A new look at intergenerational mobility in Germany compared to the US

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Abstract

Motivated by contradictory evidence on intergenerational mobility in Germany, I present a cross-country comparison of Germany and the US, reassessing the question of whether intergenerational mobility is higher in Germany than the US. I can reproduce the standard result from the literature, which states that the German intergenerational elasticity estimates are lower than those for the US. However, based on highly comparable data, even a reasonable degree of variation in the sampling rules leads to similar estimates in both countries. I find no evidence for nonlinearities along the fathers' earnings distribution. In contrast, the analysis shows that mobility is higher for the sons at the lowest quartile of the sons' earnings distribution in both countries. In Germany this result is mainly driven by a high downward mobility of sons with fathers in the upper middle part of the earnings distribution. The corresponding pattern is clearly less pronounced in the US.

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1 Introduction

The extent to which a family's economic advantage or disadvantage persists across generations is widely seen as a key indicator of equality of opportunities. Thus there is a large body of research on intergenerational economic mobility.[1] Since the seminal articles by Solon (1992) and Zimmerman (1992), numerous contributions analyze intergenerational mobility in most developed countries as well as some developing countries. Most contributions focus, especially in economics, on the estimation of intergenerational earnings elasticities (hereafter IGEs) or intergenerational earnings correlations (hereafter IGCs) as measures of intergenerational mobility.

However, these estimates are highly sensitive to differences in sampling rules and the nature of the applied data sets (Solon, 2002). Therefore, international comparisons based on the results of single-country studies are difficult to interpret and can be misleading. Given these restrictions, scholars developed a separate research strand focusing on cross-country comparisons based on multiple countries in one study (e.g. Björklund and Jäntti, 1997; Couch and Dunn, 1997; Jäntti et al., 2006). Existing results from these cross-country comparisons provided the widely accepted stylized fact that intergenerational mobility is lowest in the US and highest in the Scandinavian countries (Björklund and Jäntti, 2000; Solon, 2002; Corak, 2006). In contrast, empirical evidence on Germany is inconclusive.

Results from existing single country studies place Germany somewhere between the US and Scandinavian countries (Solon, 2002; Corak, 2006; Black and Devereux, 2011; Corak, 2013). Eisenhauer and Pfeiffer (2008) estimate an IGE of 0.28, which is in line with further existing results on Germany (Wiegand, 1997; Schnitzlein, 2009; Yuksel, 2009). The consensus estimate in the literature for US IGE lies between 0.4 and 0.5 (Corak, 2006).[2]

[1] See Solon (1999), Björklund and Jäntti (2009) and Black and Devereux (2011) for an overview of the economics literature and Erikson and Goldthorpe (1992) and Breen (2004) for a review of the sociological literature.

[2] Based on long-running administrative data, Mazumder (2005) even estimates an IGE of 0.6 for the US.

However, all of these contributions are single-country studies and, therefore, do not provide a US estimate based on a comparable sample.

The evidence from cross-country studies does not necessarily support the notion that Germany is more mobile than the US. Couch and Dunn (1997) compare the level of intergenerational mobility in Germany and the US, based on data from the German Socio-Economic Panel (SOEP) and the Panel Study of Income Dynamics (PSID), and find no significant differences.[3] Couch and Lillard (2004) also find similar results comparing German SOEP based estimates with US estimates based on data from the National Longitudinal Survey (NLS),[4] finding no difference in the standard IGE estimates. In contrast, Vogel (2006) shows intergenerational mobility to be less pronounced in Germany.[5] Thus the empirical evidence on Germany is inconclusive (section 2 provides a discussion of possible sources of bias that may drive these differences).

A related strand of research analyzes the impact of family background on an individual's economic success. The importance of the family in this literature is measured by sibling correlations in economic outcomes (Solon et al., 1991; Solon, 1999; Björklund and Jäntti, 2012). International comparisons based on sibling correlations replicate the notion that the US represents the country with the highest importance of family background, while Scandinavian countries represent the opposite extreme (Björklund et al., 2002). Based on sibling correlations in permanent earnings, family background is of equal importance in Germany as in the US (Schnitzlein, 2014). Again, this does not support the result of higher intergenerational mobility in Germany.[6]

[3] The authors update their results in Dunn and Couch (1999) and again find no differences between Germany and the US.
[4] Couch and Lillard (2004) present their paper as an update of Lillard's (2001) work, which also shows results for Germany and the US.
[5] Additional estimates for the IGE in Germany can be found in Ermisch et al. (2006), who compare the role of assortative mating for intergenerational mobility in Germany and UK; as well as in Comi (2004), who carries out an European comparison using data from the European Community Household Panel.
[6] Note that a sibling correlation is a related measure to the discussed IGEs or IGCs but incorporates much more influence factors from the family than only parental income.

This paper aims to clarify this contradictory evidence on intergenerational mobility in Germany. I present a cross-country comparison of the intergenerational earnings mobility in Germany and the US that addresses the question, "Is intergenerational mobility higher in Germany than in the US?" The theoretical model (Becker and Tomes, 1979, 1986) underlying these types of analysis, as well as several empirical contributions, point out that the strength of the intergenerational relationship can be different at different parts of the earnings distribution (Bratsberg et al., 2007). Thus, I analyze whether the two countries differ in their structures of intergenerational mobility. I extend the classical tests for nonlinearities along the distribution of the fathers' earnings – including higher order polynomials of fathers' earnings measures – and the estimation of quantile regressions with the results from an unconditional quantile regression.

My main results are as follows: I can reproduce the standard result from the prior literature, which states that the German IGE estimates are lower than the US ones. However, based on highly comparable data for the two countries, this result is not very robust. Even a reasonable degree of variation in the sampling rules leads to very similar estimates in both countries. While I find no evidence for nonlinearities along the fathers' earnings distribution, the analysis shows that mobility is higher for the sons at the lowest quartile of the sons' earnings distribution in Germany and the US. Additional analysis shows that, in Germany, this result is mainly driven by a higher downward mobility of sons with fathers in the upper middle part of the distribution. This pattern is clearly less pronounced in the US.

The remainder of the paper is structured as follows. Section 2 presents the data. Section 3 presents the theoretical background and the empirical strategy. Section 4 presents and discusses the results and section 5 concludes.

2 Data

Cross-country comparisons are highly dependent on reliable and comparable data sets. For this analysis, I apply data from the SOEP (Wagner et al., 2007) and the PSID, both of which are long-running household surveys that are widely used in economic research. Both panels started with an initial set of households and track their members over time. Because the individuals are also followed when they leave their initial households and form new ones, it is possible to observe the children even after leaving their parental homes. Additionally, both surveys are included in the Cross-National Equivalent File (CNEF) project (Frick et al., 2007). This project is conducted at Ohio State University and provides a harmonized subset of the information included in the SOEP and the PSID that is prepared for international comparisons. I use the information on the parent-child relations from the family tables in the original surveys and take the individual labor earnings variable[7] (annual earnings) from the CNEF data sets.

As there is no data available on the lifetime earnings for the two generations (as would be implied in the theoretical models), I must approximate the lifetime earnings using annual earnings observations. As Solon (1989, 1992) and Zimmerman (1992) point out, the use of annual earnings observations instead of the parent's lifetime earnings leads to a substantial underestimation of the true intergenerational elasticity because annual status is a noisy measure of lifetime status. Annual status introduces a measurement error in the model that leads to *attenuation bias*. Solon (1989, 1992) propose using multiyear averages instead and showed that the estimated IGE for the US rises from 0.2 to 0.4 if one uses a five-year average of parental earnings instead of annual earnings. Mazumder (2005) adds to this discussion and suggests using ten- to fifteen-year averages instead of five-year averages.

[7] The individual labor earnings variable in the CNEF covers wages and salary from all employment and self-employment as well as income from bonuses, overtime, and profit-sharing. For details on the computation algorithm see Grabka (2012, p. 50) for the SOEP and Lillard et al. (2011, p. 18) for the PSID.

Haider and Solon (2006) provide another important methodological contribution addressing the absence of valid observations of lifetime earnings. The authors highlight the potential *life-cycle bias* arising from a measurement error in the dependent variable, which is the log earnings of the child. According to the classical errors-in-variables model, measurement error in the child's earnings would only result in higher standard errors for the estimated IGE. The critical assumption in this case is that the noise or error component is random over the life cycle.[8] Haider and Solon (2006) show that the classical errors-in-variables model is not appropriate and that the association between current and lifetime earnings varies over the life-cycle. The authors point out that, based on their US data, annual earnings are only suited as a proxy for lifetime earnings if these earnings are observed for individuals between their mid-thirties and mid-forties. Earnings observations taken at younger ages lead to a substantial underestimation of the IGE. These findings are confirmed by Böhlmark and Lindquist (2006) for Sweden and Brenner (2010) for Germany. This argument substantially challenges the early IGE estimates on Germany and the US as the observed children in these samples were very young. For example, the average age of the sample of oldest sons in Couch and Lillard (2004) was 29.22 years in Germany and 28.61 years in the US. This is well below the suggested age range.

I follow these findings in the composition of my estimation samples. First, for the fathers' earnings average, I use earnings information from 1984-1993 in both countries. I include only observations that were taken when the fathers were 30-55 years old.[9] Following the suggestions of Solon (1989, 1992), I restrict my sample of fathers in both countries to individuals with more than five annual earnings observations over this period and compute an

[8] A similar discussion can be found in Jenkins (1987), Björklund (1993) and Grawe (2006).
[9] Haider and Solon (2006) show that, when used as explanatory variable, the age range of the earnings measure can be wider than when used as dependent variable.

average of the earnings observations available in the ten years observed.[10] Following Bratsberg et al. (2007) I restrict my analysis to father-son pairs.[11]

Second, the observations of the sons' earnings are taken from the most recent survey years. Here the SOEP and the PSID differ in one important aspect. While the SOEP contains annual earnings observations over the full period, since 1997 the PSID is only carried out biannually. To maximize comparability between the two countries I therefore draw two different samples from the SOEP data. My *Main Sample* is constructed to ensure maximal comparability between the SOEP and the PSID. This means that I include only every second SOEP observation year since 1997 along with the PSID data and stop my observation period in 2009, which is the last year available in the PSID CNEF data. In contrast, my *Full SOEP Sample* makes use of all available SOEP information, which means I include annual observations for the full period through 2011.

In addition, the individual labor earnings variable in the SOEP CNEF contains imputed earnings components. While I excluded all imputed observations in the *Main Sample* to ensure maximal comparability with the PSID, these are included (for fathers and sons) in the *Full SOEP Sample*. In section 4 I provide estimates for the *Full SOEP Sample* with and without imputed values. Included in both samples are all sons with at least one valid earnings observation in either 1997-2009 (*Main Sample*) or 1997-2011 (*Full SOEP Sample*). To avoid life-cycle bias, I follow Haider and Solon's (2006) suggestions and restrict the analysis to sons aged between 35-42 years in the year that their earnings are observed. This age range is substantially older than the sample of sons in the prior cross-national studies that include Germany. Like for the fathers, I use an average over all available earnings observations of the sons to reduce potential measurement error.

[10] Earnings are measured in 2006 real values. I exclude annual earnings less than 1200 EUR / 1200 USD. For a discussion of this restriction see section 4.2.
[11] This is to prevent the results from being driven by differences in labor market participation of women in the two countries.

Table 1 shows the main descriptive statistics of the two resulting samples. In the *Main Sample* I observe 318 father-son pairs in Germany and 462 father-son pairs in the US. The mean age of the fathers is 47.47 years in the SOEP data and 46.36 years in the PSID data. On average I can use 8.83 earnings observations in the long-term average of the fathers in Germany and 9.05 in the US. The sons in the data set are, on average, 37.37 (SOEP) and 37.60 (PSID) years old; for their earnings average I observe 2.54 (SOEP) and 2.70 (PSID) annual observations. According to these figures, in the *Main Sample* the age structure as well as the number of available earnings observations is very similar in both countries and meets the age requirements for fathers and sons stated above.

The *Full SOEP Sample* includes 408 father-son pairs with fathers being, on average, 47.34 years and sons 37.41 years old. I observe on average 5.40 annual earnings observations for the sons and 9.16 annual observations for the fathers. Again this sample meets the age requirements for fathers and sons stated above.

3 Theoretical background and empirical strategy

The theoretical basis of the analysis of intergenerational mobility is the model of the family described by Becker and Tomes (1979, 1986). Solon (2004) presents a version of the model that provides a direct interpretation of the determinants of the estimated IGE in a cross-country framework. According to his model, first, intergenerational mobility in country A compared to country B is higher if the degree of heritability is lower. Second, intergenerational mobility is lower if the efficacy of investments in human capital is higher. Third, intergenerational mobility is higher if the returns to human capital are lower, and fourth, intergenerational mobility is higher, the more progressive governmental investments in human capital are.

Applying this to the case of Germany and the US: first, Black and Devereux (2011) argue that the heritability coefficient is unlikely to differ significantly between two developed countries. Second, the returns to human capital (for example, when measured as education) are higher in the US than in Germany (OECD, 2011). Third, because the German educational system is free up to the university-level, governmental investments in human capital can be seen as more progressive in Germany than in the US.[12] The remaining influence factor - the efficacy of the educational system - is hard to measure because the definitions of a valid input and output measure of the educational system are not clear. Thus, while it is not possible to derive an unambiguous expectation from the theoretical model, two out of four determinants would support higher intergenerational mobility in Germany. However, given this ambiguity the comparison of the two countries remains an empirical question.

The standard empirical approach in the analysis of intergenerational mobility is to estimate some variant of equation (1):

$$\log Y_{i,t} = \alpha_t + \beta \log Y_{i,t-1} + \psi Z_{i,t-1} + \theta W_{i,t} + \varepsilon_{i,t} \quad (1)$$

Estimated via OLS, β can be interpreted as IGE. $\log Y_{i,t}$ and $\log Y_{i,t-1}$ are measures of the parent's (*t-1*) and offspring's (*t*) log earnings. $Z_{i,t-1}$ and $W_{i,t}$ contain control variables including two polynomials of fathers' and sons' age as well as the number of years in the child's earnings average.

Several contributions provide results that the intergenerational earnings elasticity is a nonlinear relationship in some countries. For example, Bratsberg et al. (2007) present evidence that the intergenerational relationship is concave in the Scandinavian countries but mostly linear in the US and UK, concluding that the level of intergenerational mobility is

[12] Starting in the mid of the last decade, some German Federal States introduced moderate fees to attend universities, but the German sample in this study is not affected by this change.

underestimated in the Scandinavian countries if only the standard OLS estimate is applied. Some of the early studies on Germany also analyze if there are nonlinearities in the intergenerational relationship in Germany. Lillard (2001) finds that mobility differs along the distribution of earnings. Couch and Lillard (2004) present evidence for nonlinearities in Germany and the US. However, given that these contributions are based on samples containing very young children (due to the short duration of the SOEP at that time), it is unclear if these results will also hold with a more mature sample of children. To test for nonlinearities along fathers' earnings distribution, I add higher order polynomials of fathers' log earnings to the regression model.

One explanation for the existence of nonlinearities in the intergenerational relationship, which can be derived from the theoretical model (Becker and Tomes, 1979, 1986), is the existence of credit market constraints. Grawe (2004) discusses testing for the existence of credit-market constraints by estimating quantile regressions (Koenker and Bassett, 1978). A quantile regression gives the estimated IGE at a specific conditional quantile of the sons' earnings distribution, irrespective of the position of the child in the offspring's unconditional distribution. This ensures the interpretation of the results in the context of constraints. Grawe (2004) illustrates this with the following example: two families have equal parental earnings; one family has a son with a high ability and the other family's son has low ability. After certain years of education, the costs of further education are higher than the returns for the low-able child, driving him to leave the education system. For the high-able child it would be rational to stay in the education system and attend university. Therefore, if credit market constraints exist, conditional on parental earnings, the high-able son will be affected most. Although his earnings will be lower than in the non-constrained case, due to his higher ability, he will still earn more than the low-able child. That means, in the case of credit market constraints, the relationship between fathers' and sons' earnings

should be stronger in the upper region of the conditional earnings distribution of the sons (Grawe, 2004). This is exactly the interpretation of a quantile regression.

I extend this analysis of nonlinearities by applying an *unconditional* quantile regression (UQR) approach, which is a method developed by Firpo et al. (2009). In contrast to the standard (*conditional*) quantile regression, UQR estimates provide information on the marginal effect of parental earnings at a given percentile of the *unconditional* distribution of the child's earnings. Thus, this method allows me to determine whether the effect of parental earnings differs along the *unconditional* child's earnings distribution. This turns the focus to the outcome of the intergenerational transmission process: the position of the sons in their own earnings distribution. The discussion of the results in the following section will show that this dimension is of even importance in evaluating the level of intergenerational mobility than the traditional approaches.

4 Results

4.1 Descriptive evidence

Figure 1 gives a first impression of the relationship between fathers' and sons' earnings based on the *Main Sample*. To ensure comparability between the two countries, fathers' and sons' earnings are measured by their earnings position.[13] First, fathers' earnings are divided into quartiles and each father is assigned one quartile. Then, sons' earnings are divided into 100 percentiles and each son is assigned one percentile rank. The boxplots depict the distribution of the earnings position (measured by percentiles) of the sons given the earnings quartile of the father. The solid dark area of the boxplots marks the middle 50 percent of the distribution and the white indicator line within each boxplot marks the median. The wider the solid box, the more disperse is the distribution of the earnings positions of the sons given a certain

[13] See Chetty et al. (2014) and DeLeire and Dahl (2008) for applications of intergenerational rank associations and Bhattacharya and Mazumder (2011) and Corak et al. (2014) for analysis of directional rank movements.

earnings quartile of the father. If there is more variability in the earnings position of the sons, this indicates higher intergenerational mobility. To give an example, the first boxplot on the left side of Figure 1 can be interpreted as follows: German sons with a father in the bottom quartile of the fathers' earnings distribution, find themselves between the 1st and the 97th percentile of their own distribution. This is given by the position of the whiskers of the boxplot. Fifty percent of these sons fall between the 21st and 52nd percentile of their own distribution, while the median son, given a bottom quartile father, finds himself at the 34th percentile of his own distribution. Given this interpretation, Figure 1 shows that there is a clear positive relationship between the earnings of sons and fathers in both countries.

In Germany sons from fathers in the lowest and highest percentiles show the lowest dispersion in their positions. This is not the case in the US. From the purely descriptive data presented in Figure 1, persistence at the ends of the fathers' distribution seems to be more pronounced in Germany. Instead the dispersion of the earnings positions of sons having a father in the third quartile is higher in the SOEP data. That means mobility for sons from the upper middle part of the fathers' distribution is higher in Germany than in the US.

Figure 2 extends this analysis by adding the perspective of mobility matrices. The upper left part of the figure gives the share of sons that stay in the same earnings quartile than their fathers. The share of stayers is very similar in Germany and the US with the exception of sons from third-quartile fathers. There the share of stayers is 32 percent in the US and 26 percent in Germany. In contrast, 36 percent of sons from bottom-quartile fathers in Germany and 38 percent in the US end up themselves in the lowest quartile of their earnings distribution. At the upper end, the share of stayers is 43 percent in Germany and 44 percent in the US. So, based on this – more aggregate – measure, both countries have greater persistence of the earnings position at the ends of the distribution.

But in which direction do the movers - the sons that end up in a different earnings quartile than their fathers - move? Figure 2 also gives the shares of those moving up in the distribution and those going down. Naturally, the share of those going up decreases over the fathers' distribution and the share of those going down increases. The lines again are very similar for the two countries, save for the sons of third-quartile fathers. While there is virtually no difference in upward mobility at this position between the two countries, German sons face greater downward mobility. 49 percent end up in a lower earnings quartile than their fathers, compared to 42 percent in the US. This is in line with the findings from Figure 1.

Figure 3 and 4 take a more detailed look at the mobility processes at the two extremes of fathers' earnings distribution. Figure 3 gives the share of sons with a father from the bottom quartile that fall into a specific quartile of their own distribution. Again we see that 36 percent of these sons stay in the bottom quartile in Germany compared to 38 percent in the US. At 36 percent, a larger share moves to the second quartile in Germany than in the US (32 percent). Nevertheless, that means that, in total, a little less than three out of four sons whose fathers were in the bottom quartile in either country (74 percent in Germany and 70 percent in the US) do not move above the median in their own distribution. Compared to that, only 15 percent in Germany and 13 percent in the US succeed to move up to the top 25 percent of their distribution.

Finally, Figure 4 shows the path of those with fathers in the top quartile. Again, we see that 43 percent of these sons in Germany and 44 percent in the US stay in the top earnings quartile. Like their bottom quartile counterparts, German sons exhibit more mobility to the neighboring quartile, but in total again about three out of four (75 percent in Germany and 70 percent in the US) stay in the upper half of their distribution. Notably a higher share of these sons ends up in the bottom quartile in the US compared to Germany.

To summarize the descriptive findings: both countries show a positive relationship between sons' and fathers' earnings. Based on the aggregate numbers of stayers and movers over the distribution of fathers' earnings, the two countries show similar mobility patterns, except for the greater mobility of sons from fathers in the upper-middle quartile in Germany. Looking at the more detailed picture shows that – in both countries – most of the sons with fathers in the bottom or top quartile do not end up more than one quartile better or worse than their fathers.

4.2 Estimated intergenerational earnings elasticities

So what is driving the differences in recent estimates of the IGE for Germany and the US? Initially I address this question by estimating equation (1) using OLS. The results based on the different samples described in section 2 are shown in Figure 5. Estimating the IGE using the *Full SOEP Sample* leads to an elasticity of 0.318. This is in line with the results discussed above from single-country studies.[14] To give an interpretation of this estimate: a German son who's father's earnings are 100 percent above the mean in the parent's generation can expect, on average, his own earnings to be 32 percent above the average in his generation.[15]

The corresponding estimate in the *Main Sample* – the SOEP sample with highest comparability to the PSID – is clearly higher at 0.391. This is still lower than the corresponding US PSID estimate of 0.494 but the gap between the estimates reduces substantially from 0.176 to 0.103. The third bar in Figure 5 shows, that this effect comes mainly from excluding the imputed earnings observations from the *Full SOEP Sample*. Estimating the IGE on the *Full SOEP Sample* – excluding the imputed earnings observations – results in an estimated IGE of 0.397.

[14] The slightly higher German IGE estimate compared for example to Eisenhauer and Pfeiffer (2008) is likely to be due to the more mature sample of sons and the higher number of earnings observations in the fathers' average earnings measure.
[15] Note that this finding is a correlation, not a causal effect.

One important sampling restriction (at least with survey data) is the decision on the lower earnings limit. To analyze the impact of this restriction, I present estimates of the IGE based on two additional samples. In the *Main Sample*, annual earnings observations below 1200 EUR/USD per year are considered implausibly low and are, therefore, excluded from the estimation. This is a very low threshold as it implies – on average – earnings of about 100 EUR/USD per month. Thus, I raise the lower annual earnings limit in two steps, first to 4800 EUR/USD and, finally, to a lower earnings limit of 9600 EUR/USD. Note, that the earnings measure used in the estimation is a multiyear average. Therefore, raising the earnings limit will have two effects: first, for some father-son pairs, it will reduce the number of annual observations in the multiyear averages. Second, it excludes those father-son pairs from the sample for whom the fathers' average now consists of five or fewer annual observations or for whom there are now no valid earnings observations for the son left. The results are presented in Table 2.[16]

Performing this analysis reveals an interesting pattern: while the IGE estimates for the US slightly decrease from 0.494 to 0.428, the German estimates (in the *Main Sample*) increase from 0.391 to 0.436. For the specification with a lower earnings limit of 9600 EUR/USD, which is still not very high (remember that the individuals in the sample are at least in their thirties), the IGE estimates between Germany and the US are now virtually the same. The same pattern can be found in the *Full SOEP Sample* and is especially pronounced in the sample including the imputed values. Comparing the estimates in the last row of Table 2, which is the specification with a lower earnings limit of 9600 EUR/USD, shows there is virtually no difference between the four estimates. Note that the difference between the three specifications is not only the number of father-son pairs, but also the number of annual earnings observations that are included in the earnings averages of the two generations.

[16] See Table A.1 and Table A.2 in the appendix for descriptive statistics of the restricted samples.

Table A.3 in the appendix presents the same analysis for the *Main Sample*, conditional on the father-son pairs being still part of the estimation sample under the 9600 EUR/USD restriction. Accordingly, the differences between the estimates in Table 2 and Table A.3 are due to the differences in the number of father-son pairs. While the pattern in the SOEP data is the same as in Table 2, it becomes clear that the decrease in the PSID estimate comes from a different composition of the estimation sample. In Table A.3 – based on the more restrictive sample – the initial PSID IGE estimate is 0.433, which only slightly changes to 0.428.[17]

To summarize these findings, first, I can reproduce the standard result from the prior literature, which states that the German IGE estimates are lower than the US ones. However, this result is not very robust. Restricting the SOEP sample to non-imputed earnings observations substantially closes the gap between the estimates. Further, even a reasonable degree of variation in the sampling rules leads to very similar estimates in both countries. Second, the observed differences in the reaction of the estimated IGE to a variation in the lower annual earnings limit (decrease of the estimate in the PSID data and increase in the SOEP data) strongly highlights the need for a cross-country comparison. The next section examines the structure of the intergenerational mobility. As I am mainly interested in a comparison of the two countries, from here I will proceed with the *Main Sample* to ensure a maximum of comparability between the SOEP and the PSID.

4.3 Structure of the intergenerational mobility

The first step in the analysis of the structure of intergenerational mobility in the two countries is to include higher order polynomials of fathers' log earnings into the model. The results of these estimations are presented in Table 3. All of the cases including higher-order

[17] In this analysis I use fixed nominal cut-off values for the lower annual earnings limit in both countries and do not convert them into the other currency to make the results comparable to the variation that is found in single country studies. Using the 1200/4800/9600 EUR earnings limits, converting them into USD and applying these new limits to the PSID data leaves the results presented in this section virtually unchanged. The results of this robustness test can be obtained from the author upon request.

polynomials of fathers' log earnings lead to insignificant coefficient estimates for the fathers' earnings variables. An F-test for the joint significance of the higher-order polynomials also fails to reject the null hypothesis in both countries.[18] In sum there is no evidence that the IGE differs along the distributions of the fathers' earnings, neither in Germany nor in the US. This is in line with findings by Bratsberg et al. (2007) for the US but differs from findings by Lillard (2001) and Couch and Lillard (2004) for Germany.[19]

Table 4 presents the results from the conditional (CQR) and unconditional quantile regressions (UQR). The results from the standard conditional quantile regression are given in the first two columns of the table. Presented are estimates for the 25th, 50th and 75th percentiles of the conditional earnings distribution. In the PSID data there is no evidence for substantial differences along the conditional earnings distribution. All estimated IGEs lie between 0.4 and 0.5. While the corresponding SOEP estimates at the median and the 75th percentile are very similar to the PSID estimates, the one at the lowest quartile is clearly lower than the PSID estimate and also clearly lower than the other SOEP estimates. The SOEP estimates are also increasing with the percentile of the *conditional* earnings distribution, indicating nonlinearities along the *conditional* distribution of sons' earnings in Germany.

A related and equally important, but less analyzed, question is whether there are differences with respect to the *unconditional* distribution of the sons' earnings. The focus on the distribution of the children's earnings changes the perspective of the analysis. Whereas parental earnings are the origin of the transmission process, the offspring's earnings are the outcome. To assess this question, I apply a UQR approach to equation (1). The results are shown on the right side in Table 4, which presents the UQR estimates at the 25th, 50th, and 75th percentiles of the sons' earnings. The results reveal an interesting pattern in the German

[18] An F-test for the joint significance of all fathers' earnings variables is significant in all specifications.
[19] Based on the Full SOEP sample (including imputed values) lowering sons' minimum age from 35 to 25 leads to significant results in the cubic specification. This is not the case in the *Main Sample*.

data. The IGE estimate at the bottom quartile is very low compared to the other SOEP estimates. Note that in an analysis along the distribution of the fathers' earnings this finding would be positive. Higher intergenerational mobility for sons whose fathers are at the bottom of the earnings distribution would indicate that the sons can improve their position. In contrast, the finding in this analysis indicates higher mobility for sons at the bottom of *their* distribution of earnings. As the sons' earnings are the outcome of the intergenerational transmission process, that result means that ending up at the bottom of the distribution of sons' earnings is a severe risk for sons with fathers from *all* parts of the distribution in Germany. The corresponding US estimates show that also in the US, the estimate at the 25th percentile is the lowest, but the difference is less pronounced than within the German estimates.

Figure 6 further illustrates this finding. The figure shows the origin (fathers quartile) of the sons in the bottom quartile of their distribution for both countries. In the US, the shares are decreasing over the distribution of fathers' quartiles: more than a third of bottom-quartile sons have a father from the bottom quartile. The situation in Germany is different for sons from the upper half of the fathers' distribution. While a lower share of top-quartile sons end up in the lowest quartile in Germany, ending up at the bottom of the sons' distribution is a clear threat to those from the third quartile of the fathers' distribution. This finding specifies the observation made in section 4.2 that downward mobility is higher for sons from the upper middle part of the fathers' earnings distribution in Germany.

To summarize these findings: based on the IGE estimates, there is only weak evidence for differences in the intergenerational mobility between the two countries. In contrast, the analysis of nonlinearities reveals differences in the mobility structure. There are no differences along the fathers' earnings distribution (in both countries), but the results show different patterns along the *conditional* and *unconditional* distribution of the sons' earnings.

While in the US there is no clear pattern in the CQR results, intergenerational transmission increases along the sons' *conditional* earnings distribution in Germany.[20] While in both countries mobility is highest at the lowest percentile of the sons' *unconditional* earnings distribution, this pattern is more pronounced in Germany. In particular, the greater downward mobility of sons with fathers in the upper middle part of the distribution is not found in the US.

5 Conclusion

In this paper I carry out a cross-country comparison of intergenerational earnings mobility in Germany and the US based on internationally comparable data. The analysis is initially motivated by existing contradictory evidence on German IGE estimates. Reassessing the question whether intergenerational mobility is higher in Germany than the US, I analyze in particular whether the two countries differ in the level and structure of intergenerational mobility. I test for nonlinearities along the distribution of the fathers' earnings. In addition I present results from a standard and an unconditional quantile regression.

I can reproduce the standard result from the prior literature, which states that the German IGE estimate is lower than the US one. However, based on highly comparable data, even a reasonable degree of variation in the sampling rules leads to similar estimates in both countries. The differences in the reaction of the estimated IGE to these variations highlight the need for a cross-country comparison. While I find no evidence for nonlinearities along the fathers' earnings distribution in both countries, the analysis shows that intergenerational mobility is higher for the sons at the lowest quartile of the sons' earnings distribution in Germany and the US. Additional analysis shows that this result is mainly driven by a higher

[20] Following Grawe (2004) this could be interpreted as evidence for credit market constraints in Germany.

downward mobility of sons with fathers in the upper middle part of the distribution in Germany. This pattern is clearly less pronounced in the US.

What can we learn from this analysis? Do these results help to answer the question raised in the introduction "Is intergenerational mobility higher in Germany than in the US"? The short answer to that question is that, although differences occur, there is only weak evidence for higher intergenerational mobility in Germany compared to the US. The main difference is that the relationship between fathers' and sons' earnings is weaker for low-earning sons compared to mid- and top-earning sons in Germany. This is important for evaluating the situation. Both countries do not show evidence of nonlinearities along the fathers' earnings distribution. In a broad sense this means that the level of equality of opportunity does not differ along the earnings position of the father. On the other hand, the IGE estimate at the lowest quartile of the sons' unconditional earnings distribution is an informative measure for the uncertainty that individuals face to fall into the lowest quartile.

This analysis adds two suggestions for future research on intergenerational mobility in Germany: first, future research should explicitly focus on the group of low-earning sons and their further progress in the German labor market. Second, the results highlight once again the need for cross-country studies in international comparisons of intergenerational mobility.

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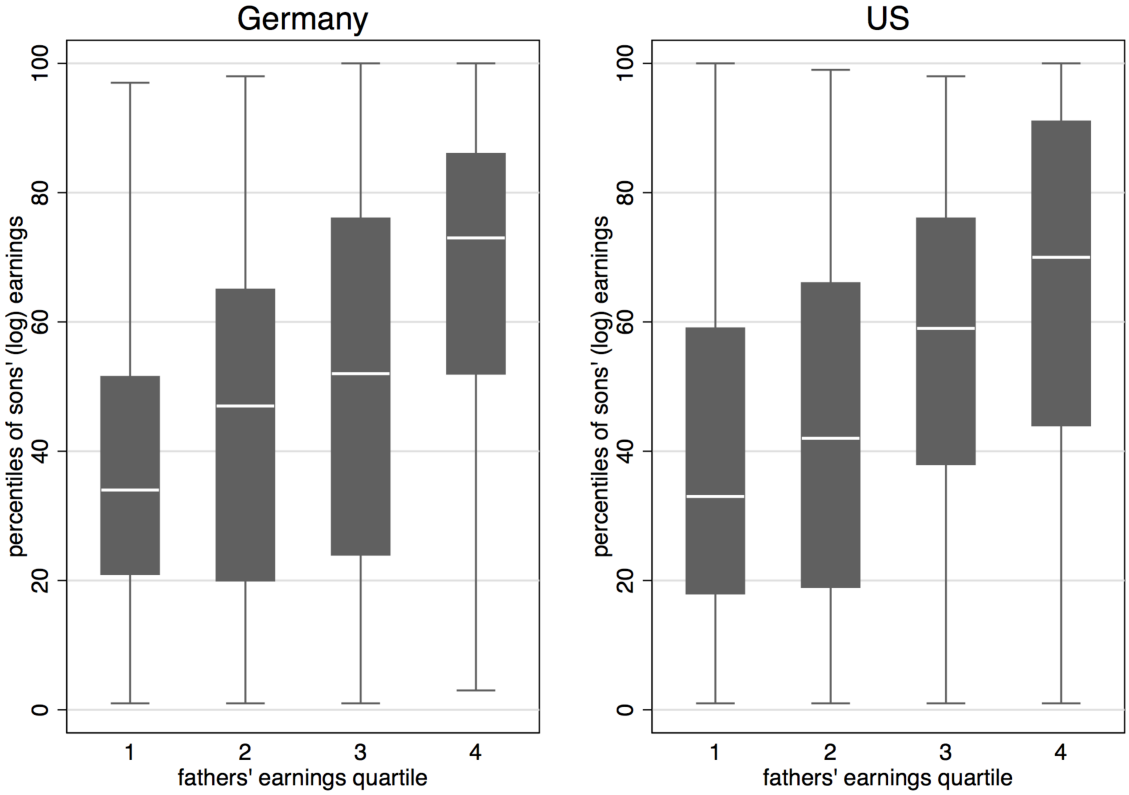
Figures and tables

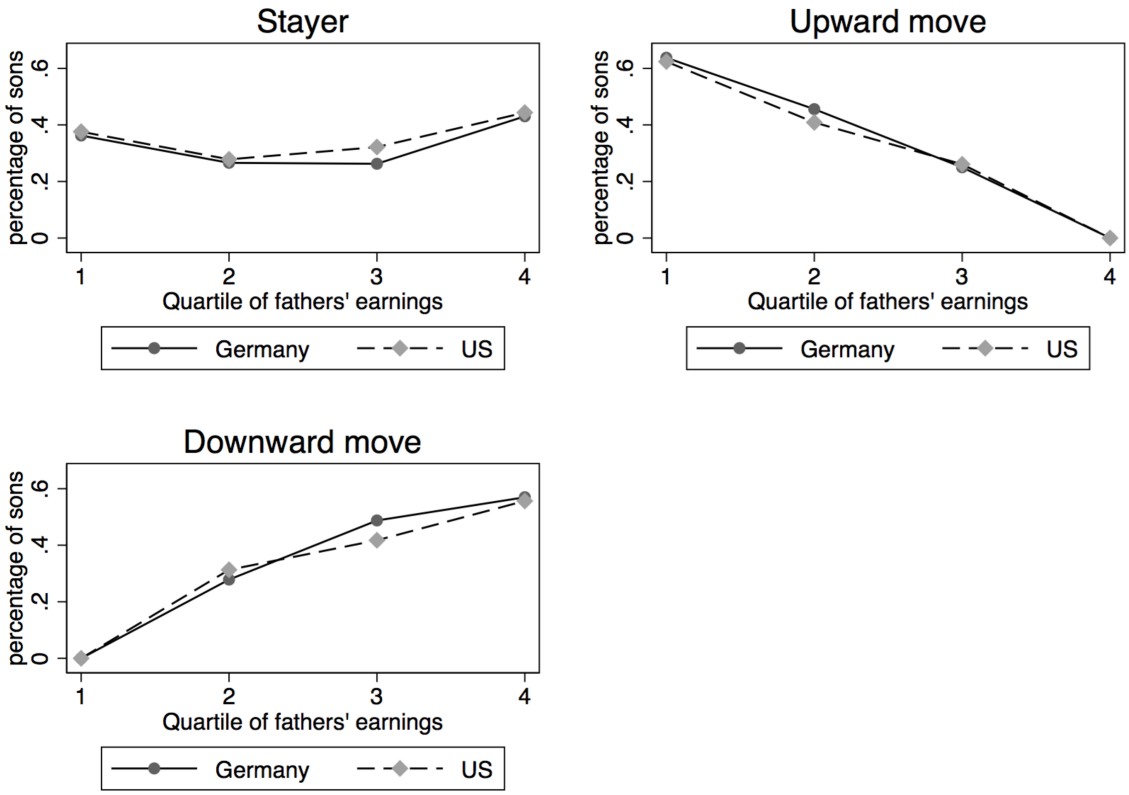
Figure 1: Distribution of sons' earnings position by quartiles of fathers' earnings in Germany and the US



Note: the figure shows the distribution of sons' earnings percentiles by quartiles of fathers' earnings. A higher dispersion indicates a weaker relationship between the earnings position of the father and the earnings position of the son. Earnings positions are computed separately for each generation and country. Results are based on the *Main Sample* (for details, see note to Table 1 and section 2 in the text).

Source: SOEPv28 (1984-2009), PSID (1984-2009).

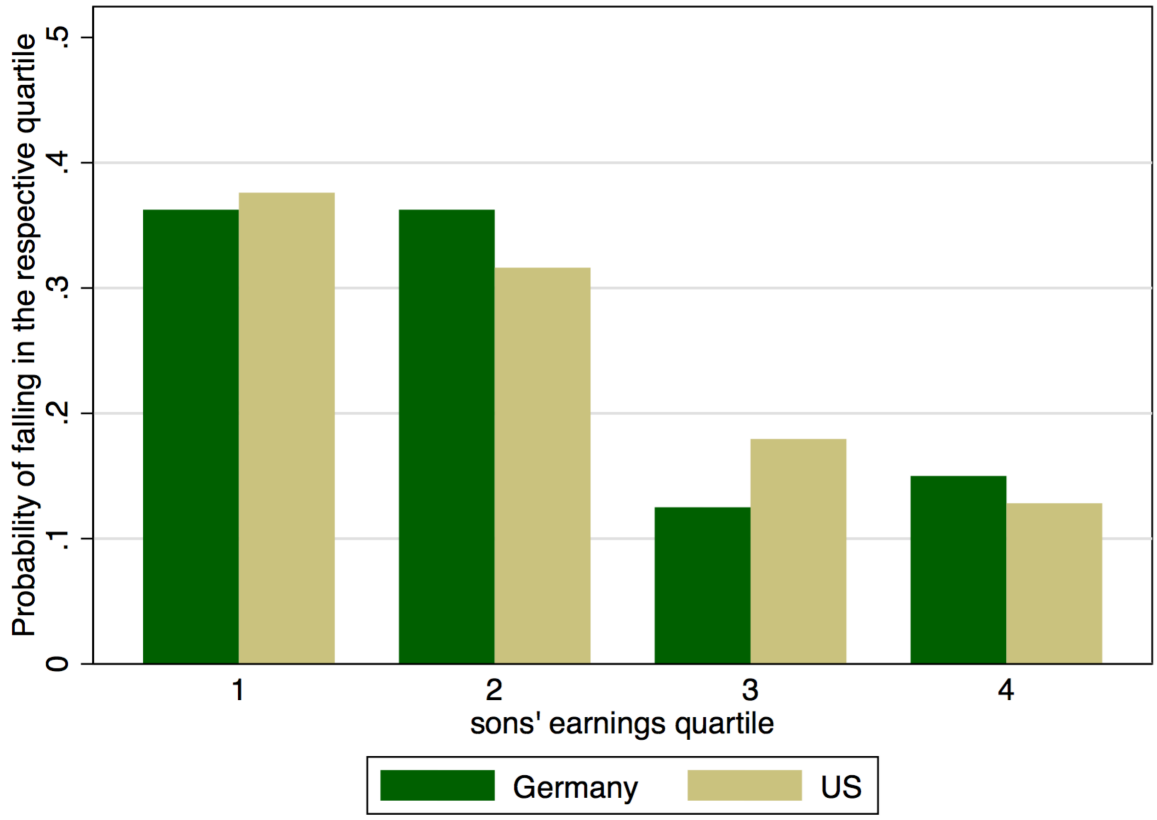
Figure 2: Intergenerational mobility of sons by fathers' quartile in Germany and the US



Note: the figure shows intergenerational mobility patterns. Sons' and fathers' earnings are divided into quartiles. Given are the shares of stayers (son is in the same quartile as father), upward movers (son is in a higher quartile as father), and downward movers (son is in a lower quartile as father). Earnings quartiles are computed separately for each generation and country. Results are based on the *Main Sample* (for details, see note to Table 1 and section 2 in the text).

Source: SOEPv28 (1984-2009), PSID (1984-2009).

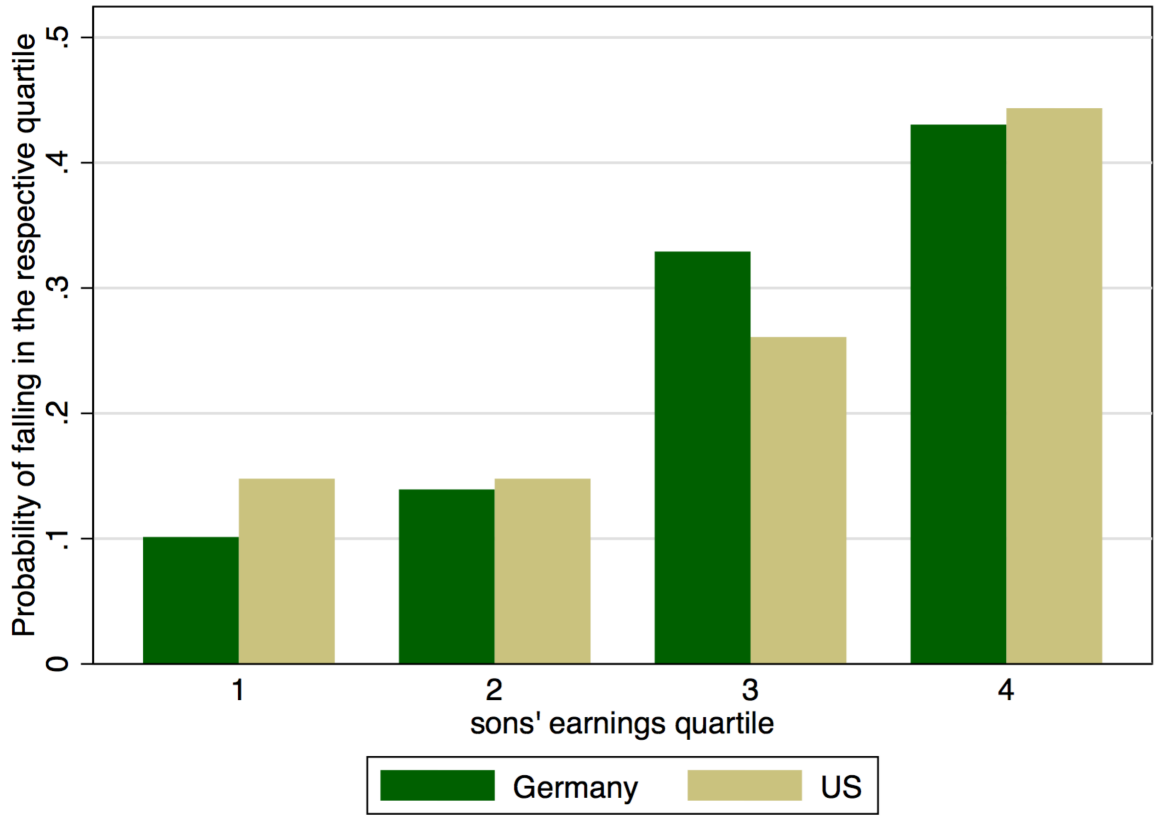
Figure 3: Earnings quartiles of sons born to fathers from bottom quartile in Germany and the US



Note: the figure shows a son's probability to fall into the respective earnings' quartile, given his father is in the bottom quartile. Earnings quartiles are computed separately for each generation and country. Results are based on the *Main Sample* (for details, see note to Table 1 and section 2 in the text).

Source: SOEPv28 (1984-2009), PSID (1984-2009).

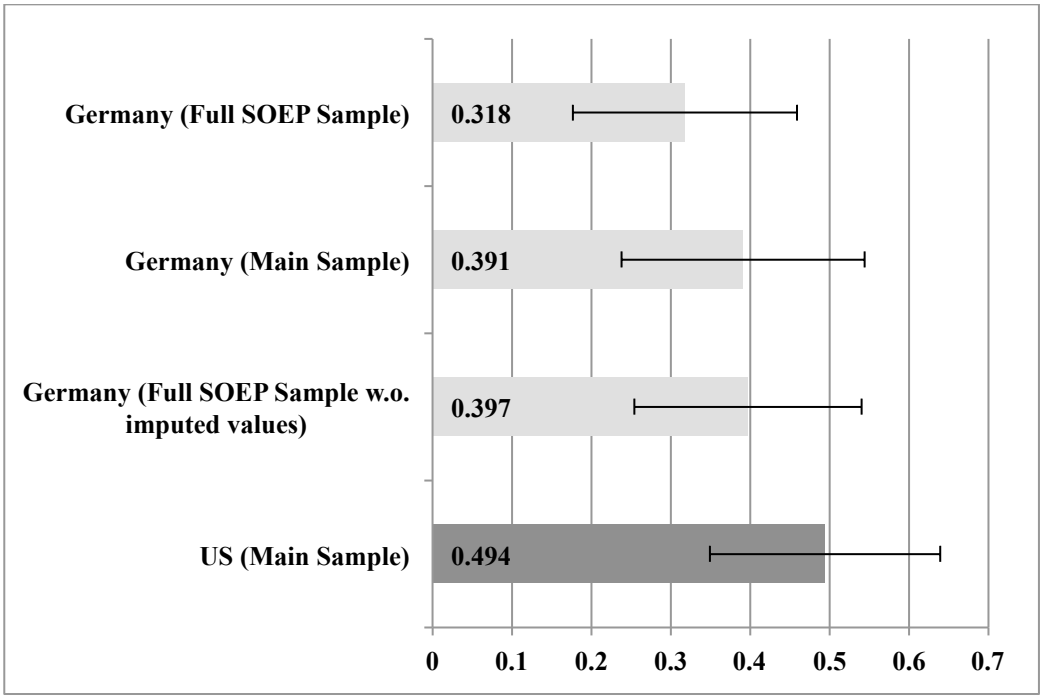
Figure 4: Earnings quartiles of sons born to fathers from top quartile in Germany and the US



Note: the figure shows a son's probability to fall into the respective earnings' quartile, given his father is in the top quartile. Earnings quartiles are computed separately for each generation and country. Results are based on the *Main Sample* (for details, see note to Table 1 and section 2 in the text).

Source: SOEPv28 (1984-2009), PSID (1984-2009).

Figure 5: Estimated intergenerational elasticities in Germany and the US



Note: the figure shows estimated intergenerational elasticities based on different samples for Germany and the US. Indicators represent standard errors clustered at family level. The numbers of observations are given in first row of Table 2. For detailed description of *Main Sample* and *Full SOEP Sample* see note to Table 1 and section 2 in the text.

Source: SOEPv28 (1984-2011), PSID (1984-2009).

Figure 6: Fathers' quartile of sons that are in the bottom quartile of their own distribution in Germany and the US

Note: the figure shows the probability for each quartile of fathers' earnings of a son, given he is in the bottom quartile, to stem from the respective quartile. Earnings quartiles are computed separately for each generation and country. Results are based on the *Main Sample* (for details, see note to Table 1 and section 2 in the text).

Source: SOEPv28 (1984-2009), PSID (1984-2009).

Table 1: Descriptive statistics

	Mean/Median	SD	Min	Max	Mean/Median	SD	Min	Max
	Main Sample				*Full SOEP Sample*			
Germany								
sons' earnings	39,013	25,579	2,261	323,252	37,410	22,389	2,370	227,625
fathers' earnings	31,801	16,569	9,563	141,689	31,842	17,387	8,963	144,721
number of years in sons' average	2.54	1.11	1	4	5.40	2.41	1	8
number of years in fathers' average	8.83	1.33	6	10	9.16	1.27	6	10
fathers' age	47.47	4.01	35.5	52.5	47.34	4.18	33.5	52.5
sons' age	37.37	1.40	35	41	37.41	1.30	35	41
sample size	318				408			
number of families	253				327			
US								
sons' earnings	42,631	56,800	1,048	571,292				
fathers' earnings	49,191	58,431	6,182	845,915				
number of years in sons' average	2.70	1.27	1	5				
number of years in fathers' average	9.05	1.38	6	10				
fathers' age	46.36	4.63	33	52.5				
sons' age	37.60	1.57	35	42				
sample size	462							
number of families	340							

Note: the table contains descriptive statistics of the samples used in the analysis. The table presents the median of the earnings and the mean for all of the other variables. Earnings are expressed in 2006 Euros. For better comparability earnings are given in EUR using the following exchange rates: for the fathers' earnings 1 EUR=1.032 USD (average exchange rate 1984-1993) and for the sons' earnings 1 EUR=1.166 USD (average exchange rate 1997-2009). Exchange rates are taken from OECD (2014). *Main Sample* denotes the sample used for the cross-country comparison ensuring highest comparability of the data. Included are biannual earnings observations from 1997-2009 for the sons and annual observations from 1984-1993 for the fathers. In both cases only non-imputed values are included. In contrast, *Full SOEP Sample* includes also yearly observations for the sons and also incorporates imputed values.

Source: SOEPv28 (1984-2011), PSID (1984-2009).

Table 2: Estimated intergenerational elasticities

	Germany *Main Sample*	**US**	**Germany** *Full SOEP Sample*	**Germany** *Full SOEP Sample w.o. imputed values*
		lower annual earnings limit 1200 EUR / 1200 USD		
IGE	0.391***	0.494***	0.318***	0.397***
se	*0.078*	*0.074*	*0.072*	*0.073*
N	318	462	408	355
		lower annual earnings limit 4800 EUR / 4800 USD		
IGE	0.395***	0.468***	0.373***	0.397***
se	*0.071*	*0.067*	*0.064*	*0.067*
N	315	446	401	353
		lower annual earnings limit 9600 EUR / 9600 USD		
IGE	0.436***	0.428***	0.424***	0.439***
se	*0.072*	*0.064*	*0.065*	*0.068*
N	309	421	393	346

Note: the table contains estimates of intergenerational elasticities for the *Main Sample* and the *Full SOEP Sample* (for details on the samples see notes to Table 1 and section 2 in the text). The first row contains IGE estimates based on a lower annual earnings limit of 1200 EUR/USD, the second row applies a lower earnings limit of 4800 EUR/USD and the last row is based on a lower earnings limit of 9600 EUR/USD. See Table A.1 and Table A.2 for descriptive statistics of the restricted samples. The figures in italics are standard errors clustered at family level. Additional controls include: the number of years in sons' earnings average and two polynomials of average age for fathers and sons.
"***": significance at 1 percent level, "**": significance at 5 percent level, "*": significance at 10 percent level.

Source: SOEPv28 (1984-2011), PSID (1984-2009).

Table 3: Estimated intergenerational elasticities - different functional forms

	Germany			US		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
ln (fathers' earnings)	0.391 ***	-1.378	-33.691	0.494 ***	0.904	-25.322
se	*0.078*	*2.135*	*37.491*	*0.074*	*1.495*	*18.991*
ln (fathers' earnings)^2		0.084	3.580		-0.019	2.332
se		*0.101*	*3.530*		*0.068*	*1.669*
ln (fathers' earnings)^3			-0.096			-0.070
se			*0.114*			*0.049*
N	318	318	318	462	462	462
R-squared	0.105	0.107	0.108	0.164	0.162	0.168
p-value F-Test	-	0.408	0.364	-	0.782	0.121

Note: the table contains estimates of intergenerational elasticities for different functional forms of fathers' earnings. The figures in italics are standard errors clustered at family level. Additional controls include: the number of years in sons' earnings average and two polynomials of average age for fathers and sons. F-test for joint significance of higher order polynomials of fathers' earnings. Results are based on the *Main Sample* (for details, see note to Table 1 and section 2 in the text).
"***": significance at 1 percent level, "**": significance at 5 percent level, "*": significance at 10 percent level.

Source: SOEPv28 (1984-2009), PSID (1984-2009).

Table 4: Estimated intergenerational elasticities – results from (unconditional) quantile regressions

	Germany		US			Germany		US	
OLS	0.391	***	0.494	***					
se	*0.078*		*0.074*						
N									
results from CQR:					**results from UQR:**				
25th percentile	0.362	***	0.447	***	25th percentile	0.310	***	0.389	***
se	*0.120*		*0.090*		*se*	*0.083*		*0.078*	
50th percentile	0.433	***	0.401	***	50th percentile	0.503	***	0.423	***
se	*0.083*		*0.065*		*se*	*0.066*		*0.051*	
75th percentile	0.468	***	0.494	***	75th percentile	0.486	***	0.488	***
se	*0.075*		*0.093*		*se*	*0.101*		*0.072*	
N	318		462		N	318		462	

Note: the table contains estimates of intergenerational elasticities based on standard quantile regressions and unconditional quantile regressions based on the main sample. The figures in italics are standard errors clustered at family level. Additional controls include: the number of years in sons' earnings average and two polynomials of average age for fathers and sons. Results are based on the *Main Sample* (for details, see note to Table 1 and section 2 in the text).
"***": significance at 1 percent level, "**": significance at 5 percent level, "*": significance at 10 percent level.

Source: SOEPv28 (1984-2009), PSID (1984-2009).

Appendix

Table A.1: Descriptive statistics – lower annual earnings limit 4800 EUR/USD

	Mean/Median	SD	Min	Max	Mean/Median	SD	Min	Max
		Main Sample				*Full SOEP Sample*		
Germany								
sons' earnings	39,116	25,302	7,542	323,252	37,754	22,178	8,633	227,625
fathers' earnings	31,995	16,588	10,475	141,689	32,199	17,300	10,475	144,721
number of years in sons' average	2.53	1.12	1	4	5.33	2.44	1	8
number of years in fathers' average	8.81	1.34	6	10	9.16	1.24	6	10
fathers' age	47.44	4.01	35.5	52.5	47.31	4.21	33.5	52.5
sons' age	37.35	1.38	35	41	37.38	1.30	35	41
sample size	315				401			
number of families	250				321			
US								
sons' earnings	43,251	57,260	4,151	571,292				
fathers' earnings	50,078	59,159	12,442	845,915				
number of years in sons' average	2.70	1.27	1	5				
number of years in fathers' average	9.02	1.36	6	10				
fathers' age	46.37	4.63	33	52.5				
sons' age	37.62	1.58	35	42				
sample size	446							
number of families	328							

Note: the table contains descriptive statistics of the restricted samples (lower annual earnings limit 4800 EUR/USD) used in Table 2. The table presents the median of the earnings and the mean for all of the other variables. Earnings are expressed in 2006 Euros. For better comparability earnings are given in EUR using the following exchange rates: for the fathers' earnings 1 EUR=1.032 USD and for the sons' earnings 1 EUR=1.166 USD (for details, see note to Table 1).

Source: SOEPv28 (1984-2011), PSID (1984-2009).

Table A.2: Descriptive statistics – lower annual earnings limit 9600 EUR/USD

	Mean/Median	SD	Min	Max	Mean/Median	SD	Min	Max
	Main Sample				*Full SOEP Sample*			
Germany								
sons' earnings	39,423	25,350	9,746	323,252	38,294	22,007	9,760	227,625
fathers' earnings	32,378	16,455	17,701	141,689	32,406	17,231	17,623	144,721
number of years in sons' average	2.52	1.12	1	4	5.27	2.46	1	8
number of years in fathers' average	8.80	1.34	6	10	9.13	1.25	6	10
fathers' age	47.48	3.98	35.5	52.5	47.28	4.22	33.5	52.5
sons' age	37.38	1.39	35	41	37.39	1.33	35	41
sample size	309				393			
number of families	246				314			
US								
sons' earnings	45,863	57,862	8,298	571,292				
fathers' earnings	51,683	60,331	13,999	845,915				
number of years in sons' average	2.69	1.27	1	5				
number of years in fathers' average	9.01	1.34	6	10				
fathers' age	46.23	4.61	33	52.5				
sons' age	37.60	1.58	35	42				
sample size	421							
number of families	313							

Note: the table contains descriptive statistics of the restricted samples (lower annual earnings limit 9600 EUR/USD) used in Table 2. The table presents the median of the earnings and the mean for all of the other variables. Earnings are expressed in 2006 Euros. For better comparability earnings are given in EUR using the following exchange rates: for the fathers' earnings 1 EUR=1.032 USD and for the sons' earnings 1 EUR=1.166 USD (for details, see note to Table 1).

Source: SOEPv28 (1984-2011), PSID (1984-2009).

Table A.3: Estimated intergenerational elasticities – restricted sample

	Germany	**US**
	Main sample	
lower annual earnings limit 1200 EUR / 1200 USD		
IGE	0.403***	0.433***
se	*0.079*	*0.064*
N	309	421
lower annual earnings limit 4800 EUR / 4800 USD		
IGE	0.414***	0.430***
se	*0.073*	*0.064*
N	309	421
lower annual earnings limit 9600 EUR / 9600 USD		
IGE	0.436***	0.428***
se	*0.072*	*0.064*
N	309	421

Note: the table contains estimates of intergenerational elasticities for the *Main Sample* (for details on the samples see notes to Table 1 and section 2 in the text). The first row contains IGE estimates based on a lower annual earnings limit of 1200 EUR/USD, the second row applies a lower earnings limit of 4800 EUR/USD and the last row is based on a lower earnings limit of 9600 EUR/USD. Included are only those father-son pairs that are also included in the specification with a lower earnings limit of 9600 EUR/USD. The figures in italics are standard errors clustered at family level. Additional controls include: the number of years in sons' earnings average and two polynomials of average age for fathers and sons.
"***": significance at 1 percent level, "**": significance at 5 percent level, "*": significance at 10 percent level.

Source: SOEPv28 (1984-2009), PSID (1984-2009).