Intergenerational earnings mobility in the Nordic countries, the United Kingdom and the United States: An overview[1]

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Abstract

The present paper examines the extent of intergenerational earnings mobility in Denmark, Finland, Norway, the United Kingdom and the United States. We examine earnings mobility among pairs of fathers and sons as well as fathers and daughters using both mobility matrices and regression and correlation coefficients. Our results suggest that all countries exhibit substantial earnings persistence across generations, especially in the tails of the distribution. The US seems to have less mobility than the other countries we examine. Daughters tend to be more mobile than sons, and, with the exception of men in the US, there is greater persistence of rich rather than poor earnings. The likelihood that poor fathers' sons end up rich, and that rich fathers' sons end being poor, is also greater in the Nordic countries and the UK than in the US.

1 Introduction

The extent to which socio-economic outcomes depend on family background is an issue of great interest to social scientists and policy-makes. Sociological studies of class and occupational have for decades provided insights into cross-country differences and similarities in intergenerational mobility. Economic studies have increased rapidly in the past 10-15 years, in large part due to the maturing of panel studies that allow members of two generations to be observed at economically active ages and to the availability of administrative data that allow for the linking of parents and children.

Corak (2004) provides papers from several countries using various approaches to the study of intergenerational mobility. There are papers that compare intergenerational mobility across pairs of countries (e.g. Couch & Dunn 1997, Björklund & Jäntti 1997), or surveys that include results from several countries (Solon 1999, 2002). The evidence tends to suggest that, while the ordering of other countries varies, the US and the UK tend to have high rates of persistence. However, there a few efforts to date that attempt to compare mobility across several countries using similar methods and data definitions. Studies with data for only a single country can be quite unreliable guides to how countries line up when studied using common definitions.

While there are exceptions to the strongly parametric approach, such as Corak & Heisz (1999), Eide & Showalter (1999) or Checchi et al. (1999), the majority of papers tend to concentrate on either the correlation of (the natural logarithm of) parent-child permanent income or the elasticity of child income with respect to that of his parent. The correlation or elasticity measures persistence rather than mobility and, moreover, may conceal interesting differences in mobility patterns across the whole range of the bivariate distribution.

Cross-country differences in intergenerational income mobility are of interest, because they may be able to shed light on the mechanisms of such mobility. For instance, Solon (2004) develops a model in which the intergenerational income elasticity depends on heritability, the progressivity of public schooling investments, the marginal product of human capital investments and the return to human capital. Since there is little within-country variation in, say, the progressivity of schooling investments, such models can most effectively be assessed in light of cross-country evidence.[1]

The present paper examines the extent of intergenerational earnings mobility in Denmark, Fin-

[1]See the introduction to the volume Corak (2004). Other recent papers include Mazumdar (2003) and Chadwick & Solon (2002) for fresh US evidence (the former includes several data sources and the latter studies daughters) and Björklund & Chadwick (2003) for Swedish evidence.

land, Norway, the United Kingdom and the United States. The purpose of this paper is to take a fresh look at intergenerational earnings mobility across the countries. We use micro data in order to be able to use the same specifications across all included countries, such as common age limits, similar exclusion restrictions and so on. In order to get a broad picture of the patterns across countries, we study the mobility matrices of the father-son relative earnings distribution, that is, we examine the mobility matrix that results from classifying both fathers and sons by their quantile groups (and treating zero earnings as a separate case).

We are interested in the socio-economic mobility of all persons. However, given the large differences in women's labour markets in the 1970s (the point in time in which our parental generation was in its prime economic age), we examine the mobility of father-son and father-daughter pairs (rather look also at mothers). Comparing the intergenerational mobility of women across the countries we include involves numerous complications, such as deciding on how to deal with the inevitably varying degree to which mothers stay outside of the labour force. A study of the intergenerational *family income* mobility that would include women would have to solve fewer of these types of problems. However, such a study is difficult to do with the data we have. While we have settled for studying both sons' and daughters' mobility with respect to their fathers, we have in no way attempted to standardise for differences in labour market conditions faced by young women in the included countries.

The paper is organised as follows. In Section 2, we describe the datasets from which we extract the father-son pairs to be analysed. In this version of the paper we use data for Denmark, Finland, Norway, the UK and the US. Data for Sweden will be added later. Section 3 presents the methods and in Section 4 we show some descriptive statistics. In Section 5 we present our main results, discussing the estimated mobility matrices, the mobility ordering these define according to the mobility indices they generate and the regression and correlation coefficients that we estimate using the same data. In Section 6 we offer a few concluding remarks.

2 Data

The guiding principle in deciding on how to define our data samples is to strive for maximal similarity across the countries. We need to start from the least common denominator, which turns out to

be provided by the UK data, the National Child Development Survey. In order to proceed, we need earnings information of parents and offspring in their prime age. This precludes the possibility that parents and offspring are observed at the same point in time. Instead, the data for the two generations need to be linked by some procedure. In this version of the paper we use data for Denmark, Finland, Norway, the UK and the US. Data for Sweden will be added later.

The UK National Child Development Study (NCDS) sampled all offspring born during a week in 1958. The sample persons and their families have been surveyed several times since they were first drawn. From our point of view, the interesting information stems from 1974, at which point we have *parental weekly pay*, and from 1991 and 1999, at which point we have child weekly *earnings*. The two latter waves also dictate that our "children" are 33 and 41 years old during the two waves for which we have data.

In order to have meaningful analyses we must depart from these specifications for other countries. First, since the only country taht is also based on but a single cohort in this study is Norway, we expand in most cases the age ranges of the offspring somewhat to get a decent sample size. Second, no data source has the exact same earnings variables as the NCDS and, in fact, all the others have an annual earnings or parental income (NLS) variable instead. Third, for the US and UK data, earnings variables are obtained through interviews or surveys, while for the Nordic countries, the earnings variables (and all other variables) stem from different administrative registers, including those kept by the tax authorities. Fourth, the data have been drawn differently. In some countries, a sample (with possibly varying sampling probabilities) was drawn early on and the offspring were first observed as children and followed into adulthood (e.g., the Finnish data). In others, the data consists of a sample of offspring who were followed into adulthood and of whose parents we also have information. In yet others (Sweden), the data is based on offspring observed as adults, whose childhood families (including siblings and parents) we can reconstruct based on census and other information.

The data are described in detail in the appendix. We have for the US used both the Panel Study of Income Dynamics (PSID) and the National Longitudinal Survey (NLS). For the PSID, we are unable to get a decently sized sample, so we only report in this paper results using the NLS.

3 Methods

While we have striven to make data as comparable as possible, differences remain. In order to construct mobility tables, we need to decide on age limits for both generations, standardise for differences in age structures, estimate the relevant earnings cut-offs and finally estimate the mobility tables.

We include only father-child pairs where the father is between 35 and 64 years old in 1974 and where for whatever definition we use for families, that relationship applies to the father and son in 1974.[2] The father is thus in the UK data born between 1910 and 1939. [3] We include twin pairs, but exclude siblings who were born in the same year (but are not twins). This omission is a little strange, perhaps, and affects but a small number of cases.

For fathers, we inflate earnings to 2000, then regress the natural log of earnings in the single outcome year on a quartic polynomial in age and record the residual from that regression. We then predict what their earnings had been had they been 40 years old, add to this their estimated residual and take the anti-log. (which is then their "predicted permanent earnings at age 40").[4] We assign, again, zero earnings to those with zero earnings. We estimate earnings quintiles for this age-corrected distribution of father's earnings and classify each father as belonging to one of five earnings quintile groups.

It should be noted that the same father may appear several times (in the UK, where the data include a single cohort, only fathers of twins will appear twice). For instance, if a father has two sons and two daughters in the appropriate age range, that father occurs twice in the father-son sample and twice in the father-daughter sample when the mobility tables and regression and correlation coefficients are estimated. However, we include each father only once in constructing the fathers' earnings distribution and in the age correction. Thus, the mobility table is constructed based on the actual distributions of father's earnings or earnings. One implication of this is that the marginal distribution of fathers is not exactly (.20, .20, .20, .20, .20) as it would be if there was only one father

[2]Thus, e.g., if we use social families, the father is observed as living with his son in 1974. Further, there is some variation as to the calendar year in which the father-son relationship is established across countries. There is also variation across countries in which two years are chosen for child outcomes, the prototype being the UK with 1991 and 1999. The two years are, however, never close than five years apart. and the are all in the 1990s.

[3]The lower age limit is to avoid teen dads (and may be unnecessary) but the upper age limit has to do with labour market age in 1974.

[4]We predict at age 40 to make offspring approximately and on average the same age as their offspring. Most of the sample of fathers is older than this, though. Making them some age seems useful for the same purpose as with the offspring, it makes the examination of the limits more cogent.

per child.

For offspring, we inflate the earnings to the year 2000, then regress the log of annual earnings on a year indicator and save the random effect for each individual. We add the estimated time effect in the later year (1999 for the UK) to the average of the OLS residuals across the years (call this "predicted permanent earnings at age 40") and take the anti-log. An offspring with zero earnings in both years is assigned zero earnings and is included in the main analyses, but not in the sensitivity analyses excluding zeros. [5] After adding in zeros (or not, when we exclude them) we estimate the quintiles of the newly defined age-corrected distribution of earnings and classify cases as belonging to one of five earnings quintile groups.

In order to contrast our findings with the previous literature, we have estimated regression and correlation coefficients for the parent-child pairs. Much has been made of the fact that the magnitude of such least-squares coefficients appear very sensitive to exact sample definitions and, in particular, the treatment of zeros (see Couch & Lillard 1998). While we have chosen not to arbitrarily assign a number where one is not defined (i.e., to the natural logarithm of 0, which some choose to define to be 1) we estimate the parameters using both natural logarithms and levels.

Finally, we compute summary measures of mobility based on the estimated quintile group mobility matrices. [6] The choice of measures is a non-trivial task, but we rely on fairly standard indices.

Formally, let the $(k \times k)$ mobility matrix P have elements p_{ij} for which $\sum_j p_{ij} \equiv 1$. Ideally, a mobility index $M(P) \in [0,1]$ should satisfy $0 \equiv M(I_k) < M(P) < M(PM) < 1$, where PM is the "perfect mobility" matrix. Not all measures suggested in the literature satisfy the bounds of 0 and 1.

The "perfect mobility" matrix *could* be taken to be $M(p_{ij} \equiv 1/k \forall i,j)$, i.e., the mobility matrix with independence of origin and destination (each destination is equally likely). This is the usual standard of comparison. Alternatively, it could be one matrix in the class for which $p_{ii} \equiv 0$ (in which nobody remains in their class of origin). This class would have maximal mobility if for every row (save the first and the last), the probabilities in the cells that are in the first and last columns sum to one and were zero elsewhere (in the first and last columns the anti-diagonal elements would both be one; see the matrix C in the example in Table 1 below).

[5] We add the estimated year effect so that the earnings quintiles have an immediate interpretation in you local currency. Technically, this only shifts the limits, but it makes for a more cogent discussion of the limits them selves. We convert all numbers to international dollars (although we still use the within-country-within-generation quartiles to delimit the classes.

[6] See Checchi et al. (1999), Fields & Ok (1999).

Checchi et al. (1999), Bartholomew (1982) and, recently, Fields & Ok (1999) review mobility indices based on mobility / transition matrices. The trace index is the sum of the main diagonal elements of a mobility matrix, normalised to observe the bounds of 0 and 1:

$$M_T = \frac{k - tr(P)}{k-1}. \tag{1}$$

The determinant index again uses the appropriately standardised absolute value of the determinant of the mobility matrix:

$$M_D = 1 - |P|^{\frac{1}{k-1}}. \tag{2}$$

For $k > 2$, however, M_D may generate counterintuitive results, as we shall see. We examine three other indices. One index is based on the second largest eigen value λ_2 of the mobility matrix,

$$M_L = 1 - |\lambda_2(P)| \tag{3}$$

which takes the value of one if the mobility matrix assigns equal probability to all transitions (or, more generally, if each row is equal to the limiting distribution [which in our case is 0.2 in each cell]). The index M_F is based on a direct comparison of the limiting distribution and the mobility matrix, defined to be

$$M_F = 1 - \frac{1}{k^2} \sum_i \sum_j \left| \frac{p_{ij}}{k^{-1}} - 1 \right|. \tag{4}$$

Finally, one index suggested by Bartholomew (1982) measures the expected number of classes to be moved across:

$$M_B = \sum_i \sum_j p_{ij} p_i |i - j|. \tag{5}$$

We show in Table 1 5 (3×3) matrices that we use to illustrate the indices. Matrices A and B are similar in that the sons of fathers in classes f1-f3 all have a 0.5 probability of remaining in that class. In A, the remaining one half in each class has an equal chance of 0.25 of moving into the two other classes, but in B, sons of fathers in f1 and f3 have a probability of zero of moving to the class farthest away (o3 and o1, respectively). We would argue, based on intuition, that A exhibits more mobility than B. C is the identity matrix, which, taken as a mobility matrix is the extreme of no mobility. D again assigns the sons of fathers of a given class an equal probability of ending up

in any of the three classes. Most researchers think of this as representing maximal mobility in that son's class is independent of father's. Matrix E, however, shows a case where sons move farthest away from fathers' class and arguably represents greater mobility than D (independence).

To decide on either D or E as the matrix of perfect mobility is beyond the scope of this paper. We illustrate using these five example matrices what values the indices take in the lowest panel of Table 1. The last three columns mainly serve to show whether the suggested normalisation is in effect for the different measures, while our substantive interest focusses in the comparison of A and B.

Table 1 Example mobility matrices

A

	o1	o2	o3
f1	0.50	0.25	0.25
f2	0.25	0.50	0.25
f3	0.25	0.25	0.50

B

	o1	o2	o3
f1	0.50	0.5	0.00
f2	0.25	0.5	0.25
f3	0.00	0.5	0.50

C

	o1	o2	o3
f1	1	0	0
f2	0	1	0
f3	0	0	1

D

	o1	o2	o3
f1	0.33	0.33	0.33
f2	0.33	0.33	0.33
f3	0.33	0.33	0.33

E

	o1	o2	o3
f1	0.0	0	1.0
f2	0.5	0	0.5
f3	1.0	0	0.0

Summary measures

	A	B	C	D	E
M_T	0.75	0.75	0.00	1.00	1.50
M_L	0.75	0.50	0.00	1.00	0.00
M_F	0.67	0.44	−0.33	1.00	−0.11
M_B	0.67	0.50	0.00	0.89	1.67

Note: For all the mobility indices greater values suggest greater mobility. See text and equations 1 to 5 for definitions and interpretation.

As Bartholomew (1982, p 19) warns, the determinant index M_D exhibits unsatisfactory and counterintuitive orderings. D, E and B have the same value (unity) and B is ranked as having more mobility than A. The trace index M_T, which sums the main diagonal elements, assigns A and B the same level of mobility, whereas the values for M_L, M_F and M_B all suggest that A has more mobility than B.[7] Our little demonstration suggests that we should look at the values of the last three indices M_L,

[7]For M_B we must also specify the marginal distribution, which in our example, as in our application below, is the

M_F and M_B in attempting to gauge the mobility ordering of countries. We drop only the determinant index in our empirical tables, however, as the trace index has a substantive interpretation in terms of the aggregated persistence of earnings group in the mobility table.

4 Descriptive statistics

In this section, we discuss descriptive statistics for our samples. Tables 2 and 3 show selected descriptive statistics for fathers and children. Starting with fathers (Table 2), we see that our Danish fathers tend to be older than the rest, with the others being on average in the range of 44 and 47 when observed with earnings. Denmark also has by far the largest number of zero earners (which may suggest data-quality problems and has lead us to examine mainly non-zero earners' mobility in the remainder of the paper). The estimated 20th, 40th, 60th and 80th earnings percentiles (i.e., quintiles 1-4) suggest that the US was a lot richer than the other countries in the early to mid 1970s.

Table 2 Descriptive statistics – fathers

	Denmark	Finland	Norway	UK	USNLS
Age	52	45	44	46	47
Zero earnings	27	5.2	3.1	0	0.4
Percentile					
20	0	6865	19115	13961	36975
40	18836	12550	23718	16393	52822
60	28196	16626	27670	18871	66028
80	35985	23384	34138	22259	92439

Note: The earnings have been adjusted to 2000 prices and converted to 2000 international US dollars using OECD's PPP exchange rate for that year. The earnings have been adjusted for age by running a regression against age, taken the predicted level at age 40 and added in the residual. For zero earnings fathers, a value of zero was used and these are included in the data. Fathers are between 35-64 years of age and earnings are measured in Denmark in 197X, Finland in 1971, Norway in 1974, UK in 1974 and the US in 1978.

Table 3 shows selected descriptives for the offspring. We focus here on the proportion with zero earnings in both the years they are observed in and the 20th, 40th, 60th and 80th percentiles of their earnings measured as the average across the two years. Denmark has in the offspring generation also many more zero earners than for the other countries. The differences in the real earnings across the

distribution with equal probability in all classes.

distribution are less than was the case in the fathers' generation, although the US is still substantially higher than the rest in the top end of the distribution.

Table 3 Descriptive statistics – offspring

	Denmark	Finland	Norway	UK	USNLS
A. Sons					
Zeroes	10.5	2.67	2.01	0	2.54
Percentile					
20	13883	11456	21700	17084	19639
40	28453	19386	28332	21465	31647
60	34528	24899	33596	26483	42044
80	43766	31865	42655	33297	61192
B. Daughters					
	Denmark	Finland	Norway	UK	USNLS
Zeroes	8.65	4.2	4.02	0	7.66
Percentile					
20	11476	6744	9403	6424	4301
40	21957	12960	15682	9615	14124
60	26614	17697	20903	13454	23728
80	32278	22054	26480	18754	37717

Note: The sons and daughters are born in Denmark: 195X-195Y, Finland: 1953-55, Norway: 1958, UK: 1958 and the US: 1957-1964 and their earnings are measured in Denmark: 199X-199Y, Finland: 1990 and 1995, Norway: 1992 and 1999, UK: 1991 and 1999, US: 1995 and 1999. The youngest offspring are 30 and oldest 42 in the years earnings are measured.

Table 4 Inequality of earnings – fathers. Single cross-section of earnings ca. 1974

	Denmark	Finland	Norway	UK	USNLS
p90/p10	5.504	7.705	2.669	2.293	4.100
p90/p50	1.680	2.404	1.622	1.597	1.783
p10/p50	0.305	0.312	0.608	0.696	0.435
Gini	0.291	0.369	0.210	0.187	0.299

We turn next to the estimated inequality indices for fathers and their offspring (Tables 4 and 5; the numbers shown include only non-zero observations). For fathers, the estimate percentile ratios p90/p10, perhaps quite surprisingly, that Finland had in the early 1970s the highest level of inequality of these nations, followed by the US, Denmark and Norway, with the UK having the lowest. While the ordering for the p90/p50, p10/p50 and the Gini coefficients shuffles countries around to some extent, the UK is always the country with least inequality, followed by Norway. The US is always in 2nd or third place and Finland in 1st or 2nd.

Table 5 Inequality of earnings– offspring. Over-time average of two years, early and mid-late 1990s

A. Sons

	Denmark	Finland	Norway	UK	USNLS
p90/p10	4.276	4.993	3.532	2.844	5.222
p90/p50	1.705	1.742	1.703	1.705	2.238
p10/p50	0.399	0.349	0.482	0.599	0.429
Gini	0.279	0.309	0.268	0.263	0.383

B. Daughters

	Denmark	Finland	Norway	UK	USNLS
p90/p10	3.958	6.074	4.830	5.275	11.486
p90/p50	1.488	1.653	1.644	2.085	2.416
p10/p50	0.376	0.272	0.340	0.395	0.210
Gini	0.253	0.317	0.296	0.345	0.437

Among the offspring, the inequality orderings look more like what we would expect from modern studies of income and earnings differences. For men, the US has most inequality as measured by the p90/p10, p90/p50 rations and the Gini coefficient. Denmark, Finland and Norway tend to be close together and the UK (surprisingly) has least degree of inequality. The exception to US' position is the p10/p50 ratio, where the US is ranked 3rd. For women, the US always exhibits the most inequality whereas Denmark tends to exhibit the least. The rank of other countries varies by measure.

5 Intergenerational earnings mobility

In this section, we discuss our main results. We start by showing estimated intergenerational earnings elasticities and correlations, after which we proceed to the analysis of our estimated mobility tables. We focus on the results that exclude those father-offspring pairs where either the father had zero earnings or the offspring had zero earnings in both the years observed. The mobility tables and the mobility indices based on those for the samples including zero earners (in both generations) are shown in the appendix. For the intergenerational tables we focus on mobility matrices, i.e., we look at how the sons are distributed *conditional* on father's status.[8]

Table 6 Intergenerational mobility – elasticity and correlation coefficient for parent and offspring earnings

A. Sons					
	Denmark	Finland	Norway	UK	USNLS
Non-zero observations					
Elasticity β	0.069	0.140	0.287	0.297	0.503
Correlation $\beta\sigma_P/\sigma_O$	0.088	0.135	0.164	0.222	0.339
Shaved sample					
Elasticity β	0.062	0.152	0.243	0.344	0.429
Correlation $\beta\sigma_P/\sigma_O$	0.092	0.152	0.151	0.260	0.320
B. Daughters					
	Denmark	Finland	Norway	UK	USNLS
Non-zero observations					
Elasticity β	0.034	0.106	0.200	0.310	0.288
Correlation $\beta\sigma_P/\sigma_O$	0.047	0.104	0.094	0.154	0.162
Shaved sample					
Elasticity β	0.040	0.097	0.164	0.285	0.232
Correlation $\beta\sigma_P/\sigma_O$	0.055	0.090	0.078	0.135	0.120

Note: See sections 2 and 3 for definitions of the data. These results include only non-zero observations of both offspring and father, Regressions are in log form and the shaved sample exclude pairs where either or both father and offspring have earnings below the 1st or above the 99th percentile.

It is by now well known that when estimating the elasticity of offspring permanent earnings with respect to that of the parent using a noisy measure of parental earnings the resulting elasticities are downward biased. The correlation coefficient, by extension, is biased by measurement errors in both offspring and parent earnings. Since we only have a single year of parental earnings, we know for

[8]The unconditional cross tabulations are available from the authors on request. We will in a future version estimate the standard errors of our estimates. The US data, based as on surveys with varying sampling probabilities, supply sampling weights that should be used to generate unbiased estimates. We use those but rescale the weights to sum to sample rather than population size. Thus, for these data sets the raw counts in the appendix can take non-integer values even if they sum (approximately) to the actual number of underlying cases.

certain that our regression coefficients are downward-biased estimates of the population parameters.[9]

We also need to bear in mind that, while we know for sure that our regression and correlation coefficients are downward-biased, we can not with any confidence (at least not in this version of the paper) estimate the extent to which they miss their target. The bias may well and indeed is very likely to vary from country to country. Thus, any orderings that arise from our current estimates need to be treated with caution.

We show in Table 6 the estimated log earnings elasticities and correlations for those father-offspring pairs with positive earnings in at least one year. The first panel, labelled "Non-zero observations", is for the full sample of positive earners whereas the second, labelled "Shaved sample", includes only those pairs where both the father and the offspring had age-adjusted earnings within the inner 98 percent of the sample.[10] Focussing first men in the top two lines in Table 6, which is for father-son pairs the "ideal" case, the ordering that arises places Denmark as the country with the lowest earnings persistence, followed by Finland, Norway, the UK and the US. The elasticity and the correlation generate the same ordering for this full sample. For the shaved sample, the ordering is similar, except that when using the elasticity, Finland is ranked above Norway (i.e., as having less earnings persistence), but this ranking is reversed when we turn to the correlation.

For women, the picture is more complex. Denmark has in the full non-zero earners' sample the lowest estimated elasticity and correlations. Finland has lower persistence than Norway as measured by the elasticity, while Finland is ranked after Norway in terms of the correlations. Similarly, the US has lower persistence than the UK as measured by the correlation, but higher as measured by the correlation coefficient. The "shaved" sample displays the same ordering of countries (with the rank reversals occurring between samples), but the magnitudes of the differences between countries are less pronounced.

The mobility matrices (excluding zero earners) for father-son pairs are shown in Table 10. We focus here on two aspects of the estimated transition probabilities: the likelihood of being in the same earnings quintile group as one's father (see Figures 1 and 2) and the likelihood of ending up in the earnings quintile group furthest away (see Figure 3).

[9] This is not necessarily a reason for preferring mobility matrices, however, as measurement errors in earnings lead to both biased estimates of the percentiles (depending on the exact type of measurement error) and classification error. It is possible that, as in the regression coefficient case, this leads us to overestimate mobility.

[10] That is, the shaved sample deletes father-offspring pairs where either the father or the offspring had earnings below the 1st or above the 99th percentile in the sample.

The likelihood of remaining in the same earnings quintile group as one's father, i.e., the probabilities on the main diagonal in the mobility matrix, are shown in Figure 1 grouped by country and in Figure 2 grouped by quintile. We show the likelihood for sons and for daughters next to each other.

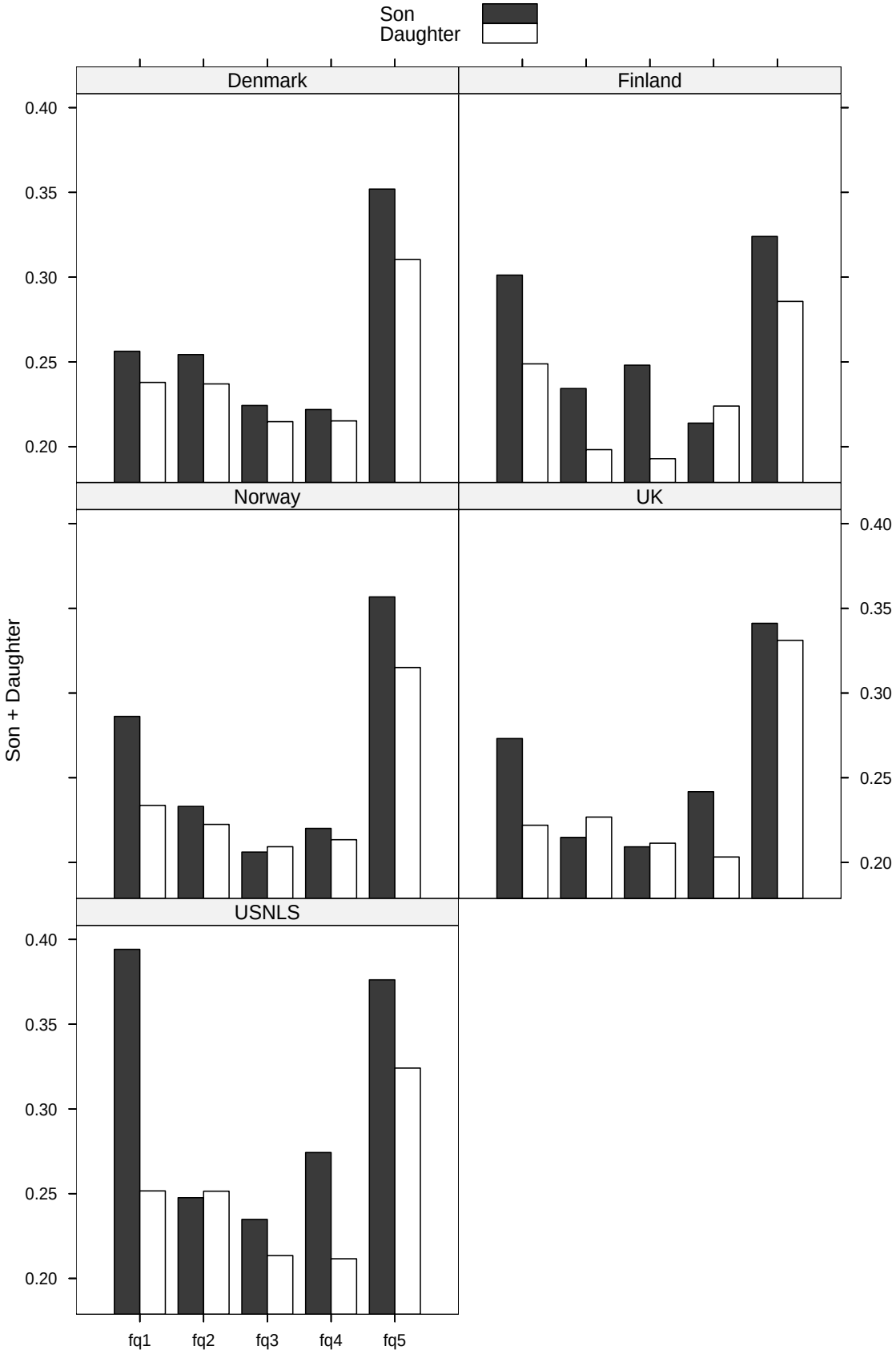
All countries exhibit more persistence than would be expected if offspring earnings group were independent of father's group (see Figure 1). The estimated persistences are highest in the lowest and highest quintile groups (which is unsurprising because there is only one direction out of each of these). In all countries except the US, the likelihood that the son of a poor father (one in the lowest quintile group) ends up poor is lower than the likelihood that the son of a rich father (one in the highest group) ends up being rich. That the persistence of poverty is less than the persistence of riches is reassuring. For women, there tends to be less earnings persistence and the persistence of poverty is smaller than the persistence of riches in all cases, including the US.

The difference in levels of persistence tends to be larger for men than for women. In the lowest quintile, for instance, US sons born to poor fathers have a probability of 0.394 of remaining poor, which in Denmark, this likelihood is 0.256. The US has the greatest persistence of riches also, 0.376, compared to the lowest level of 0.324 in Finland. For women, the persistence of poverty exceeds 0.25 for no country, is very close to the limiting probability of 0.20 for the 3rd and 4th quintile groups and is around 0.30 for the persistence of riches. For women, it may be that the similarities of countries is what is most striking. In all, daughters seem more mobile than sons, but this may in part be accounted for by the fact that these women are, to a large extent, in child bearing and rearing age.

We show in Figure 3 the probability of moving to the quintile group that is furthest away from one' father. I.e., we show the likelihood that the son of a poor father is rich and the son of a rich father is poor ("rags to riches" and "riches to rags"). The likelihood of these extreme movements is in general a lot higher for men than for women, is the likelihood of "riches to rags" exceeds that of "rags to riches" (except for UK sons) and is lowest in the US. While the comparatively small sample sizes suggest these extreme movements should be viewed with some caution, it is noteworthy that the likelihood of "rags" to riches in the US is around 0.089 compared to substantially greater than 10 percent in the other countries.

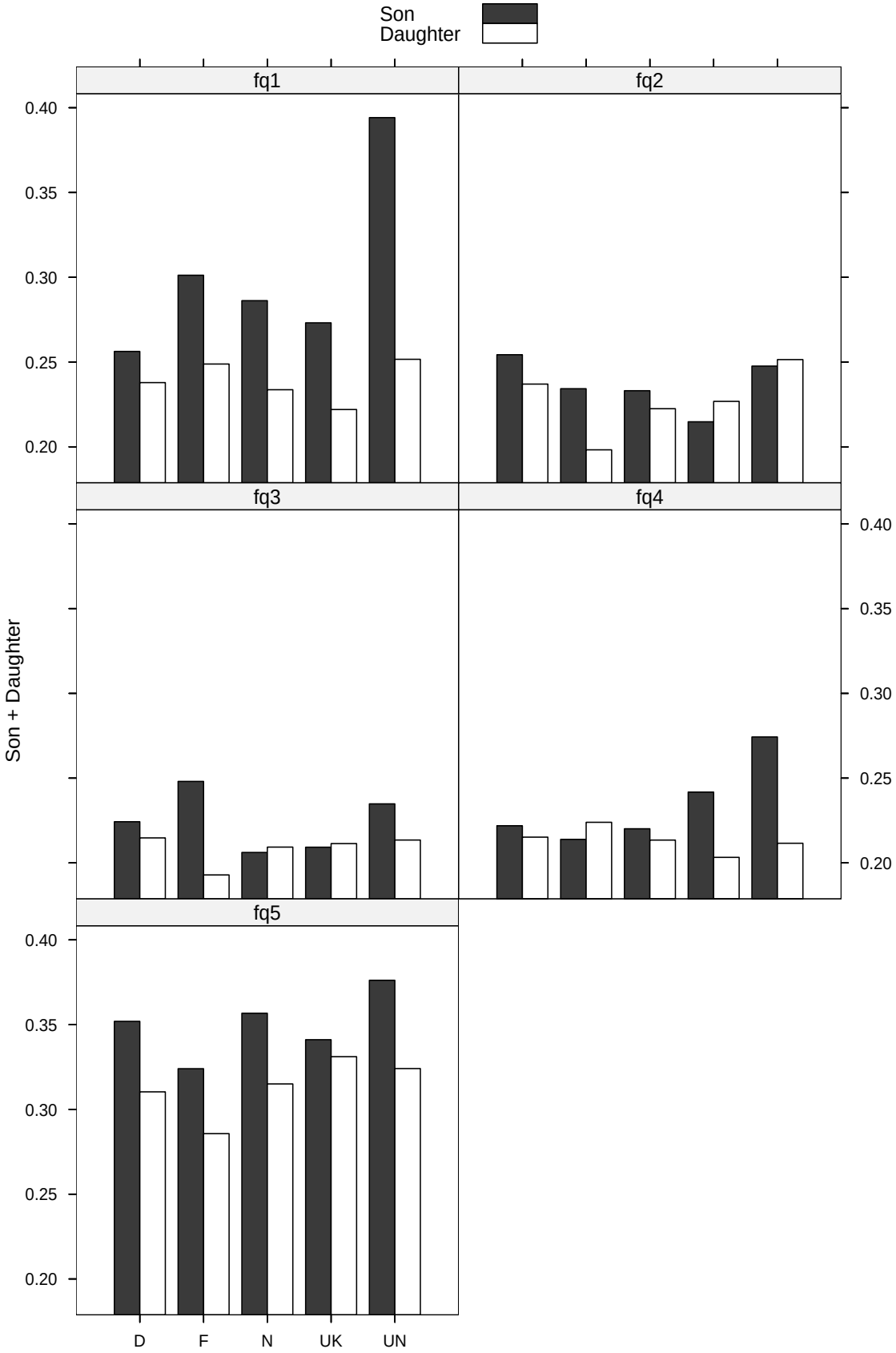
From a methodological perspective it is noteworthy feature that, while we have not formally tested for (log-)normality, visual inspection suggests it is not the case in that the mobility matrices do not appears to be even close to symmetric.

Figure 1 Estimated probabilities of staying in father's earnings quintile group – by country



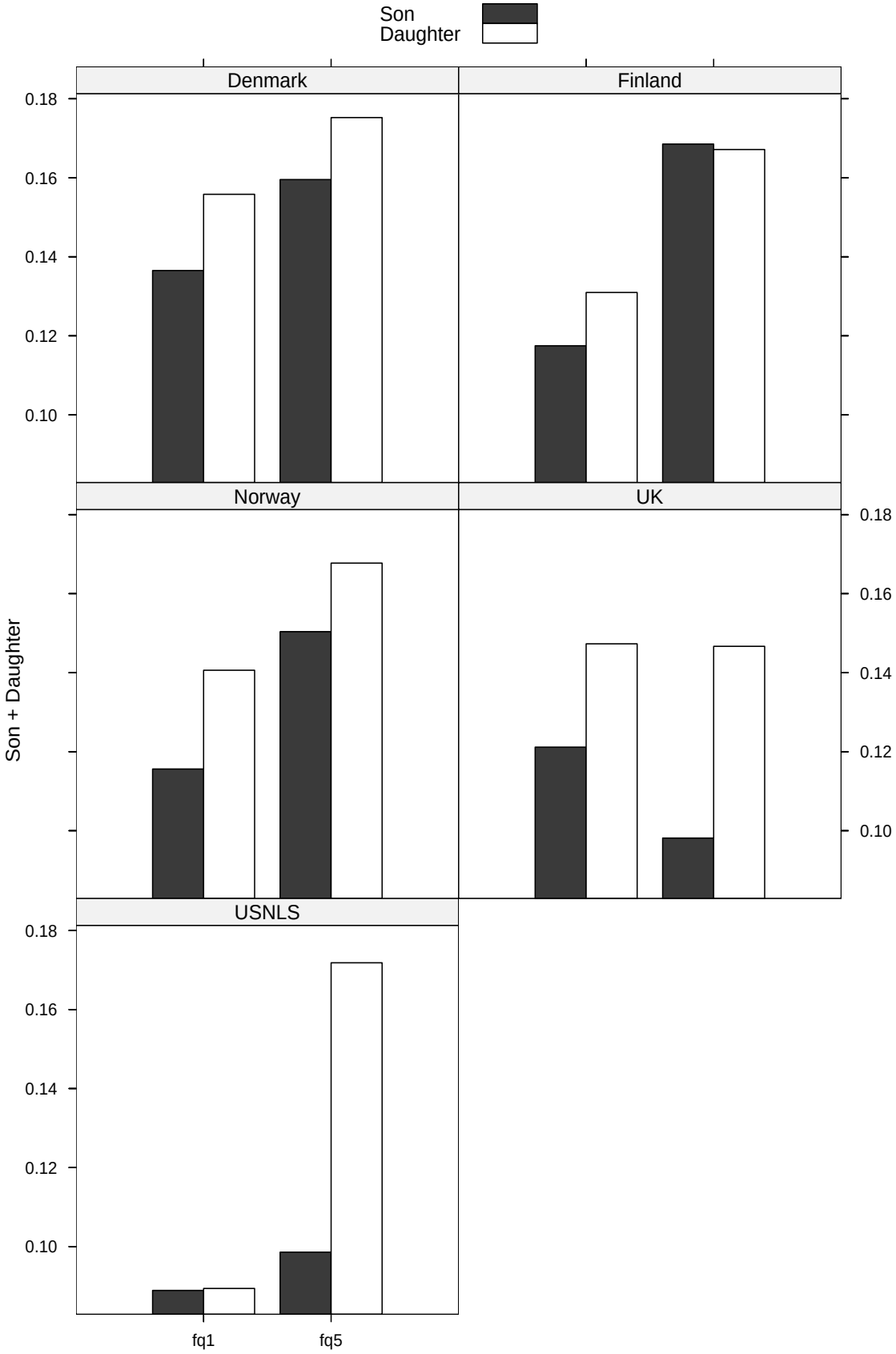
Note: These numbers results only those father-offspring pairs that have non-zero earnings.
Source: Tables 8 and 9.

Figure 2 Estimated probabilities of staying in father's earnings quintile group – by quintile group



Note: These numbers results only those father-offspring pairs that have non-zero earnings.
Source: Tables 8 and 9.

Figure 3 Likelihood of ending up in the farthest earnings quintile group from father



Note: These numbers results only those father-offspring pairs that have non-zero earnings.
Source: Tables 8 and 9.

Table 7 Summary mobility table indices – based on earnings quintile group transition matrices excluding zero earners

A. Sons

	Denmark	Finland	Norway	UK	USNLS
M_T	0.923	0.920	0.924	0.930	0.868
M_L	0.776	0.809	0.778	0.761	0.653
M_F	0.829	0.821	0.829	0.816	0.717
M_B	1.372	1.365	1.363	1.349	1.201

B. Daughters

	Denmark	Finland	Norway	UK	USNLS
M_T	0.946	0.963	0.952	0.951	0.937
M_L	0.835	0.868	0.840	0.828	0.788
M_F	0.869	0.881	0.886	0.873	0.803
M_B	1.433	1.455	1.447	1.442	1.372

Note: For all the mobility indices greater values suggest greater mobility. See equations 1 to 5 and Table 1 for definitions and interpretation.

The mobility indices shown in Section 3 are shown in Table 12 (except the determinant index M_D). These produce quite different rankings, except that the US always has the lowest level of mobility. Also for men, the UK tends to rank as having the next lowest level of mobility except when we look at the trace index. Thus, the UK's position changes once we look not only on the persistence of earnings group (the sum of the main diagonal elements) but take the full transition matrix into account.

for women the numbers are quite high and the estimated probabilities that underlie the numbers are quite close to each other. Moreover, to repeat, examination of the mobility of women is complicated by their (conjectured, at this point) greater rate of labour force entry and exit. Here, too, the US ends up always exhibiting the least mobility. Norway and Finland are always ranked first or second while Denmark and the UK have the 3rd or 4th position.

In conclusion, a fairly rich picture emerges from examination of the transition probabilities combined with the elasticities and correlations. While our data suffer (in this version) from the well-known short-coming that having only a single year of offspring data tends to bias, to a degree that may well vary between countries, the estimated persistence downward and very likely affects the mobility tables was well, our regression-based results suggest the same ordering as other studies where this bias has been reduced.[11] The mobility matrices enrich our picture of the orderings generated by the elasticities and correlations, in particular in allowing us to examine persistence and

[11] See Solon (2002, 1999) and Björklund & Jäntti (2000) for reviews.

movements in various parts of the distribution. While the picture that we can paint using these data is a complicated one, it does suggest that the prevalence of rags-to-riches stories across countries may be very different in fact from what it is in the popular debate.

6 Concluding comments

There is by now a substantial literature on the extent of intergenerational earnings mobility from different countries. For the most part, this literature examines the extent of earnings persistence across generation. We know far less about the nature of the deviations from that persistence. Also, very few studies are explicitly comparative. This paper has attempted to shed light on these two latter aspect of intergenerational mobility. Allowing for the somewhat more general mobility patterns that are possible in a quintile group mobility matrix, what do the patterns look like across countries when we try to impose as much similarity across countries as is possible?

We found both similarities and dissimilarities. First, while an unsurprising finding, our estimates certainly suggest that earnings mobility is far from a log-normal process. Second, all data sets exhibit some persistence, which is most pronounced in the tails of the distributions. Third, for men the persistence of riches is greater than that of poverty, with the exception of the US. Fourth, also for men, the persistence of poverty seems greater in the US than in our Nordic countries. Finally, young women seem substantially more mobile than men, although this finding needs to be taken with some caution, as we do not know to what extent the observed mobility patterns are driven by child bearing and rearing. There is evidence that there is very great intra-generational mobility among women in all our data sets.

In this version of the paper, we have only used a single year of parental earnings, which is a well-known source of bias. This becomes worse in a cross-national setting, because little is known of the size of the bias. We shall in future work address this problem directly.

We should also point out, as is evident in our discussion of mobility patterns for women, we know little and have not attempted to find out more about the mechanisms that generate mobility across countries. Such work is on the agenda. Given the difficulties in establishing the facts for such an undertaking to explain, however, we we fell that a robust exploration of those facts is a challenging research task in itself.

A Detailed data descriptions

In this section, we describe in greater detail the data sources that are used.

Denmark The Danish data have been constructed by merging two longitudinal databases: a representative 5 per cent sample of the population aged 15 to 74 in the period 1980-97, which contains detailed information about individuals' labour market status and earnings for each year, and the so called fertility database which provides detailed demographic and economic information about the individuals in the 5 per cent, their parents and siblings.

Finland The present Finnish data available come from the quinquennial census panel covering the period 1970 to 2000. The data set covers a representative sample of Finnish residents in 1970, and follows them and their household members over the years. We can, therefore, study both a larger household unit and a (social) family, depending on how people choose to live. This data set contains information on among other things education, earnings and taxable income, which makes it suitable to use when studying the links between economic resources of the family and educational outcomes, sibling and intergenerational correlations.

Norway The Norwegian data are collected from various administrative registers. Father-child pairs are biological, as defined in the population register. The off-springs are all born during 1958, in Norway by Norwegian born parents and registered as residents in Norway in 1999. The fathers are born in 1923 or later. In other words, members of the 1958 cohort born by fathers older than 35 at time of birth are excluded due to a specific limitation in the data sources available. Earnings are annual and measured in 1992 and 1999 for the children, while the fathers earnings are from the year 1974. The earnings are based on tax reports and contain wages, self-employment earnings, unemployment benefits and sickness pay. Interest revenue, capital income and means-tested transfers are not included as the earnings measure is restricted to sources that qualify for retirement pension. Fathers earnings are truncated since they are derived as functions of the observed retirement pension credit points which is a zero unless earnings exceed a threshold equal to USD 4,651 (measured in 2000-prices) in 1974. The top coding in 1974 is at USD 55,812 in 2000-prices, affecting about only 1 per cent of the sample.[12] There is no truncation of earnings for the children.

Sweden The main data sets from several registers held by Statistics Sweden and consist of samples of persons born and living in Sweden, persons born and adopted in Sweden, and persons born abroad

[12]The estimates are not affected if a higher number is imputed for the top-coded fathers.

but who have moved to Sweden. Combining these samples provides information about siblings, their background educational attainment, earnings and labour status as adults.

United Kingdom The National Child Development Study (NCDS) is a continuing, multi-disciplinary longitudinal study which takes as its subjects all those living in Great Britain who were born between 3 and 9 March, 1958. As the chart below shows, to date there have been five attempts to trace all members of the birth cohort in order to monitor their physical, educational, social and economic development. These were carried out by the National Children's Bureau in 1965, 1969, 1974, and 1981; and by the Social Statistics Research Unit, City University, in 1991

United States (NLS) The US micro data are drawn from the National Longitudinal Surveys (NLS) and the Panel Study of Income Dynamics (PSID). We describe (and treat in the analyses) these data separately.

The National Longitudinal Survey of Youth (NLSY), our primary source of NLS data is a nationally representative sample of 12,686 youth who were 14-22 years old at the time of the first interview in 1979. These individuals are now in their late thirties and early forties, and have been interviewed for two decades. Because the initial sampling unit was the household and because a high proportion of these households contained several teenagers, a large number of siblings may be paired in these data. Since the first interview, respondents have made transitions from school to work and from their parent's home to becoming parents and homeowners. Data collected yearly chronicle these changes and allow detailed study of the experiences of a large group of Americans born in the late 1950s and early 1960s.

United States (PSID) The US data are taken from the Panel Study of Income Dynamics (PSID) (Morgan et al. 1992). The PSID is a panel of households that was started in 1968 and consisted at that time of about 5000 households. The most complete information in the PSID, and the information that we use, is about the household head and the spouse. All information in the PSID is collected by interviews, mostly by telephone. Validation studies have found the earnings data in the PSID to be of quite high quality (see e.g. Bound & Krueger 1991).

Table 8 Intergenerational mobility tables – earnings quintile group transition matrices corrected for age for fathers and sons. Excluding zeros

	Denmark (n = 58865)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.256	0.231	0.194	0.183	0.137
fq2	0.215	0.254	0.220	0.183	0.127
fq3	0.197	0.213	0.224	0.201	0.164
fq4	0.171	0.180	0.204	0.222	0.222
fq5	0.160	0.120	0.157	0.211	0.352
	Finland (n = 5328)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.301	0.233	0.172	0.177	0.117
fq2	0.205	0.234	0.214	0.206	0.140
fq3	0.172	0.221	0.248	0.197	0.161
fq4	0.164	0.180	0.201	0.214	0.241
fq5	0.169	0.140	0.165	0.203	0.324
	Norway (n = 15913)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.286	0.234	0.212	0.152	0.116
fq2	0.203	0.233	0.221	0.207	0.136
fq3	0.182	0.215	0.206	0.214	0.183
fq4	0.179	0.189	0.203	0.220	0.209
fq5	0.150	0.128	0.158	0.207	0.357
	UK (n = 2238)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.273	0.233	0.211	0.161	0.121
fq2	0.262	0.215	0.197	0.172	0.154
fq3	0.216	0.207	0.209	0.203	0.165
fq4	0.147	0.191	0.196	0.242	0.224
fq5	0.098	0.152	0.185	0.224	0.341
	USNLS (n = 1797)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.394	0.244	0.180	0.092	0.089
fq2	0.227	0.248	0.224	0.181	0.120
fq3	0.177	0.212	0.235	0.208	0.168
fq4	0.123	0.186	0.189	0.274	0.228
fq5	0.099	0.113	0.174	0.238	0.376

Note: These results include only those father-offspring pairs that have non-zero earnings.

Table 9 Intergenerational mobility tables – earnings quintile group transition matrices corrected for age for fathers and daughters. Excluding zeros

	Denmark (n = 54935)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.238	0.219	0.204	0.183	0.156
fq2	0.216	0.237	0.227	0.185	0.135
fq3	0.193	0.208	0.215	0.206	0.179
fq4	0.177	0.187	0.198	0.215	0.223
fq5	0.175	0.148	0.156	0.211	0.310
	Finland (n = 5200)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.249	0.236	0.203	0.181	0.131
fq2	0.230	0.198	0.217	0.200	0.155
fq3	0.178	0.218	0.193	0.206	0.205
fq4	0.176	0.177	0.199	0.224	0.224
fq5	0.167	0.172	0.188	0.188	0.286
	Norway (n = 14929)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.234	0.224	0.208	0.194	0.141
fq2	0.212	0.222	0.220	0.197	0.148
fq3	0.204	0.209	0.209	0.198	0.181
fq4	0.183	0.189	0.199	0.213	0.215
fq5	0.168	0.156	0.163	0.198	0.315
	UK (n = 2401)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.222	0.224	0.201	0.205	0.147
fq2	0.237	0.227	0.208	0.171	0.157
fq3	0.197	0.215	0.211	0.211	0.165
fq4	0.201	0.177	0.203	0.203	0.215
fq5	0.147	0.162	0.180	0.180	0.331
	USNLS (n = 1593)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.252	0.248	0.245	0.166	0.089
fq2	0.192	0.251	0.202	0.189	0.165
fq3	0.221	0.217	0.213	0.178	0.170
fq4	0.167	0.170	0.202	0.212	0.249
fq5	0.172	0.110	0.139	0.256	0.324

Note: These results include only those father-offspring pairs that have non-zero earnings.

Table 10 Intergenerational mobility tables – earnings quintile group transition matrices corrected for age for fathers and sons. Include zero earners

	Denmark (n = 88704)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.250	0.207	0.198	0.180	0.165
fq2	0.239	0.232	0.195	0.185	0.149
fq3	0.181	0.239	0.235	0.201	0.144
fq4	0.164	0.195	0.216	0.223	0.202
fq5	0.161	0.134	0.155	0.213	0.337
	Finland (n = 5788)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.277	0.221	0.188	0.185	0.128
fq2	0.229	0.235	0.197	0.197	0.142
fq3	0.174	0.223	0.233	0.206	0.163
fq4	0.165	0.174	0.217	0.206	0.238
fq5	0.159	0.152	0.163	0.206	0.320
	Norway (n = 16749)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.290	0.235	0.211	0.150	0.116
fq2	0.202	0.233	0.221	0.205	0.139
fq3	0.182	0.218	0.209	0.214	0.177
fq4	0.174	0.187	0.203	0.222	0.215
fq5	0.152	0.128	0.158	0.209	0.353
	UK (n = 2238)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.273	0.233	0.211	0.161	0.121
fq2	0.262	0.215	0.197	0.172	0.154
fq3	0.216	0.207	0.209	0.203	0.165
fq4	0.147	0.191	0.196	0.242	0.224
fq5	0.098	0.152	0.185	0.224	0.341
	USNLS (n = 1921)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.389	0.254	0.178	0.094	0.085
fq2	0.203	0.259	0.233	0.181	0.124
fq3	0.207	0.197	0.220	0.213	0.164
fq4	0.125	0.180	0.198	0.251	0.246
fq5	0.093	0.113	0.169	0.255	0.369

Note: These results include all father-offspring pairs, including those where either or both have zero earnings.

Table 11 Intergenerational mobility tables – earnings quintile group transition matrices corrected for age for fathers and daughters. Including zero earners

	Denmark (n = 82207)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.214	0.209	0.204	0.194	0.178
fq2	0.239	0.211	0.203	0.182	0.164
fq3	0.201	0.225	0.230	0.197	0.147
fq4	0.178	0.195	0.206	0.211	0.209
fq5	0.176	0.159	0.155	0.211	0.298
	Finland (n = 5722)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.260	0.227	0.218	0.169	0.126
fq2	0.220	0.212	0.198	0.205	0.165
fq3	0.178	0.218	0.191	0.211	0.202
fq4	0.176	0.165	0.206	0.228	0.224
fq5	0.162	0.178	0.187	0.188	0.287
	Norway (n = 16016)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.245	0.210	0.207	0.191	0.147
fq2	0.215	0.225	0.219	0.199	0.141
fq3	0.204	0.207	0.208	0.197	0.183
fq4	0.173	0.199	0.200	0.213	0.215
fq5	0.163	0.159	0.165	0.200	0.314
	UK (n = 2401)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.222	0.224	0.201	0.205	0.147
fq2	0.237	0.227	0.208	0.171	0.157
fq3	0.197	0.215	0.211	0.211	0.165
fq4	0.201	0.177	0.203	0.203	0.215
fq5	0.147	0.162	0.180	0.180	0.331
	USNLS (n = 1814)				
	oq1	oq2	oq3	oq4	oq5
fq1	0.249	0.228	0.249	0.187	0.087
fq2	0.150	0.261	0.219	0.190	0.180
fq3	0.177	0.226	0.243	0.176	0.179
fq4	0.203	0.150	0.177	0.226	0.244
fq5	0.221	0.138	0.113	0.221	0.306

Note: These results include all father-offspring pairs, including those where either or both have zero earnings.

Table 12 Summary mobility table indices – based on earnings quintile group transition matrices. Including zero earners

A. Sons

	Denmark	Finland	Norway	UK	USNLS
M_T	0.931	0.932	0.923	0.930	0.878
M_L	0.808	0.813	0.780	0.761	0.653
M_F	0.842	0.835	0.825	0.816	0.720
M_B	1.440	1.390	1.359	1.349	1.208

B. Daughters

	Denmark	Finland	Norway	UK	USNLS
M_T	0.959	0.956	0.949	0.951	0.929
M_L	0.856	0.863	0.840	0.828	0.862
M_F	0.891	0.873	0.887	0.873	0.801
M_B	1.518	1.447	1.442	1.442	1.422

Note: For all the mobility indices greater values suggest greater mobility, See equations 1 to 5 and Table 1 for definitions and interpretation. These results include all father-offspring pairs, including those where either or both have zero earnings.

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