A Comparison of Intergenerational Mobility Curves

in Germany, Norway, Sweden and the U.S

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Abstract: We use two non-parametric measures to characterize intergenerational mobility (IGM) throughout the income distribution: Rank Mobility and Income Share Mobility. We examine differences in these IGM curves between Germany, Norway, Sweden and the United States using comparable samples. Although we find that these curves are approximately linear through most of the income distribution, non-linearities are important in describing cross-country differences. The linear representations of these curves lead to different conclusions regarding cross-country differences depending on the measure. Using ranks, we find that the U.S. is substantially less intergenerationally mobile than the three European countries which have fairly similar degrees of rank mobility. Despite the substantial heterogeneity in intergenerational rank mobility within the U.S., we show that the most mobile region of the U.S. is still less mobile than the least mobile regions of Norway and Sweden. When we use a linear estimator of Income Share Mobility we find that the four countries have very similar rates of IGM. However, there are some notable cross-country differences at the bottom and the top of the income distribution for both types of mobility. For example, the U.S. tends to experience lower upward mobility at the very bottom of the income distribution according to both measures. We conclude that researchers should be careful in drawing conclusions regarding cross-country differences in intergenerational mobility given that the results may be sensitive to the concept being used and to non-linearities.

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I. Introduction

Intergenerational mobility has risen to prominence among policymakers in many countries. In the U.S., President Barack Obama has described growing inequality and lack of upward mobility as the "defining challenge of our time". In the UK, intergenerational mobility is such a salient issue that the government has begun been tracking indicators of social mobility in recent years. The OECD is now examining social mobility as one important measure in its program Measurement of Economic Performance and Social Progress. Given the growing world-wide importance of intergenerational mobility to policy makers one would imagine that an important priority would be to document differences in rates of intergenerational mobility across countries. Establishing a sound body of descriptive facts concerning cross-country differences in intergenerational mobility may yield fruitful insights into understanding the sources of intergenerational persistence in any given society.

Thus far, however, most existing evidence on cross-country differences in intergenerational mobility has focused on one particular measure, the intergenerational elasticity or "IGE" in income.[1] For example, the oft-cited "Great Gatsby" curve plots the IGE against the Gini coefficient for a sample of countries.[2] While the IGE is a useful summary measure of relative intergenerational mobility that requires just one parameter, it has some limitations. For example, it is not informative about differences between upward and downward mobility or how mobility differs at different points in the income distribution. It also does not tell us anything about absolute intergenerational income mobility. Recent work by Davis and Mazumder (2015) uses a non-parametric approach that estimates "mobility curves" to measure intergenerational

[1] An exception is Corak, Linquist and Mazumder (2014) which use measures of directional rank mobility.
[2] See Corak (2014). The curve shows that countries with higher levels of inequality also have higher levels of the intergenerational persistence, or lower mobility. The relationship was first shown by Corak (2006) and the expression, the Great Gatsby curve was coined by Alan Krueger.

mobility across the entire income distribution using US data. They are motivated by studies from the literature on inequality and social welfare where under certain assumptions the Lorenz curve can be used to make statements about social welfare.

In this study, we extend the Davis and Mazumder (2015) framework to look at three additional countries, Germany, Norway and Sweden. We focus on two general measures of intergenerational mobility from Davis and Mazumder, a measure of Rank Mobility and a measure of Income Share Mobility. Rank Mobility is a useful measure of relative positional mobility. We use a variant of this measure, the rank-rank association or "rank persistence" which has also been used in previous work by Dahl and Deliere (2009) and more recently by Chetty et al (2014). Our second measure, Income Share Mobility, is a hybrid measure containing aspects of both absolute and relative mobility. Instead of using a relative measure such as ranks, it utilizes absolute income in each generation but scales it by the average income in each respective country in each generation. In addition to providing a different conceptual measure of mobility it also solves the problem of how to compare absolute changes in income across different currencies.

With respect to Rank Mobility we highlight several results. First, if we focus on a summary measure of rank persistence that imposes a linear relationship, the intergenerational rank association, we find that Rank Mobility is quite similar between Germany, Norway and Sweden while the US is a clear outlier. In the US there is generally much greater rank persistence. The intergenerational rank association is about 0.383 in the U.S. compared to 0.257 in Germany, 0.223 in Norway, and 0.215 in Sweden. The Rank Mobility curves also demonstrate that the US is characterized by much less upward mobility from the bottom and significantly less downward mobility from the top. For example, children whose parents were in

the bottom five percentiles of the income distribution are expected to rise to about the 40th percentile of the income distribution in Norway and Sweden, the 34th percentile in Germany, and the 31st percentile in the United States. Our results also imply that although there is considerable heterogeneity in intergenerational rank mobility across the US as highlighted by Chetty et al (2014), it is nonetheless exceptionally rare for a US city to exhibit the degree of rank mobility in these other societies. We also directly examine heterogeneity in rank mobility by looking at sub-regions in each country. We find that the most mobile region of the U.S. is still less mobile than the least mobile regions of Norway and Sweden.

Moreover, relative to simply assuming linearity, we find that the use of non-parametric mobility curves is important in evaluating these cross-country differences in rank mobility. We see very little difference in mobility between the countries from around the 35th to the 60th percentiles but quite significant differences between the US and the European countries at the bottom and the top of the income distribution.

Our conclusions about cross-country intergenerational mobility differences are notably different when we turn to the Income Share Mobility measure. This measure considers the expected *change* in absolute income over a generation at every percentile of the income distribution. Similar to the finding of mean reversion in ranks there is also mean reversion in absolute income. Families that start at higher percentiles in the distribution experience smaller increases in absolute income over a generation than families that start at lower percentiles. When we scale those absolute income changes by the average level of family income in each country and if we impose linearity on the relationship, we find that the rate of mean reversion is nearly identical in all four countries. We find that in all of our samples, that moving up 10 percentiles in the parent income distribution is associated, on average, with a reduction in the

change in income over generations equal to 10 percent of the average family income level in that country.[3] However, when we allow for non-linearities we find substantial cross-country differences at the bottom and the top of the income distribution. For example, among children who start in the bottom decile of the parent income distribution, income is expected to increase by 29 percent of average income in Germany, 40 percent of average income in the United States, 46 percent of average income in Norway, and 49 percent of average income in Sweden. Corak, Lindahl and Mazumder (2014) also found lower absolute income gains among those at the bottom of the distribution who experienced upward mobility when comparing the U.S. to Sweden.

We show that the differing conclusions regarding cross-country differences in intergenerational mobility between the linear version of Rank Mobility and the linear version of Income Share Mobility reflect the difference in concepts between the two measures. Intuitively, in a country with higher inequality it will be much more difficult to change ranks since the ranks will be farther apart in dollar terms than in a country where the ranks are closer together.[4] Therefore countries can experience similar rates of absolute mobility but experience very different degrees of rank mobility. Therefore, when it comes to *interpreting* estimates of intergenerational income mobility, it is critical to choose the estimator that captures the concept of mobility that one is interested in measuring. A focus on relative mobility as measured by changes in ranks over a generation suggests that the US is significantly less intergenerationally

[3] For example, a family at the 30thth percentile of the parent generation distribution in our US sample would expect to experience an absolute income gain ($25,419) that would increase its ratio of income measured relative to the national average by 0.19 over a generation. A family at the 50th percentile would expect to experience an absolute income gain ($11,296) which would increase its ratio of income measured relative to the national average by 0.01. In this example, there is an 18 percentage point difference in Income Share Mobility between two families that are 20 percentiles apart in the income distribution.

[4] In a slightly different context, Aaberge and Mogstad (2013) argue that there is an almost mechanical relationship between cross-sectional inequality and mobility measures.

mobile than Germany, Norway and Sweden. On the other hand, a measure of mobility based on absolute income changes scaled to average income shows little difference across the countries. We also find that for both measures there are important non-linearities and that the broad conclusions implied by the linear estimators do not hold throughout the income distribution, highlighting the importance of using non-parametric estimators when studying intergenerational mobility. This echoes a similar point first made by Jäntti et al (2006).

The rest of the paper proceeds as follows. In section II we describe our measures and outline our methodological approach. In section III we discuss our data. In section IV we present our main findings. In section V we analyze regional differences in rank mobility. In section VI we conclude.

II. Measures and Methods

We focus our attention on two of the three mobility measures discussed in Davis and Mazumder (2015): Rank Mobility and Income Share Mobility. Throughout, we refer to the initial generation as the *parent generation* and the later generation the *child generation*. Rank mobility is the difference between a child's rank in her national income distribution, P_{1i}, and her parents' rank in their national income distribution, P_{0i}:

$$RM_i = P_{1_i} - P_{0_i}.$$

Rank mobility measures are the basis for many recent non-parametric intergenerational mobility estimates (Bhattacharya and Mazumder 2011, Chetty et al. 2014, Mazumder 2014). Rank mobility measures are useful for several reasons. First, unlike the intergenerational elasticity they can provide information about how mobility differs at different points of the income distribution. Second, when fixing ranks relative to the entire population, they can be used to

compare the mobility of subgroups of the population (Mazumder, 2014). Third, rank mobility measures are relatively robust to measurement issues (Nybom and Stuhler, 2015). For example, top coded values will all be correctly classified as being in the top percentiles of the income distribution. Rank mobility measures also appear to be more robust to lifecycle issues than the intergenerational elasticity since within cohort ranks are much more stable than within cohort income.[5]

On the other hand, rank mobility measures are not always ideal. If one is interested in the actual *magnitude of income changes* and how that differs at different points in the income distribution, then the rank mobility measure is not an appropriate measure since it treats all rank changes equally. For example, in our US data, moving from the 10th to the 11th percentile of the child income generation is associated with $1,313.64 in additional family income (measured in 2007 dollars), whereas moving from the 90th to the 91st percentile is associated with $5,575.03 in additional family income. To address this issue, we also study income share mobility. Income share mobility is defined as the difference between a child's income relative to her generation's average income and her parents' income relative to their generation's average income:

$$ISM_i = \frac{Income_{1i}}{E[Income_{1i}]} - \frac{Income_{0i}}{E[Income_{0i}]}.$$

Since we use a balanced panel of families in each generation, this measure is equal to the change in a family's share of their generation's total income scaled by the population of the generation. Consequently, income share mobility can be thought of as the change in the share of the total pie

[5] Chetty et al (2014) argue that the rank-rank association stabilizes at around age 30. Mazumder (2015) using the PSID shows that there is still some downward bias in using estimates of the rank association when kids' income is measured around the age 30 compared to when kids' income is measured around the age 40. Davis and Mazumder (2015) also find this to be the case when using the NLSY.

a family receives between the two generations.[6] Here we simply estimate the change in the real dollar value of income at each percentile of the parent income distribution.

As in Davis and Mazumder (2015), we show how both of these mobility measures vary over the parent income distribution using non-parametric *mobility curves* (Aaberge and Mogstad 2013). A mobility curve presents the expectation of a mobility measure conditional on being at each rank of the parent income distribution. A "Rank Mobility Curve" (RM) is given by:

$$RM(p) = E[P_{1i} - P_{0i} | P_{0i} = p], p = 1,2, \dots ,100.$$

An alternative representation of a rank mobility curve is the conditional expectation (CE) of the child's rank. This representation is simply a 45 degree rotation of the rank mobility curve (i.e. just adding P_{0i} to the rank mobility measure).

$$CE(p) = E[P_{1i} | P_{0i} = p], p = 1,2, \dots ,100.$$

Although they contain identical information, the CE curve tends to be more appealing visually and more intuitive and is also the formulation utilized by Chetty et al. (2014) in their highly influential work.

An "Income Share Mobility" (IS) curve is given by:

$$IS(p) = E\left[\frac{Income_{1i}}{E[Income_{1i}]} - \frac{Income_{0i}}{E[Income_{0i}]} \middle| P_{0i} = p\right], p = 1,2, \dots ,100.$$

We estimate these mobility curves using a bin estimator. Specifically, we calculate the average of each mobility measure at each percentile of the parent income distribution.

We often report slope coefficients from linear versions of mobility curves as summary measures of mobility. A linear mobility curve is given by the linear regression of either child rank or income share mobility on parent rank.[7]

[6] Although the Income Share Mobility measure uses absolute income changes, the fact that we scale it relative to average income, it is not a true measure of absolute mobility. Davis and Mazumder (2015) refer to it as a "hybrid" of both absolute and relative mobility.

III. Data

Our analysis uses separate datasets from Germany, Norway, Sweden and the United States. We begin by explaining our sample for the United States, since the other samples were selected to be comparable to this dataset.

For the United States, we use the cross-sectional and supplemental samples[8] of the National Longitudinal Survey of Youth's 1979 (NLSY79) cohort. The NLSY79 is nationally represenative of youth who were 14 to 22 years old when the survey was conducted in 1979. All youth in the sample were born between 1957 and 1964. We restrict the sample to families with all parents living in the household born between 1920 and 1950. Lastly, we restrict the sample to families for which we observe at least one year of total family income in both the adult and child generations. In total, our sample includes 6,414 parent-child pairs.

Parents who were still living with their children were asked to report their total pre-tax family income from the previous year in the 1979, 1980, and 1981 parent interviews, covering years when their children were 14 to 23 years old. Therefore, parents are 28 to 60 when we measure their total family income. We subtract any earnings the youth had during this period from the total family income measure. We use the average of all of the available family income measures in this period to construct our income measure for the parent generation. For the child generation, we take the average of self-reported total pre-tax family income in 1996, 1998, 2000, 2002, 2004, 2006, and 2008 when the children were 32 to 52 years old.

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[7] The linear regressions are estimated using our full samples, not the bin estimates used for the non-parameteric mobility curves.

[8] Because we include the supplemental sample, which was designed to oversample minority and economically disadvantaged youth, we weight the estimates by the 1979 sample weights.

For Sweden, we use a 35 percent population random sample drawn from administrative data. Mirroring the NLSY79, we restrict this sample to children born between 1957 and 1964 whose parents were born between 1920 and 1950. Our parent generation income measure is average pre-tax household income between 1978 and 1980. Our child generation income measure is average pre-tax household income in 1996, 1998, 2000, 2002, 2004, 2006, and 2007. In total, our Swedish sample includes 252,745 parent-child pairs.

For Norway, we use Statistics Norway's full population administrative data. The sample is restricted to children born between 1957 and 1964 whose parents were born between 1920 and 1950 and were married. In total, the sample includes 328,428 parent-child pairs. We measure income in the parent generation as average pre-tax family earnings in 1978, 1979, and 1980. We measure income in the child generation as average pre-tax family earnings in all years between 1996 and 2006. It should be highlighted that cohabitants are not included in the family income measure, which is a concern for the child income measure given declining marriage rates in Norway.

For Germany, we use the German Socio-economic Panel.[9] Here, unlike the other data sources, we restrict the sample to children born between 1957 and 1979 whose parents were born between 1926 and 1956. The sample includes 1,072 parent child pairs. We measure income in the parent generation as average annual pre-tax household income between 1984 and 1986 when the children were 5 to 29 years old. For the child income measure, we use average annual pre-tax household income between 2001-2012 in years when the child was between 32 and 54 years old. The German income measures differ from the other countries' measures in that they do not include government transfers and a small share of income measures are imputed.

[9] We use SOEPv29. For more details, see http://dx.doi.org/10.5684/soep.v29.

Summary statistics for the four samples are shown in Table 1. We report all income measures in 2007 American Dollars.

Average family income in the parent generation ranges from $53,352 in Sweden to $93,400 in Norway. In Norway and Sweden, the average father was born in 1931 and the average mother was born in 1934. In the United States, parents are about two years younger. Since children in all three samples were born in 1961 on average, parents in the United States are about 2 years younger when they have children. Parents in our German sample are about 8 years younger than in Norway and Sweden and 6 years younger than in the United States. However, children in our German sample are 7 years younger, on average, so parents in our German sample were about the same age as parents in our American sample when they had their children. Both our Norwegian and German samples are restricted to families with both parents present in the parent generation. In Sweden and the United States, 87 and 85 percent of households had two parents present in the parent generation.

In the child generation, average income ranges from $71,715 in Germany to $79,245 in Norway. There are slightly more men than women in all of our samples of the child generation. Our Norwegian and Swedish samples are 49 percent female, our American sample is 48 percent female, and our German sample is 45 percent female. In our American sample, 64 percent of individuals in the child generation were married at the time of 2002 survey. In Norway, 59 percent of children were married in 2002. In Germany, 54 percent of children were married in the first year a valid income measure was reported. We do not observe marital status for children in our Swedish sample.

We present IGE estimates from a regression of log child income on log parent income for each country in order to benchmark our samples to previous estimates from the literature. These

estimates are shown in Table 2. The IGE estimates vary substantially across the four countries. The IGE is 0.194 in Norway, 0.231 in Sweden, 0.348 in Germany, and 0.432 in the United States.

III. National Mobility Curves

Rank Mobility

Figure 1 presents Rank Mobility Curves for Germany, Norway, Sweden, and the United States. Separate figures for each country are shown in the appendix. All of the mobility curves have a roughly similar shape. Rank mobility is approximately linear over most percentiles of the parent income distribution, but curves downward at the bottom of the parent income distribution and upward at the top of the parent income distribution in some of the countries. There is a slight curvature in rank mobility in the middle of the income distribution. Children whose parents were below the median have more upward rank mobility than the linear fit predicts and children whose parents were above the median tend to have more downward rank mobility than the linear fit predicts. For Norway and Sweden, the nonparametric rank mobility estimates curve sharply upward at the top of the parent income distribution. In all countries, the rank mobility curves appear to bend at least somewhat downward at the bottom of the parent income distribution. This suggests that in many instances there is relatively more persistence in ranks among the poorest and wealthiest families than the linear curves indicate.

Looking across countries, Germany, Norway, and Sweden have similar levels of rank mobility across the parent income distribution. The slopes of linear mobility curves, which are summary measures of rank persistence, are 0.257, 0.223, and 0.215 in Germany, Norway, and

Sweden, respectively.[10] This implies that each percentile increase in the parent income distribution is associated with a 0.257, 0.223, and 0.215 percentile increase in the child's rank in the income distribution in Germany, Norway, and Sweden respectively. Put another way, the *gap* in ranks between a child whose parents were in the 100th percentile of the parent income distribution and a child whose parents were at the bottom of the income distribution –a gap of 99 percentiles in the parent generation-- would be expected to fall to just 21.5 percentiles in a single generation in Sweden. In contrast, the slope of the American linear mobility curve is 0.383. The gap in ranks between the two hypothetical children just discussed would be nearly twice as large if the two children were from the United States instead of Germany, Norway, or Sweden.

This cross-country disparity in rates of rank persistence can also be scaled based on the geographic mobility estimates across U.S. cities from Chetty et al. (2014). Moving from 0.26 (Germany) to 0.39 (U.S.) is the equivalent of moving from the 40th ranked American city to the 309th ranked American city.[11] Furthermore, there are only 11 out of 384 U.S. cities where the rank persistence is found to be less than 0.22. Simply put it is difficult to find the rank mobility experience of Norway or Sweden anywhere in the U.S.

Importantly, focusing instead on the nonparametric mobility curves allows for a richer and more nuanced comparison of mobility at different points in the parent income distribution. Children whose parents were at the bottom percentile were expected to be in the 29th percentile in Germany, 35th percentile in the United States, and 37th percentile in Norway and Sweden. As is evident in Figure 1, the nonparametric estimates at any given percentile of the American and German rank mobility curves are imprecisely estimated. Averaging over several percentiles yields more precise estimates. Children whose parents were in the bottom five percentiles of the

[10] Boserup et al (2013) estimate a rank persistence of 0.18 for Denmark.
[11] This calculation uses the online tables from Chetty et al. (2014).

income distribution are expected to rise to about the 40th percentile of the income distribution in Norway and Sweden, the 34th percentile in Germany, and the 31st percentile in the United States. In contrast, children whose parents were in the top five percentiles of the income distribution are expected to fall to the 61st percentile in Germany, the 63rd percentile in Norway, the 66th percentile in Sweden, and the 69th percentile in the United States. Therefore, the gap in ranks between children of the wealthiest and poorest families is expected to fall to 23 percentiles in Norway, 26 percentiles in Sweden, 27 percentiles in Germany, and 38 percentiles in the United States.

At other points of the parent income distribution, there are only small differences in rank mobility. Children whose parents were in the 5th decile of the income distribution are expected to be in the 49th percentile in all four countries. Children whose parents were in the 6th decile are expected to be in the 50th percentile in Sweden and the United States, the 51st percentile in Norway, and the 60th percentile in Germany.

Income Share Mobility

Income Share Mobility considers changes in income normalized by the average income in the economy.[12] Figure 2 shows Income Share Mobility curves for the four countries in our analysis. Importantly, Income Share Mobility is on the y-axis in Figure 2, so we expect a *downward* sloping curve if there is regression towards the mean. Figure 1 was upward sloping since we presented the conditional expectation of the child's rank rather than the *difference* between the child and his or her parent's rank.

[12] Footnote 3 provides a concrete example.

What is immediately evident is that the nonparametric Income Share Mobility curves are approximately linear over most of the income distribution as was the case with Rank Mobility. The slopes of all four linear Income Share Mobility Curves are approximately -0.01. More precisely, the slopes are -0.009 in Germany and Norway, -0.010 in Sweden, and -0.011 in the United States. This indicates that in all countries moving up 10 percentiles in the parent income distribution is associated, on average, with a reduction in the change in income over the next generation equal to about 10 percent of average income. Put another way, the income of two children whose parents were at the top and bottom of the income distribution, respectively, will converge by 100 percent of the average income in a single generation, on average.

How is it possible that large cross-country differences in Rank Mobility can be consistent with small differences in Income Share Mobility? This can be reconciled by considering the differences across countries in the levels of cross-sectional inequality. Consider two countries with equal levels of average income but where one country has significantly higher income inequality in the parent generation. A given change in absolute income over a generation would lead to higher change in ranks in the country with smaller cross-sectional inequality than an identical change in absolute income in a country characterized by a high degree of inequality, where surpassing the next rank requires a greater income change.[13] The identical absolute income change, however, would lead to an identical level of Income Share Mobility.

We illustrate that this is exactly the case when we compare the U.S. to our other samples. Figures 3a and 3b show the cross-sectional income distributions in the parent and child generations of each of our samples. Incomes are measured as shares of average income in each generation within a country. In both generations, the poor in the United States have relatively

[13] As Aaberge and Mogstad (2013) emphasized, this creates an almost mechanical relationship between cross-sectional inequality and rank mobility measures.

lower incomes and the rich have relatively higher incomes. A child whose parents were in the bottom decile of Norway's income distribution is expected to be in the 42nd percentile of the child generation family income distribution. This is associated with an increase in earnings equal to 46 percent of the generation's average earnings. In contrast, a similar child in the United States is only expected to be in the 30th percentile of her generation's family income distribution which is associated with an earnings increase equal to 40 percent of the average income. Although the child from Norway is expected to move up 40 percent more percentiles than the child from the United States, this higher rank mobility is only associated with a 15 percent larger increase in income.

In contrast to the rank mobility curves, the Income Share Mobility curves bend sharply downwards at the top of the income distribution. This suggests that, although children whose parents are born at the top of the income distribution persistently stay in the highest ranks of the income distribution, the small rank changes are associated with relatively large declines in their income.

The nonparametric income share mobility curves indicate some notable differences at the top and the bottom of the income distribution. The income of children whose parents were in the bottom decile of the parent income distribution is expected to increase by 29 percent of average income in Germany, 40 percent of average income in the United States, 46 percent of average income in Norway, and 49 percent of average income in Sweden. At the other end of the distribution, the income of children whose parents were in the top decile are expected to fall by 51 percent of average income in Norway, 62 percent of average income in Sweden, 73 percent of average income in Germany, and 84 percent of average income in the United States.

There is even more downward mobility among the very top of the distribution. Children whose parents were in the top five percentiles can expect their income to fall by 65 percent of average income relative to their parents in Norway, by 83 percent of average income in Germany, by 84 percent in Sweden, and by 120 percent in the United States.

These results are in some respects similar to the findings of Corak, Lindquist and Mazumder (2014) who find significant cross-country differences between Canada, Sweden and the U.S.in absolute income changes at the very bottom and top of the income distributions. For example they find that the U.S. experiences lower absolute upward income mobility at the very bottom and greater absolute downward mobility than Canada and Sweden from the very top. However, Corak, Lindquist and Mazumder condition their estimates on having either upward or downward mobility and do not scale these income changes relative to average income.

V. Regional Results

An important question is whether Germany, Norway, Sweden, and the U.S. are reasonably comparable. The U.S. is much larger than the other countries in terms of its population and geographic area. The United States' population is nearly four times the population of Germany and more than thirty and sixty times the populations of Sweden and Norway, respectively. Similarly, the area of the U.S. is over twenty times larger than the area of Germany, Norway, or Sweden. Chetty et al. (2014) have shown that the overall level of rank mobility in the U.S. conceals a considerable degree of heterogeneity across smaller geographic areas. While we have already shown that it is rare to find a city in the U.S. with the same degree of intergenerational rank mobility as the entire nation of Norway or Sweden, it may also be

useful to look at heterogeneity within all of our sample countries. Perhaps, it is fairer to compare the most mobile region of U.S. to the most mobile regions of Germany, Norway and Sweden.[14]

To address this issue, we examine intergenerational mobility separately for regional subdivisions of each country. For this analysis, we treat regions as if they are separate countries. We generate separate income distributions for each region and restrict the sample to children who lived in the region as children and adults. This restriction is meant to mirror the fact that the national analysis is implicitly conditional on not emigrating, since emigrants will generally not be observed in both generations and will therefore be excluded. For simplicity, we focus on summary measures of rank persistence instead of the nonparametric mobility curves.

Table 3 shows rank persistence measures for each country and for regional subdivisions of each country. Only one region of the U.S., the West, has comparable rank persistence as Germany, Norway, and Sweden. The slope of the linear rank mobility curve for the American West is 0.252. For comparison, the lowest rank mobility regions in Norway and Sweden have a rank persistence of 0.250 and 0.233, respectively. Therefore, the highest mobility region of the United States still has higher rank persistence than the lowest mobility regions of the two Nordic countries, Norway and Sweden. If we compare the U.S. West to the most mobile regions of Norway and Sweden then there is a fairly substantial gap as the Western region of Norway and the Northern region of Sweden exhibit rank persistence below 0.180. The comparison between the U.S. West and Germany is not as striking as the rank persistence of the U.S. West ranks between that of the two regions of Germany, which have a rank persistence of 0.216 and 0.265, respectively.

[14] We thank Magne Mogstad for suggesting that we make this comparison.

The other three regions of the United States have much higher rank persistence than the U.S. West or any of the other regions in the other three countries. The North Central region's rank persistence is 0.367, the Southern region's rank persistence is 0.431, and the Northeastern region's rank persistence is 0.439. Figures 4a and 4b show that the regional income distributions are similar in both the parent and child generations. In other words, regional differences in cross-sectional inequality do not appear to explain the differences in rank mobility within the United States.

Overall, we find that there is a striking difference in rank mobility between the U.S. and the Nordic countries that remains even when comparing the most mobile region of the U.S., the West to the least mobile regions of the Nordic countries. The other regions of the U.S. are substantially less mobile than any other region in Germany, Norway or Sweden.

VI. Conclusion

We use comparable intergenerational samples from Germany, Norway, Sweden and the U.S. to construct estimates of intergenerational mobility curves for each country. Using our first measure, Rank Mobility, we find that the U.S. is an outlier compared to the other three countries when we assume a linear relationship. The U.S. has much greater intergenerational rank persistence with roughly comparable levels in the other three countries. The U.S. exhibits both less upward mobility from the bottom of the distribution and less downward mobility at the top of the distribution. We also find that even the most mobile region of the U.S. is less mobile than the least mobile regions of the Nordic countries. However, non-parametric estimates which relax linearity are important as the rank mobility differences are not constant at all points of the income distribution and the countries are fairly similar in the middle of the parent income distribution.

In contrast, when we examine our second measure, Income Share Mobility and impose linearity, we find that rates of intergenerational mobility are very similar across countries. The difference between these results and those using Rank Mobility is explained by the fact that the U.S. has much higher cross-sectional inequality than the other countries making it more difficult to change ranks for any given change in income.

Taken together our findings highlight several important points. First, the cross-country differences in rank mobility are consistent with many previous studies of intergenerational mobility that focused on a different measure of relative mobility, the intergenerational elasticity.[15] Second, although there is considerable heterogeneity in rank mobility within the U.S. as documented by Chetty et al. (2014), it is clear that the cross country differences in rank mobility are robust to spatial heterogeneity in the four countries. Third, there are important non-linearities with respect to cross-country differences in rank mobility. We find that there are relatively small differences in rank mobility if we compare those who start in the middle of each country's respective income distributions. Fourth, our results with respect to income share mobility suggest that once we move to a measure of mobility that is closer to a measure of absolute mobility and impose linearity, that the countries are quite similar in their rates of intergenerational mobility. Fifth, we also find evidence of important non-linearities in income share mobility at the very bottom and top of the income distributions that can significantly affect cross-country comparisons.

Overall, we find that one must take care in drawing firm conclusions regarding cross-country differences in intergenerational mobility. The differences depend to some degree on

[15] See for example Corak (2006) and Jantti et al (2006). Schnitzlein (2014) argues that the relative ordering in mobility between the U.S. and Germany based on the intergenerational elasticity is somewhat sensitive to the choice of how income is measured.

what portion of the income distribution one is examining and conceptually, whether one is interested in looking at relative or absolute outcomes. Future research should further investigate these aspects of intergenerational mobility.

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Table 1. Summary Statistics

	Germany	Norway	Sweden	United States
Observations	1,072	324,870	252,745	6,414
Parent Generation				
Family Income[a]	66211	93400	53352	65141
Father Birth Year	1942	1931	1931	1933
Mother Birth Year	1939	1934	1934	1936
Two Parents	1.00	1.00	0.87	0.85
Child Generation				
Family Income[a]	71715	79245	72200	76877
Child Birth Year	1968	1961	1961	1961
Female	0.45	0.49	0.49	0.48
Married	0.54	0.59	-[b]	0.64

Notes. [a]All currencies are reported in 2007$. Currencies were converted to 2007 units using GDP deflators reported by the World Bank and converted to American Dollars using the average 2007 exchange rate reported by the OANDA Corporation. [b]Marital Status of Swedish children is not available in the data, but total household income is reported.

Table 2. IGE Estimates

	Germany	Norway	Sweden	United States
IGE	0.348	0.194	0.231	0.432
	(0.044)	(0.002)	(0.002)	(0.014)
N	1,066	324,870	251,288	6,298

Table 3. Rank Persistence by Country and Region

	Germany	Norway	Sweden	USA
National Distribution				
National	0.257	0.223	0.215	0.383
	(0.030)	(0.002)	(0.002)	(0.012)
Regional Distributions, Regional Stayers				
Region 1	0.216	0.179	0.175	0.252
	(0.041)	(0.003)	(0.006)	(0.030)
Region 2	0.265	0.189	0.183	0.367
	(0.044)	(0.006)	(0.006)	(0.026)
Region 3	-	0.191	0.197	0.431
		(0.006)	(0.003)	(0.019)
Region 4	-	0.250	0.233	0.438
		(0.003)	(0.005)	(0.029)

Figure 1. Rotated Rank Mobility Curves

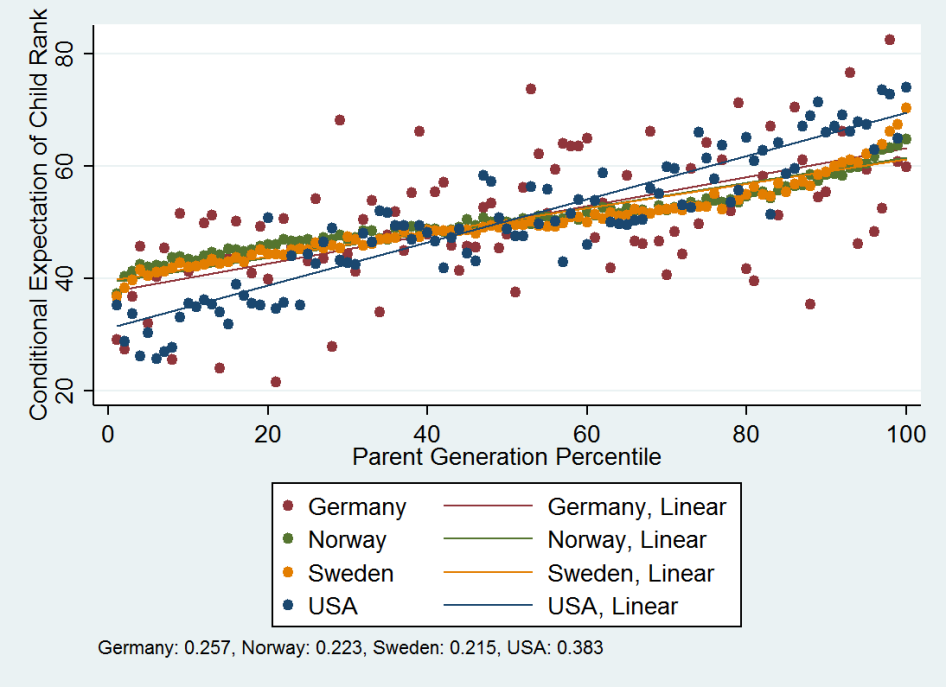


Figure 2. Income Share Mobility Curve

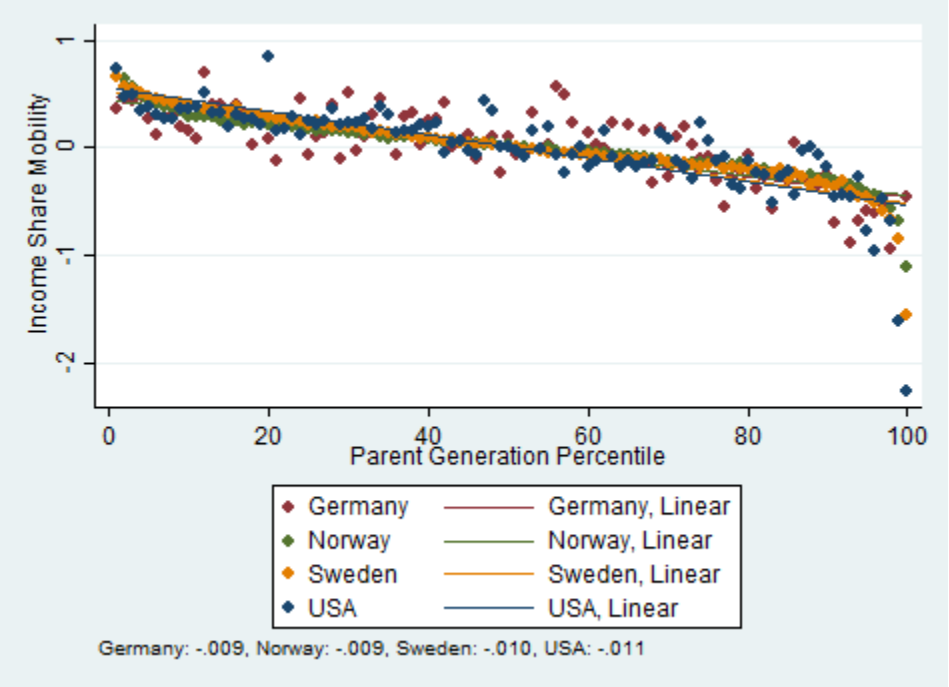


Figure 3a. Parent Generation Income Distributions

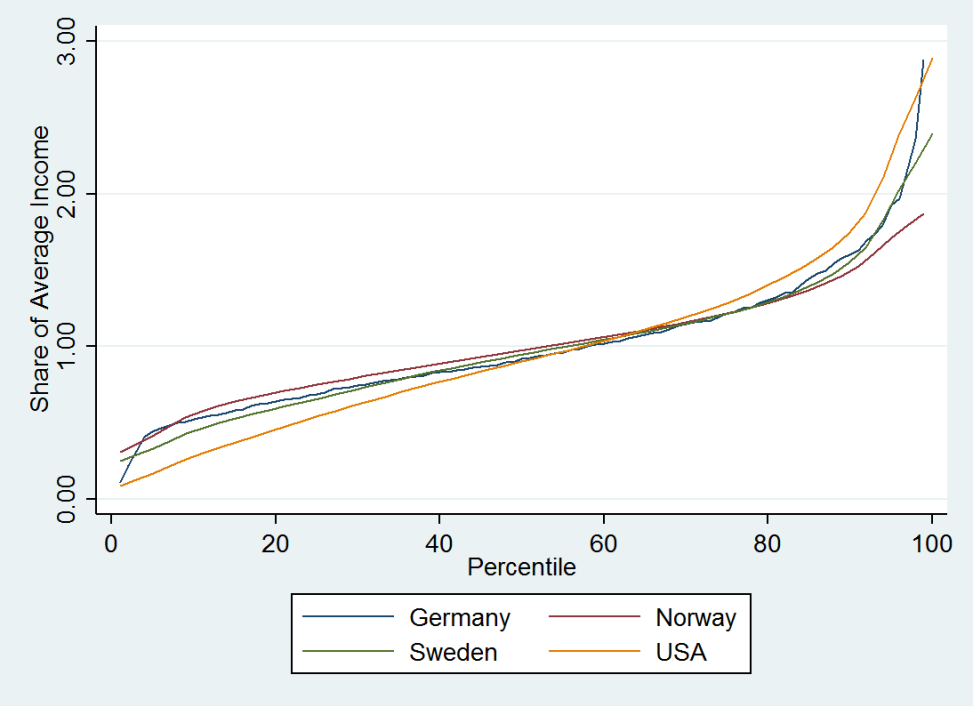


Figure 3b. Child Generation Income Distributions

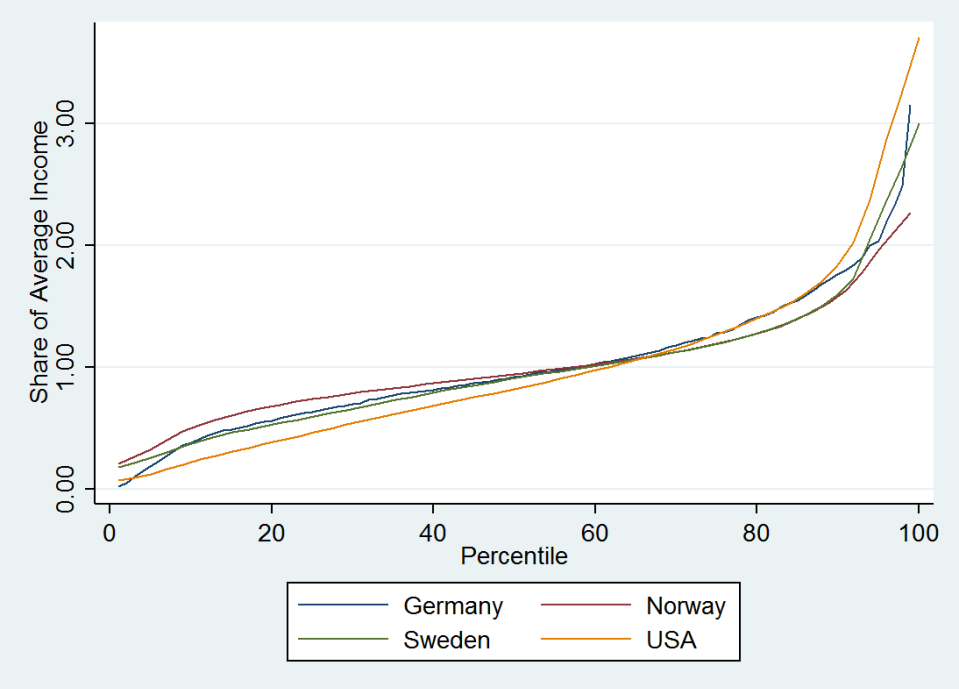


Figure 4a. Parent Generation Income Distributions, USA Regions

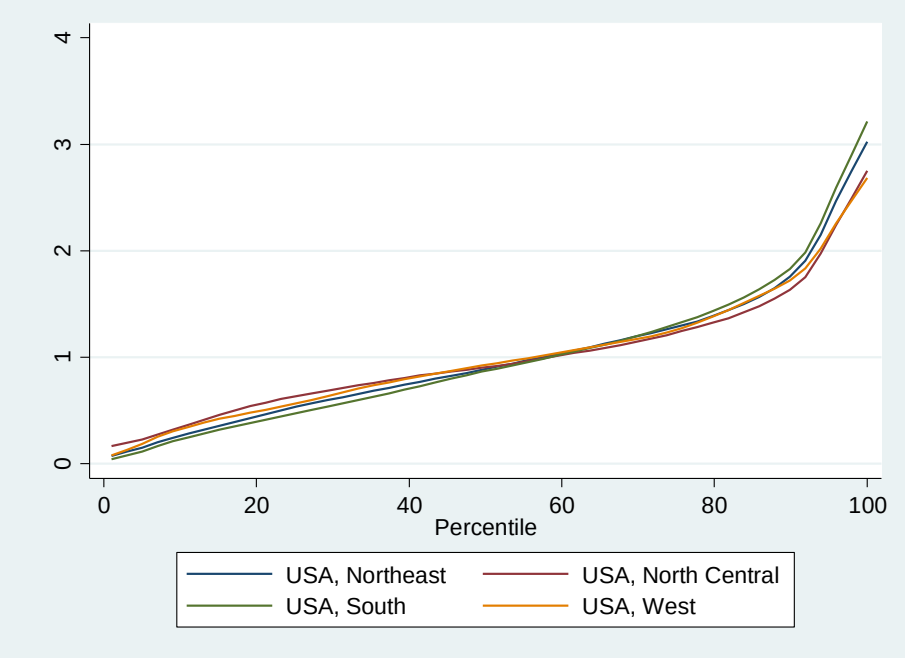
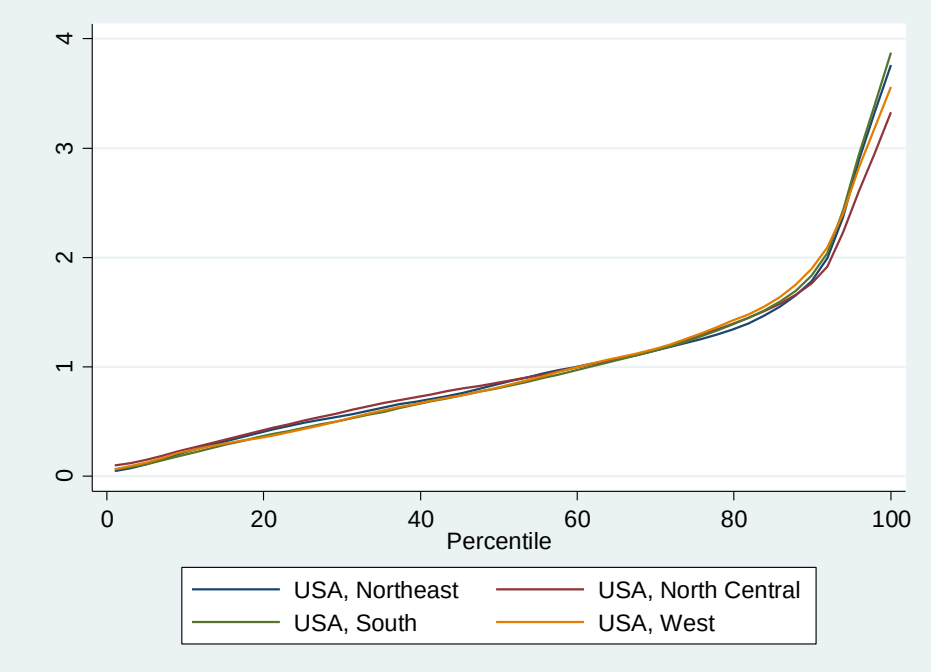


Figure 4b. Child Generation Income Distributions, USA Regions



Appendix I. Country Specific Figures

Figure A1. Rank Mobility Curve, Germany

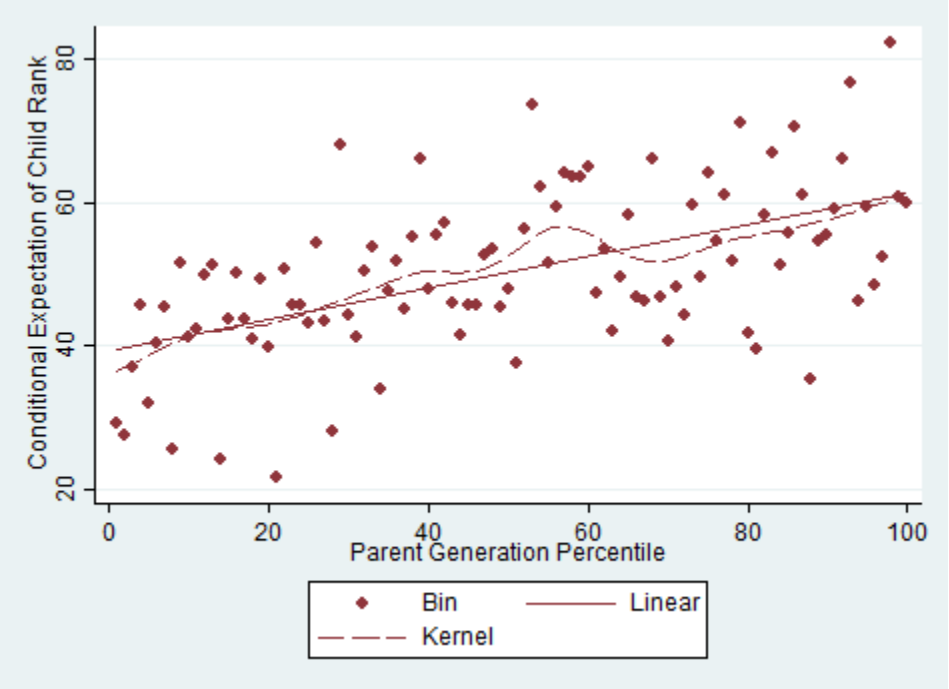


Figure A2. Rank Mobility Curve, Norway

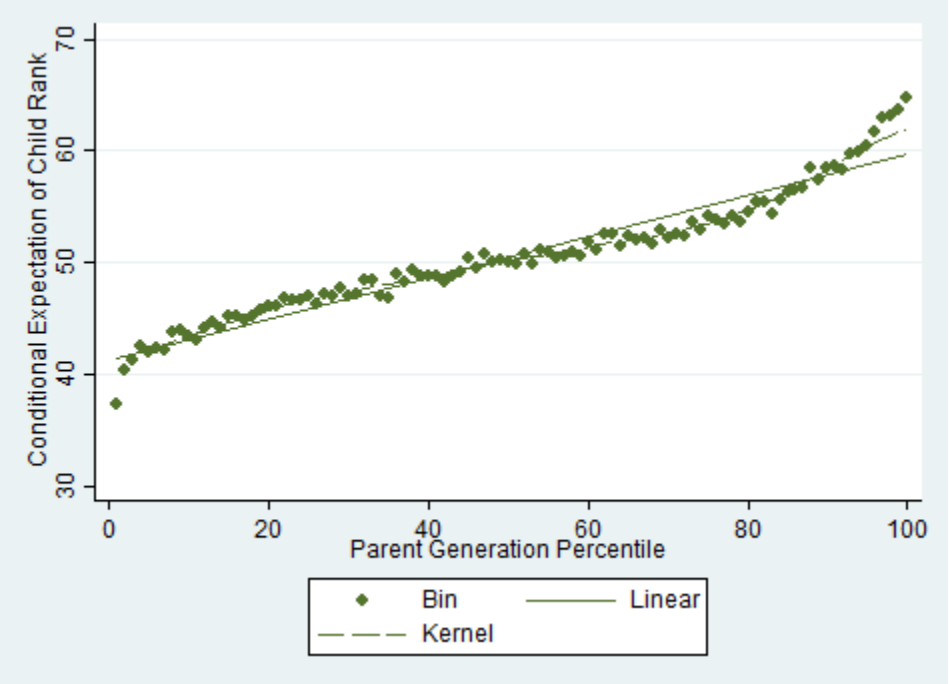


Figure A3. Rank Mobility Curve, Sweden

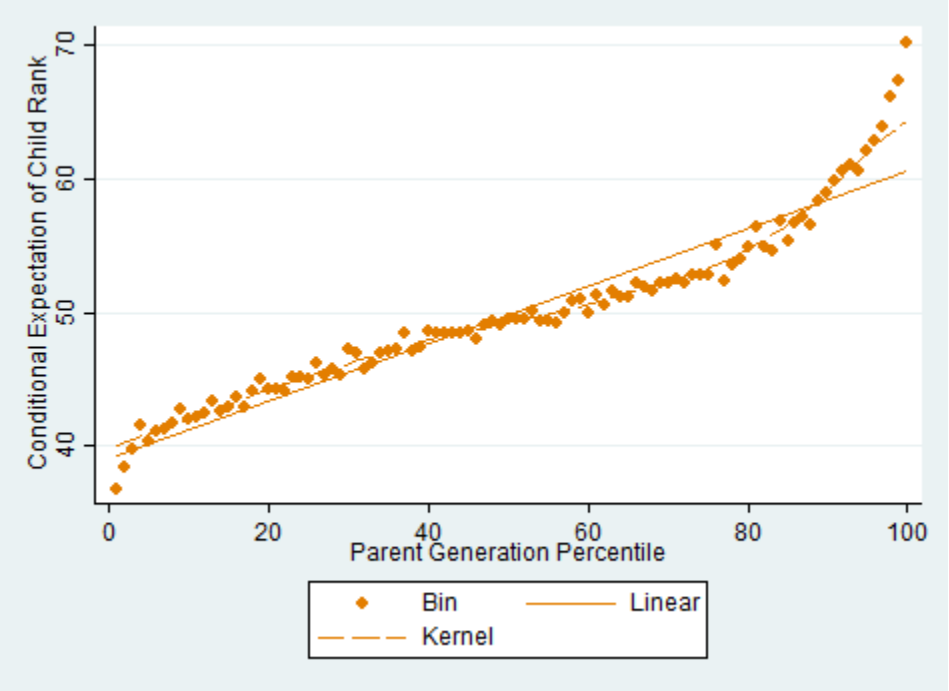


Figure A4. Rank Mobility Curve, USA

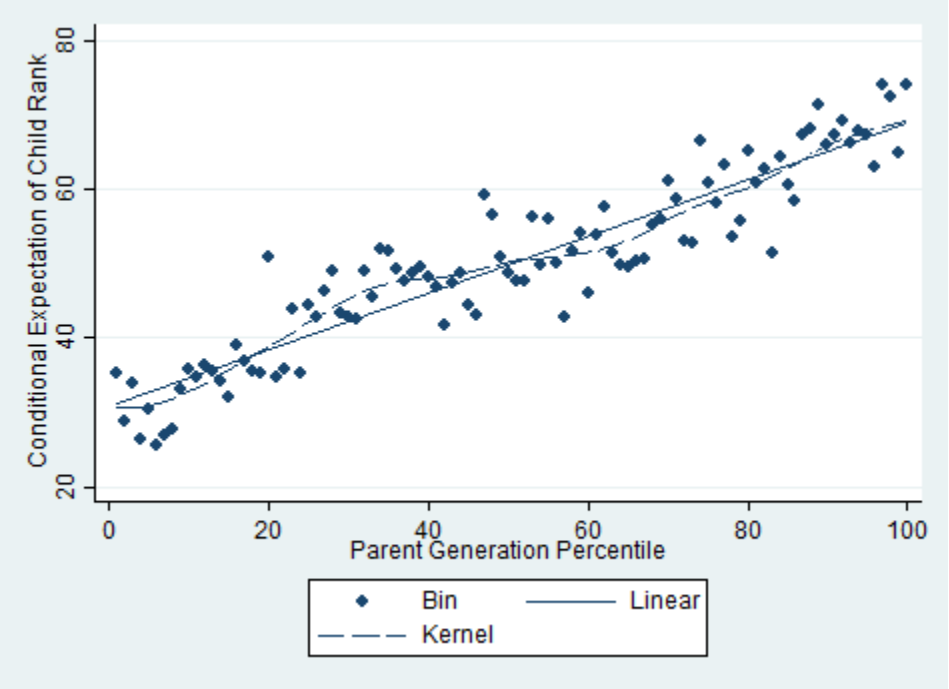


Figure A5. Income Share Mobility Curve, Germany

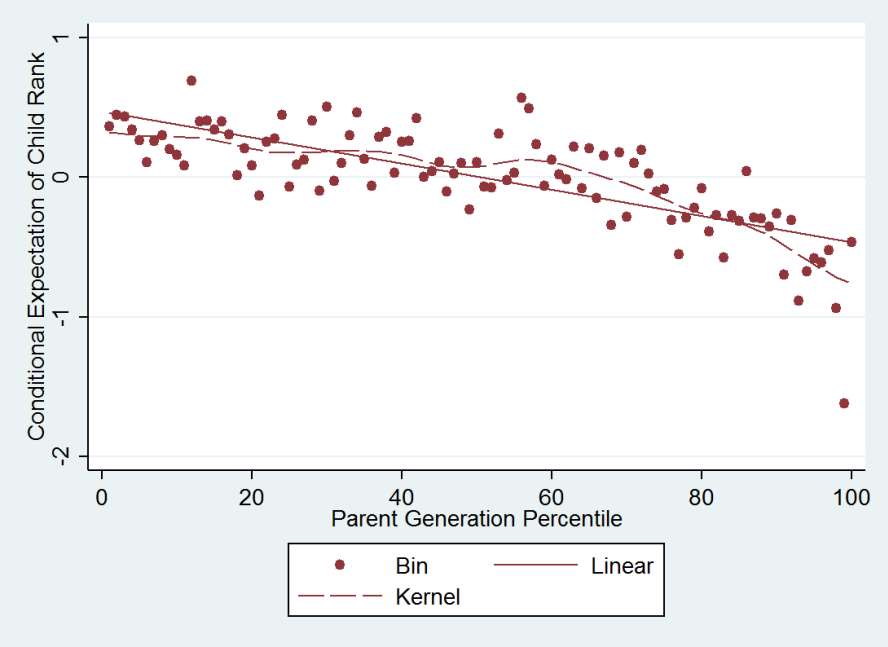


Figure A6. Income Share Mobility Curve, Norway

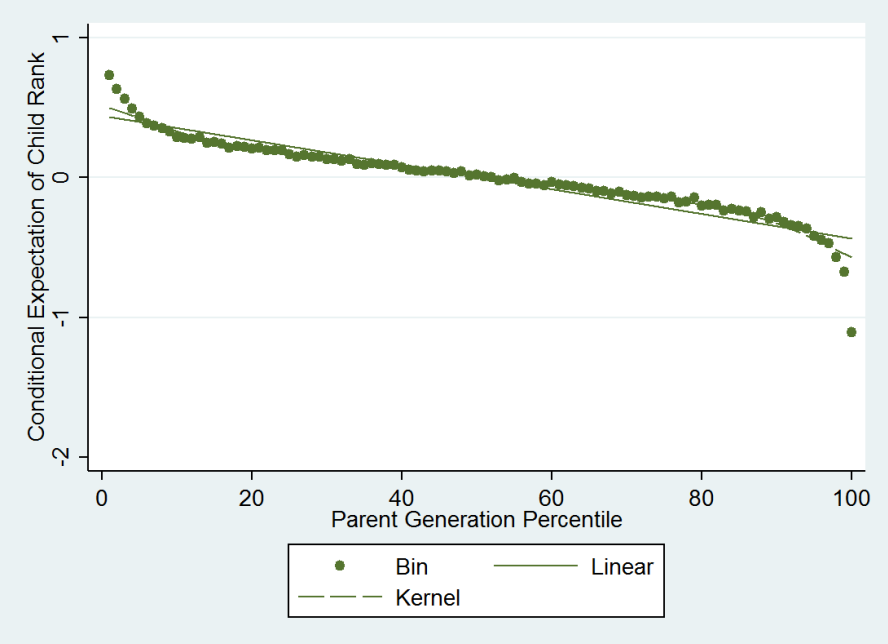


Figure A7. Income Share Mobility Curve, Sweden

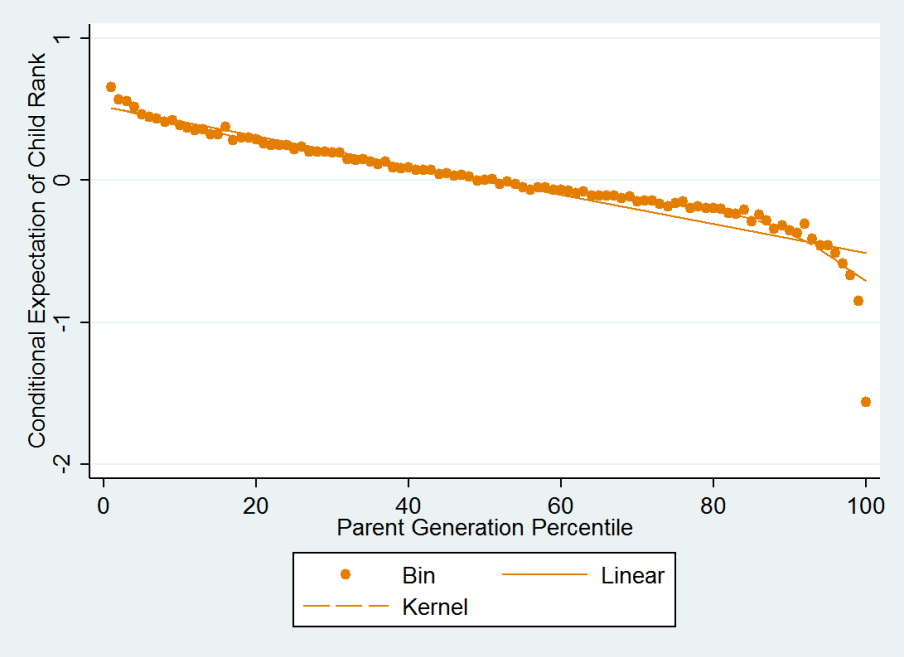


Figure A8. Income Share Mobility Curve, United States

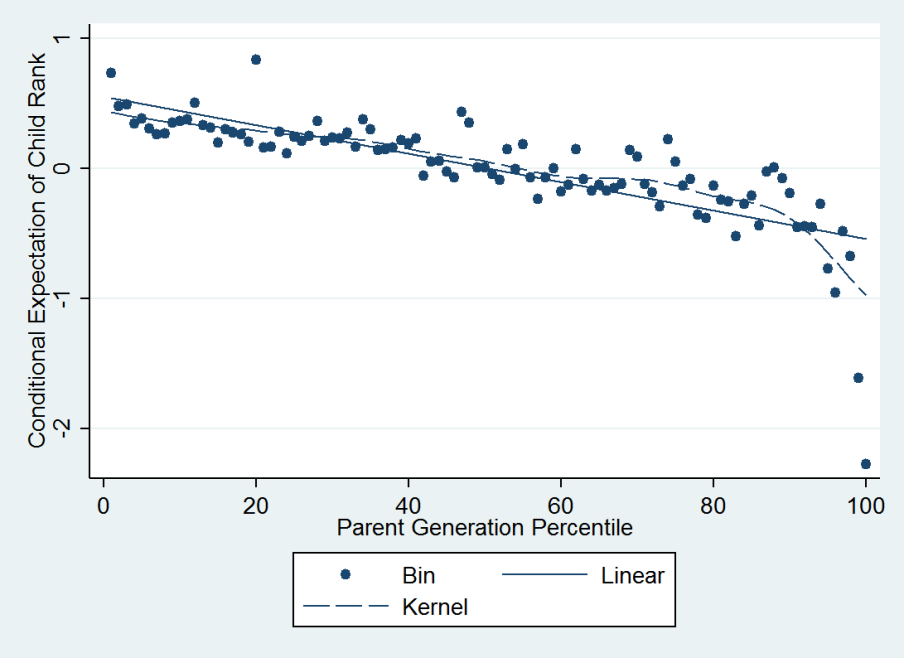


Figure A9. Norway Income Distributions

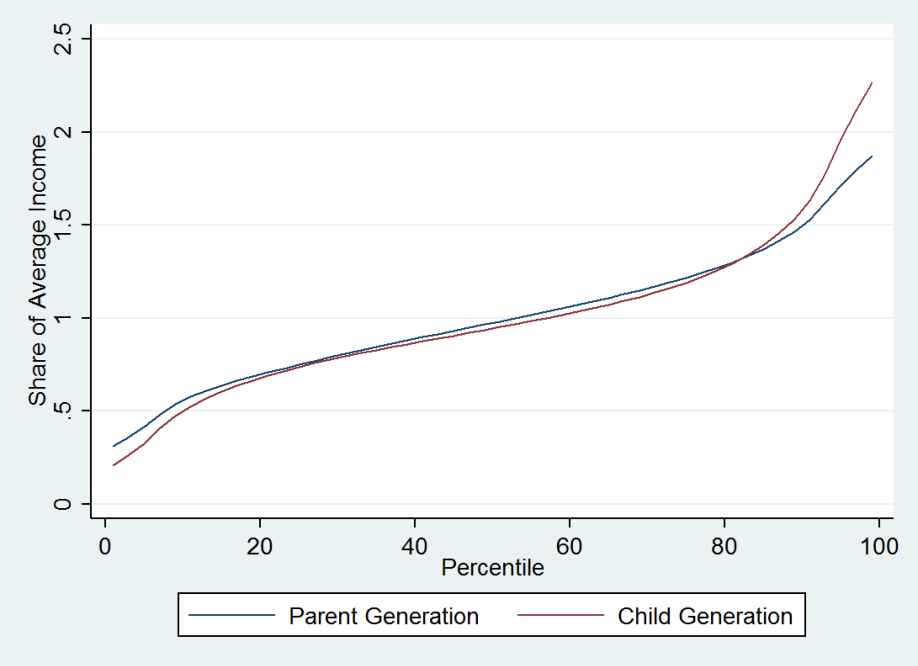


Figure A10. Sweden Income Distributions

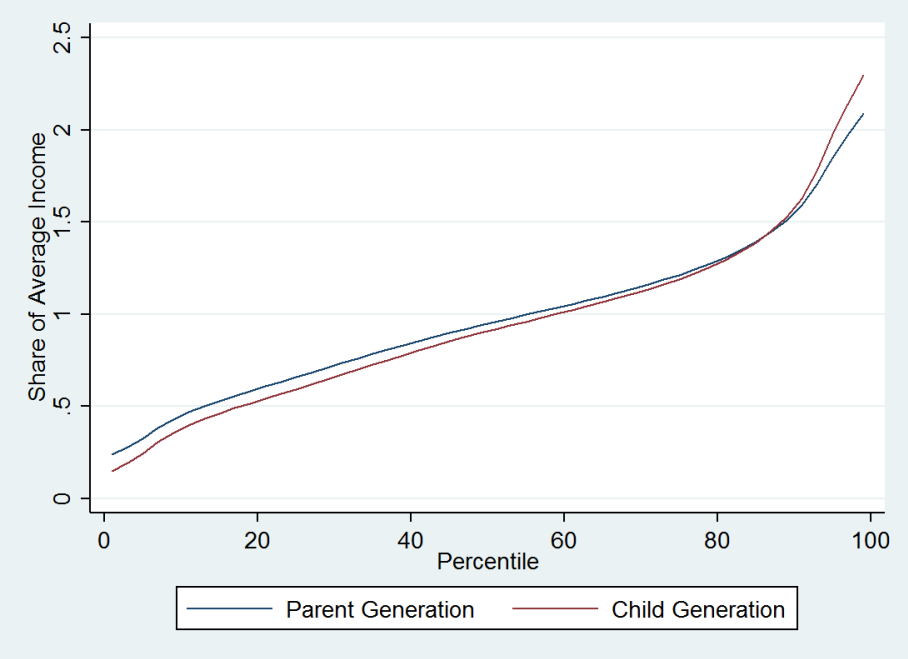


Figure A11. USA Income Distributions