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Origins of attainment: do brother correlations in occupational status and income overlap?

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We study the overlap in the overall impact of family background on two widely studied labour market outcomes by considering whether brother similarities in occupational status are rooted in the same underlying family characteristics that affect brother similarities in income. We extend previous research using sibling correlations as an omnibus measure of total family background impact on a given outcome by directly quantifying how brother correlations in occupational status and income overlap. We apply a novel variance components model to data from Denmark and the United States, two countries known to follow a contradictory pattern: While income mobility is much lower in the United States, occupational mobility is virtually similar. Apart from confirming this pattern, we find a substantial overlap, around 70 per cent, in brother similarities in income and occupational status in both countries. Conventional family background variables account for less than one-fifth of this overlap in each country, suggesting that shared family origins of attainment in these two domains are constituted by largely unknown family characteristics. We speculate what these characteristics might be.

Introduction

Research in intergenerational mobility points to a puzzling paradox: Countries’ ranking in terms of their level of mobility depends on the way mobility is measured (Breen and Jonsson, 2005; Blanden, 2013). Perhaps most prominently, the United States is characterized by a relatively high level of occupational mobility, at par with the levels reported for the Scandinavian countries, but a very low level of economic mobility. While research suggests that there is ample room for the two types of mobility to differ (Björklund and Jäntti, 2000; Blanden, Gregg and Macmillan, 2013; Breen, Mood and Jonsson, 2016), the existing literature mainly focuses on the relationship between canonical types of mobility (e.g., intergenerational associations in income, class, or education), thus relying on a relatively stylized framework for analyzing the many and potentially differing family background factors that affect labour market success (Björklund and Jäntti, 2020; Thaning, 2021).

In this paper, we examine the extent to which occupational and economic attainment originate in the same underlying characteristics that make up a person’s family background. We extend previous research using sibling correlations to gauge the overall impact of family background and local community by considering how sibling correlations in different labour market outcomes overlap. We analyze brother data from Denmark and the United States and quantify the degree to which the unmeasured family background factors that affect attained occupational status also affect attained income in the two countries. This ‘overlap’ in family background factors is a direct measure of whether attainment in different labour market outcomes are rooted in the same underlying family characteristics, and can be considered an overall measure of the extent to which intergenerational mobility in different labour market domains overlap. Denmark and the United States constitute an ideal comparison because they represent two countries that likely follow the mobility paradox pattern: While the two countries have similar levels of occupational mobility, Denmark is characterized by a much higher level of income mobility.

Our estimated brother correlations confirm this pattern, showing that while the correlation in occupational status is identical in the two countries (35 per cent), the correlation in wages is much larger in the United States than in Denmark (50 compared to 30 per cent). However, despite these significant
differences, we find that the overlap in unmeasured family factors that affect the two outcomes is substantial, amounting to around 70 per cent, and is virtually identical in the two countries. This finding suggests that attainment in the two labour market outcomes to a very considerable extent is rooted in the same family characteristics. Further analyses show that, although conventional family background covariates explain about half of the family variance components in each outcome, they explain only about one-fifth of the overlap in these components in each country. These surprising findings point to that brothers being similar in attainment across different labour market domains results from largely unknown family characteristics.

Background

Stratification scholars consider sibling correlations an omnibus measure of the total impact of family background on a given life outcome of interest. Sibling correlations express in percentages how much of the total variance in an outcome can be attributed to ‘what siblings share’, i.e. their shared genetic make-up, common rearing environment, mutual interactions, and local community (Solon, 1999; Sieben and de Graaf, 2001). Sibling correlations thus provide a much more comprehensive picture of how life chances depend on family background than more conventional mobility metrics focusing on the transmission of specific resources such as occupational status (Treiman and Terrell, 1975), social class (Erikson and Goldthorpe, 1992), income (Solon, 1992), or education (Pfeffer, 2008). Indeed, estimated levels of intergenerational mobility may differ across resources, even in contradictory ways, because these resources are not perfectly exchangeable (Björklund and Jäntti, 2000; Jæger, 2007; Blanden, 2008, 2013; Blanden, Gregg and Macmillan, 2013; Breen, Mood and Jonsson, 2016; Mood, 2017; Thaning, 2021; Hällsten and Thaning, 2022).

The lack of exchangeability may also affect country comparisons of overall levels of mobility as some countries may be highly mobile in some resources but not in others (Breen and Jonsson, 2005). One prominent example—sometimes referred to as the ‘mobility paradox’—is the comparison of liberal welfare state countries such as the United States with universal welfare state countries in Scandinavia (Breen, Mood and Jonsson, 2016). Mobility in income, for example, is much lower in liberal welfare countries (Black and Devereux, 2011; Corak, 2013), whereas mobility in occupation or education is virtually similar and comparably high in international comparison (Erikson and Goldthorpe, 1992; Hout and Dohan, 1996; Beller and Hout, 2006; Blanden, 2008; Pfeffer, 2008).

However, this literature mainly studies canonical forms of mobility (i.e. in income or occupation), thus neglecting the many other ways in which family background, broadly considered, affects life outcomes across different domains. A growing literature attempts to resolve this issue by including multiple parental characteristics to obtain a more comprehensive picture of how different aspects of family background affect different outcomes (e.g. Bukodi and Goldthorpe, 2013; Gugushvili, Bukodi and Goldthorpe, 2017; Sullivan et al., 2018; Hällsten and Thaning, 2022). For example, Thaning (2021) examines how parental income, occupation, and education account for sibling similarities within and between three outcomes (income, occupation, and education). He finds that parent-to-child transmission rates are larger in the same parent-child resources, pointing to the salience of within-resource transmission.

Another literature examines the extent to which sibling similarities, i.e. the total influence of family background and local community on a given outcome, can be accounted for by parental characteristics (Mazumder, 2008; Björklund, Lindahl and Lindquist, 2010; Andrade, 2016; see also, Sieben and de Graaf, 2001). For example, Björklund, Lindahl and Lindquist (2010) find that about one-third of the sibling correlation in labour market income in Sweden can be explained by conventionally used socioeconomic characteristics such as parental income, occupation, and education. In their six-country comparative study, Sieben and de Graaf (2001) similarly report that parental education and occupation account only for a moderate portion of the sibling correlation in occupational status. Considered together, these studies suggest that conventional family background variables cannot fully explain why siblings are more similar in key labour market outcomes than two randomly selected individuals (for a similar finding, see Thaning, 2021).

Notwithstanding the key insights offered by these studies, previous research has not directly considered the extent to which sibling similarities in one outcome overlap with similarities in other outcomes. This paucity is surprising given that such overlap speaks directly to whether unmeasured family background (and local community) characteristics that affect for example income are similar to or distinct from the unmeasured characteristics that affect occupational status (or any other outcome of interest). Indeed, we consider empirically establishing this overlap fundamental to quantifying the shared family origins of attainment across different domains. The overlap approach provides a general framework for studying the overall influences of family background on different life outcomes. Whereas existing research examines outcomes separately, the overlap approach allows for an assessment.
of which observed family factors make up the common (over outcomes) and unique (to outcomes) family background influence on different outcomes.\(^3\)

We propose measuring the overlap directly using a variance components model in which between-family and within-family errors correlate across outcomes.\(^4\) This correlation in ‘family unobservables’ is a direct measure of the overlap, and we propose using the squared correlation as a measure of the overlap expressed in percentages. Moreover, following the approach in Mazumder \((2008)\) and Björklund, Lindahl and Lindquist \((2010)\), we add conventional family background covariates to the income and occupational status equations. This analytical approach allows us to study not only how family characteristics explain sibling similarities in each outcome but also their overlap. We detail this approach in the data and methods section.

We apply our overlap approach to data on brothers from the United States and Denmark.\(^5\) These two countries constitute an ideal comparison, because they—on the one hand—represent different welfare state regimes with very different levels of redistribution and provision of public services \((\text{Esping-Andersen, 1990; Heckman and Landerso, 2022})\) and—on the other—follow a contradictory pattern in which income mobility differs but occupational mobility does not. For income mobility, research clearly points to the United States being characterized by low mobility and Denmark by high mobility \((\text{Björklund et al., 2002; Jäntti et al., 2006; Schnitzlein, 2014; Landerso and Heckman, 2017; Mitnik, Helsø and Bryant, 2022})\). For example, Schnitzlein \((2014)\) reports a brother correlation in permanent earnings of 45 and 20 per cent for the United States and Denmark, respectively, implying that Denmark is more than twice as mobile by this measure.\(^6\)

For occupational mobility, research shows that the United States is a relatively fluid country \((\text{Erikson and Goldthorpe, 1992; Björklund and Jäntti, 2000; Beller and Hout, 2006; Blanden, 2008; Hertel and Groh-Samberg, 2019})\), while the evidence for Denmark is scarce. Hertel and Groh-Samberg \((2019)\) place Denmark as a relatively fluid country with fluidity levels not far from those reported for the other Nordic countries and the United States and the United Kingdom. Findings from comparisons of the United States to other Nordic countries generally support this pattern of similarity in occupational mobility \((\text{e.g. Erikson and Goldthorpe, 1992; Beller and Hout, 2006})\).\(^7\) Furthermore, Karlson and Birkelund \((2022)\) find that the brother correlation in occupational status for Danish men born in 1965–1971 is 35 per cent, a percentage similar to that reported for the United States by Jencks et al. \((1979)\); Hauser and Mossel \((1985)\); Hauser and Sewell \((1986)\); Hauser et al. \((1999)\), or Conley and Glauber \((2005)\). It is also very close to the 37 per cent average over five countries reported in Sieben and de Graaf \((2001)\).\(^8\)

In sum, we expect the brother correlations in occupational status and income to follow the ‘paradoxical’ pattern that Denmark and the United States are similar in terms of occupational mobility but different in terms of income mobility. However, we have no a priori expectations about whether the overlap in family unobservables in the two outcomes is similar or different between the two countries. Indeed, even if family background has a larger impact on income in the United States than in Denmark, we cannot predict from the previous literature how large is the overlap in family unobservables and whether it differs between the two countries. We provide empirical evidence to shed light on this question, and we explore whether conventional family background variables account for the overlap in each country.

### Data and methods

We analyze brother data from the United States and Denmark. For the United States, we rely on the National Longitudinal Survey of Youth 1979 \((\text{NLSY79})\), which follows a sample of 14–21-year-olds in 1979 \((\text{i.e. born 1957–1964})\) through today \((\text{Bureau of Labor Statistics, 2019})\). Because the NLSY79 samples households, we can identify brothers living in the same household at the time of the interview. The survey contains information on the occupational and economic attainment of brothers, and also comprises information on parents’ attainment and other aspects of the family of origin. Of the 6,403 male respondents in the original sample, 2,016 are brothers distributed on 913 families. As a result of missing values on key variables, our analytical sample comprises 2,616 males of which 1,835 are singletons and the remaining 781 brothers are distributed on 363 families.\(^9\)

For Denmark, we analyze Danish administrative registers, which is a collection of annually updated databases containing information on the entire Danish population. We restrict our sample to all males born 1960–1965, and identify brothers born within that period.\(^10\) Similar to the NLSY79, the administrative registers contain very rich, repeated information on occupational and economic attainment and characteristics of the family of origin. Our final sample comprises 176,881 males, of which 44,409 are brothers distributed on 21,485 families.

We measure occupational attainment in terms of occupational status. For the United States, we use Duncan’s socioeconomic index \((\text{SEI})\) using the scoring of occupations provided in Attachment 3 of the NLSY79 documentation \((\text{Bureau of Labor Statistics, 2019})\).
To average out measurement error, we measure occupational status as an average of five reports from ages 35/36 through 41/42. For Denmark, we recode a person’s ISCO code at age 40 into the International Socioeconomic Index (ISEI) using the scoring in Ganzeboom, De Graaf, and Treiman (1992).

We measure income in terms of permanent log hourly wages. For the United States, we follow Mazumder (2008) and take an average of total hourly wages over five reports from ages 36/37 through 44/45. For Denmark, we take an average of annual total hourly wages from ages 36 through 44. We measure all income variables in 2017 USD and, following Mazumder (2008), we omit those with average hourly wages lower than 1.7 USD and higher than 338 USD (the equivalent of 0.5 USD and 100 USD in 1970 dollars).

We include three ‘conventional’ family background variables: total net family income, parental highest grade completed, and parental highest occupational status. Although we have done our best to harmonize these family background variables across the two countries, the Danish registers only start recording income from 1980, education from 1981, and occupational status from 1991. For this reason, we cannot measure parental attainment at around ages 15–16 for the Danish cohorts we analyze here. For example, for a man born in 1961, we only observe his parents’ occupation from when he turns 20, i.e. when his parents are likely to be in their mid- or late 50s. Similarly, we can only observe the parents’ income from around the time he turns 20. These differences reduce the comparability with the United States for which most parental characteristics are measured between children ages 13 and 24.

Empirical strategy
We estimate by full information maximum likelihood a variance components or multilevel model in which the within- and between-family components are allowed to correlate across equations for wages and occupational status. In this model, we estimate four variances (a within- and between-family component for each outcome) and two covariances (one for the within-errors and one for the between-errors). We are particularly interested in the between-error covariance as it directly measures the overlap in family-specific unobserved characteristics that affect hourly wages and occupational status. Let $INC_{ij}$ and $SES_{ij}$ denote the permanent hourly wages and occupational status of brother $i$ in family $j$. The variance components model is then given by

$$INCl_{ij} = \muINC + \omegaINC_{ij} + \varepsilonINC_{ij}$$ (1)
$$SESl_{ij} = \muSES + \omegaSES_{ij} + \varepsilonSES_{ij}$$ (2)

with variance-covariance matrices

$$\omega_{ij} \sim N \left( \frac{\text{VAR}(\omegaINC_{ij}) \text{COV}(\omegaINC_{ij}, \omegaSES_{ij})}{\text{COV}(\omegaINC_{ij}, \omegaINC_{ij}) \text{VAR}(\omegaINC_{ij}) \text{VAR}(\omegaSES_{ij})} \right)$$ (3)

$$\varepsilon_{ij} \sim N \left( \frac{\text{VAR}(\varepsilonINC_{ij}) \text{COV}(\varepsilonINC_{ij}, \varepsilonSES_{ij})}{\text{COV}(\varepsilonINC_{ij}, \varepsilonINC_{ij}) \text{VAR}(\varepsilonINC_{ij}) \text{VAR}(\varepsilonSES_{ij})} \right)$$ (4)

where $\omega_{ij}$ and $\varepsilon_{ij}$ are the between- and within-family errors in income and occupational status.

In our study, we consider the between-family covariance a measure of the overlap in the unobserved family characteristics that affect each outcome. More specifically, we quantify the overlap as the squared correlation in family unobservables in each outcome,

$$R^2_\omega = \frac{\text{COV}(\omegaINC_{ij}, \omegaSES_{ij})^2}{\text{VAR}(\omegaINC_{ij}) \text{VAR}(\omegaSES_{ij})}$$ (5)

Moreover, following conventions in the literature (Solon, 1999), we define the intraclass or brother correlations in each outcome as

$$ICC = \frac{\text{VAR}(\omega_{ij})}{\text{VAR}(\varepsilon_{ij}) + \text{VAR}(\omega_{ij})}$$ (6)

What makes our model flexible is that we can control for observed predictor variables, and not necessarily the same, in each of the two equations in Eqs. (1) and (2). Because we only consider family-level characteristics, we denote these covariates by $Z_i$. Once we enter such covariates into the regression, the between-family error terms represent the impact of unobserved family characteristics unrelated to or ‘net of’ these covariates. This yields a squared partial correlation in the family unobservables, which we express as

$$R^2_{\omega|Z} = \frac{\text{COV}(\omegaINC_{ij}, \omegaSES_{ij}|Z_j)^2}{\text{VAR}(\omegaINC_{ij}|Z_j) \text{VAR}(\omegaSES_{ij}|Z_j)}$$ (7)

This partial correlation expresses the extent to which the same family unobservables net of the predictors in $Z$ affects the two outcomes. Although comparing the unconditional squared correlation in Eq. (5) to the conditional counterpart in Eq. (7) may seem as providing insights into the extent to which observed family characteristics can ‘explain’ the overlap, one cannot directly compare partial to a gross correlation coefficients in this way. The reason is that the partial correlation can increase even when an observed family characteristic is uncorrelated with one of the family-level errors. As a consequence, to enable such interpretation we rescale the conditional correlation in Eq. (7) to a standardized partial regression or beta coefficient assuming
ORIGINS OF ATTAINMENT?

that occupational status affects income (see Blalock, 1967:133):

\[ b^*_\omega | Z = R_{\omega|Z} \sqrt{1 - R_{\omega|Z}^2} \]  

(8)

where \( R_{\omega|Z}^2 \) and \( R_{\omega|INC}^2 \) are the proportional reduction in the between-family variance in occupational status and income, respectively, when we introduce \( Z \) in the regression equations (i.e. they measure the proportion explained in the between-family variance components). The standardized beta coefficient in Eq. (8) can be compared directly to the square root of the gross squared correlation in Eq. (5), and any change in the coefficient can be said to reflect the extent to which the observed family characteristics in \( Z \) ‘explain’ the overlap in or association between the family unobservables between the two outcomes.17

Our analytical strategy is straightforward: For each country, we report the intraclass correlations in occupational status and wages as well as the squared correlation in the between- and within-family errors. We then introduce family level covariates into the regression equations to see how much of the between-family variance they explain in each outcome, and how much of the ‘overlap’ in between-family errors they account for.

Results

Table 1 reports the results from the gross variance components model in Eqs. (1)–(4).18 We find that the brother correlations conform to the mobility paradox pattern described earlier. The brother correlation in occupational status is virtually the same in the two countries—roughly 37 per cent—suggesting that slightly more than one-third of the total variance in brothers’ status results from systematic differences among families. For the brother correlation in wages, however, Denmark has a much lower correlation (29 per cent) than the United States (48 per cent). Thus family background (including local community) has a similar overall impact on occupational status in the two countries, but is much more important for income in the United States. Indeed, as reported in previous studies (Mazumder, 2008; Schnitzlein, 2014), brother correlations in income are in the range between 45 and 55 per cent in the United States, pointing to a comparably high level of intergenerational persistence in income, whereas for Denmark it is much smaller and overall similar to the estimates reported for other Scandinavian countries (Björklund et al., 2002).

Table 1 also reports the squared correlation in the family level (or between-family) errors, which is our measure of the overlap in family unobservables. We find that the squared correlation is virtually identical in the two countries, amounting to roughly 70 per cent. This correlation implies that the vast majority of the family factors that affect occupational status also affect income. Although the overlap is very similar in the two countries, we cannot know whether it is the same characteristics that overlap in each of the two countries.19 Nevertheless, to investigate what constitutes the overlap in each country, in Table 2 we report the decomposition of the overlap into components that can be ‘explained’ by conventional family background covariates. The table reports the between-family variance components, the proportional reduction in these components, and the squared correlation in family-level errors, and the implied partial beta coefficients when controlling for different covariates.

When we control for domain-specific parental resources (parental income in the wage equation and parental occupational status in the occupational status equation; column two in Table 2), the between-family variance in income is reduced by about 30 per cent in both countries. However, whereas the corresponding variance in wages is reduced by 25 per cent in the United States, it is reduced by merely six per cent

<table>
<thead>
<tr>
<th></th>
<th>United States</th>
<th></th>
<th></th>
<th>Denmark</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Est.</td>
<td>95% CI</td>
<td></td>
<td>Est.</td>
<td>95% CI</td>
<td></td>
</tr>
<tr>
<td><strong>Brother correlation</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupational status</td>
<td>0.377</td>
<td>[0.300;0.455]</td>
<td></td>
<td>0.373</td>
<td>[0.363;0.384]</td>
<td></td>
</tr>
<tr>
<td>Wages</td>
<td>0.483</td>
<td>[0.413;0.552]</td>
<td></td>
<td>0.290</td>
<td>[0.278;0.302]</td>
<td></td>
</tr>
<tr>
<td><strong>Squared correlation in unobservables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between (( R^2_\omega ))</td>
<td>0.688</td>
<td>[0.535;0.841]</td>
<td></td>
<td>0.715</td>
<td>[0.685;0.745]</td>
<td></td>
</tr>
<tr>
<td>Within (( R^2_\varepsilon ))</td>
<td>0.101</td>
<td>[0.050;0.151]</td>
<td></td>
<td>0.152</td>
<td>[0.144;0.159]</td>
<td></td>
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</tbody>
</table>
in Denmark. Although this result appears counterintuitive, it is perfectly consistent with the existing literature reporting much higher intergenerational elasticities and correlations in income in the United States than in Denmark and other Scandinavian countries (Jäntti et al., 2006). Moreover, the result for occupational status is consistent with the existing literature reporting similarity between the two countries in occupational mobility.

When we control for a wider range of family characteristics (columns three and four in Table 2), we explain a larger share of the between-family variances in wages and occupational status in both countries. When we control for both parental occupational status and income, we explain about 40–45 per cent for the United States. Further adding parental education, however, does not lead to any significant, incrementally explained between-family variance for the United States. For Denmark, including both parental occupational status and income results in about one-third of explained between-family variance in occupational attainment and one-quarter in wages (column three). Thus adding parental occupational status to the equation for wages leads to a very significant increase in the portion explained, suggesting that parental status is a much stronger predictor of occupational attainment than parental income in Denmark.

Further adding parental education for Denmark (column four) results in even larger portions of the between-family variances being explained. For occupational status, the three parental characteristics explain 41 per cent, which is not far from the percentage reported for the United States (45 per cent). For income, the three characteristics explain roughly 29 per cent, which is a smaller, but not much smaller, fraction than that being explained in the United States (41 per cent). Thus, even though there is some asymmetry in how the parental covariates explain the brother similarities in the two outcomes, when we consider their joint explanatory power, the percentages for the two countries are overall quite similar: In both countries, the three characteristics jointly explain about 30–45 per cent. We consider this degree of explanation a moderate portion and not far from corresponding percentages reported in other studies (Sieben and de Graaf, 2001; Mazumder, 2008; Björklund, Lindahl and Lindquist, 2010).

When we consider how the squared correlation in family-level errors changes once we enter the domain-specific parental controls (row 5 in Table 2), we find decreases in both countries, although the decrease is slightly larger in the United States (dropping from 69 to 54 per cent) than in Denmark (from 72 to 61 per cent). Although these decreases point to domain-specific parental controls explaining a minor portion of the overlap in family unobservables, when we analyze this question we prefer using standardized beta coefficients (as they are directly comparable

<table>
<thead>
<tr>
<th>Parental covariates controlled</th>
<th>Null</th>
<th>Domain-specific</th>
<th>+ Cross-domain</th>
<th>+ Education</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>United States</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>var ($\omega_{ses}$)</td>
<td>173.4</td>
<td>116.1</td>
<td>99.5</td>
<td>94.5</td>
</tr>
<tr>
<td>var ($\omega_{inc}$)</td>
<td>0.173</td>
<td>0.126</td>
<td>0.104</td>
<td>0.102</td>
</tr>
<tr>
<td>Proportional reduction var ($\omega_{ses}$)</td>
<td>–</td>
<td>33%</td>
<td>43%</td>
<td>45%</td>
</tr>
<tr>
<td>Proportional reduction var ($\omega_{inc}$)</td>
<td>–</td>
<td>27%</td>
<td>40%</td>
<td>41%</td>
</tr>
<tr>
<td>$R^2$</td>
<td>69%</td>
<td>54%</td>
<td>52%</td>
<td>51%</td>
</tr>
<tr>
<td>Implied standardized beta coefficient</td>
<td>0.83</td>
<td>0.70</td>
<td>0.70</td>
<td>0.69</td>
</tr>
<tr>
<td>Proportion explained (beta coef.)</td>
<td>–</td>
<td>15.2%</td>
<td>15.1%</td>
<td>17.0%</td>
</tr>
<tr>
<td><strong>Denmark</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>var ($\omega_{ses}$)</td>
<td>111.9</td>
<td>77.3</td>
<td>72.2</td>
<td>66.2</td>
</tr>
<tr>
<td>var ($\omega_{inc}$)</td>
<td>0.040</td>
<td>0.038</td>
<td>0.030</td>
<td>0.029</td>
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<tr>
<td>Proportional reduction var ($\omega_{ses}$)</td>
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<td>31%</td>
<td>35%</td>
<td>41%</td>
</tr>
<tr>
<td>Proportional reduction var ($\omega_{inc}$)</td>
<td>–</td>
<td>6%</td>
<td>26%</td>
<td>29%</td>
</tr>
<tr>
<td>$R^2$</td>
<td>72%</td>
<td>61%</td>
<td>62%</td>
<td>61%</td>
</tr>
<tr>
<td>Implied standardized beta coefficient</td>
<td>0.85</td>
<td>0.67</td>
<td>0.73</td>
<td>0.71</td>
</tr>
<tr>
<td>Proportion explained (beta coef.)</td>
<td>–</td>
<td>20.8%</td>
<td>13.1%</td>
<td>16.1%</td>
</tr>
</tbody>
</table>
across models controlling for different covariates. We find that controlling for domain-specific controls reduces the coefficient by about 15 per cent for the United States and 21 per cent for Denmark (row six in Table 2). Thus domain-specific controls explain only a relatively minor portion of the overlap in the unmeasured family (and local community) characteristics that affect wages and occupational status. Even when we add the remaining parental covariates (row six, columns three and four in Table 2), the explained portion remains virtually constant in both countries.

In the model including all three parental characteristics (column four), we explain only about 16–17 per cent of the overlap.

In other words, even if we can explain 30–45 per cent of overall brother similarities in wages and occupational status in the two countries with three widely used family background characteristics, these characteristics explain very little of the overlap in these sibling similarities. Thus the overlap must be rooted in other family characteristics. However, as we show in Appendix Table A2, additionally controlling for race, cultural capital, two-parent family dummy, rural-urban area, foreign language spoken in the home, and number of siblings explains only a minor, additional portion of the overlap in the United States. Although we cannot conduct a similar analysis for Denmark, these results strongly suggest that the overlap in family unobservables in income and occupational status is rooted in factors not directly measurable by a broad range of family characteristics.

Discussion

This paper is the first to study the overlap in brother correlations in two widely analyzed labour market outcomes: income and occupational status. Even though brother correlations—the most comprehensive measure of the total impact of family background on attainment—have been analyzed extensively in previous research, their overlap has never been empirically established. Providing estimates of the overlap is nonetheless important if we are to understand the extent to which success across different labour market outcomes is rooted in the same or different family characteristics. Such estimates will also be informative about the extent to which we should consider family background influences as operating in the same or in different ways on key life outcomes.

We propose using a variance components model with correlated errors across the labour market outcomes to estimate the overlap, and we apply the model to harmonized data from the United States and Denmark for cohorts born in the late 1950s and early 1960s. In line with the existing literature, we find that brother correlations in income are much larger in the United States (~ 50 per cent) than in Denmark (~ 30 per cent), whereas correlations in occupational status are virtually identical (~ 35 per cent). However, the overlap in the unmeasured family-specific factors that affect wages and income is very large, around 70 per cent, and is virtually identical in the two countries. This finding suggests that, to a very considerable extent, it is the same unmeasured characteristics of one’s family background that affect occupational and economic attainment. Despite this substantial overlap, however, we also find that only a minor portion (around 16–17 per cent) of the overlap can be accounted for by conventional family background characteristics, including parental income, occupation, and education. This finding holds for both countries.

Our finding that only a minor portion of the overlap can be explained by conventional family background characteristics begets the question of what other family factors may explain this overlap. For the United States, we provide an auxiliary analysis in which we control for a range of other family factors such as family status, race, and cultural capital. However, these covariates explain only a minor, additional portion of the overlap over and above that explained by the conventional family background variables. What then may explain the overlap? In their study of what explain sibling correlations in income, Björklund, Lindahl and Lindquist (2010) include measures of what can broadly be considered parenting styles. They find that including these family-level measures explain a substantial, additional portion of the family-level variance. Although we do not have such rich data at our disposal for this study, their findings suggest that the significant, residual overlap in unmeasured family factors may originate in aspects of the home environment that are uncorrelated with parental socioeconomic resources but which otherwise explain why siblings tend to be more similar than two randomly selected individuals in a range of key life outcomes. These mechanisms are likely related to skill and preference formation, and future research could therefore fruitfully attempt to unpack these effects with appropriate data.

Another factor that brothers share and which is receiving renewed attention in the sociological literature is genetics (see, e.g. Baier et al., 2022; Erola et al., 2022). Brothers share on average 50 per cent of their genetic make-up, and to the extent that genetic inheritance affects individuals’ occupational and income prospects, genetics is another family factor that may explain the overlap we report, at least to the extent that genetics affect these outcomes over and above the conventional family background variables we control for. For example, Conley et al. (2015) find that a direct measure of children’s educational genetic score affects their educational attainment net of parental education.
They also find that a substantial between-family correlation between children’s educational genetic score and educational attainment. Although these results clearly point to genetics as an important candidate for explaining the overlap, it remains a task for future research to quantify the extent to which this is the case. Other parental characteristics that we cannot include in this study but which might be important are parental wealth and social networks. Studies show that wealth constitutes a crucial dimension of stratification over and above that caused by income and can act as a tool for families to maintain their social positions across generations (Pfeffer and Hällsten, 2012; Hällsten and Pfeffer, 2017; Hansen and Toft, 2021; Hällsten and Thaning, 2022). Parents may also draw on their social networks to provide advantages for their children in terms of getting access to lucrative jobs (Erikson and Jonsson, 1998). To the extent that parental wealth and social networks provide advantages to children independently of the conventional family background characteristics that we control for in this study, they will likely explain some of the remaining overlaps in the family unobservables. Determining the extent to which this is the case will be important to settle in future research on this topic.

Our findings also indirectly speak to the literature examining the overlap in intergenerational mobility in different domains or the exchangeability of resources in intergenerational transmission (e.g. Breen, Mood and Jonsson, 2016; Thaning, 2021). Given the nature of sibling correlations (Solon, 1999), estimates of intergenerational associations from this literature will be contained in the overlap estimates we report. From this perspective, our approach could be considered a common baseline for studies examining resource exchangeability and/or overlap in levels of mobility across different domains, and future research might therefore benefit from applying our approach for better understanding cross-national variation in the transmission of resources across generations.

Notes

1 A related literature examines the relative role of mothers and fathers, pointing to the importance of considering both parents’ characteristics to measure family background in a more comprehensive way (Beller, 2009; Thaning and Hällsten, 2020).

2 Björklund, Lindahl and Lindquist (2010) show that variables tapping into parenting styles account for a substantial, additional portion of sibling similarities in labour market outcomes, pointing to that ‘soft’ resources constitute a key explanation of sibling similarities in life chances (see also Jæger, 2007). We return to this point in the discussion.

3 Our approach is thus related to approaches pursued in behavioural genetics in which the correlation between phenotypical traits is partitioned into genetic effects, and shared or nonshared environmental influences (see, e.g. Bartels et al., 2012).

4 The approach we pursue can be considered an extension of Hauser and Mossel's (1985) model to include families with more than two siblings. The model of Hauser and Mossel (1985) is a recursive structural equation model in which education affects occupational status via within- and between-family paths via brother pairs. Our approach is similar to the unrestricted model of Hauser and Mossel (1985) that allows the within- and between-family effect of education on status to differ, although we allow for multiple siblings per group and cast the relationship between income and occupational status in terms of covariances, not standardized path coefficients.

5 We restrict our analyses to brothers because brothers’ attainment has been the major focus of most of the sibling correlation literature and thus our results can be directly compared to results from that literature.

6 As Bingley and Cappellari (2019) show, this result likely depends on the ages at which income is measured. They show how brother correlations in earnings in Denmark follow a U-shaped pattern by age, with lower correlations in the 30s and higher correlations in the late 40s.

7 The same appears to hold for educational mobility (see, e.g. Hout and Dohan, 1996; Beller and Hout, 2006; Pfeffer, 2008; Karlson, 2021).

8 The estimates in Sieben and de Graaf (2001) are based on data from England, the Netherlands, Scotland, Spain, and the United States for cohorts born 1916 through 1990, and the 37 per cent average covers quite country-by-cohort substantial variation. For example, the brother correlation in occupational status reported for U.S. men born 1961–1975 in Sieben and de Graaf (2001) is merely 21 per cent, pointing to that—by this metric—the United States is a more fluid country than Denmark for similar birth cohorts.

9 Although singletons cannot contribute to the between-family variance component, we include singletons to increase the precision of the estimated variance components (see Björklund, Lindahl and Lindquist, 2010).

10 Thus we restrict the birth spacing to a maximum of six years. While it is possible to link all siblings born after 1960 in the registers, we do not rely on this information here.

11 As the NLSY start using new census occupational classifications from the 2002 round, we obtain SEI scores for these rounds by using crosswalks from the OCC2000 and OCC2002 to the OCC1970 and then applying the SEI scores for the 1970 codes to the transformed variables. We thank Xi Song for providing this crosswalk.

12 For Denmark, we measure hourly wages by normalizing annual earnings by annual work hours.

13 For Denmark, we measure parental income as average disposable income, which also includes income from transfers. We measure parents’ occupational status using Duncan’s SEI for the United States and ISEI for Denmark.

14 We use Stata's command gsem for this purpose. A replication package with the syntax to reproduce the findings for USA (for which the data is openly accessible) is available at the Open Science Framework: https://osf.io/2sajm/.
We define cultural capital using the simple sum of three indicators of the home environment at age 14: whether the household held any magazines, newspaper, or library card.

We notice that the variance components model assumes bivariate normality of the errors. It would also be possible to estimate the variances and covariances using method of moments, which makes less restrictive assumptions (see Solon, Page and Duncan, 2000). However, as these estimation methods often yield very similar results, we do not pursue this any further in this paper.

This is a general property of partial correlations (see, e.g. Linn and Werts, 1969; Breen, Holm and Karlson, 2014: 579–580): Even if a third control variable is uncorrelated with one of the two focal variables, the partial correlation can increase. This is not the case with regression coefficients which only can change if the third variable is correlated with both focal variables.

An equivalent interpretation is to say that it reflects the extent to which Z explains the between-family or family level ‘income returns’ to occupational status (Hauser et al., 1999). In contrast to the partial correlation, a change in standardized regression coefficients after controlling for Z can only come about if Z is correlated with both family level errors.

Appendix Table A1 reports the raw variances and covariances on which the results in Table 1 are based.

In other words, we cannot know whether the common unmeasured factors are the same in the two countries. We can only learn about this overlap by including family covariates that tap into the same observed family characteristics.

As Solon (1999) shows, the reduction in the between-family variance in income that follow from including parental income is equal to the elasticity coefficient squared multiplied by the variance in parents’ income. As both the elasticity and parental income variance are much lower in Denmark than the United States, we would expect parental income to play a smaller role in explaining the between-family variance in income that follow from including parental income.

We notice that for Denmark, the implied beta coefficients increase slightly in magnitude from columns two through three or four, something that point to a pattern of suppression effects. However, the differences across the implied beta coefficients for Denmark are so small in substantive terms that we do ignore them here.

We define cultural capital using the simple sum of three indicators of the home environment at age 14: whether the household held any magazines, newspaper, or library card.

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### References


### Supplementary Data

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