used.

The last model we are going to discuss is the Sex-role one. According to it, sons tend to mimic their father's behaviour, while daughters their mother's (Johnston et al., 2005). This happens because they form the belief that what their parents do is appropriate for their sex (Perry and Bussey, 1979). Even if some controversy has arisen during the years,[30] the role of imitation is present in the most popular sex typing theories, such as Psychoanalytic theory (Freud, 1989), cognitive consistency theory (Kagan, 1964), social learning theory (Bandura and Walters, 1963), and cognitive-developmental theory (Kohlberg, 1969). Schneebaum et al. (2015) find evidence for the Sex-role model with European data for what regards educational attainment, it particularly holds for the Nordic and Eastern European countries.

[30] An example is found in the work of Barkley et al. (1977).

II Data and Descriptive Statistics

In what follows, I am going to analyse the correlations between the children's educational attainment and their parents' levels of education, by making use of data collected in SHARE.

2.1 Data Description

SHARE is an ongoing multidisciplinary, longitudinal European survey that collects interviews from individuals in a number of European countries plus Israel. The survey focuses on the population of age 50 and above and their spouses. It started in 2004, running every 2 years, and the number of countries involved has increased, from 11 in the first wave, to 28 in the most recent one. SHARE has by now 8 waves, the latest one has run between 2019 and 2020, with the data being released in 2022. Participants are interviewed in every wave (every 2 years), allowing researchers to understand the changes in the respondents' situation, until their exit (through death or resignation). The interview is performed using a computer-assisted personal interview (CAPI) method. This means that interviews are conducted face-to-face with the help of a laptop. This is a fundamental characteristic, allowing interviewers to perform several physical tests contained in the questionnaire,[31] which make possible to evaluate some particular features related to respondents' health status.

While the regular waves collect information on the most relevant aspects of the individuals' current situation (health, employment situation, financial situation, accommodation, etc.) plus a set of demographic characteristics, waves 3 and 7 are different. They collect retrospective data regarding respondents' health, accommodation, employment, family, children, and early-life conditions by means of the so-called SHARELIFE questionnaire.

In our analysis we mainly use data from wave 5 onwards, as it is only starting with this wave that the ISCED level is reported for both respondents and parents. More specifically, we use ISCED 1997 classification since it is the only educational measure that is available in all datasets.[32] The fact that respondents are usually older than 50 helps us avoiding issues regarding age and education, as by this time they should have already completed their studies.

[31] A few examples are grip strength and walking speed.

[32] ISCED 2011 is also present, but for obvious reasons it was not present in wave 3, which ran between 2009 and 2010.

An important advantage of SHARE is that it contains also variables that shed light on the participants' early-life conditions (may be a proxy for the socio-economic situation), such as the number of rooms in the house and relative financial position. Assessing the socio-economic condition during the first years of life would be beneficial as that period of time is critical for the development of children's cognitive and non-cognitive abilities (Cunha and Heckman, 2008; Cunha et al., 2010).

We keep in our sample people born between 1925 and 1964. This decision is made for statistical purposes. Due to the focus of the SHARE survey (the population of age 50 and above), the number of observations relative to individuals born in the years outside this interval is considerably small, posing a threat to the sample representativeness, which may cast doubt upon the validity of the results. Moreover, keeping people that were particularly old when the survey was conducted could bias our estimates, as attrition due to mortality may induce on over-representation of healthier, richer and more educated people at older ages. This bias is defined as "survivor bias" (Banack et al., 2019, pg. 1971). In our case, it is likely that longevity is positively correlated with the kind of job the interviewed had,[33] thus, with his level of education (Bronfenbrenner et al., 1996). We also left out of the study three countries: Ireland, Portugal, and Hungary, because the data on parental educational level was either missing or scarce.

In our analysis, we shall account for the birth cohort in several ways. On the one hand, we mainly work with birth cohorts of 10 years, which increase the sample sizes while still allowing to capture cohort specific effects. On the other hand, as robustness checks, we also performed our analysis considering 5-years cohorts and even 1-year ones and the results were very similar.

Based on the ISCED 1997 levels, we created a new variable, which we refer to as ed_lev, taking values 1 to 4. The correspondence between our grouping and the ISCED 1997 categories is presented in Table 1. In our study, education plays a crucial role, however, different schooling systems adopted in different countries and time periods call for an encompassing definition of schooling levels. This is why we do not use ISCED 1997 as our main variable in the regressions. Furthermore, in some countries such as Germany, people between the values 1 and 2 were indistinctly reported with the value 2. France, Croatia, Slovakia, and Denmark display almost null observations for level 4 of ISCED 1997. These complications regarding the ISCED 1997 level 4 might be due to differences in the

[33] As an example, Costa (1996) finds that people working night-shifts experience various health issues due to their job.

educational system among countries.

Table 1: Correspondence table between *ed_lev* categories and ISCED 1997 education levels

Educational level	ISCED 1997	*ed_lev*
No education	0	1
Up to high school	1, 2	2
High school	3, 4	3
College	5, 6	4

In our sample we have a high number of interviewed people that did not report their parents' educational level.[34] In order to assess whether there is a selection bias in the sample, we follow the approach presented in Neidhöfer et al. (2018). Comparing the mean educational level between the whole sample and the restricted one for which both parents' information is available, we find that the average level of education is slightly higher in the restricted group than in the unrestricted one. However the difference is only 0.04 and, when looking at each country, we find that there is no clear trend and differences are negligible. As an example, Bulgaria has a positive difference[35] of 0.076 while Poland has a negative one of 0.13.

2.2 Descriptive Analysis

The descriptive statistics we are going to present are relative to the respondents that reported the level of education of at least one parent. However, the results do not seem to vary much when using the full sample, making again the case for absence of selection in the sample.

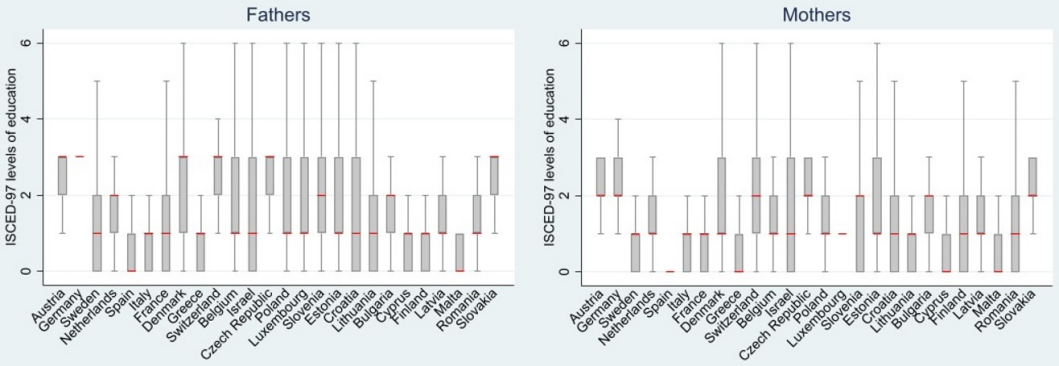
We start our analysis by examining and comparing the level of education of respondents' parents. The distributions by country of their ISCED 1997 levels are described separately for mothers and fathers in Figure 7. Overall, the parents' education for the cohorts in study was rather low. Indeed, the median ISCED 1997 level of education for both fathers and mothers was 1 (that is, primary education) in most of the countries. Exceptions are Austria, Germany, Switzerland, Denmark, Slovakia and the Czech Republic, where the median educational attainment was 3 for fathers and 2 for mothers, and the Netherlands,

[34]The total number of observations is 125142 and 41838 people neither reported their father nor their mother ISCED level.

[35]Meaning that the unrestricted has a higher average level of education than the restricted.

Cyprus and Slovenia with a median level of 2 for fathers.[36] Moreover, the third quartile does not stand above the 3-rd ISCED 1997 category in any country, for neither parents. Particularly low education is observed in Spain and Malta where the median for both parents is equal to 0. Leaving out Israel and Croatia, which display the largest spread, hence the largest variation, educational attainments are rather concentrated in almost all countries. When making comparisons between parents, it is rather easy to observe that fathers were usually more educated than mothers in most of the countries, except for Israel, Estonia, Bulgaria, Latvia, Malta and Finland. The last one is an interesting case as it is the only country were mothers were more educated than fathers. Furthermore, there is no country were the median level of education of mothers is equal to 3, while it does happen for fathers.

Figure 7: Distribution of fathers (left panel) and mothers' (right panel) ISCED 1997 education levels by country



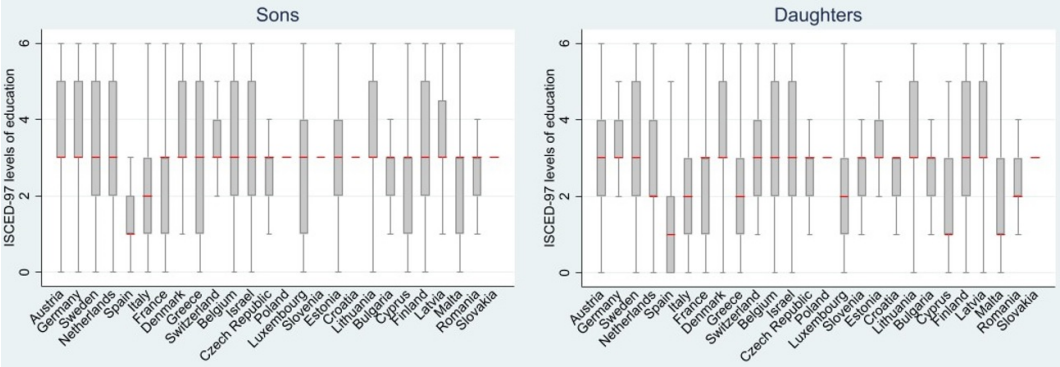
Note: the red line corresponds to the median.
Source: own elaboration based on SHARE data.

Comparing parental education with the one of children, in Figure 8 we can see that the offspring is more educated. The majority of countries presents a median ISCED 1997 level of education of 3, both for females and males. Interestingly, Spain is still the country performing worst for both sexes, while Malta seems to perform much better for men. The distribution of the educational attainments of children becomes more similar between genders (e.g. in Sweden, Finland, France, Italy, the boxplot is identical for both). Still in a number of countries, such as, Austria, Germany, Spain, etc, sons appear to have a higher education when compared to daughters. It is worth noticing that the sons' median level of education is never below the one of daughters, in any country. The countries that display more educated females, to some extent, are the Baltic countries, with Latvia being the

[36] A value of 2 corresponds to middle school while 3 stands for lower secondary education.

only country where the third quartile stands at a higher educational level for daughters, specifically, at level 5 and Estonia displaying a right-skewed distribution.

Figure 8: Distribution of sons (left panel) and daughters' (right panel) ISCED 1997 education levels by country

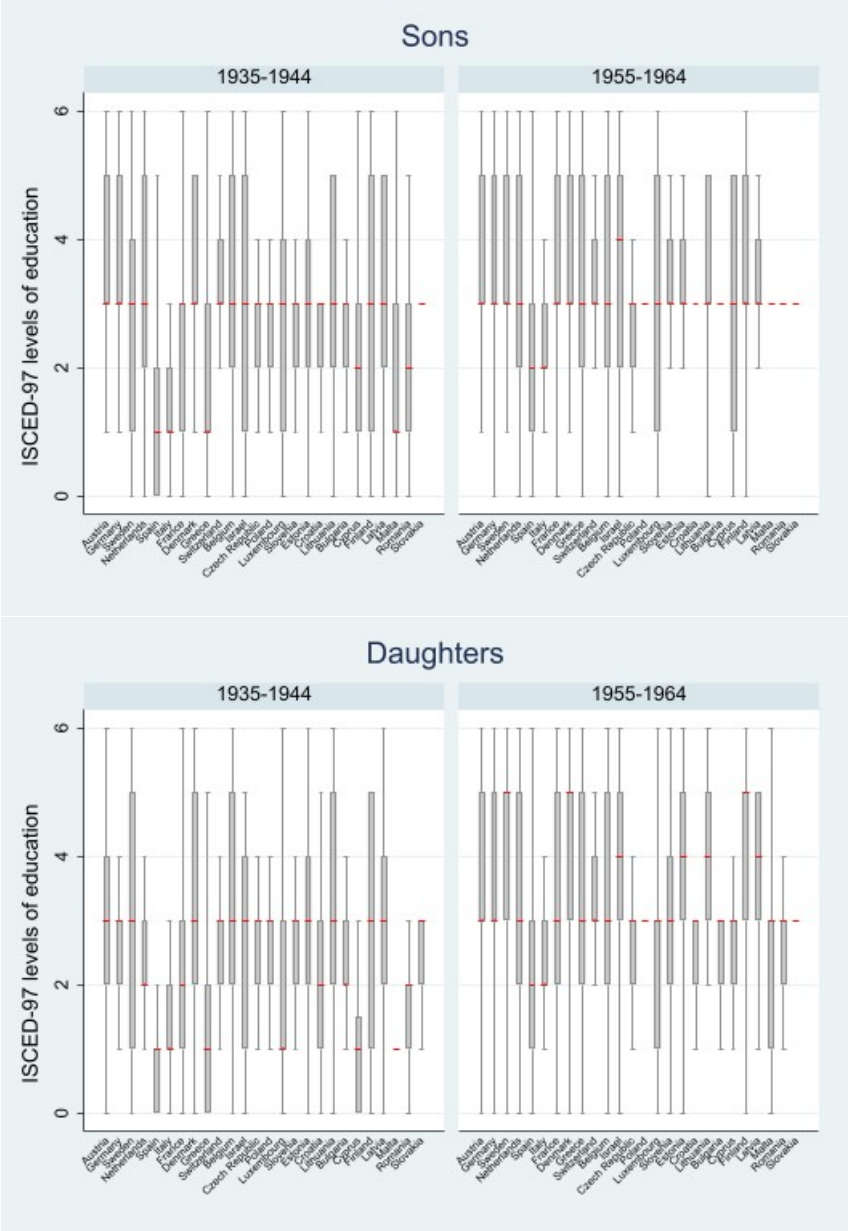


Source: own elaboration based on SHARE data.

Figure 9 describes the educational attainments for sons and daughters for two 10-years birth cohorts situated at ten years time distance, namely, 1935-1944 versus 1955-1964. These plots can give us an idea on the trends in education over time by gender. It is easy to note the increase in schooling for the new generations with respect to the older ones. As for sons, there is a clear shift upwards for the majority of countries. Only the Netherlands, Denmark, Switzerland, Belgium, and Czech Republic do not display variations. Interestingly, Latvia presents less cases of low levels of education but, at the same time, a lower share of men got a tertiary education, as we can see from the higher concentration around the median.
Daughters experienced a stronger positive trend, no country presents a median level of education below 2 in the youngest cohort and only Italy and Spain have a median value of 2. Furthermore, while in the older generation women were on average less educated than men, in the 1955-1964 one, they recovered significantly to the extent that in some countries females display a higher median level of education than males. The Nordic countries, Sweden, Denmark, and Finland present a surprisingly high median of 5, while Estonia, Lithuania and Latvia a level of 4.

Some additional evidence on the differences between the two cohorts is provided in Figure 10, which depicts the percentages of individuals in each of the four categories defined by the variable *ed_lev*, described above, separately by gender. We can still clearly appreciate

Figure 9: Distribution of sons (top panel) and daughters' (bottom panel) ISCED 1997 education level for cohort 1935-1944 (left panel) versus 1955-1964 (right panel)

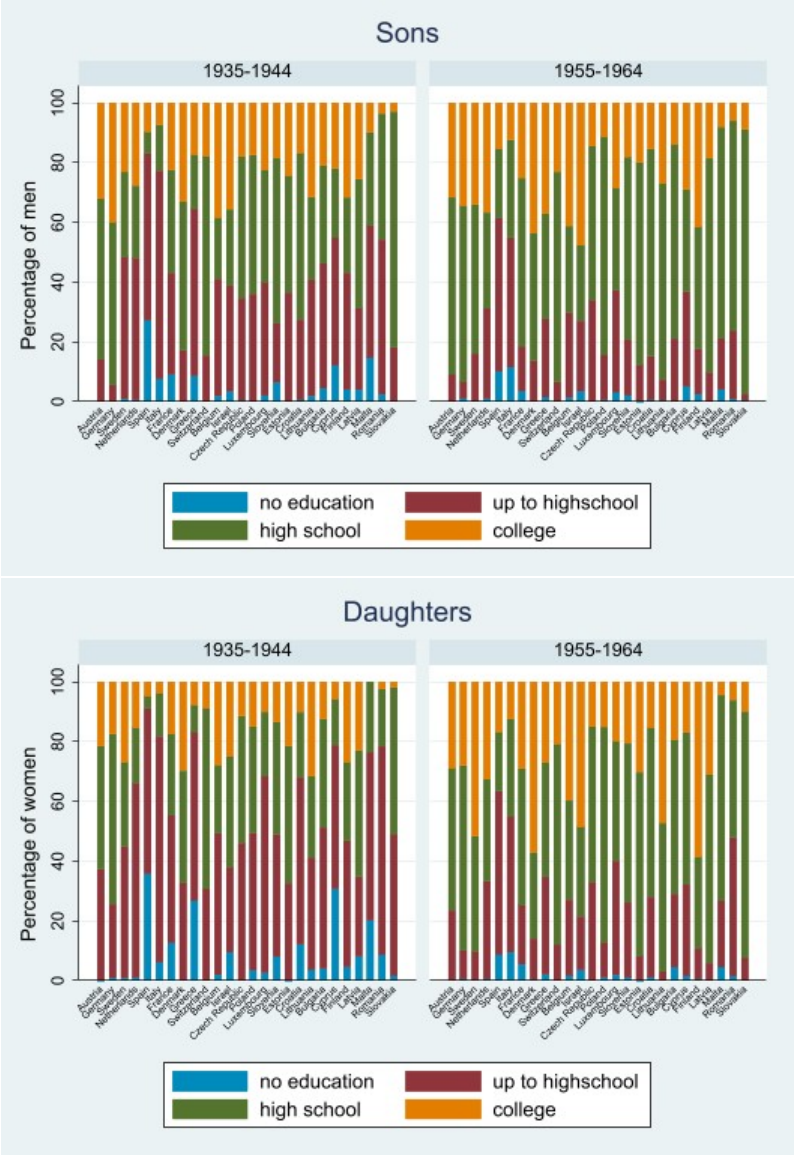


Source: own elaboration based on SHARE data.

an increase in the level of education. Surprisingly, when looking at the percentage of people with no education, we notice that women were in a worse condition than men in the older

cohort, but in the younger one the percentage of females with no education is lower than the one of males in every country. It is worth observing the marked increase of women with a tertiary education.

Figure 10: Prevalence of sons (top panel) and daughters' (bottom panel) educational attainment by country and cohort

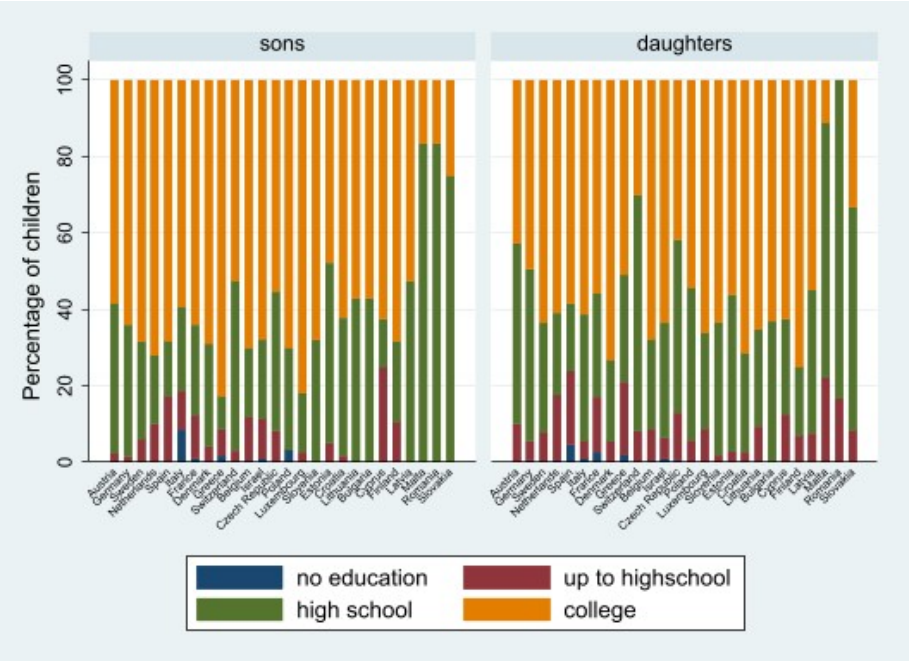


Source: own elaboration based on SHARE data.

In order to provide some *prima facie* evidence of the intergenerational persistence of

education, we show the distribution of levels of education for children conditional on having at least one parent with a college degree. From Figure 11 we see that in the majority of countries at least half of the children got a college degree. Furthermore, usually at least two thirds of the children end up with at least a high school degree and for the majority of the countries no children have zero education.

Figure 11: Distribution of education levels of sons (left panel) and daughters (right panel) for families with at least one college educated parent

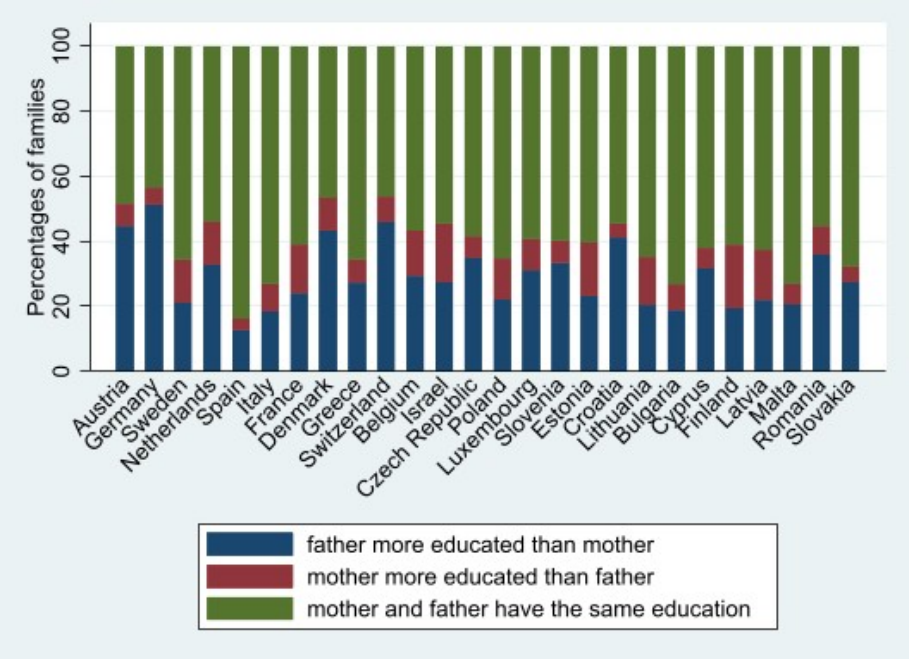


Note: in this figure we have only taken into consideration children whose father or mother had a college degree. This sample is considerably smaller as it only consists of 8650 observations.
Source: own elaboration based on SHARE data.

Since we are also going to apply the dominance approach in one of our specifications, we present in Figure 12 the distribution of the respondents' families based on which parent that has the highest educational attainment. In most families both parents have the same educational level. This could indicate the presence of homogamy, which consists in the people choosing partners with similar characteristics (Ravazzini et al., 2017). In sociological terms, it means that there could be assortative mating in our sample. However, there are some variations among countries. In particular, in Germany the majority of families has fathers as the most educated member. While in all countries the percentage of households with the mother having a higher education than the father is lower than the opposite

scenario, the Nordic countries, the Baltic countries (Estonia, Lithuania, Latvia) and Israel display the highest percentage of families in which mothers represent the most educated parent. On the other hand, South European countries, Germany, and Austria are those where families with mothers as the most educated parent are the least in percentage terms.

Figure 12: Comparison of educational level between parents



Note: this graph is performed ISCED 1997 educational levels.
Source: own elaboration based on SHARE data.

III Results

In this chapter we present the main results of the empirical evidence. Our goal is to analyse the relationship between the educational attainments of parents and of their offspring, in an attempt to evaluate the persistence of education and socio-economic status throughout generations as well as to get an idea on the role of the public investment on the socio-economic mobility. For this, we use several approaches adopted in the existing research in the field, and estimate a number of empirical specifications corresponding to the models presented in the literature, using the data provided by the SHARE survey. An important strength of using SHARE data is that we can take advantage of the heterogeneity among countries: twenty-five European countries plus Israel, which display important differences in the education systems as well as in the public investments in education, especially for the generations in study.

3.1 Empirical Specifications

We use several econometric specifications in order to analyse the influence of parents on their children's educational status. First, we attempt to explore the effect of parents' educational attainment on the probability for children to obtain a college degree. For this we estimate both a linear probability model (LPM) and a logit specification in which the dependent variable is a binary variable taking value 1 if the respondent is college educated and 0 otherwise. We will run the regression using both OLS and logit specifications, as each of them has several advantages and drawbacks. Employing both regression models can be useful in order to control the robustness of our results. The literature teaches us that the linear approach through OLS estimation sometimes fits rather well a probability model, leading to results that are very close to the logistic ones (especially if the probability is between 0.2 and 0.8) but benefit of a much easier interpretability (Hellevik, 2009). Unfortunately, the LPM does not perform well when the probabilities are extreme (very close to 0 or very close to 1).

In a second step, we extend the analysis to four outcomes, corresponding to four levels of educational attainment: (i) no education, (ii) up to high school, (iii) high school and (iv) college degree. To do this, we use a multinomial logistic regression setup, where the dependent variable is the child's level of education measured by the categorical variable we already described in Table 1. We use the multinomial logistic regression as it accounts for the nonlinearities that characterize categorical variables and that we have discussed to some extent in paragraph 1.3. Our main independent variables are parental educational levels, reported in the same terms of our categorical variable *ed_lev*. In each of the two

steps (both when estimating the probability to get a college degree and when estimating the multinomial logit) we run several specifications, which allow us to get more insight into the role of the parents' socio-economic status and which correspond to different approaches used in the existing literature. We will first control only for the father's schooling, and then we include the education of both mother and father. Moreover, we run another specification considering only the highest level of education between the two parents. As additional controls, we include the child gender, the country of residence and a set of 10-years birth cohorts.

As multinomial logistic regressions are not of easy interpretation, we are going to interpret them in terms of relative risk ratios, called "odds ratios". This means that the coefficients will report how the chance for the outcome to fall in a specific group rather than in the reference one changes as the variable takes different values. Thus, a coefficient greater than 1 should be interpreted as an increase in the probability that the outcome is falling into a particular category relative to the baseline comparison one as the variable increases; the opposite holds true when the coefficient is lower than 1.
It should be reminded that if the dependent variable takes k values, we obtain $k-1$ output tables (one for each category of the output variable different of the baseline one). In all our multinomial logit specifications, the reference group is represented by the respondents with a high school education, which is the most numerous.

In what follows, we shall denominate the **sex-role model** a specification in which we include, besides a binary variable indicating the gender of the offspring, $female$, also the interaction variables between the child's sex and each parent's educational level, like in Schneebaum et al. (2015). This means that in a linear regression specification, female respondents not only are characterized by a different intercept if compared to males, but also the coefficients estimating the role of parental educational level are different (different slopes). Equation 4 presents the empirical specification for the linear probability model estimated for the likelihood of getting a college degree.

$$\begin{aligned} y_i = \beta_0 + \beta_1 female + \beta_2 ed\_lev_f + \beta_3 ed\_lev_m + \beta_4 (female * ed\_lev_f) \\ + \beta_5 (female * ed\_lev_m) + \beta_6 X_i + \gamma_c + \delta_c + \epsilon_i \end{aligned} \tag{4}$$

Where $female$ is a binary variable that takes value 1 when the respondent is a woman and zero otherwise. The variables ed_lev_f and ed_lev_m respectively stand for the father

and mother's educational level.[37] Thus, by reordering, in the case of a female respondent we obtain what is represented in equation 5.

$$y = \beta_0 + \beta_1 + (\beta_2 + \beta_4)ed\_lev_f + (\beta_3 + \beta_5)ed\_lev_m + ... \tag{5}$$

From this, it is clear that, for example, a negative interaction between paternal level of education and $female$[38] means that fathers have a lower impact on the education levels of their daughters than on the one of their sons.

3.2 Results

In Table 2 we present the LPM estimates of our four main specifications, corresponding to four approaches in the literature. The dependent variable is a binary variable taking a value of 1 when the respondent has a college education and 0 otherwise. This gives an initial hint on the intergenerational persistence/mobility at the highest level of education. In the second specification we include among the regressors both father and mother's schooling attainment, while in the third model we also control for the interaction variables between the child gender and each of the parents' education level. The fourth specification, the dominance approach, uses as key explanatory variable the highest between the parents' schooling degrees.

It is easy to note that all the coefficients corresponding to our main regressors are highly significant. The higher the educational attainment of either parents, the higher the probability that children would get a college education. Our results indicate a strong level of persistence, as having college educated parents makes it more likely for children to have a college degree. In particular, in the first specification, a college-educated father is associated to a 50 percentage points increase in the likelihood of college educated offspring. Note that the coefficients remain strongly significant, although their size is lower, when including in the regression the mother's education and the interaction variables. It is important to observe that being a woman is always associated to a lower probability of a college education. Generally, maternal level of education has a lower impact than the paternal one. However, we find a notable exception in the sex-role model, where, accounting for the interaction effects, mothers have a stronger role for daughters compared to fathers.[39]

[37] By educational level we refer to the categorical variable we have described in Chapter 2.

[38] Thus, a negative value of β_4.

[39] As an example, considering the interaction, the coefficient for college educated mothers would be of 0.361 while the fathers' one of 0.3.

Table 2: College educated children and their parents: OLS regression output

	(1) College	(2) College	(3) College	(4) College
Father				
up to high school	0.0915***	0.0525***	0.0684***	
high school	0.235***	0.154***	0.190***	
college	0.501***	0.360***	0.434***	
female	-0.0324***	-0.0347***	-0.0218***	-0.0343***
Mother				
up to high school		0.0602***	0.0445***	
high school		0.177***	0.150***	
college		0.312***	0.250***	
*Father*female*				
up to high school × female			-0.0289**	
high school × female			-0.0639***	
college × female			-0.134***	
*Mother*female*				
up to high school × female			0.0284**	
high school × female			0.0486***	
college × female			0.111***	
Highest education between parents				
up to high school				0.0945***
high school				0.241***
college				0.507***
Observations	79974	79470	79470	82206

Note: in all regressions we have controlled for country fixed effects and for birth cohort. The dependent variable is a dummy taking value 1 when the respondent is college educated and 0 otherwise.

As the literature points at the possible existence of nonlinearities (Hout and DiPrete, 2006), we run a similar set of logistic regression keeping the same dependent and independent variables. Their results are reported in Table 3 as odd ratios, with the reference category being parents with no education. In the first specification, the coefficient of 2.298 for

fathers with an education up to high school means that children with fathers that had attained that educational level are 2.298 times more likely to get a college degree than those with a father with no education at all. Note that all the specifications indicate very high persistence for college education.
Results in column 1 and 4 show that, respectively, children with a college educated father or, a college educated parent, are more than 15 times more likely to get a college education than those with parents with no education. Mothers have a significant role as well. Estimates presented in column 2 indicate a similar impact for fathers' and mothers' schooling level on the offspring education, as their coefficients do not differ much up to the college degree. However, introducing interaction effects like in column 3, we see that fathers have a stronger influence on sons than mothers while the opposite is true for daughters. Such differences in the role of parents' educations are larger and their significance is stronger in the case of college-educated parents.

Table 3: College educated children and their parents: logistic regression output

	(1) College	(2) College	(3) College	(4) College
Father				
up to high school	2.298***	1.677***	1.828***	
high school	5.323***	3.124***	3.701***	
college	16.20***	7.521***	10.37***	
female	0.801***	0.785***	0.724***	0.788***
Mother				
up to high school		1.673***	1.416***	
high school		3.118***	2.456***	
college		5.384***	3.682***	
*Father*female*				
up to high school × female			0.845*	
high school × female			0.724***	
college × female			0.552***	
*Mother*female*				
up to high school × female			1.396***	
high school × female			1.591***	
college × female			2.019***	
Highest education between parents				
up to high school				2.599***

high school				6.255***
college				19.02***
Observations	79974	79470	79470	82206

Note: in all regressions we have controlled for country fixed effects and for birth cohort. The dependent variable is a dummy taking value 1 when the respondent is college educated and 0 otherwise. The coefficients are presented as odd ratios.

As for our multinomial logistic regressions, due to the extended output (for each category except for the baseline one, we get a complete set of estimates), we present the results in a separate table for each specification. It is useful to recall that in all the multinomial logit estimations the baseline comparison group is represented by the respondents with a high school degree.

We first analyse the conventional model (including only the father's education as main explicative variable) in Table 4. The columns report the relative risk ratios for each of the three outcomes: no education (column 1), up to high school (column 2) and college degree (column 3) with respect to the reference, high school degree. The results indicate that children born to fathers with some education display significantly lower probabilities of ending up without schooling relative to getting a high school degree, with respect to those that have fathers with no education. A similar pattern emerges for the second outcome, "up to high school education". It is easy to observe that the relative risks decrease gradually for both outcomes as the father's educational attainment increases. Differently, for the third outcome, the relative risks that the offspring get a college degree is significantly larger for more educated fathers. Children born to parents with a tertiary education display a 6.5 times higher relative risk of getting a college degree with respect to a high school one than those born to a father with no education. The results suggest the existence of strong persistence in the transmission of education from parents to children.
Relevant for our analysis is that being a woman is always associated with having lower education: daughters present significantly larger relative risks of getting no education or an up to high school instruction and smaller relative risk of a college degree with respect to their male counterparts. Similar results are obtained when using the dominance approach, which is reported in Table 9 in the Appendix B. This is likely due to the fact that, on the one hand, fathers are usually the most educated parent in the household and, on the other hand, parents in the same family display similar educational levels in most countries as shown in Figure 12.

Table 4: Multinomial logistic regression output for the conventional model

	(1) No education	(2) Up to high school	(3) College
Father			
up to high school	0.173***	0.541***	1.424***
high school	0.0692***	0.214***	2.421***
college	0.0595***	0.136***	6.567***
female	1.717***	1.502***	0.936***
Observations			79974

Note: we have controlled for country fixed effects and for birth cohort. The coefficients are presented as relative risk ratios. The reference category is high school education and the base outcome for parental education is no education.

When taking into consideration also mothers' schooling with the Individual model in Table 5, the magnitude of the impact of fathers decreases considerably. It is important to observe that both parents present significant coefficients in all the specifications. Interestingly, for the first two outcomes, "no education" and "up to high school education" schooling, mothers with an education up to high school seem to have a stronger influence than fathers, as their corresponding relative risk ratios are smaller in size. As for the third outcome, the relative risk for the offspring to get a college degree with respect to a high school one is gradually increasing in each parent's educational attainment. The influence of fathers with up to high school and college instruction seem to be larger than that of mothers with the same instruction level. However, mothers with a high school degree are associated with a larger increase in the relative risk of a college-educated child than fathers with the same schooling level. It is worth observing that a college educated father and mother increase the relative risk of a college degree for the offspring by 3.9 and 3.5 respectively, with respect to remaining with a high school instruction, indicating therefore important persistence.

Moreover, this specification supports also the previous results regarding the gender effects, namely that women are more likely to have low educational levels. It is important to note that the relative risk ratios are very similar to the ones obtained in the other regressions.

Table 5: Multinomial logistic regression output for the individual model

	(1) No education	(2) Up to high school	(3) College
Father			
up to high school	0.339***	0.706***	1.243***
high school	0.153***	0.326***	1.785***
college	0.141***	0.228***	3.922***
Mother			
up to high school	0.313***	0.643***	1.241***
high school	0.196***	0.317***	2.013***
college	0.223***	0.365***	3.558***
female	1.733***	1.526***	0.917***
Observations			79470

Note: we have controlled for country fixed effects and for birth cohort. The coefficients are presented as relative risk ratios. The reference category is high school education and the base outcome for parental education is no education.

To check the robustness of our results, we also ran a multinomial logistic regression using both men and women and including interaction effects between the educational level of the parents and the sex of the child, as well as using the dominance approach. The direction and the significance of the estimates does not change, proving consistency with the ones described above. The results of these supplementary regressions are presented in the Appendix A and B.

In order to get more insight into the differences between genders with respect to educational attainment we re-run our "individual" specification also separately for sons and daughters. This would allow us to see more clearly whether parents' education exerts a different impact on male versus female offspring. In Table 6 we present the relative risk ratios obtained from the multinomial logistic regressions. Column 1 contains the estimates for men while column 2 for women. As previously, also in this specification parental educational attainment have a significant impact on all the three outcomes. However, it is worth observing some differences in the effects between male and female offspring. Usually fathers play a stronger role for sons than for daughters. Indeed, for example, having a father with up to high

school education reduces the relative risk of a child having up to high school education (with respect to getting a high school degree) by 0.69 for men but by 0.71 for women, with respect to a non-educated father. However, the effect is different for college-educated fathers with respect to the first two outcomes. In this case, we see that fathers with a tertiary education have a stronger impact on their daughters' schooling. The presence of a father with a college degree reduces the relative risk ratios that a daughter ends up non-educated or with a low education more than it does for a son. Similar results are found by Buchmann and DiPrete (2006). The value of the coefficient for both males and females might be in part due to income effects, as higher parental education is associated with higher income. Furthermore, college educated parents have a higher incentive to invest in their children's human capital when returns to schooling are higher (Corak, 2013). Another factor at play for what regards daughters is that college educated fathers are likely to be more open-minded than those who are not, thus encouraging their daughters to get an education.

Fathers are always more influential than mothers when analysing sons schooling attainment, but the mothers' education displays stronger and larger impacts for daughters. However, some exceptions are found (i) for the "no education" outcome when fathers have at least a high school diploma; (ii) for the "up to high school" group when fathers have a college degree. In these two situations, fathers exert a stronger influence on daughters than mothers do. In the college educated group, we observe a high level of persistence when parents are college educated as well. Furthermore, here the sex-role model applies perfectly as fathers have stronger influence over sons and mothers over daughters.

Until now we have not reported the birth cohort coefficients, however, in this case there is an interesting difference. When running regressions on the pooled sample we always found that younger birth cohorts have higher schooling attainment. Now that we analyse men and women separately, we find that female educational level has risen more than the male one in the more recent cohorts.

Table 6: Regression output for sons (column 1) and daughters' (column 2) educational levels

	(1) Sons' ed. lev.	(2) Daughters' ed. lev.
no education		
Father		
up to high school	0.317***	0.346***

high school	0.140***	0.154***
college	0.143***	0.125***
Mother		
up to high school	0.398***	0.264***
high school	0.275***	0.156***
college	0.274*	0.208***
up to high school		
Father		
up to high school	0.693***	0.712***
high school	0.304***	0.331***
college	0.273***	0.193***
Mother		
up to high school	0.663***	0.620***
high school	0.405***	0.269***
college	0.403***	0.343***
College		
Father		
up to high school	1.338***	1.154*
high school	1.997***	1.617***
college	5.254***	3.167***
Mother		
up to high school	1.127*	1.367***
high school	1.832***	2.245***
college	2.961***	4.266***
Observations	35681	43789

Note: in both regressions we have controlled for country fixed effects and birth cohort. The coefficients are presented as relative risk ratios. The reference category is high school education and the base outcome for parental education is no education.

Since the countries in our sample differ largely in their characteristics, such as educational policies and societal norms, we take three countries as key examples of these structural differences. The countries chosen are France, Italy, and Sweden and we run the "individual" multinomial logistic specification separately for each of them. The results of these regressions are reported in Table 7. Running these regressions allows us to understand

and highlight the differences in persistence/mobility in education between generations among countries and that one cannot really appreciate in Table 3, where countries are only represented through their fixed effects coefficient. Furthermore, such an approach gives an idea on the structural differences between countries, that must be taken into account when considering possible policy implications of our results.

In Table 7, French results are reported in column 1, Swedish ones in column 2 and Italian ones in column 3. While the sign of the estimates is generally the same with very few exceptions, the size of the estimates display important differences among the three countries. Interestingly, looking at the no education outcome in Sweden, all coefficients are insignificant. This can be explained by the fact that people with no education in Sweden are very few. This might not be an issue of sample size or selection but represent the efficacy of the policies implemented by Sweden in the educational system. To further substantiate this claim, it should be reminded that among the three countries, Sweden established compulsory primary education in 1842, France did so in 1881 while Italy only in 1923 (Garrouste, 2010).[40]
Referring to the "no education" outcome, France is an interesting case as mothers' education seems to be more important than fathers'. Having a mother with an up to high school education significantly decreases the relative risk of a non-educated child (with respect to a high school degree) by 0.38 versus 0.44 which is relative to a father with the same education level. In Italy, for the same outcome, the coefficients for fathers present a peculiarity as well. The relative risk of the offspring ending up with no education is decreasing with the father's schooling but at a slower pace for a college degree with respect to a high school one. As for the up to high school education outcome, we see that Italy is the country with most persistence as its coefficients for fathers with at least a high school education onwards are far lower than the other countries. Analysing the college educated group, the Italian results make an interesting case. The coefficients for maternal education are all highly significant and larger than the paternal one. While there is some similarity with France in this sense, the magnitude of the effects is much larger in Italy indicating that in this country mothers definitely play a very important role. Furthermore, in Italy only college educated fathers seem to have a significant impact on their children's chance of getting a college degree, as fathers with different levels of education display insignificant coefficients. This last result together with the estimates for the other two outcomes point to a high degree of persistence in education between generations in Italy.

Very interesting results come out also when analysing the role of the offspring gender.

[40]Before 1923, in Italy only the first two years of elementary school were compulsory (Garrouste, 2010).

While Italy and Sweden display a non-significant effect for being a women on the probability of ending up with no education, being a female significantly and surprisingly increases by 1.8 the relative risk of no education in France. As for the university education, each country presents a different picture. The effect of gender is not significant in France, negative and significant in Italy, making clear that tertiary education is still mostly attained by men in this country and positive in Sweden where women are more likely than men to obtain a college degree.

While our results regard older generations due to the target population of SHARE (age fifty and above), interestingly, the differences we found among these three countries seem to be still present. When looking at data from Eurostat (2021), we find that all three countries have increased their graduates percentages. In Italy and France the number has almost doubled for people aged 25-54 compared to those aged 55-74. However, in Italy only 22.7% of people aged 25-54 has a tertiary education, while in France it is 45.6% and in Sweden 50.2%.

Table 7: Intergenerational educational association in 3 different countries: multinomial logistic specification

	(1) France Child ed. lev.	(2) Sweden Child ed. lev.	(3) Italy Child ed. lev.
no education			
Father			
up to high school	0.439***	0.337	0.343***
high school	0.275***	0.000000163	0.298***
college	0.289**	0.000000210	0.160**
Mother			
up to high school	0.384***	0.441	0.613**
high school	0.196***	0.000000403	0.546
college	0.186*	0.000000952	0.471
female	1.895***	0.969	0.883
up to high school			
Father			
up to high school	0.779*	0.913	0.570***
high school	0.447***	0.456***	0.100***
college	0.476**	0.211***	0.0663***

Mother			
up to high school	0.629***	0.869	0.560***
high school	0.297***	0.445***	0.153***
college	0.653	0.638	0.0994***
female	1.674***	0.983	1.160*
College			
Father			
up to high school	1.471**	1.203	0.713
high school	2.657***	1.726***	1.548
college	5.765***	3.151***	3.139***
Mother			
up to high school	1.485**	1.116	2.275***
high school	1.965***	1.642**	5.739***
college	3.459***	2.100***	6.755***
female	1.128	1.305***	0.766*
Observations	4353	4258	5729

Note: in all regressions we have controlled for birth cohort. The first column presents results for France, the second for Sweden and the third one for Italy. The coefficients are presented as relative risk ratios. The reference category is high school education and the base outcome for parental education is no education.

Conclusions

In this thesis we studied educational intergenerational mobility in Europe through empirical research based on the SHARE dataset. We compared the main empirical specifications outlined in the literature in order to show the importance of the role of women in intergenerational mobility: we do so including both mothers and daughters in our analysis. While overall in our sample the intergenerational mobility seems to be rising because younger cohorts have higher educational attainment, confirming the secular trend found in the literature (Breen et al., 2009a,b), we find that both parents present highly significant coefficients for all levels of education. It is important to observe that, when accounting for maternal education, the impact of paternal schooling attainment becomes lower. The sex-role model gives additional insight, particularly interesting in the case of college educated respondents. College educated fathers have a stronger impact on sons than daughters, while the opposite holds for mothers. However, we remind the reader that our analysis only estimates correlations between parents and children's educational outcomes, we do not address causality in this work.[41]

Interestingly, being a woman is always associated with having a lower level of education in the regressions performed on the pooled sample. However, when we consider men and women separately, women experienced a stronger rise in educational attainment than men over time.

Since we have controlled for country fixed effects, our results should be carefully interpreted when considering country specific characteristics. Policymakers should be aware that countries in our sample greatly differ.
As a clarifying example, we analysed France, Sweden, and Italy separately. The results showed marked differences between the three countries. In particular, we found a considerably high level of persistency in Italy, especially at the top of the educational distribution. On the contrary, Sweden seems to be the most mobile country among the three and, thanks to its long history of public investments in education, it is also the country with more highly educated respondents.[42]
Furthermore, Swedish women are more likely to get a college degree compared to Italian and French ones. France makes an interesting case for the inclusion of women, as in this

[41] For a survey of the literature investigating causality in intergenerational mobility, see Black and Devereux (2010); Torche (2014).

[42] Our findings for Sweden confirm what has been previously found in the literature (Black and Devereux, 2010).

country mothers have a stronger role than fathers determining their children's education in "no education" and "up to high school" cases.

We controlled for cohort and country fixed effects, but there is still room for improvement. We could not include occupational status in our specification as the data is not available for every country in the SHARE dataset at the moment. Controlling for occupational status of parents will likely shed more light on the initial conditions of our respondents. More emphasis should be placed on early life conditions because this time is crucial in the development of child's cognitive and non-cognitive abilities (Cunha and Heckman, 2008; Cunha et al., 2010).
More work could be done by considering potential biases induced by assortative mating. This is likely to be an issue in our sample, as that the majority of families are homogamous (see Figure 12). Furthermore, new research should try to assess the role of migration in intergenerational mobility. It is a delicate topic as one should be very careful in considering several issues with respect to the migration moment in the respondent's life. For example, whether it was before or after completing his studies. In addition, other issues may be relevant such as having parents that experienced migration or the region of origin. Promising work in this direction has been carried out by Schneebaum et al. (2016) but it still leaves place for additional refinements.

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A Sex-role model with interactions

Table 8: Regression output with interactions between parental levels of education and child's sex

	(1) Child ed. lev.
no education	
Father	
up to high school	0.307***
high school	0.125***
college	0.130***
female	1.829***
*Father*female*	
up to high school × female	1.185
high school × female	1.387
college × female	1.114
Mother	
up to high school	0.411***
high school	0.300***
college	0.285*
*Mother*female*	
up to high school × female	0.632***
high school × female	0.505*
college × female	0.699
up to high school	
Father	
up to high school	0.667***
high school	0.261***
college	0.237***
female	1.492***
*Father*female*	
up to high school × female	1.107
high school × female	1.435***
college × female	0.928
Mother	

up to high school	0.665***
high school	0.433***
college	0.440***
*Mother*female*	
up to high school × female	0.946
high school × female	0.605***
college × female	0.760
College	
Father	
up to high school	1.329***
high school	2.076***
college	5.560***
female	0.970
*Father*female*	
up to high school × female	0.871
high school × female	0.742***
college × female	0.521***
Mother	
up to high school	1.122*
high school	1.846***
college	2.775***
*Mother*female*	
up to high school × female	1.227**
high school × female	1.199*
college × female	1.594***
Observations	79470

Note: we have controlled for country fixed effects and for birth cohort. The coefficients are presented as relative risk ratios. The reference category is high school education and the base outcome for parental education is no education.

B Dominance model results

Table 9: Dominance model regression output

	(1) Child ed. lev.
no education	
Highest education between parents	
up to high school	0.157***
high school	0.0615***
college	0.0564***
female	1.728***
up to high school	
Highest education between parents	
up to high school	0.507***
high school	0.191***
college	0.134***
female	1.511***
College	
Highest education between parents	
up to high school	1.479***
high school	2.535***
college	7.012***
female	0.920***
Observations	82206

Note: we have controlled for country fixed effects and for birth cohort. The coefficients are presented as relative risk ratios. The reference category is high school education and the base outcome for parental education is no education.