

Variation in education attainment within families: sibling differences in Scotland

Introduction and theoretical background

It is well known the family background plays an important role for individuals' educational and occupational outcomes later in life (e.g. Shavit and Blossfeld 1993; Breen 2004; Iannelli and Paterson 2007). However, while many studies have focused on the relationship between different parental characteristics (e.g. parental education and social class) and various outcomes of their offspring, fewer studies have analysed the broader environment in which children grow up, capturing therefore the relative importance of the different family background components within the overall social milieu in which individuals' lives are embedded. Sibling designs have been suggested as an important analytical strategy to capture the family environment as a global measure (Conley & Glauber, 2008; Björklund et al., 2002) providing a summary indicator of all measured and unmeasured characteristics shared by siblings at birth and during their upbringing, such as genes, social environment and siblings interactions. Thus, the analysis of sibling data allows researchers to obtain better estimates of the overall effect of family of origin than the analysis of data based on independent individual observations.

Benefiting from new linked administrative data, our paper will present the first estimates of variation in educational attainment within families (between siblings) compared with variation in attainment between people from different families in Scotland. As well as estimating the extent of between and within family difference we also investigate whether the within/between family differences are themselves larger or smaller, depending on characteristics of the families themselves. Therefore, we ask the following questions: (1) What is the share of between and within family variance in siblings' educational outcomes? (2) Does this differ by social class of origin and by other family characteristics? (3) How much of the total variance between families is explained by parental social class, education and other family-level characteristics? (4) What are the individual-level factors that explain differences between siblings in the same family?

Previous studies have shown that about half of the variance in educational attainment is related to family background factors shared by siblings, with some indication that sibling correlations are stronger among those from more privileged backgrounds compared to those from less privileged backgrounds (e.g. Conley & Glauber, 2008). However, the existing evidence is mixed and results tend to differ depending on the measures employed and the study design. Moreover, similarities between siblings have been found to vary by country, outcome considered, the stage in the life course, and even across historical time (Knigge et al., 2014). Research examining brothers' correlations in earnings has found a correlation of 0.40 in the United States and in the range 0.14–0.26 in the Nordic countries (Björklund et al., 2002). Nevertheless, there is scarce evidence about sibling similarity in the UK. Rasbash and colleagues (2010) analysed twins correlations in the General Certificate of Secondary Education (GCSE) results in England. They found that 40% of the variation in twins' outcomes was due to shared family factors, 22% to shared environment beyond the immediate family (e.g. school) and 38% to individual level. Nonetheless, they did not have information about the non-twin siblings and about parental background characteristics. In addition, their study focused on early educational outcomes.

Our study contributes to the existing literature by providing new important evidence of the relative importance of individual and family factors on later educational outcomes. Also, relying on information on twins and their gender, our research provides an estimate of how much of the total variance explained at the family level is likely to be due to genetic factors. Given the scarcity of sibling research in the UK, this is the first study to unravel these aspects in this national context.

Data

The data comes from the Scottish Longitudinal Study (SLS), a large-scale linkage study created using data from administrative and statistical sources. It is a 5.3% sample of the Scottish population and includes census data from 1991 to 2011. Our sample consists of pairs of siblings among the SLS members who were aged between 25 and 50 at either the 2001 or the 2011 Census. Three family background characteristics were analysed: (1) 'parental social class' measured using the NS-SEC three class schema (Rose et al., 2005) with the inclusion of a fourth category 'parents unemployed or inactive'; (2) 'parental education' which distinguishes between parents with a degree or not; and (3) 'housing tenure', that is whether siblings and their parents lived in social housing or not.

Analytical strategy & Preliminary results

Our initial analyses have focussed on a binary outcome: whether or not a person attained a University degree. Using a random effects linear probability model (LPM) we estimate the ICC (the correlation in the outcome among siblings) to be 0.38 (se = 0.03). Using a random effects logit model, the variance partition coefficient (VPC) is 0.56. The pattern of a larger VPC than ICC is found in all our analyses. Basing our conclusions on the ICC, it appears that about 40% of the variation in the probability of acquiring a University degree lies between siblings in the same family. This is very close to the sibling correlation for overall educational attainment in the UK of 0.42 reported by Grätz et al (2018) who used data from Understanding Society. Our preliminary findings also show that parental social class accounts for about 10% of the total variation at the family level.

We then investigate whether or not the correlation between siblings depends on their social background. In the literature (see Conley 2008) this is usually framed as a debate between whether parents follow a strategy of specialization or compensation. In our data we find a consistent pattern that the correlation is larger among siblings from more advantaged backgrounds. This is shown in Table 1. The correlation is significantly larger in Managerial and Professional, rather than manual, social class families, and among those not living in public authority housing compared with those who do. There is also a difference in the ICC between siblings according to their parental education, though this difference is not statistically significant.

Table 1: Sibling correlations by social background

| | <i>ICC</i> | <i>s.e.</i> |
|-----------------------------|------------|-------------|
| Class background | | |
| Unemployed | 0.31 | 0.1 |
| Manual | 0.19 | 0.05 |
| Intermediate | 0.34 | 0.23 |
| Managerial and Professional | 0.38 | 0.3 |
| Parental Education | | |
| No degree | 0.28 | 0.03 |
| Degree | 0.36 | 0.06 |
| Housing tenure | | |
| Local authority | 0.18 | 0.05 |
| Not local authority | 0.39 | 0.03 |

Note: Estimates based on linear probability models.

Source: SLS

These differences are found alongside differences in the average education attained. For example, we estimate that, compared with children from Managerial and Professional backgrounds, those from Intermediate backgrounds are 18 percentage points less likely to acquire a degree, and those from manual backgrounds 36 percentage points less likely (Table 2). Similarly, children whose families live in public authority housing are much less likely to have a degree than those who live elsewhere and children who come from a home where neither parent has a degree are at a particularly large disadvantage.

Table 2: Linear probability model random effects regression estimates (Y = 1 if person has a University degree)

| | <i>Coeff.</i> | <i>s.e.</i> | <i>Coeff.</i> | <i>s.e.</i> | <i>Coeff.</i> | <i>s.e.</i> |
|--|---------------|-------------|---------------|-------------|---------------|-------------|
| Intercept | 0.54 | 0.02 | 0.68 | 0.02 | 0.69 | 0.02 |
| Social Class (ref. Managerial& Professional) | | | | | | |
| Unemployed | -0.40 | 0.04 | -0.25 | 0.04 | -0.18 | 0.05 |
| Manual | -0.36 | 0.03 | -0.21 | 0.03 | -0.17 | 0.03 |
| Intermediate | -0.18 | 0.03 | -0.06 | 0.03 | -0.05 | 0.03 |
| Parental Education (ref. Degree) | | | | | | |
| Non-Degree | | | -0.30 | 0.03 | -0.29 | 0.03 |
| Housing tenure (ref. Not local authority) | | | | | | |
| Local Authority Housing | | | | | -0.12 | 0.03 |

Note: Estimates based on linear probability models.
Source: SLS

A plausible explanation of these findings is that better off families are able to compensate for variation in the abilities of their children to ensure that they all acquire a high level of education, whereas families from poorer backgrounds are not able to pursue such a strategy.

As expected, we find that siblings are more similar if they are of the same sex and if they are twins. We can also use the method proposed by Bjorklund and Jännti (2012) to carry out an ACE decomposition using the ICC estimates for twins and non-twins. These estimates are reported in Table 3. Under the assumptions that (i) half of all same sex twins are monozygotic, and (ii) that sex-composition differences in ICC for different sex dizygotic twins are the same as the observed sex composition difference in ICC for different sex non-twins (ie the difference between the ICCs for same sex non-twin siblings and different sex non-twin siblings) we arrive at estimates of the ICC for MZ twins of .571 and for same sex DZ twins of .393. Together these imply that 36 per cent of the variance in the probability of attaining a degree can be attributed to genes, 21 per cent to shared non-genetic sources, with the remaining 43 per cent arising from non-shared environmental factors.

Table 3: ICC estimates for twins and non-twin pairs

| | <i>ICC</i> | <i>s.e.</i> |
|---------------------------------|------------|-------------|
| Same sex twins | .482 | .05 |
| Different sex Twins | .329 | .10 |
| Same sex non-twin siblings | .398 | .04 |
| Different sex non-twin siblings | .334 | .04 |

Note: Estimates based on linear probability models.
Source: SLS

Planned analyses

The next steps in our work are: (a) to try to gain a firmer understanding of why the ICC differs by social background and especially to investigate the greater variation in sibling attainment in less well-off families; (b) to replicate our analyses using a continuous measure of educational attainment; and (c) to carry out some methodological investigations into the use of binary outcomes in the calculation of the ICC.

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