Social inequalities in occupational attainment: using sibling data to estimate the total effect of family of origin and the role of education

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Acknowledgements

This work was supported by the Economic and Social Research Council (ESRC) [ES/P009301/1]

The help provided by staff of the Longitudinal Studies Centre – Scotland (LSCS) is acknowledged. The LSCS is supported by the ESRC/JISC, the Scottish Funding Council, the Chief Scientist's Office and the Scottish Government. The authors alone are responsible for the interpretation of the data. Census output is Crown copyright and is reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland.

Abstract

This study provides new evidence about the extent to which individual occupational status is determined by family of origin (ascription) and by educational attainment (achievement). Using linked administrative data from the Scottish Longitudinal Study, we measure intergenerational mobility using sibling correlations and we assess the effect of education on occupational status by examining between- and within-sibling differences. The results from our between-family analysis (random effect models) show that about 36% of siblings' variation in occupational status in Scotland is attributable to shared family factors. Our observed measures of family background (including parental education, occupation and living in social housing) explain only 28% of the shared family effect while siblings' educational attainment accounts for more than two thirds of the between-family variance. The results from our within-family analysis (fixed-effect models) confirm that education is a strong predictor of occupational status. They also reveal that the effect of education is slightly overestimated in the random effect models, but in the Scottish case, this potential bias is small enough not to threaten our conclusions.

Introduction

The persistence of social inequalities in labour market outcomes has been widely documented (OECD, 2018; Social Mobility Commission, 2019). There is a long tradition in sociological research which analyses the extent to which individuals' occupational status is determined by ascriptive factors (such as parental characteristics) and achieved factors (most prominently educational attainment). This research stems largely from the seminal work on the status attainment process by Blau and Duncan (1967). In their study, they analysed both the direct effect of father's occupational status on son's occupational status and its indirect effect through education. They found that the achievement of occupational status in the US was highly dependent on ascriptive factors (family socio-economic status but also race and where people lived) and that most of this effect was mediated by educational attainment. They also believed that with the increasing importance of education for acquiring higher status occupations, all of the family effect would come to be mediated by education. Many other studies in different countries have replicated this analysis and shown similar results, as have comparative studies including Breen (2004), Breen and Müller (2020), and Bernardi and Ballarino (2016). Recent studies of the UK include Laurison and Friedman (2016), Sullivan, Parsons, Green, Wiggins, and Ploubidis (2018) and Bukodi, Goldthorpe, Halpin and Waller (2016). The former two studies focused on entry into elite social class destinations. The first study uncovered a persistent class pay gap even among people who reach top professional and managerial occupations. The second study found that social class differences in top class occupational destinations in the UK were fully explained by differences in cognitive and educational outcomes which accumulate during the life course. The latter study (Bukodi et al. 2016) adopted a life-course perspective and examined occupational trajectories of three British birth cohorts covering the period between the mid-twentieth and early twenty-first

century. Their findings show an increase across cohorts in individual chances of entering into and remaining at the higher levels of the managerial and professional classes, but also little evidence of a change over time in the role of education in determining individuals' social class position.

In economics, intergenerational persistence in income or earnings has been found to vary widely, with Nordic countries displaying a higher degree of intergenerational mobility than the US and UK (Björklund and Jäntti 2012; Black and Devereux 2011; Corak 2013). Economists have also investigated the role of education in explaining intergenerational mobility. For example, Gregg, Jonsson, Macmillan and Mood's study (2017) pointed out that education plays a lower role in explaining the intergenerational income association in Britain and the US than in Sweden, and Gregg, Macmillan, and Vittori (2019) further found that in the UK, even among people with the same educational attainment, there is a strong association between their earnings and their parental income.

In this paper, we add to that large body of existing research but we depart from the majority of earlier studies in two main ways: we measure intergenerational mobility using sibling correlations rather than the more usual adult child – parent association; and we assess the 'purer' effect of education (Conley et al.'s, 2007) for occupational status using a fixed effect model which estimates the effect of education while accounting for the overall effect of family of origin. Despite a long tradition in status attainment and social mobility studies in the UK, there is hardly any evidence on sibling similarity in occupational outcomes, except for the study by Sieben and de Graaf (2001). Moreover, very few studies have analysed the role of education in explaining the within-family variation in occupational outcomes using a sibling

design (e.g. Conley and Glauber, 2005). Yet, investigating the role of education within this framework allows researchers to get closer to truly causal estimates of the effect of education on labour market outcomes and assess the degree to which this this effect might be over-estimated when using individual level data with controls for only a few family background factors.

The child – parent comparison is particularly valuable when we want to focus on specific forms of mobility such as class mobility, or on how, for example, class position is reproduced in successive generations. But it is less satisfactory if our concern is with the broader question of how much social background, or family of origin, determines outcomes like education or occupation. Parental social class or parental income are but single dimensions of social origins and they surely do not exhaust all the channels by which families affect their children's outcomes. Of course, one can consider several measures of social origin together, such as parental education and parental class (Bukodi and Goldthorpe 2018), but the possibility remains that family characteristics that have not been included may shape children's fortunes. Our study addresses this problem by using sibling data, thus providing a more comprehensive measure of the effect of family of origin on children's labour market outcomes (Conley & Glauber, 2008; Björklund et al., 2002). Sibling correlations provide a way of capturing the consequences of all influences stemming from the family of origin without the need to specify and measure them. Moreover, this approach allows us to examine the extent to which commonly used measures of parental background (such as parental social class and education) account for the total estimated family effect and the extent to which education explains differences in occupational status between pairs of siblings (where it plays the role of a

mediator) and within-sibling pairs (its direct effect after controlling for measured and unmeasured family-of-origin influences).

We use new linked sibling data from Scotland to address the following questions:

(1) What is the overall effect of family of origin on the occupational status of individuals in Scotland born between around 1960 and the mid-1980s?
(2) To what extent is the overall effect of family of origin explained by social background characteristics (ascription) and how far by educational attainment (achievement)?
(3) To what extent does education explain within-sibling differences in occupational status?

Scotland is an interesting case to study since it is a country which had higher levels of social inequalities among the cohorts born in the first half of the 20th century than the rest of Great Britain and other countries (Payne, 1987; Erikson and Goldthorpe, 1992; Sieben and de Graaf, 2001) but it also witnessed a substantial increase in the relative rates of social mobility, reaching a level which is no longer different from those of England and Wales (Iannelli and Paterson, 2005a). Moreover, since the 1960s Scotland introduced distinct, socially inclusive education reforms, close to those implemented in the Nordic countries, such as a fully comprehensive reorganisation of secondary education, the raise of the school leaving age (from 14 to 16), the expansion of tertiary education supported by higher education funding policies which either did not require students to pay tuition fees or required them to pay a small financial contribution. Since our sample benefited from these education reforms and from the general expansion of secondary and tertiary education, it is interesting to examine the extent to which observed and unobserved family factors continue to matter for a more recent Scottish cohort than previously analysed and whether education

has now become the main driver behind between-family and within-family differences in individual occupational status.

Research on intergenerational mobility using sibling studies

Sibling correlations have been used in sociology to study educational attainment: see Duta et al. (2021) for an application and extensive review. They have been used less frequently to study intergenerational mobility but there are, by now, a number of studies that do so. For the USA, early examples include Jencks et al. (1979) and Hauser and Mossel (1985), while Conley and Glauber (2007, 2008) are more recent studies. De Graaf and Huinink (1992) estimated sibling correlations for men and women and compared them across three West German birth cohorts. More recently, Karlson and Birkelund (2022) used register data from Denmark to study sibling similarities in occupational status and wages and the role of education in mediating the association between family of origin and siblings' labour market outcomes. The earliest comparative study was by Sieben and de Graaf (2001) who estimated brother correlations for six countries over the 20th century, including Scotland (see next section).

In economics, sibling correlations in long-run earnings have been reported for Sweden, Denmark, Norway, and Finland (Bjorklund et al., 2002), the USA (Mazumder, 2012), Germany (Schitzlein, 2012) and Sweden (Bjorklund and Jantti, 2012). These show the same pattern of inter-country differences as the more conventional father-son correlations or elasticities, with generally more mobility (lower associations) in the Scandinavian countries and the least mobility in the USA.

Two conclusions can be drawn from this literature. First, sibling correlations are always larger than inter-generational correlations. This is to be expected, given that they capture the impact of all dimensions of family background rather than just one. However, because sibling correlations measure all of the variation in an outcome that can be attributed to factors that affect both siblings in a family in the same way, they also reflect shared influences that might arise from non-family sources, such as neighbourhoods or schools. Thus, they provide an upper bound measure of the effects of family background. Second, in the sibling literature, education explains most of the association between parents' and children's occupational outcomes (and, to a lesser extent, the association between parents' and children's income/earnings). This suggests that research based on individual level data may underestimate the mediating role of education on labour market outcomes, since it captures only the effect of observed family factors.

Previous studies about Scotland

Social mobility patterns have been studied in Scotland both as a single case and in comparison with England and Wales and with other countries. One of the most influential studies was conducted by Payne (1987) and analysed data from the 1970s for men. This showed high rates of upward mobility of men from lower non-manual classes and from manual groups. As in the rest of Britain, the expansion of professional and managerial occupations had brought about an increase in the recruitment of people from lower social classes. However, this did not lead to an equalisation of occupational opportunities (i.e. an increase in social fluidity or relative mobility) because the expansion of top level jobs also benefited the sons of the most advantaged groups, thus leaving relative mobility chances unchanged.

Similar results were found by Iannelli and Paterson (2006), using data for men and women from the Scottish Household Survey. Among cohorts born between 1937 and 1976, social mobility was a very common phenomenon (about two thirds of people on their sample were socially mobile), and upward mobility was more common than downward. Once again, however, these high rates of absolute mobility did not translate into any change in relative mobility chances. The authors also found that education did not account for most of the association between origin and destination (Iannelli and Paterson, 2005b). Comparing different birth-cohorts, it emerged that education increasingly explained this association among those people who entered the labour market between the early 1950s and the 1980s but this trend stopped for people entering after this period. The authors concluded that, despite Scotland's comprehensive reorganisation of its educational system and its higher education participation rates compared to England, social mobility patterns resembled the patterns found in the rest of Britain. They questioned the effectiveness of educational reforms for improving social mobility without the support of wider programmes of egalitarian social reform. Similar conclusions were reached in a recent comparative study among the four UK devolved administrations by Paterson (2022). Analysing data from the UK Household Longitudinal Study and class outcomes up to the year 2019, the author found that the expansion of educational attainment in Scotland did not bring about changes in the patterns of competition among people originating from different social classes for entry to managerial and professional careers.

Scotland was one of the six countries included in Sieben and de Graaf's (2001) comparative study of intergenerational mobility using sibling correlations. They used the same data as

Payne (1987), namely the Scottish Mobility Study 1974–1975, and compared men born in different cohorts across the mid-20th century. They reported that, for Scotland, the sibling correlation for occupations was 0.23 in the oldest cohort (who entered the labour market in 1916-30) and between 0.40 and 0.45 for later cohorts (1931-45, 1946-60, and 1961-75). However, the Scottish correlations for the last three cohorts were somewhat larger than the average sibling correlation over all countries and cohorts which was 0.365 (Sieben and de Graaf, 2001: 452, Table III). This may suggest stronger social background effects on occupational attainment in Scotland than in some other countries.

Our study improves upon Sieben and de Graaf's research since it covers siblings born in a more recent period, includes both men and women, and investigates the importance of education in explaining between-sibling and within-sibling correlations.

Data

We use data from the Scottish Longitudinal Study (SLS), a large-scale linkage study of a 5.3% sample of the Scottish population, created using census data from 1991 to 2011 and data from other administrative and statistical sources. The sample we use is composed of 2038 individuals, 1019 pairs of two siblings spaced a maximum of 6 years apart and born between 1961 and 1986. These siblings were living in the same household in the 1991 Census and were present at the 2011 Census (aged 25 and 50). Summary statistics are presented in Table 1. The siblings in our sample benefited from the comprehensive reorganisation of secondary education and a substantial educational expansion, in particular in the tertiary sector (Paterson, 2021). Indeed, 49% of respondents have a tertiary qualification or above (sub-

degrees, degrees and post-graduate certifications), a much higher percentage than their parents (21%).

TABLE 1 ABOUT HERE

Our outcome variable is siblings' occupation at the time of 2011 Census coded in two ways: (1) occupational status measured by the International Socio-Economic Index (ISEI), a continuous scale ranging from 10 to 90 (Ganzeboom et al., 1992), and (2) whether sample members were in a Managerial & Professional occupation (NS-SEC 1&2, Rose, Pevalin and O'Reilly, 2005) or not. The siblings in our sample have an average ISEI score of 45 (s.d. 21) and 38% of them hold a managerial or professional occupation (Table 1). For parsimony, only the results of the analysis based on ISEI will be presented in the main text while the results related to entry into managerial and professional occupations can be found in the supplementary material; these latter confirm the ISEI results.

Parental background information, measured at the 1991 Census, includes three variables which capture social, cultural and economic resources of the family of origin: *parental social class* measured by NS-SEC distinguishes: 1) Managerial & Professional, 2) Intermediate, 3) Routine and manual classes. To these three social classes a fourth category is added to include parents with no employment, i.e. 4) Never worked or long-term unemployed. *Parental education* differentiates between parents who achieved a tertiary education qualification (degree and sub-degree) or not. In the absence of information on family income, we use housing tenure, that is whether siblings and their parents lived in social housing, as a proxy for family economic disadvantage. Table 1 shows that about 30% of siblings had parents working in managerial and professional occupations while about 48% grew up in

families where parents were employed in routine and manual occupations or were long-term unemployed. Among the other family characteristics, 21% of the sample had a parent with tertiary education and 31% lived in council housing, 14% grew up in a lone-parent family and 11% had a parent suffering from long-term illness.

Other independent variables included in our analysis are: gender, age, whether the siblings were twins, and sibling's birth order. We also have variables measuring characteristics of the area in which the siblings lived: urban/rural classification and decile of the Carstairs score (a measure of area deprivation). Once we included the family background measures these area variables did not explain any further variation between families. The distribution of all these variables is reported in Table 1.

Methods and Analytical Approach

Our analysis makes use of random effects sibling models, focusing in particular on the sibling correlation or intraclass correlation, ICC.

Consider a sample of individuals, indexed $i = 1, \dots, N$. The sample is made up of pairs of siblings, with $j = 1,2, \dots, \mathrm{J}$ denoting sibling pairs (families), and $k = 1,2$ denoting siblings within families. Let Y_{jk} denote a continuous outcome (in our case, ISEI). In multilevel terminology, siblings are level-1 observations, families are level-2. Assuming that the variance of *Y* within sibling pairs is independent of the variance between them, the sibling correlation or ICC is the ratio of the between-family variance to the overall variance.

The total variance in Y is

$$\sigma^2 = \frac{\sum_{j=1}^{N}\sum_{k=1}^{2}(y_{jk}-\bar{y})^2}{2J} \qquad (1)$$

where $\bar{y}$ is the overall mean. The within family or between sibling variance is estimated as

$$\sigma_e^2 = \sum_{j=1}^{N}\sum_{j=1}^{2}(y_{jk} - \bar{y}_j)^2/J \qquad (2)$$

Where $\overline{y_j}$ is the mean within family *j*.

The between family variance is

$$\sigma_u^2 = \frac{\sum_{j=1}^{J}(\bar{y}_j-\bar{y})^2}{J} \qquad (3)$$

The sibling correlation is $\frac{\sigma_u^2}{\sigma^2}$, capturing the share of the variation in *Y* that lies between different families. The larger this is, the lower is intergenerational mobility. In this respect the sibling correlation or ICC is like the odds ratio (in sociological studies) and the inter-generational elasticity (in economics studies) in being inversely related to social fluidity.

Our analyses are based on the following general, random effects model:

$$y_{ij} = x'_{ij}\beta + z'_j\gamma + e_{ij} + u_j \qquad (4)$$

The *X* variables potentially differ between siblings in the same family (such as their gender and their own educational attainment), and the *Z* variables are family-level measures (such as parental social class and parental education) that do not vary between siblings. Similarly, residual influences affecting each sibling separately are captured in *e*, and residual influences common to both siblings in a family by *u*. The total variation in the outcome between individuals is $\sigma_e^2 + \sigma_u^2$.

The total and within-variances, and thus the ICC, can be estimated using random effects linear models. We run model (4) without any predictors and then calculate the ratio of σ_u^2 to $\sigma_e^2 + \sigma_u^2$ to get the unconditional ICC. When we add covariates to these models we can calculate conditional sibling correlations using the residual variances. Covariates that do not vary between siblings in the same family will only explain the between-family variance while those variables that can take different values within sibling pairs can reduce both the within- and between-family variances. Reductions in the between-family variance will cause the ICC to decrease (because average differences between families are diminishing) while reductions in the within-family variance will lead it to increase (because siblings are becoming more similar).

For the study of intergenerational mobility we are concerned with that part of the variation in *Y* that differs between families, relative to the total variation. The advantage of sibling data over conventional data based on independent observations is that it allows us to focus on this. In the more conventional approach we would regress Y_i on W_i, a set of explanatory variables including measures of social origins such as parental class and education as well as individual measures such as respondent's education:

$$y_i = w'_i\theta + \varepsilon_i \qquad (5)$$

Here W includes both X and Z and, similarly, σ_ε^2, the residual variation across individuals, does not distinguish between the variation between families and the variation within them. As we noted, it is the former that matters for the study of intergenerational mobility, where our interest lies not in how *Y* varies over individuals but how *Y* varies between individuals from different families.

Later in the paper we investigate the importance of education in explaining within-sibling pair variation in occupational status. We report the results from a fixed effect model:

$$y_{ij} = x'_{ij}\beta + z'_j\gamma + e_{ij} + \alpha_j \qquad (6)$$

Here, α_j are family fixed effects (effectively a dummy variable for each sibling pair), replacing the random effect *u*. One consequence of this is that γ cannot now be estimated because the *Z* variables do not vary within families. A fixed effect model will yield estimates of β (the effects of individual-level variables) that are closer to truly causal estimates because the fixed effects will deal with any unobserved, time constant, family level factors that might be confounders of the relationship between *Y* and *X*.

To summarize: the conventional model focuses on variation between individuals, while the random effects model separates this variation into that which lies between families (which is what we care about when studying intergenerational mobility) and that which lies between individuals within families. A fixed effect model removes all the variation between families but

provides more plausibly causal estimates of factors that differ between siblings (such as their education) than the random effects model.

Results

Random effects model

To answer our first research question about the overall effect of family of origin on the occupational status of individuals in Scotland, we estimate the ICC by running a random effect model without any predictors. Then we add measures of family background and observe how these reduce the ICC: this shows us how far specific characteristics of family of origin explain the proportion of the between-family variance, in other words the strength of origin – destination relationship. Then we add individual education to the model and observe not only how this affects the ICC but also its impact on the coefficient estimates of the family-level variables. The results of these analyses will allow us to establish the extent to which the overall effect of family of origin is explained by our measures of family characteristics (ascription) and by individual educational attainment (achievement), the focus of our second research question.

These results are shown in Table 2. The first column reports the estimates of level 1 and level 2 variance and the ICC from the null model. The ICC, or sibling correlation, is equal to 0.36: that is 36% of the variation in siblings' occupations can be attributed to shared family factors. This is identical to Sieben and de Graaf's (2001) average estimate across the six countries in their study, suggesting a reduction of the Scottish family effect which was around 0.45 for those who entered the labour market between the 1960s and mid-70s. The second model includes the individual-level variables for gender, age, twin status and sibling's order. Only

gender and age show a significant positive association with the outcome: on average women and people aged 35-39 achieve a higher occupational status (6 and 3 points higher respectively) than men and younger people (aged 25-29). The estimates of level 1 and level 2 variance and the ICC show that these factors explain very little of the within- and between-family variance in siblings' occupational status.

TABLE 2 ABOUT HERE

The aim of the next set of models is to estimate the extent to which our measures of family factors can explain variation in sibling outcomes. Model 3 adds parental social class to the individual level measures. The ICC falls from 0.36 to 0.28, a reduction of 22%. When all the other parental background factors, i.e. education, living in social housing, family structure and parental long-term illness, are also included in the model the ICC drops further to 0.26 (model 7), indicating that about 28% of the family-of-origin effect can be explained by our family background measures. The coefficients of parental social class, education and living in social housing are all statistically significant and in the expected direction: on average, siblings from more disadvantaged backgrounds achieve a lower occupational status than siblings from more advantaged backgrounds. Thus, when all three factors are included in the model, we find that children with parents in long-term unemployment or in routine or manual occupations have, on average, an occupational status 9 points lower than children born to parents in managerial and professional occupations. The same 9-point gap emerges between the offspring of low and highly educated parents. To provide a concrete example and more intuitive understanding of these differences, 9 ISEI points separate university lecturers (ISEI score 78) from primary school teachers (ISEI score 69). A difference of about 4

points in the ISEI scale is found between siblings who lived in social housing and those who did not. This smaller difference is most likely due to the high heterogeneity of those not living in social housing.

The final two models aim to establish the importance of respondents' own educational attainment (our measure of achievement) in explaining between-family variation. In model 8, respondents' education is added to the individual level variables of model 2. This reduces the ICC to 0.11, indicating that 70% of the between-family variance in siblings' occupational status can be explained by differences in their educational attainment. The coefficients related to different educational qualifications also show a strong effect. People with lower secondary, upper secondary, sub-degree and degree qualifications have an occupational position which is 8, 12, 16 and 35 points higher than people who have no qualifications. Perhaps our most striking result is that when, in model 9, we add parental social background factors to the model that includes individual educational attainment this does not explain any more of the between-family variance (the ICC remains unchanged).

The results reported in Table 2 lead us to conclude that the effect of social background on occupational attainment is largely mediated by education, which accounts for about 70% of the sibling correlation. This is close to but slightly lower than the 80% mediation of the total family effect by educational qualifications found in a similar recent study in Denmark (Karlson and Birkelund, 2022) and in a less recent study in West Germany (De Graaf and Huinink, 1992). Measured family background factors explain relatively little, leaving about 30% of the variation unexplained. If we visualize this is terms of the conventional OED (origin – education – destination) triangle, shown in Figure 1, we would conclude that the path from

education, *X*, to ISEI, Y, labelled β is strong, while the path from family background measures, *Z*, to *Y*, labelled γ, is weak. In other words, in Scotland, education is the main explanation for social inequalities in occupational status. This may be interpreted positively, since it indicates that the labour market is broadly meritocratic. However, we know from earlier research (Duta et al, 2021), that educational attainment in Scotland depends heavily on family background; the path labelled α in Figure 1 is also strong. This suggests that social inequalities in education are the main mechanism reproducing inequalities in the labour market.

To some degree, however, Figure 1 is misleading insofar as it does not distinguish between family background influences that we have measured and those we have not but which are nevertheless captured in the sibling correlation. Figure 2a includes these. Here Z_O represents observed family background factors, while Z_U represents unobserved. Our results thus far show that, while γ is small, δ is quite substantial. Although we found little direct effect of observed family factors, family background nevertheless accounts for about 30% of the variation in occupational attainment between families.

FIGUREs 1 AND 2a ABOUT HERE

Fixed effect model

The random effects model assumes that, although the unobserved family background factors affect *Y*, they do not affect individual education, *X* (there is no arrow from Z_U to *Y* in Figure 2a). But if this assumption does not hold, the effects of education on ISEI estimated by the random effects model will be biased. In Figure 2b we allow Z_U to affect both *X* and *Y*. In this

case, failing to take account of the $Z_U - X$ relationship means that Z_U becomes a confounder of the X – Y relationship, biasing our estimate of β and it also induces bias in the estimate of γ, the direct effect of Z_O on Y. This is because, in Figure 2b, X is a collider (Elwert and Winship 2014) which opens a biasing path from Z_O to X to Z_U to Y. But a fixed effect model captures all social background effects with a dummy variable for each family, and so, unlike the random effects estimates, fixed effect estimates of the effects of X on Y will not be biased by the fact that Z_U affects X as well as Y.

FIGURE 2b ABOUT HERE

In Table 3 we report the results from such a fixed effect model. As in the random effects results, gender and, in particular, respondents' educational attainment, are strongly associated with occupational attainment. Having an upper-secondary education or higher education increases occupational status by 7, 10 (sub-degrees) and 25 (degrees) points. These estimates are a little lower than those from the random effects model suggesting that the effect of education in the latter may be slightly over-estimated.[i] Borrowing from Conley et al.'s terminology (2007), the fixed-effect estimates in our model measure the ''purer'' effect of individual educational attainment on occupational outcomes by allowing us to control for unobserved social background factors that affect educational attainment and ISEI. However, in our view, the differences between the estimates from the fixed and random effects specification are sufficiently small as not to cast doubt on our assessment of the relative importance of individual education and family background for occupational attainment. In particular, the random and fixed effect estimates confirm the key role of education in explaining variation in the occupational outcomes between siblings from

different families (between-family variance) and within the same family (within-family variance).

TABLE 3 ABOUT HERE

Conclusions

Using linked administrative data on siblings in Scotland, this study provided new evidence about the extent to which individual occupational status is determined by family of origin (ascription) and by educational attainment (achievement). We have found that 36% of siblings' variation in occupational status in Scotland is attributable to shared family factors, with the rest of the variance being explained by non-shared factors. In addition, our results show that parental social class, parental education, living in social housing (our proxy for economic disadvantage), living with a single parent and having a parent with a long-term illness explain only 28% of the family-of-origin effect. This confirms the findings from other recent research which also found that observed family characteristics related to parental occupation, education and income explain only a relatively small part of the family effect (Duta, Iannelli and Breen, 2021; Karlson and Birkelund, 2022; Marks & Mooi-Reci, 2016). But it differs from the findings of previous studies which analysed the outcomes of older cohorts and found that observed family factors explained about half or more of the total family effect (De Graaf and Huinink, 1992; Sieben and de Graaf, 2001). This may suggest a weakening role of the traditional family indicators relative to other types of family factors and/or relative to the increasing importance of education for occupational destinations.

Our results leads to two conclusions, one substantive and another methodological. From a substantive point of view, it is clear that future research should pay more attention to the

identification of the 'other' family factors which are not usually included in studies of social reproduction. Common genetic and environmental factors (such as neighbourhoods and schools), social networks but also inherited common attitudes, social behaviour and preferences (Black and Devereux 2011) are likely to be among these other factors. From a methodological point of view, conventional approaches used in the estimation of effects in the OED triangle and especially the so-called "DESO" or direct effect of social origin (Bernardi and Ballarino 2016) on the outcome, controlling for education, which can only consider observed aspects of family background, are likely to understate the true extent to which family background continues to affect labour market outcomes.

Our analysis shows that educational attainment is very strongly associated with occupational attainment, explaining 70% of the between-family variance. Surprisingly, our measures of social background do not have any additional explanatory power after accounting for respondents' own education (as demonstrated by the lack of a further reduction in the between-family variance when social background factors are added to the model including respondents' education – model 9 compared with model 8 in Table 2).

Sociologists have long argued that increasing meritocracy in intergenerational transmission implies the greater, and growing, importance of achievement over ascription (Blau and Duncan 1967; Treiman 1970). In the framework of our analyses, this means that the effect of education on ISEI, net of family background, should be greater than the effect of family background, net of education. We have found this to be the case. Measured family background has only weak effects on ISEI once we control for education. Unmeasured family background factors do have an effect, but this is much less than education. In this sense, Scottish society appears to be

relatively meritocratic. However, this is offset to some degree by the fact that educational attainment in Scotland continue to be heavily dependent on social origins (Paterson, 2022; Duta, Iannelli and Breen, 2021).

There is a final methodological point to make. Unmeasured family background factors that affect both education and labour market outcomes will lead to bias in estimates of DESO. This is because these unmeasured factors not only bias the estimate of the effect of education on the outcome, conditioning on measured family factors (confounder bias), they also act as colliders, leading to bias in the estimate of the direct effect of measured family factors on the outcome (Elwert and Winship 2014; Breen 2018). We ran a fixed effect model to deal with both kinds of bias.[ii] However, a simple regression of the kind shown in equation (4) is potentially subject to both. In our analysis, our estimates of the effect of education on ISEI from a fixed effect model were only slightly lower than those from our random effects model, suggesting that, in this case, biases from the unobserved family factors are quite small and certainly not large enough to threaten our conclusions concerning the relative importance of observed and unobserved aspects of family background.

ENDNOTES

[i] The coefficients for sub-degree and degree are statistically significantly smaller in the fixed- than in the random-effects model (column 6 in Table 2) but those for lower- and upper-secondary education are not.
[ii] A fixed effect model however does not deal with bias arising from factors that affect each sibling in a family differently, including factors that might affect one sibling but not the other.

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Table 1: Descriptive statistics

	Mean/column **%**
ISEI	45.12 (SD=21.18)
Respondent's social class	
Managerial&Professional	37.78
Intermediate	25.42
Routine and Manual	36.8
Degree/FE	
No degree or higher	50.83
Further education	15.06
First degree or higher	34.1
Gender	
Male	50.44
Female	49.56
Age group	
25-29	27.18
30-34	29.93
35-39	25.12
40-44	14.18
45-50	3.58
Twins	
Non-twins	73.5
Twins	26.5
Parental social class	
Long-term unemployed	8
Lower occupations	40
Intermediate occupations	22
Managerial professional occupations	30
Parental higher education (HE)	
First degree or higher & higher non-degree	21.3
No HE qualifications	78.7
Council house	
No	69.19
Yes	30.81
Marital status family of origin	
Married/Cohabiting	86.46
Lone-parent	13.54
Parental illness	
No illness	89.4
Some illness	10.6
Carstair decile	
1	12.66
2	11.48
3	9.81
4	9.81
5	8.93
6	9.13
7	9.81
8	10.5
9	9.91
10	7.95
Area of residence	
City 125.000+	31.4
Urban 10.000+	31.4
Small towns	14.43
Rural	22.77
Total sample	2038

Source: Scottish Longitudinal Study

Table 2: Random effects linear regression, ISEI

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Gender (ref.: male)									
Female		5.807***	5.706***	5.778***	5.937***	5.830***	5.787***	3.248***	3.473***
		(0.887)	(0.858)	(0.861)	(0.874)	(0.884)	(0.847)	(0.743)	(0.737)
Age group (ref.: 25-29)									
30-34		1.325	0.983	1.451	1.063	1.200	0.989	2.038*	1.771
		(1.264)	(1.206)	(1.213)	(1.238)	(1.260)	(1.188)	(1.011)	(1.004)
35-39		2.989*	2.663*	3.378*	2.657	2.937*	2.746*	5.063***	4.656***
		(1.406)	(1.322)	(1.332)	(1.369)	(1.400)	(1.297)	(1.077)	(1.072)
40-44		-0.562	0.326	0.642	-0.538	-0.355	0.520	3.869**	3.763**
		(1.679)	(1.574)	(1.588)	(1.630)	(1.681)	(1.552)	(1.282)	(1.282)
45-50		-5.392	-2.982	-2.710	-4.823	-5.241	-2.494	1.785	2.193
		(2.795)	(2.648)	(2.667)	(2.725)	(2.801)	(2.619)	(2.201)	(2.204)
Twins (ref.: no)									
Yes		1.784	1.334	1.189	1.794	1.947	1.213	-0.210	-0.263
		(1.301)	(1.209)	(1.221)	(1.259)	(1.292)	(1.181)	(0.973)	(0.965)
Sibling's order									
Older		1.183	1.024	0.933	1.184	1.167	0.983	-0.403	-0.313
		(0.912)	(0.905)	(0.906)	(0.909)	(0.912)	(0.904)	(0.838)	(0.831)
Parental social class (ref.: Managerial professional occupations)									
Long-term unemployed			-17.41***				-9.450***		-4.159*
			(2.088)				(2.525)		(2.031)
Lower occupations			-15.42***				-9.216***		-4.195***
			(1.192)				(1.415)		(1.148)
Intermediate occupations			-7.565***				-3.032*		-1.540
			(1.378)				(1.470)		(1.175)
Parental higher education (HE) (ref.: yes)									
No HE qualifications				-15.64***			-9.495***		-3.128**
				(1.233)			(1.422)		(1.159)

Continuation Table 2	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Council housing (ref.: no)									
Yes					-10.10***		-4.031***		-1.102
					(1.129)		(1.196)		(0.959)
Family structure (ref.: dual family married/cohabitation)									
Single-parent family						-6.931***	-0.905		0.464
						(1.567)	(1.629)		(1.299)
Parental long-term illness (ref.: no)									
Yes						-0.481	2.319		1.131
						(1.760)	(1.619)		(1.291)
Respondent's level of education (ref.: no qualifications)									
Lower secondary								7.705***	6.967***
								(1.455)	(1.453)
Upper secondary								12.36***	10.54***
								(1.560)	(1.585)
Sub-degree/ Further education								16.20***	14.46***
								(1.587)	(1.605)
Degree or higher								35.01***	31.57***
								(1.436)	(1.521)
Constant	45.12***	40.46***	49.61***	52.63***	43.64***	41.42***	54.15***	22.86***	29.73***
	(0.548)	(1.172)	(1.346)	(1.478)	(1.200)	(1.192)	(1.464)	(1.551)	(1.879)
Level 2 variance	162.39	156.50	111.39	116.65	135.49	151.59	97.28	30.89	30.04
	(14.957)	(14.613)	(12.799)	(13.009)	(13.758)	(14.421)	(12.267)	(8.929)	(8.696)
Level 1 variance	286.39	280.62	279.92	280.18	280.30	280.52	279.85	245.00	240.53
	(12.688)	(12.469)	(12.425)	(12.441)	(12.449)	(12.463)	(12.420)	(11.008)	(10.758)
ICC	**0.36**	**0.36**	**0.28**	**0.29**	**0.33**	**0.35**	**0.26**	**0.11**	**0.11**
	(0.027)	(0.027)	(0.029)	(0.029)	(0.028)	(0.028)	(0.029)	(0.032)	(0.032)

Total number of cases: 2038 Standard errors in parentheses; * p<0.05; ** p<0.01; *** p<0.001;
Source: Scottish Longitudinal Study

Table 3: Fixed effects linear regression, ISEI

	ISEI
Gender (ref.: male)	
Female	4.253***
	(1.091)
Age group (ref.: 25-29)	
30-34	-1.761
	(2.192)
35-39	-1.925
	(3.551)
40-44	-2.570
	(5.064)
45-50	-0.777
	(7.323)
Sibling's order	
Older sibling	0.974
	(1.184)
Respondent's level of education (ref.: no qualifications)	
Lower secondary	5.989***
	(1.804)
Upper secondary	7.421***
	(2.026)
Sub-degree/ Further education	10.25***
	(2.169)
Degree or higher	24.67***
	(2.200)
Constant	31.37***
	(2.690)
Sigma_u	13.414
Sigma_e	15.377
Rho	0.432
R-squared within	0.182
R-squared between	0.458
R-squared overall	0.3607

Total number of cases: 2038; Standard errors in parentheses; * p<0.05; ** p<0.01; *** p<0.001;
Source: Scottish Longitudinal Study

FIGURES

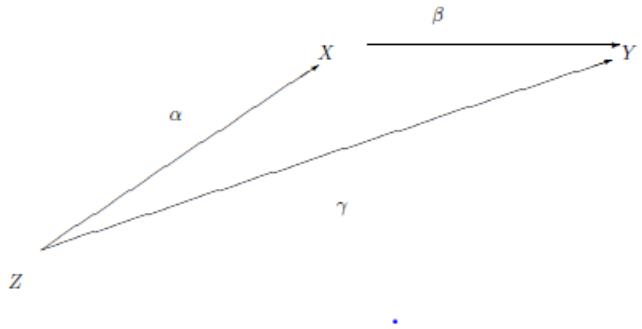

Figure 1: Social background, Z, education, X, and ISEI, Y

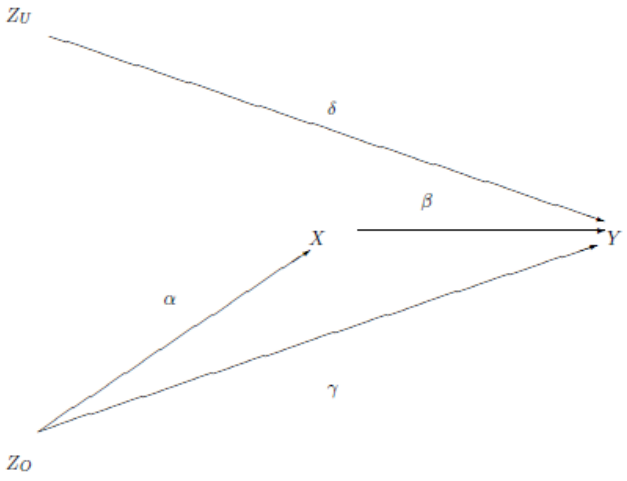

Figure 2a: DAG showing Random Effects Model assumptions

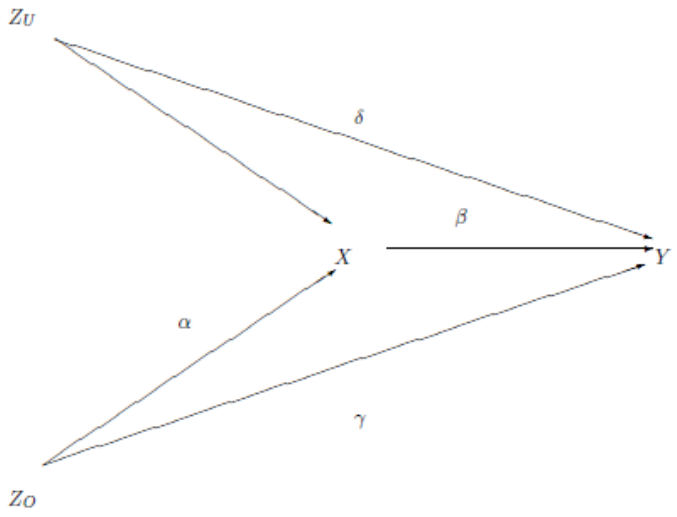

Figure 2b: DAG showing Fixed Effects Model assumptions