IWQW

Institut für Wirtschaftspolitik und Quantitative
Wirtschaftsforschung

Diskussionspapier
Discussion Papers

No. 05/2011

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ISSN 1867-6707

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February 2011

Abstract

This paper is the first to analyze intergenerational economic mobility based on sibling correlations in permanent earnings in Germany and to provide a cross-country comparison of Germany, Denmark, and the US. The main findings are as follows: the importance of family and community background in Germany is higher than in Denmark and comparable to that in the US. This holds true for brothers and sisters. In Denmark 20 percent of the inequality in permanent earnings can be attributed to family and community factors shared by brothers while the corresponding estimates are 43 percent in Germany and 45 percent in the US. For sisters the estimates are 19 percent for Denmark, 39 percent for Germany and 29 percent for the US. This ranking is shown to be robust against alternative approaches.

Keywords: Sibling correlations, Intergenerational mobility, Inequality, REML
JEL-Code: J62

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*I thank Regina T. Riphahn, Anders Björklund, and Olaf Groh-Samberg as well as conference participants in Perth (GB), Philadelphia, Nuremberg, and Delmenhorst for helpful comments and suggestions. Part of this research was carried out during a research visit at Aarhus School of Business. I thank Tor Eriksson for helpful comments and valuable support during this stay.

1 Introduction

The last three decades witnessed a substantial growth of the economic literature on intergenerational mobility with results covering a large number of countries.[1] The authors addressed numerous questions, starting with simple linear estimates of the intergenerational association of earnings and ending up in international comparisons of non-linearities in the intergenerational transmission of labor market success. Most of these studies focus on the calculation of intergenerational earnings elasticities (hereafter IGEs) which measure the association between parental income and the economic success of the offspring. Intergenerational mobility in this sense answers the question: *"How strong is the relationship between parental income and the income of the offspring in adulthood?"*

The main reason why research on intergenerational mobility gets attention in the literature is that the degree of intergenerational mobility in a society is often seen as a key indicator of equality of opportunities. Having this interpretation in mind, it might not be enough to analyze the association between the earnings or the income of parents and children. The relevant question to ask would rather be: *"How dependent or independent is the economic outcome of children of the situation of the family they were born into?"*

Of course this includes much more than only parental income but all family (and community) factors that are faced by the children. While parental income might be an important factor it is not obvious that it should be the only, or the major influence factor. Recent research on intergenerational mobility based on sibling correlations has shown that parental income and factors correlated with it explain less than half of the total impact of family background and community factors on children's economic outcome in adulthood (Björklund et al., 2010; Mazumder, 2008). Thus, to draw firm conclusions with respect to the degree of intergenerational mobility as an indicator of equality of opportunities in a specific country it is necessary to calculate a broader measure of the influence of family background than an IGE.

[1] See Solon (1999), Black and Devereux (2010), and Björklund and Jäntti (2009) for an extensive overview of the literature on intergenerational mobility.

Sibling correlations provide such a broader measure: if family and community factors have a significant impact on the outcome of children, two siblings should resemble each other more than two randomly drawn individuals (Solon, 1999). While calculating sibling correlations is a well known method in sociological research it is so far a rarely used approach in the economic literature on intergenerational mobility.[2]

One way to evaluate the level of intergenerational mobility as an indicator of equality of opportunities, is to compare the situation in different countries. The three countries considered in this paper represent different types of modern welfare states with different institutional settings. More precisely they are examples of the three different major types of welfare capitalism identified by Esping-Andersen (1989).

We know from the literature on sibling correlations as well as intergenerational correlations, that family background is much less important for offspring's economic outcomes in the Scandinavian countries than it is in the US. The evidence about the ranking of Germany remained unclear in the literature. Here this paper contributes in three ways:

It delivers estimates of sibling correlations for Denmark, the US, and Germany based on comparable samples. As there are no results on sibling correlations on Germany so far, this paper fills a gap in the literature. Second, it updates the US-Denmark comparison carried out by Björklund et al. (2002) based on recent data and an alternative estimation strategy. Third, it provides evidence on where to rank Germany in terms of intergenerational mobility in international comparison. Additionally, I present extensive robustness checks for the results using different sample selection rules. All estimations are carried out for both, brothers and sisters.

To summarize the main findings: the importance of family and community background in Germany is higher than in Denmark and comparable to that in the US. This holds true for brothers and

[2]In contrast to the economic literature the sociological literature on sibling correlations or sibling resemblance mainly focused on educational outcomes or prestige score measures. See for example (Hauser and Wong, 1989) for the US and Sieben et al. (2001) for Germany.

sisters. In Denmark 20 percent of the inequality in permanent earnings can be attributed to family and community factors shared by brothers while the corresponding estimates are 43 percent in Germany and 45 percent in the US. For sisters the estimates are 19 percent for Denmark, 39 percent for Germany and 29 percent for the US. I present extensive robustness checks on these results and the developed ranking appears to be robust to most of the variations in sample selection rules.

The remainder of the paper is organized as follows. Section 2 gives a short review of the existing literature; section 3 shows a simple statistical model to derive the sibling correlation and discusses the estimation strategy; section 4 contains a description of the data; section 5 presents the results; section 6 shows robustness analyses and section 7 concludes.

2 What we know from the literature

2.1 Literature on sibling correlations

Table 1 contains the existing results on sibling correlations in permanent earnings by country. It shows that, until now, there are estimates available only for the US and for Scandinavian countries.

The earliest study is Solon et al. (1991) which uses PSID (Panel Study of Income Dynamics) data for the US.[3] These authors pointed out, that it is important to separate transitory fluctuations from the earnings measure. Their results showed that intergenerational mobility measured by sibling correlations in permanent economic outcomes is much lower in the US than what was known from previous studies based on short run measures.[4] They found the brother correlation in earnings to be 0.34-0.45, depending on which assumptions they impose on their model.

These results are updated by Mazumder (2008): using the PSID and the NLSY (National Longitudinal Survey of Youth) he found the brother correlations in earnings to be 0.49 (NLSY) and

[3]There were some studies published before the Solon et al. (1991) article, but as they suffer from various sources of bias as described in Solon et al. (1991) I did not include them in Table 1. See Solon (1999) for a survey.

[4]This is very similar to the findings in Solon (1989) and Solon (1992) for intergenerational correlations.

0.39 (PSID). He also presents estimates of the contribution of specific factors explaining sibling correlation; e.g., he shows that only 36 percent of the brother correlation in earnings can be explained by parental income measures and factors correlated with it. Human capital factors explain about half the sibling correlation, as does occupation and factors correlated with it.

A much more detailed study on the question which factors determine sibling correlations is Björklund et al. (2010) based on Swedish data. Besides parental income, human capital, and occupation they found that measures of parental behavior (indicators like parental involvement in schoolwork, parenting practices and maternal attitudes) have substantial explanatory power.

In another study using Swedish data, Björklund et al. (2009) show that intergenerational mobility rose remarkably in Sweden during the rise of the welfare state. They found brother correlations of about 0.49 for cohorts born in the 1930s and brother correlations of about 0.32 for cohorts born in the 1950s, slightly increasing back to 0.37 for cohorts born in the 1960s. The authors show that factors related to schooling can account for a large part of this decline; however, they cannot identify which factors were the important determinants after eliminating changes in returns to schooling and changes in the brother correlations in schooling. In their conclusion the authors suggest that this rise in mobility is most likely driven by school reforms.

2.2 Cross-country comparisons

There are two published studies that present results on cross-country comparisons of sibling correlations. Björklund et al. (2002) compared the US to Denmark, Finland, Sweden, and Norway. They focused on brother correlations and concluded that the influence of family background is much less important in the Scandinavian countries than in the US. Björklund et al. (2004) extended the results for Finland, Sweden, and Norway to sisters and found the same cross-national pattern but lower overall correlations for sisters.

These results based on sibling correlations are in line with results on intergenerational mobility

based on IGEs, which delivered the following widely accepted stylized fact:[5] the US mark the lower end of the mobility scale in international comparisons of industrialized countries. On the other end of this scale the Scandinavian countries face the lowest influence of parental economic status on the labor market success of their offspring.

In the case of Germany the existing evidence is unclear. As there are no previous results on sibling correlations, all published comparisons are based on IGEs. Couch and Dunn (1997) carried out the first comparison of intergenerational mobility between Germany and the US. They used data from the PSID and the GSOEP (German Socioeconomic Panel) to estimate IGEs for both countries. Their German sample of sons and daughters was very young due to the short duration of the GSOEP at the time. When constructing a US sample that was comparable in age to their German data, they found no significant differences between the two countries. As, among others, Haider and Solon (2006) pointed out that observing offspring at very young ages could lead to serious bias in the estimation of the IGE, this leaves the question if their result was biased. This skepticism is supported by recent estimates of IGEs for Germany that are much lower than the consensus estimate for the US, indicating higher intergenerational mobility in Germany than in the US (Eisenhauer and Pfeiffer, 2008; Schnitzlein, 2009; Yuksel, 2009). But as these studies only provided national analyses it remains unclear how comparable the results are to the US estimates.

3 Statistical model and empirical strategy

An important issue in the analysis of intergenerational mobility is the choice of an outcome measure. One obvious choice could be annual earnings. However, annual earnings deliver not only information on the economic outcome of an individual but also contain a transitory part which reflects temporary fluctuations. In the sense of the research question stated above "How dependent or independent is the economic outcome of the children of the situation of the family they were born into?" transitory fluctuations are of minor interest. The important outcome is the permanent

[5] See for example Corak (2006).

or long-run component of earnings. Thus, the empirical strategy has to separate the transitory and the permanent component of annual earnings.

In the context of sibling correlations this was first addressed by Solon et al. (1991).[6] They showed that not controlling for transitory fluctuations when using annual earnings leads to serious underestimation of sibling correlations. The authors found an attenuation factor above 0.55 for their US data. This suggests that not taking into account the difference between permanent and annual earnings might lead to estimates for the sibling correlation of only half of the correct size.

The following statistical model is based on Solon et al. (1991) and Solon (1999). Let y_{ij} be a measure of permanent or long-run earnings for child j of family i. Next, let us assume that we can characterize the interaction of family background (including community effects) and individual effects such that permanent earnings can be decomposed into the sum of two orthogonal components, a family component α_i and an individual component μ_{ij}.

$$y_{ij} = \alpha_i + \mu_{ij} \tag{1}$$

The family component in this framework represents the combined effect of all factors that are shared by siblings from family i. The individual component covers all factors that are purely idiosyncratic to sibling j. Assuming orthogonality of α_i and μ_{ij}, the variance of permanent earnings σ_y^2 can be expressed as the sum of the variances of the family component α_i and the individual component μ_{ij}:

$$\sigma_y^2 = \sigma_\alpha^2 + \sigma_\mu^2 \quad . \tag{2}$$

In our case the measure of interest is the correlation coefficient between the permanent earnings

[6] See Solon (1992) for a discussion of the same issue in the case of IGEs.

of two siblings. So we need an expression for the covariance between the permanent earnings of two siblings j and j' of the same family i. This covariance can be shown to be

$$Cov(y_{ij}, y_{ij'}) = \sigma_\alpha^2 \qquad with\ j \neq j' \quad , \tag{3}$$

which equals the variance of the family component. With this information the correlation coefficient ρ of the permanent earnings of two siblings j and j' equals the ratio of the variance of the family component σ_α^2 and the variance of the complete permanent earnings $\sigma_\alpha^2 + \sigma_\mu^2$:

$$\rho = corr(y_{ij}, y_{ij'}) = \frac{\sigma_\alpha^2}{\sigma_\alpha^2 + \sigma_\mu^2} \qquad with\ j \neq j' \quad . \tag{4}$$

The intuitive interpretation of this ratio is, that the correlation in permanent earnings between two siblings (therefore sibling correlation) equals the proportion of the variance of permanent earnings that can be attributed to factors shared by siblings. If variance is interpreted as a measure of inequality, the sibling correlation denotes the share of inequality in a permanent outcome that can be attributed to factors shared by siblings.

As σ_α^2 and σ_μ^2 cannot be negative, ρ takes on values between 0 and 1. Linking this measure to the question of intergenerational mobility, a correlation of 0 indicates that there is no influence from family and community factors and 1 indicates that there is no influence from the individual. The first case would describe a fully mobile society and the latter a fully deterministic one.

Solon (1999) shows that there is a straightforward link between a sibling correlation as defined above and an intergenerational correlation (IGC) widely used in the existing literature:[7] Under some distributional assumptions a sibling correlation equals the squared IGC plus the influence of

[7]The existing literature on intergenerational mobility uses both IGEs and IGCs. With the assumption of equal variances of long-run income in both generations the IGC equals the IGE (Solon, 1999).

factors fully uncorrelated with parental income.[8] So if only parental income and factors correlated with parental income matter for the impact of family background and community origin, the brother correlation in the US would be around 0.16 (0.4^2), which is less than half the magnitude that is actually estimated. Mazumder (2008) and Björklund et al. (2010) analyzed the contribution of parental income to the sibling correlation in Sweden and the US and found that in both countries parental income measures are able to explain less than half of the impact of family background on the economic outcome of the offspring.

The sibling correlation described above can be estimated as the within-cluster correlation in the following linear multilevel model,

$$y_{ijt} = X_{ijt}\beta + \alpha_i + \mu_{ij} + \nu_{ijt} \tag{5}$$

with y_{ijt} being an annual earnings observation, X_{ijt} being a matrix of fixed year and age effects (including year dummies and polynomials of age) and the remaining three parts being the family, individual and transitory components. Following Mazumder (2008) I apply Restricted Maximum Likelihood (REML) to estimate this model and to identify the variances of α_i and μ_{ij}. In the results section I will report the variance components along with the sibling correlation. The standard error for the sibling correlation is calculated using the delta method.[9]

[8] Assume $\alpha_i = \beta I_i + z_i$ with I_i being a measure of long-run parental income and z_i being a measure identifying family characteristics uncorrelated with income. Solon (1999) shows that in this case the sibling correlation can be decomposed into the squared intergenerational correlation β^2 and influence factors uncorrelated with parental income: $\rho = \beta^2 + \sigma_z^2/(\sigma_\alpha^2 + \sigma_\mu^2)$.

[9] There is a discussion in the literature on whether the model should be estimated allowing for serial correlation of the transitory individual component. Following Mazumder (2008), the estimates in this paper are estimated without autocorrelated individual components.

4 Data and sampling rules

4.1 Data

For the US and Germany I apply data from the GSOEP (Wagner et al., 2007) and the PSID. Both are nationally representative household surveys widely used in economic and sociological research. Both datasets started with a set of households that were asked on an annual basis (in the case of the PSID the households are interviewed biannually after 1999). As the children of these original households grew up and founded own families, their households were interviewed as new survey households. This feature enables me to link siblings when they are grown up. A strength of the GSOEP and the PSID, in addition to the vast amount of information available in the data, is, that both surveys are included in the Cross-National-Equivalent-File (CNEF) project carried out at Cornell University. It contains internationally comparable variables for a subset of the information in the original surveys.[10]

I extract family relations information from the original surveys and use the information on annual labor earnings as it is stored in the CNEF data. I use the most recent waves that are available in the CNEF. For Germany these are the years 2002-2008 and for the US, as the PSID is carried out only biannually since 1997, these are the years 1999, 2001, 2003, 2005 and 2007.[11]

For Denmark I had access to data from the Danish Integrated Database for Labor Market Research (Integreret Database for Arbejdsmarkedsforskning (IDA)) which is a database that combines information from various registers of administrative data collected by the Danish government and administered by Statistics Denmark.[12] Being administrative data the IDA database has some de-

[10] See http://www.human.cornell.edu/pam/research/centers-programs/german-panel/cnef.cfm for an overview on the available data and (Burkhauser et al., 2000) for an overview of the project.

[11] To have a comparable time window for the three countries I decided not to use the 1997 wave in the analysis and to stay with five years in the US data.

[12] Unfortunately there is no English documentation available. Nevertheless an English description of the database can be found in Timmermans (2010) and http://www.asb.dk/article.aspx?pid=675. A complete list of variables, in Danish, can be found in Danmarks Statistik (1998).

sirable properties. It covers the entire Danish population so there is no sample selection or panel attrition (besides natural attrition). The earnings information might be more precise when coming from administrative data sources then from interviews. But a major advantage of this data is the high number of individuals (all Danish residents) covered.

As it would be computationally very burdensome to use the entire Danish population for the analysis I had to draw a sample comparable to the ones from Germany and the US. A natural choice would be to draw a random sample of the Danish population. But this would be different from what is stored in the surveys for Germany and the US.

In the two surveys the initial unit is the parental household and not the offspring that is observed in this study. To take this into account, I choose to first define a family indicator for every individual covered in the years 2002-2006. As it is important how to define which siblings belong to one family, I will provide results for four different alternatives and will verify that the results are robust to these definitions. In the main scenario I define two individuals to belong to one family, and thus to be considered siblings, if they have the same mother and the same father.[13] Then I draw a 10 percent random sample of these families. In the second step I include all children from the sampled families in the analysis. As an outcome I use the annual labor earnings variable available in the IDA dataset.

4.2 Sampling rules

As for example Björklund et al. (2002) pointed out, the results of a sibling correlation analysis are sensitive to the applied sample selection rules. In the following I will describe the sample selection rules for what I call the main scenario. The results based on these specifications are the results that are most comparable to the existing literature. I will present robustness checks that show how sensitive the main findings are to these sampling decisions.

[13] Note that this is not identical to being biological siblings.

In the main scenario the earnings observations of the siblings are considered between age 30 and 50 (excluding the boundaries). So in every country even the high educated have entered the labor market and should still be in the labor force. Below I will also show results for a shorter age window (35-50).

In the main scenario I follow the literature and impose a lower annual earnings limit of 1200 Euro (9000 DKK, 1200 USD) in real 2007 values. I also consider three alternative cases, a lower earnings limit of 600 Euro (4500 DKK, 600 USD) and a case with no lower earnings limit.[14]

Table 2 contains descriptive statistics for both, brothers and sisters, for the sample of the main scenario. The first column in each part of the table contains the number of individuals observed in each year.[15] These are clearly higher in the Danish administrative data compared to the household surveys from Germany and the US. This explains that the results in the next section are estimated more precisely for the Danish sample. The table further contains median earnings and mean age for brothers and sisters in the three countries. While in all three countries median earnings are higher for brothers than for sisters, the difference is clearly smaller in Denmark compared to Germany and the US.

5 Results

I start the discussion of the results with the estimates that use the main scenario. Here, siblings are defined as having the same mother and the same father, they are observed between 30 and 50 years of age and the annual earnings are truncated at a lower limit of 1200 EUR, 9000 DKK, or 1200 USD. The estimation results for brothers and sisters are shown in Table 3.

In the first three rows the estimated variance components σ_α^2, σ_μ^2, and σ_ν^2 are shown along with their standard errors. As all figures in the tables are at least significant at the five percent level the

[14] That means only missing values and zero values are left out.

[15] These numbers include siblings as well as singletons. In the estimation I follow the existing literature and estimate the model including singletons to increase the accuracy of the estimate of σ_α^2. For a discussion see Solon et al. (1991) and Mazumder (2008).

significance is not explicitly marked. The estimated sibling correlations ρ are presented in the bold typed line of Table 3.

For brothers the estimated correlation in permanent earnings is 0.20 in Denmark, 0.43 in Germany and 0.45 in the US. According to these results family and community background is of equal importance in Germany and the US and is much less important in Denmark. Thus, in Denmark, around 20 percent of the inequality in permanent earnings can be attributed to factors shared by siblings. The corresponding figures are 43 percent for Germany and 45 percent for the US.

Comparing the 95 percent confidence intervals given in brackets in the line below the standard errors, it is obvious that there is a significant difference between Germany and Denmark and between the US and Denmark. On the other hand the intervals of the German and the US estimates are clearly overlapping. This leads to the first results:

- *For brothers, there is significantly less intergenerational mobility in Germany and the US than in Denmark.*
- *For brothers there is no significant difference in intergenerational mobility between Germany and the US.*

For sisters the situation is not as clear-cut as for brothers. The estimated correlations are 0.19 for Denmark, 0.39 for Germany and 0.29 for the US. In the above interpretation, 19 percent of the inequality in permanent earnings can be attributed to factors shared by sisters in Denmark. The corresponding shares in Germany and the US are 39 percent and 29 percent.

The estimates confirm the results found in earlier studies, i.e. that sister correlations are lower than the corresponding brother correlations. While the 95 percent confidence intervals for the three countries are overlapping, I base my interpretation on the 90 percent intervals. These indicate that there is, at least at the ten percent level, a significant difference between the importance of family

background for sisters in Denmark on the one side and Germany/US on the other side. Thus, the summary for sisters resembles that for brothers:

- *For sisters there is significantly less intergenerational mobility in Germany and the US than in Denmark.*
- *For sisters there is no significant difference in intergenerational mobility between Germany and the US.*

The last three lines of Table 3 contain the number of observations, the number of individuals and the number of families that are included in the estimation. The critical value in these estimations is the difference between the number of individuals and the number of families. This is the number of children descending from families with more than one sibling in the analysis, which identifies the variation within a family. While the number of annual observations is quite high in all six estimations, this critical difference became very low especially for German sisters. This is the reason for the less precise estimation of the sister correlation in the German data.

6 Robustness of the results

As existing studies (for example Björklund et al. (2002)) showed, the estimated sibling correlations are to some extent sensitive to variations in the applied sample selection rules. The aim of this section is to analyze how robust the main findings stated above are to changes in the main sample dimensions.

First, I vary the definition of a sibling. Second, I modify the lower earnings limit holding fixed the age at which I observe the siblings. Third, I vary the age and hold the earnings limit fixed. The results of these robustness checks can be found in Tables 4-10. Tables (4), (6), and (8) present estimated sibling correlations for 40 different sample specifications in each country. Tables (5), (7), and (9) contain the associated number of observations, individuals, and families. Finally, Table 10

gives an overview over which cross-country comparisons result in a significant difference and at which level.

The structure of the Tables is oriented at the three factors mentioned above. Each column contains another definition of who is counted as a sibling: alternative 1 is the definition of the main scenario, where two individuals are counted as siblings if they have the same mother and father. Alternative 2 relaxes this to the case that two individuals are counted as siblings if they have the same father and in the case the information on the father is missing they are matched if they have the same mother. Alternative 3 counts two individuals as siblings only based on the information on the mother and Alternative 4 incorporates only the information on the father.[16]

In the first panel of the tables the age window is hold constant (30-50 years of age) and I vary the lower earnings limit. I calculate the sibling correlations for three scenarios. In the first row all results are calculated using no lower earnings limit. That means that only missing observations and those with zero earnings (because of the calculation of log earnings) are excluded.[17] The second row contains the earnings definition of the main scenario in which low earnings are cut at 9000 DKK, 1200 EUR and 1200 USD. The last row of this block relaxes the lower limit to half of the main scenario.

The second panel holds the earnings limit fixed at the definition of the main scenario and varies the age restriction. The first row presents results for siblings observed at younger ages (between 25 and 45) and the second row for siblings observed between 35 and 50 years of age.

[16]Note that this is only intended to be a robustness check for the definition of siblings. This is not intended to add to the literature nature vs. nurture. I do not have the information whether parents are natural or step parents.

[17]I also computed a case where I use $ln(wage + 1)$ as dependent variable to include years with zero income. For all three countries the resulting estimates are lower than the estimates in the baseline case. The significant differences between Denmark and the US remain, but the German estimates become all insignificant. This might be due to differences between the GSOEP and the PSID regarding when an earnings observation is counted as missing and when it is counted as zero. The results for this specification are available upon request.

6.1 Results of the robustness checks

I start the discussion with the different definitions of siblings. While every column of Tables (4), (6), and (8) contains another sibling definition, the sibling correlations in all three countries do not vary very much along this dimension. Thus, the estimates seem to be robust in this respect both, for brothers and sisters.

The modification of the lower earnings limit seems to be more influential. One important source of bias in the early studies on intergenerational mobility based on sibling correlations was that they relied on too homogeneous samples (see discussion in Solon et al. (1991)). One could expect a similar effect here. The higher the annual earnings limit, the more homogeneous the sample gets. In a more homogenous sample even unrelated individuals resemble each other, so the resulting brother correlations should be lower than in a more heterogeneous sample. This holds true for brothers in Denmark (left part of upper panel in Table 4) and Germany (left part of upper panel in Table 6) and for sisters in the US (right part of upper panel in Table 8) and Denmark (right part of upper panel in Table 4). Interestingly, for US brothers (left part of upper panel in Table 8) and for sisters in Germany (right part of upper panel in Table 6) this is not the case. For German sisters the estimates with the medium lower earnings limit are higher than the ones for the higher lower limit. For brothers in the US the highest correlations are estimated for the specification without lower earnings. As the differences in the correlations are small, the overall results are robust against changes in the earnings limit specification.

These findings highlight the need for a cross-country comparison. They show that it might be misleading to draw conclusions solely based on national studies when it is not possible to vary the sample restrictions of all countries involved. As the impact of these variations may differ between the countries, one needs to know the magnitude of the change to judge if the main results are affected.

The lower panels in Tables 4, 6, and 8 hold the earnings limit fixed at the definition of the

main scenario and varies the age at which the individuals were observed. The first row in the lower panels contains an estimate based on a younger cohort (between 25-45 years of age) and the second an estimate based on an older cohort (between 35-50 years of age).

One would expect the more narrow age window to yield a more homogenous sample. This should lead to smaller correlations compared to the main scenario. This holds true for all Danish estimates, for German sisters, and for US brothers. It is not true for US sisters and German brothers. While the results for the two different age specifications are very similar for US sisters, there is a major difference for German brothers. Restricting their age to 35-50 years rises the brother correlation from 0.43-0.47 to 0.63- 0.66. As it is the aim of this paper to present results of a cross-country comparison I interpret this differing reaction as another evidence that international rankings should be based on cross-country comparisons instead of national studies.

The German brothers are again an exception when one analyzes the change in the correlations from the older to the younger cohort. In the US and Denmark this leads to an increase in the estimated brother correlation and has little effect for the sister correlation. For German brothers and sisters, this change results in a clear decrease in the brother correlation. One possible explanation for this behavior would be that in Germany especially highly educated individuals enter the labor market at older ages. So in the first years there is not yet a big difference between high and low earners. This could lead to an overestimation of the intergenerational mobility.

The majority of the mentioned differences resulting from variations in the sampling dimensions are not statistically significant as parts of their confidence bands overlap. But especially when the response of the correlations due to a change in sample selection rules is different in two countries it is important to see whether the results stated in the main scenario are still correct.

6.2 Robustness of the main scenario results

The results stated in section 5 refer to the cross national comparison of the sibling correlations. In the following I discuss how robust these findings are to the described variations in sample selection criteria. Table 10 shows which pair wise confidence intervals are not overlapping for the different specifications. Two stars denote non-overlapping 95 percent confidence intervals and one star denotes non-overlapping 90 percent confidence intervals.

6.2.1 There is significantly less intergenerational mobility in Germany and the US than in Denmark, both for brothers and sisters

I start the discussion with the results for brothers. At the bottom of Table 10 one can find the Denmark-US comparison. As all calculated specifications show differences at the 5 percent level, the difference between Denmark and the US is a robust result. This updates and confirms the results by Björklund et al. (2002) and is in line with the results based on IGE/IGCs.

The top panel of the table indicates the place of Germany in this comparison. The differences between Denmark and Germany are significant for all specifications except for the younger cohort. Even though the point estimates are all higher in Germany, the differences are not statistically significant. This is due to the fact that the correlations respond differently to a change in the age restriction in Germany and Denmark. Given this exception for brothers the result of higher intergenerational mobility in Denmark is a robust finding.

For sisters the picture is less clear. In the Denmark-US comparison most of the specifications except the one without lower earnings limit are significantly different at least at the ten percent level. In the Germany-Denmark comparison this is only true for less than half of the specifications. Given the low number of observations, especially in the German sample, I still interpret this as support for the result stated above.

6.2.2 For brothers and sisters there is no significant difference in intergenerational mobility between Germany and the US

This result is based on the middle panel of Table 10. For sisters, no specification shows a significant difference between Germany and the US. The German estimates are higher than the US ones but none of the differences is statistically significant.

For brothers there is a clear result for the age window 30-50: for specifications based on this age group there is no significant difference between Germany and the US. But the result changes when the age restriction changes. For the younger cohort the US results are higher than the German ones indicating higher intergenerational mobility in Germany compared to the US, while for the older cohort the picture is the opposite. The German estimates are significantly higher than the US ones. Thus, the result of similar levels of intergenerational mobility is supported for the main age window. But the different reactions to the variations in age and the conclusions resulting from this for the structure of intergenerational mobility in the two countries should be the subject of further research on this topic.

7 Conclusion

This paper is the first to analyze sibling correlations in permanent earnings in Germany and it is the first to analyze Germany in a cross-country comparison with Denmark and the US. As existing studies show that these two countries mark the two ends of the scale of intergenerational mobility, this paper studies where to place Germany in this ranking.

The importance of family and community background in Germany is higher than in Denmark and comparable to the US. This holds true for brothers and sisters. This means that in Denmark 20 percent of the inequality in permanent earnings can be attributed to family and community factors shared by brothers while the corresponding estimates are 43 percent in Germany and 45 percent in the US. For sisters the estimates are 19 percent for Denmark, 39 percent for Germany and 29 percent

for the US. I present extensive robustness checks on these results and the developed ranking appears to be robust to most of the variations in sample selection rules. I interpret this as support for the findings. One important exception is the response to the variation in the age restriction of German brothers. These differences found in the response of the estimated correlations to changes in age restrictions between Germany and the US/Denmark should be a motivation for further research on the structure of intergenerational mobility in these countries.

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Appendix

Table 1: Existing literature on sibling correlations in permanent earnings

Country	Sibling correlation	Cohort	Method	Author(s)
		Brothers		
USA	0.492	1957-1965	REML	Mazumder (2008)
USA	0.452	1957-1965	REML	Levine and Mazumder (2007)
USA	0.448	1951-1958	ANOVA	Solon et al. (1991)
USA	0.429	1951-1967	ANOVA	Björklund et al. (2002)
Sweden	0.366	1962-1968	GMM	Björklund et al. (2009)
Sweden	0.250	1949-1957	REML	Björklund et al. (2010)
Sweden	0.250	1948-1965	ANOVA	Björklund et al. (2002)
Sweden	0.220	1962-1968	REML	Björklund et al. (2007)
Sweden	0.189	1951-1968	ANOVA	Björklund et al. (2004)
Finland	0.264	1953-1965	ANOVA	Björklund et al. (2002)
Finland	0.259	1950-1960	ANOVA	Österbacka (2001)
Finland	0.242	1955-1965	ANOVA	Björklund et al. (2004)
Denmark	0.230	1951-1968	ANOVA	Björklund et al. (2002)
Norway	0.142	1953-1969	ANOVA	Björklund et al. (2004)
Norway	0.138	1950-1970	ANOVA	Björklund et al. (2002)
		Sisters		
USA	0.340	1957-1965	REML	Mazumder (2008)
Sweden	0.227	1949-1957	REML	Björklund et al. (2010)
Sweden	0.146	1951-1968	ANOVA	Björklund et al. (2004)
Finland	0.114	1955-1965	ANOVA	Björklund et al. (2004)
Finland	0.109	1950-1960	ANOVA	Österbacka (2001)
Norway	0.122	1953-1969	ANOVA	Björklund et al. (2004)

Table 2: Descriptive statistics (main scenario)

	Brothers			Sisters		
Year	N	Median Earnings	Age	N	Median Earnings	Age
			Denmark			
2002	53,027	275,187	39.3	47,794	214,270	38.8
2003	54,058	286,387	39.4	49,611	225,601	39.1
2004	54,963	298,525	39.6	51,540	234,345	39.4
2005	56,013	310,085	39.7	53,014	243,472	39.6
2006	56,817	328,099	39.7	54,599	257,446	39.7
2007	56,931	349,915	39.9	55,341	274,054	39.9
			Germany			
2002	666	30,097	36.3	336	17,129	35.4
2003	692	31,076	36.8	374	17,898	35.6
2004	700	31,553	37.2	418	18,074	36.0
2005	708	32,893	37.6	433	17,227	36.5
2006	712	32,928	37.9	439	17,493	37.1
2007	693	33,200	38.5	462	18,875	37.3
2008	703	34,272	38.6	483	19,316	37.3
			US			
1999	933	30,400	39.9	968	18,400	39.8
2001	936	35,700	40.1	1,012	21,250	39.9
2003	914	35,600	40.0	998	23,140	40.2
2005	938	42,300	39.9	970	25,380	40.4
2007	923	48,500	39.8	958	30,000	40.3

Note: The table shows descriptive statistics for the three different national samples. In all three countries the figures are based on the definitions of the main scenario, i.e. age in]30 ; 50[, annual earnings > 9000 DKK, 1200 EUR, 1200 USD, siblings have, the same mother and the same father. N is the number of observed individuals including singletons.

Table 3: Sibling correlations in Denmark, Germany and the US (main scenario)

	Brothers			**Sisters**		
	Denmark	**Germany**	**US**	**Denmark**	**Germany**	**US**
Family component (σ^2_α)	0.072	0.165	0.239	0.053	0.230	0.154
	(0.003)	(0.033)	(0.028)	(0.003)	(0.066)	(0.026)
Individual component (σ^2_μ)	0.284	0.218	0.293	0.231	0.358	0.386
	(0.003)	(0.030)	(0.024)	(0.003)	(0.064)	(0.027)
Transitory component (σ^2_ν)	0.109	0.096	0.191	0.129	0.220	0.233
	(0.000)	(0.002)	(0.005)	(0.000)	(0.007)	(0.006)
Correlation (ρ)	**0.202**	**0.432**	**0.450**	**0.187**	**0.391**	**0.285**
	(0.008)	(0.078)	(0.043)	(0.009)	(0.107)	(0.045)
	[0.187 ; 0.217]	[0.279 ; 0.585]	[0.365 ; 0.535]	[0.170 ; 0.205]	[0.182 ; 0.600]	[0.196 ; 0.374]
Observations	331,806	4,874	4,644	311,897	2,945	4,906
Individuals	73,554	1,014	1,435	68,062	704	1,538
Families	55,190	858	996	52,222	642	1,067

Note: The table contains estimates of sibling correlations (separate estimations for brothers and sisters). The variance components used to calculate the sibling correlations are estimated via Restricted Maximum Likelihood. The standard errors of the correlations (in parentheses) are calculated using the delta method. The 95 percent confidence intervals are given in brackets. All calculations are based on the main scenario (individuals are between 30 and 50 years of age and annual earnings are truncated at a lower earnings limit of 9000 DKK, 1200 EUR or 1200 USD) and the main definition of siblings (same father and mother). The matrix of fixed effects X_{ijt} in the multilevel model contains dummy variables for each year and three polynomials of age.

Table 4: Sensitivity of the results - Denmark

	Brothers				Sisters			
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
	Age in]30 ; 50[				*Age in]30 ; 50[*			
no lower limit	0.158	0.150	0.142	0.139	0.154	0.148	0.146	0.152
	[0.143 ; 0.173]	[0.136 ; 0.164]	[0.128 ; 0.156]	[0.124 ; 0.153]	[0.137 ; 0.172]	[0.132 ; 0.163]	[0.130 ; 0.162]	[0.135 ; 0.168]
	[0.132 ; 0.159]	[0.138 ; 0.161]	[0.130 ; 0.153]	[0.127 ; 0.151]	[0.139 ; 0.168]	[0.134 ; 0.161]	[0.132 ; 0.159]	[0.138 ; 0.165]
annual earnings > 9000 DKK	0.202	0.184	0.194	0.190	0.187	0.188	0.192	0.197
	[0.187 ; 0.217]	[0.169 ; 0.198]	[0.180 ; 0.208]	[0.175 ; 0.204]	[0.170 ; 0.205]	[0.172 ; 0.203]	[0.176 ; 0.208]	[0.181 ; 0.214]
	[0.178 ; 0.205]	[0.171 ; 0.196]	[0.182 ; 0.205]	[0.178 ; 0.202]	[0.172 ; 0.201]	[0.174 ; 0.201]	[0.178 ; 0.205]	[0.183 ; 0.211]
annual earnings > 4500 DKK	0.188	0.169	0.181	0.176	0.176	0.177	0.186	0.185
	[0.173 ; 0.203]	[0.155 ; 0.183]	[0.167 ; 0.195]	[0.162 ; 0.191]	[0.159 ; 0.193]	[0.161 ; 0.193]	[0.170 ; 0.203]	[0.169 ; 0.202]
	[0.172 ; 0.199]	[0.157 ; 0.180]	[0.169 ; 0.192]	[0.164 ; 0.189]	[0.161 ; 0.190]	[0.163 ; 0.190]	[0.172 ; 0.199]	[0.172 ; 0.199]
	Annual earnings > 9000 DKK				*Annual earnings > 9000 DKK*			
age in]25 ; 45[	0.226	0.188	0.203	0.206	0.183	0.196	0.193	0.189
	[0.210 ; 0.242]	[0.173 ; 0.203]	[0.188 ; 0.218]	[0.191 ; 0.221]	[0.165 ; 0.200]	[0.180 ; 0.212]	[0.176 ; 0.209]	[0.172 ; 0.205]
	[0.178 ; 0.207]	[0.175 ; 0.200]	[0.190 ; 0.215]	[0.193 ; 0.218]	[0.167 ; 0.198]	[0.182 ; 0.209]	[0.178 ; 0.207]	[0.175 ; 0.203]
age in]35 ; 50[	0.194	0.183	0.190	0.183	0.170	0.166	0.167	0.194
	[0.177 ; 0.211]	[0.166 ; 0.200]	[0.173 ; 0.208]	[0.166 ; 0.200]	[0.150 ; 0.191]	[0.148 ; 0.185]	[0.147 ; 0.186]	[0.175 ; 0.213]
	[0.150 ; 0.183]	[0.168 ; 0.197]	[0.175 ; 0.204]	[0.169 ; 0.197]	[0.153 ; 0.186]	[0.150 ; 0.181]	[0.150 ; 0.183]	[0.178 ; 0.210]

Note: The Table contains estimates of sibling correlations (separate estimations for brothers and sisters). The variance components used to calculate the sibling correlations are estimated via Restricted Maximum Likelihood. The 95 percent and the 90 percent confidence intervals are given in brackets. The Table contains the information on four alternative definitions of siblings (1: Same father and same mother; 2: Same father, if no information on the father is available, then same mother; 3: Same mother; 4: Same father) and variations in age and the applied earnings limit. See the discussion in the text for a detailed description. The matrix of fixed effects X_{ijt} in the multilevel model contains dummy variables for each year and three polynomials of age.

Table 5: Number of observations, individuals and families - Denmark

	Brothers				Sisters			
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
		Age in]30 ; 50[				*Age in]30 ; 50[*		
Observations	336,974	348,153	341,107	350,191	317,100	331,105	323,129	329,594
Individuals	74,604	77,875	75,476	77,252	68,896	72,343	70,072	71,069
Families	55,809	57,477	55,280	56,841	52,735	54,368	52,377	53,486
Observations	331,806	342,314	335,895	344,525	311,897	325,489	317,925	323,945
Individuals	73,554	76,716	74,416	76,122	68,062	71,479	69,266	70,176
Families	55,190	56,836	54,715	56,204	52,222	53,871	51,920	52,977
Observations	333,809	344,647	337,981	346,751	313,975	327,733	320,025	326,143
Individuals	73,943	77,183	74,831	76,558	68,406	71,833	69,581	70,522
Families	55,414	57,091	54,935	56,467	52,431	54,082	52,109	53,172
		Annual earnings > 9000 DKK				*Annual earnings > 9000 DKK*		
Observations	340,815	348,541	342,843	349,462	325,104	335,558	330,783	334,260
Individuals	76,580	78,779	76,882	78,135	73,602	76,469	74,703	75,556
Families	58,160	58,593	56,898	58,153	56,825	57,597	55,901	57,042
Observations	240,145	249,438	243,202	251,835	225,541	238,129	230,250	236,179
Individuals	56,695	59,467	57,491	59,149	51,969	55,021	52,974	53,957
Families	43,150	44,970	43,242	44,431	40,494	42,360	40,596	41,533

Note: The Table contains the number of observations, individuals and families for the corresponding estimations in Table 4.

Table 6: Sensitivity of the results - Germany

	Brothers				Sisters			
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
	Age in]30 ; 50[				*Age in]30 ; 50[*			
No lower limit	0.344	0.367	0.341	0.366	0.387	0.366	0.372	0.376
	[0.184 ; 0.505]	[0.212 ; 0.522]	[0.181 ; 0.501]	[0.210 ; 0.522]	[0.186 ; 0.587]	[0.171 ; 0.561]	[0.170 ; 0.575]	[0.182 ; 0.570]
	[0.209 ; 0.479]	[0.237 ; 0.497]	[0.207 ; 0.475]	[0.235 ; 0.497]	[0.219 ; 0.555]	[0.203 ; 0.530]	[0.203 ; 0.542]	[0.213 ; 0.539]
annual earnings > 1200 EUR	0.432	0.465	0.430	0.461	0.391	0.360	0.369	0.373
	[0.279 ; 0.585]	[0.320 ; 0.611]	[0.277 ; 0.583]	[0.315 ; 0.607]	[0.182 ; 0.600]	[0.159 ; 0.561]	[0.159 ; 0.580]	[0.173 ; 0.574]
	[0.303 ; 0.560]	[0.343 ; 0.587]	[0.301 ; 0.558]	[0.338 ; 0.583]	[0.216 ; 0.566]	[0.191 ; 0.529]	[0.193 ; 0.546]	[0.205 ; 0.542]
annual earnings > 600 EUR	0.429	0.458	0.425	0.455	0.400	0.374	0.382	0.385
	[0.274 ; 0.583]	[0.312 ; 0.604]	[0.271 ; 0.580]	[0.308 ; 0.602]	[0.208 ; 0.591]	[0.189 ; 0.559]	[0.191 ; 0.577]	[0.200 ; 0.569]
	[0.299 ; 0.558]	[0.335 ; 0.581]	[0.296 ; 0.555]	[0.332 ; 0.578]	[0.239 ; 0.560]	[0.219 ; 0.530]	[0.222 ; 0.546]	[0.230 ; 0.539]
	Annual earnings > 1200 EUR				*Annual earnings > 1200 EUR*			
age in]25 ; 45[	0.302	0.301	0.289	0.306	0.310	0.327	0.301	0.340
	[0.164 ; 0.439]	[0.166 ; 0.436]	[0.153 ; 0.424]	[0.169 ; 0.444]	[0.143 ; 0.477]	[0.167 ; 0.486]	[0.135 ; 0.467]	[0.180 ; 0.500]
	[0.187 ; 0.417]	[0.188 ; 0.414]	[0.175 ; 0.403]	[0.191 ; 0.422]	[0.170 ; 0.450]	[0.193 ; 0.461]	[0.162 ; 0.440]	[0.206 ; 0.474]
age in]35 ; 50[	0.631	0.655	0.626	0.650	0.369	0.316	0.324	0.356
	[0.501 ; 0.762]	[0.535 ; 0.775]	[0.495 ; 0.758]	[0.529 ; 0.771]	[0.084 ; 0.654]	[0.054 ; 0.579]	[0.037 ; 0.610]	[0.094 ; 0.617]
	[0.522 ; 0.741]	[0.554 ; 0.756]	[0.515 ; 0.737]	[0.548 ; 0.752]	[0.130 ; 0.608]	[0.096 ; 0.537]	[0.083 ; 0.564]	[0.136 ; 0.575]

Note: The Table contains estimates of sibling correlations (separate estimations for brothers and sisters). The variance components used to calculate the sibling correlations are estimated via Restricted Maximum Likelihood. The 95 percent and the 90 percent confidence intervals are given in brackets. The Table contains the information on four alternative definitions of siblings (1: Same father and same mother; 2: Same father, if no information on the father is available, then same mother; 3: Same mother; 4: Same father) and variations in age and the applied earnings limit. See the discussion in the text for a detailed description. The matrix of fixed effects X_{ijt} in the multilevel model contains dummy variables for each year and three polynomials of age.

Table 7: Number of observations, individuals and families - Germany

	Brothers				Sisters			
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
		Age in]30 ; 50[				*Age in]30 ; 50[*		
Observations	4,908	5,602	5,020	5,490	3,040	3,564	3,130	3,474
Individuals	1,018	1,171	1,043	1,146	713	841	735	819
Families	862	1,005	886	980	647	767	667	746
Observations	4,874	5,565	4,986	5,453	2,945	3,450	3,033	3,362
Individuals	1,014	1,167	1,039	1,142	704	830	726	808
Families	858	1,001	882	976	642	760	662	739
Observations	4,892	5,585	5,004	5,473	3,001	3,520	3,091	3,430
Individuals	1,017	1,170	1,042	1,145	712	839	734	817
Families	861	1,004	885	979	646	765	666	744
		Annual earnings > 1200 EUR				*Annual earnings > 1200 EUR*		
Observations	6,608	7,349	6,763	7,194	4,656	5,215	4,728	5,143
Individuals	1,518	1,695	1,554	1,659	1,163	1,324	1,187	1,300
Families	1,274	1,438	1,307	1,404	1,022	1,171	1,044	1,147
Observations	3,029	3,529	3,103	3,455	1,556	1,960	1,633	1,883
Individuals	691	811	710	792	414	516	433	497
Families	588	702	607	682	385	480	402	463

Note: The Table contains the number of observations, individuals and families for the corresponding estimations in Table 6.

Table 8: Sensitivity of the results - US

	Brothers				Sisters			
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
	Age in]30 ; 50[				*Age in]30 ; 50[*			
No lower limit	0.495	0.498	0.494	0.443	0.216	0.216	0.217	0.217
	[0.407 ; 0.582]	[0.418 ; 0.579]	[0.407 ; 0.581]	[0.363 ; 0.523]	[0.126 ; 0.306]	[0.134 ; 0.298]	[0.127 ; 0.306]	[0.137 ; 0.297]
	[0.421 ; 0.568]	[0.431 ; 0.566]	[0.421 ; 0.567]	[0.376 ; 0.510]	[0.141 ; 0.291]	[0.147 ; 0.285]	[0.142 ; 0.292]	[0.150 ; 0.284]
annual earnings > 1200 USD	0.450	0.484	0.453	0.442	0.285	0.285	0.285	0.290
	[0.365 ; 0.535]	[0.409 ; 0.560]	[0.369 ; 0.537]	[0.366 ; 0.517]	[0.196 ; 0.374]	[0.203 ; 0.366]	[0.196 ; 0.373]	[0.210 ; 0.370]
	[0.378 ; 0.521]	[0.421 ; 0.548]	[0.382 ; 0.524]	[0.379 ; 0.505]	[0.211 ; 0.359]	[0.216 ; 0.353]	[0.211 ; 0.359]	[0.223 ; 0.357]
annual earnings > 600 USD	0.461	0.501	0.464	0.454	0.263	0.264	0.263	0.270
	[0.374 ; 0.547]	[0.424 ; 0.577]	[0.378 ; 0.550]	[0.377 ; 0.532]	[0.174 ; 0.352]	[0.181 ; 0.347]	[0.175 ; 0.352]	[0.189 ; 0.352]
	[0.388 ; 0.533]	[0.436 ; 0.565]	[0.392 ; 0.536]	[0.389 ; 0.519]	[0.188 ; 0.338]	[0.194 ; 0.333]	[0.189 ; 0.338]	[0.203 ; 0.338]
	Annual earnings > 1200 USD				*Annual earnings > 1200 USD*			
age in]25 ; 45[	0.515	0.520	0.511	0.501	0.285	0.278	0.286	0.277
	[0.431 ; 0.598]	[0.446 ; 0.594]	[0.427 ; 0.594]	[0.428 ; 0.574]	[0.192 ; 0.379]	[0.192 ; 0.364]	[0.194 ; 0.378]	[0.193 ; 0.362]
	[0.445 ; 0.585]	[0.458 ; 0.582]	[0.440 ; 0.581]	[0.439 ; 0.562]	[0.207 ; 0.364]	[0.206 ; 0.350]	[0.209 ; 0.363]	[0.206 ; 0.348]
age in]35 ; 50[	0.444	0.474	0.450	0.420	0.301	0.302	0.304	0.301
	[0.347 ; 0.542]	[0.387 ; 0.562]	[0.353 ; 0.546]	[0.332 ; 0.508]	[0.204 ; 0.398]	[0.214 ; 0.391]	[0.209 ; 0.400]	[0.214 ; 0.389]
	[0.363 ; 0.526]	[0.401 ; 0.548]	[0.369 ; 0.531]	[0.346 ; 0.494]	[0.219 ; 0.382]	[0.228 ; 0.377]	[0.224 ; 0.385]	[0.214 ; 0.389]

Note: The Table contains estimates of sibling correlations (separate estimations for brothers and sisters). The variance components used to calculate the sibling correlations are estimated via Restricted Maximum Likelihood. The 95 percent and the 90 percent confidence intervals are given in brackets. The Table contains the information on four alternative definitions of siblings (1: Same father and same mother; 2: Same father, if no information on the father is available, then same mother; 3: Same mother; 4: Same father) and variations in age and the applied earnings limit. See the discussion in the text for a detailed description. The matrix of fixed effects X_{ijt} in the multilevel model contains dummy variables for each year and three polynomials of age.

Table 9: Number of observations, individuals and families - US

	Brothers				Sisters			
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
	Age in]30 ; 50[				*Age in]30 ; 50[*			
Observations	4,678	5,931	4,777	5,832	5,022	6,823	5,175	6,670
Individuals	1,443	1,884	1,481	1,846	1,564	2,201	1,620	2,145
Families	1,001	1,367	1,032	1,299	1,083	1.587	1,127	1,500
Observations	4,644	5,880	4,742	5,782	4,906	6,663	5,058	6,511
Individuals	1,435	1,870	1,473	1,832	1,538	2,159	1,593	2,104
Families	996	1,357	1,027	1,290	1,067	1,560	1,110	1,474
Observations	4,658	5,900	4,756	5,802	4,962	6,741	5,114	6,589
Individuals	1,436	1,873	1,474	1,835	1,550	2,175	1,605	2,120
Families	997	1,360	1,028	1,293	1,075	1,572	1,118	1,486
	Annual earnings > 1200 USD				*Annual earnings > 1200 USD*			
Observations	5,071	6,379	5,195	6,255	5,239	7,157	5,393	7,003
Individuals	1,680	2,165	1,721	2,124	1,797	2,494	1,855	2,436
Families	1,235	1,642	1,271	1,576	1,290	1,857	1,334	1,768
Observations	3,381	4,297	3,437	4,241	3,716	4,984	3,830	4,870
Individuals	1,102	1,440	1,129	1,413	1,250	1,703	1,287	1,666
Families	758	1,033	778	984	856	1,210	885	1,143

Note: The Table contains the number of observations, individuals and families for the corresponding estimations in Table 8.

Table 10: Reliability of the results of the cross-country comparison

	Brothers				Sisters			
	Alternative 1	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**
	Denmark - Germany				*Denmark - Germany*			
	Age in]30 ; 50[				*Age in]30 ; 50[*			
No lower limit	**	**	**	**	**	**	**	**
annual earnings > 9000 DKK	**	**	**	**	*			
annual earnings > 4500 DKK	**	**	**	**	**	*	*	*
	Annual earnings > 9000 DKK, 1200 EUR				*Annual earnings > 9000 DKK, 1200 EUR*			
age in]25 ; 45[								
age in]35 ; 50[	**	**	**	**				
	Germany - US				*Germany - US*			
	Age in]30 ; 50[				*Age in]30 ; 50[*			
No lower limit								
annual earnings > 9000 DKK								
annual earnings > 4500 DKK								
	Annual earnings > 1200 EUR, 1200 USD				*Annual earnings > 1200 EUR, 1200 USD*			
age in]25 ; 45[	*	*	**	*				
age in]35 ; 50[		*		*				
	Denmark - US				*Denmark - US*			
	Age in]30 ; 50[				*Age in]30 ; 50[*			
No lower limit	**	**	**	**				
annual earnings > 9000 DKK	**	**	**	**	*	*	*	*
annual earnings > 4500 DKK	**	**	**	**		*		*
	Annual earnings > 9000 DKK, 1200 USD				*Annual earnings > 9000 DKK, 1200 USD*			
age in]25 ; 45[	**	**	**	**	*		*	*
age in]35 ; 50[	**	**	**	**	**	**	**	**

Note: The Table indicates which pair wise cross-country comparisons (according to different age and earnings restrictions and different definitions of siblings) lead to non-overlapping confidence intervals. " ** ": non-overlapping 95 percent confidence intervals; " * ": non-overlapping 90 percent confidence intervals; " ": overlapping confidence intervals.

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