Money Marries Money - Intergenerational Top Household Income Mobility in Denmark

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Publication date:
2016

Document Version
Early version, also known as pre-print

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This paper describes intergenerational earnings and income mobility among top-income households in Denmark. Access to administrative registers allowed us to look at very small fractions of the populations, and to distinguish between sons and daughters and to observe their spouses' incomes. At the top of the income distribution we find a correlation of 0.763 between father and mother's pooled income and that of their son and daughter-in-law's pooled income, which indicates that money marries money.

Key words: Intergenerational income mobility, Top incomes, Assortative mating, Piecewise regression.
JEL classification: C21; D10; D31; D63; J12; J62.

Acknowledgement:

We thank colleagues, particularly the participants at the SUNSTRAT conference at SOFI, Stockholm University, December 2011, for constructive comments to earlier versions of the paper.

1. Introduction

We investigate intergenerational top income mobility, that is, the father-son and father-daughter income mobility; the correlation between father and son-in-law and father and daughter-in-law—and the same for mother-child/child-in-law relationships - and the correlation between the two generations' aggregated household incomes. Hence, assortative mating comes in as an explanation of the appearance of 'inherited' income among top-income households.

We use information for the whole population from administrative registers at Statistics Denmark for the period 1980–2008, which allow us to investigate intergenerational income mobility throughout the income distribution.

The following section gives the background and a short review of the literature, and in the third section the empirical framework is discussed. The data are described in the fourth section and section five presents the results of the analyses. The last section concludes.

2. Background

The literature shows that intergenerational father-son income mobility is decreasing within the top incomes, reaching a very low level for the very top. This holds for Canada (Corak & Heitsz, 1999) and also for Denmark and Sweden, which, despite their low income inequality and high intergenerational income mobility (elasticities of 0.24 and 0.26)[1], has a top income elasticity of 0.47 and 0.90 (Munk et al., 2015; Björklund et al., 2012).

The mother-daughter intergenerational income mobility has also been investigated, for example, by Österberg (2000), who shows that mother's earnings influence child's earnings less

[1] Jäntti et al. (2006) and Black & Devereux (2011) found average elasticities for father-son at about 0.5–0.6 for the US and 0.3 for the UK.

than that of the father, and that this difference is lower for daughters than for sons. By looking at different intervals of the household income distribution, Hirvonen (2008) finds that intergenerational income mobility is higher in the upper than in the lower end, but that mobility in the top end is smaller (even for daughters) than in the middle range (see also Raaum et al., 2007).

The findings raise the question of marriage as a mediator of different generations' access to economic resources. Mare (1991; 2000) shows that spouses tend to be similar in terms of educational attainment, occupation and ethnic background (for an early example, see Glenn, Ross & Tully, 1974). Chiappori et al. (2011) show that not only socioeconomic characteristics but also anthropometric characteristics/physical attractiveness matter for the matching on the marriage market. For Germany and Britain, Ermish et al. (2006) find that 40–50 % of the correlation between parents' and children's permanent family income can be attributed to the spouse, due to a high correlation between the spouses' human capital, and conclude that: "both parents and parents-in-law shape their offspring's status". Particularly at the top end of the income distribution, parents have a preference for continuing the family position by having "high quality" children (Kalenkoski & Foster, 2008; Lefgren & McIntyre, 2006). Hence, by extending the relationship between generations to mother/father couple and child/spouse couple, even higher elasticities are likely to be found.

3. Empirical framework

Following usual practice within mobility studies, the intergenerational determination of children's incomes can be expressed by the following regression equation:

(1) $\log y_{ci} = \alpha_c + \beta_c \log y_{pi} + \varepsilon_{cij}$,

where log y_{ci} denotes the natural logarithm of income of a child in family *i* and y_{pi} the corresponding measure of the parent. The error term ε_{ci} depicts the combined effect on the child's income of factors orthogonal to parental income, and β_c is the intergenerational elasticity of the child's permanent income given the parent's income. The model also controls for the first generation's age and age squared, although not shown in (1).

If assortative mating in the second generation is present, we will find a high correlation between the child's and his/her partner's income, see Hirvonen (2008). This can be expressed as

$$(2) \qquad \gamma = \text{corr}\,(\log y_{ci}\,,\, \log y_{pai}\,)\,,$$

where *pa* indicates the partner. A high level of assortative mating—particularly if this is also the case for the first generation—will diminish intergenerational mobility on a family-to-family level and, conversely, if the matching is random and not conditional on income, it will accentuate mobility. The family-to-family intergenerational income mobility can be depicted as

$$(3) \qquad \log y_{cpai} = \alpha_{cpa} + \beta_{cpa} \log y_{fmi} + \varepsilon_{cpai}\,,$$

where y_{cpa} (child and his/her partner) is the second generation's family income and y_{fmi} is the first generation's family income, where *fm* indicates father and mother.

Intergenerational income persistence on a family level, β_{cpa}, will therefore be determined by two different channels[2]: the parent to child channel, $\beta_{c,}$ and the assortative mating determinant, calculated as either the elasticity of parents and children-in-laws' income relationships or simply as

[2] Mitnik et al. (2015) add a third channel, namely the likelihood of becoming and staying married, which are found to be correlated with parental income, i.e. the higher income of origin the higher the chances for this to happen. (det her komma skal vist omskrives. Hvad refererer "origin" til og origin mht hvad? Hvad henviser "this" til?).

the differential between β_{cpa} and β_c. Obviously, this requires that the first generation and second generation are married/cohabiting within their respective generations, while the usual intergenerational mobility analyses also include single families in each generation.

Because social heritage is not equally strong across the whole distribution—revealed as non-linearity (Bratberg et al., 2007; Grawe, 2004; Hertz, 2005)—intergenerational income mobility is analysed over the full range by using piecewise linear regression estimations (spline regressions). This implies "separate" estimations for parent-child pairs belonging to different parent income percentiles, so-called "knots"—P50, P75, P90, P95, P99, P99.9—which allow the slopes to vary over the earnings and income distributions (Greene, 2012; Björklund et al. 2012). The interpretation of the β-coefficient in equation (1), therefore, is the percentage differential in the expected earnings or income of the child, given a percentage, marginal differential in earning or income of the parent, for example, within the top P99.9-100 fractile.

4. Data

The data stem from administrative registers at Statistics Denmark including information on earnings, capital income, taxes, and benefit payments, and education, labour market attachment, etc. for the period 1980–2008. A unique personal ID number allows linkage of the information of every individual in the registers with information of his/her spouse, children and parents. Using register information implies that the information for the whole population is included.

The data window covers 29 years and the best proxy of a permanent income is the income earned when being in the 30s; therefore, the second generation in this study is aged 35–42 years in 2008 or, equivalently, 7–14 years in 1980 (7–18 years when their parents' incomes are included for

1980–84). This is considered to be a relatively broad age bracket, which is important for minimizing the problem of non-homogeneity in the residuals, see Lee & Solon (2009), who stresses that the assumption of unbiased measurement error does not hold for intergenerational income mobility.

Furthermore, it is important to note that even permanent income estimates based on five-year periods may underestimate the intergenerational persistence. Hendricks (2007) shows that measures of persistence based on lifetime earnings increase 30% compared with measures using only 5-year periods, and Hussain et al. (2009) find that the income measurements partly determine the results in intergenerational mobility studies (see also Mazumder, 2005). In our study, fathers are between 25 and 88 years in 1984 for which reason we control for father's age and age squared.

We use the father-son and father-daughter—and mother-son and mother-daughter—correlations as well as the correlations between father's income and son-in-law's and daughter-in-law's earnings and income. Because children-in-law are married/cohabitating, the same is necessarily also the case for sons and daughters, and this holds also for the parents. However, excluding singles from the regressions does not significantly change the coefficients for the different incomes (results are available on request), although the offspring of higher income parents is more likely to marry and stay married and thereby pooling resources with a spouse.

The income concepts applied include individual earnings from work and/or business, capital income and total income, see Björklund et al. (2012) for application of similar definitions, and only individuals with positive total income in each of the five years (the 2004–2008 period for the child and the 1980–1984 period for the parent) are included. All incomes are inflated to 2008 using the CPI from Statistics Denmark. We apply the average of natural log of each year's income.

We exclude observations if the standardised residual is above 3. These outliers count to around 1½ pct. of the observations, but the exclusion has no major impact on the estimated coefficient

structure, i.e. the correlations between coefficients for the estimates with and without the outliers are all above .96.

The income sample includes up to 172,800 pairs of married fathers and married daughters/sons, and the earnings sample includes 135,785 pairs. The number of married father and son-in-laws and daughter-in-laws with (positive) income and earnings information is 69,997; 58,890; 113,245 and 86,600. Hence, we have around 600 and 1,700 in the top-income percentile and, thereby, around 60–170 in the 0.1 top-income percentile.

Table 1 around here

Table 1 show that the discrepancy between earnings and income increases with the income level, particularly for the second generation. At the top end of the distributions (P99), sons' incomes are 10% higher than their earnings, and those of daughters are 9% higher, whereas fathers' incomes are only 4% higher than their earnings. For the median pairs (P50) the differentials are 7%, 7% and 0%, reflecting that the disparity of capital income has increased between the two generations, see Björklund et al. (2012) for nearly the same findings for Sweden.

When comparing married sons' earnings and income with those of married daughters', we found a difference for the median persons of about one third in both cases in favour of the sons. For children belonging to the top percentile, the difference between the two sexes is 73–74 pct. for earnings and income, and the same holds when comparing earnings and income of sons-in-law with those of daughters-in-law (75–77 pct.).

5. Results

Intergenerational top-income mobility—parents to children

In the following we show the results from the piecewise linear spline regressions across parent income fractiles examining how sensitive children's earnings and incomes are to their parents' earnings and incomes. For the estimations of parent to children-in-law mobility, we also refer to results obtained from spline regression estimations. To assure comparability with the parent-child estimations, the latter ones are also done solely for married sons and daughters, see Table 2.

Table 2 shows that the intergenerational earnings elasticities for father-son and father-daughter pairs increase up to a certain point after which they decrease, leaving the top percentile out of consideration. For married children only, we found elasticities equal to 0.016 and 0.017 for sons and daughters of fathers in the P0-25 against 0.430 and 0.265 for the P50-75 group, and 0.111 and 0.093 for the P99-99.9 group (Table 2)—the same pattern is found for Sweden (Hirvonen, 2008). The somewhat smaller elasticities for father-daughter pairs are also found for incomes, except at the top end of the distribution. Where the father-son and father-daughter income elasticities are 0.040 and 0.025 for the P0-25 group, they increase to 0.446 and 0.317 in the upper-middle P50-75 group[3], and fall to 0.070 and 0.138 for the P99-99.9 group, implying that the income persistence for the father-daughter is double that of the father-son.

Tables 2 and Table 3 around here

[3] The father-son earnings elasticity using OLS (e.g. not spline) is 0.176 and 0.244 when applying total income.

At the very top end of the income distribution (P99.9-100), we found that only the income elasticity for father-son is significant and very high, i.e. a 10% higher income among the P99.9-100 group of fathers is correlated with a 8.79% higher income among their sons. For married daughters of the same group of rich fathers, the total income elasticity is not significant, which also holds for the earnings correlation for married sons, whereas that of married daughters is -0.328. This indicates that the higher the earnings of the father, the lower the earnings of his daughter in this upper end of the earnings distribution.

Moreover, at the top end of the income distribution—P99-99.9—the father-married daughter income elasticities are greater than those for sons, indicating that daughters from well-off backgrounds are economically more like their parents than are sons when looking solely at married second-generation offspring.

Table 2 also shows that for children-in-law the relationship between fathers' and their daughters-in-law's incomes is smaller than the relationship between fathers' and their sons-in-law's incomes. The father and children-in-law elasticities, however, are generally smaller than those of fathers and their offspring, so that the offspring is economically more alike their parents than are the children-in-law and is therefore more "reliable" in ensuring some persistence in keeping the social position intact.

Parents to children-in-law elasticities

For the median income fractile the correlations between sons' and their wives' incomes and between daughters' and their husbands' incomes are 0.258 and 0.199, respectively, while the same correlations are 0.157 and 0.113, respectively, for earnings (Table 4), which shows that it is easier for sons than for daughters to find economically equal partners in the middle of the income

distribution. By moving upwards in the earnings and income distributions, we find that the correlations increase for daughter-son-in-law relationships while it decreases for son-daughter-in-law relationships, and at the top end of the distribution—99^{th} and 99.5^{th} fractiles—the son-daughter-in-law relationship is not significant, whereas the daughter-son-in-law relationship remains significant, and the same holds for earnings. This indicates that assortative mating is more pronounced for rich daughters than for rich sons using earnings or total income as the economic measure.

Tables 4 and 5 around here

Finally, Table 5 shows that at the top end of the distribution—P99.9-100—the son-daughter-in-law relationship is 0.259 for earnings and 0.763 for total income, while no significant relationships are found between the parents and their daughter's family. Hence, at the same time as assortative mating or the same mating strategy for the two generations—in the top end of the income distribution is more pronounced for daughters than for sons; the intergenerational mobility is smaller for sons than for daughters, independent of using earnings or total income as the economic measure.

6. Conclusion and Summary

Most studies on intergenerational earnings and income mobility focus on the father-child transmission of opportunities and social status. In this study, we also looked at the mother-to-son

and mother-to-daughter transmission of income as well as at the correlation between the aggregated household incomes of the two generations.

By applying data from administrative registers at Statistics Denmark, we were able to study the mobility throughout the income distribution, in particular the top end, since we had income information on all Danish citizens. We used piecewise linear spline regressions because of the non-linearity in mobility over the income distribution.

In line with most other studies, we found that the intergenerational elasticity is higher for income than for earnings and that these elasticities are smaller for father-daughter than for father-son pairs. At the very top end of the distribution—P99.9-100—the father-son income persistence is 0.466 but is not significant for father-daughter.

We also found that mother-married child intergenerational earnings and income mobility are relatively close to each other, while income persistence is greater than earnings persistence for father-married child relationships at the top end of the distributions. This indicates that children, particularly sons, "gain" (e.g. ability to earn and acquire) more capital income from their father than from their mother. The income elasticity is greater than the earnings elasticity for father-married son relationships than for father-married daughter relationships.

Another finding was that the father and children-in-law correlations are generally smaller than that of fathers and their offspring, so that the offspring is economically more alike their parents than are the children-in-law. This pattern indicates that a son-in-law is not as capable as a son of securing a high degree of income persistence from one generation to the next, and the same holds for daughters-in-law relatively to daughters—for both we found similar correlations relative to their fathers-in-law/fathers income throughout the income distribution.

Finally, we found that intergenerational household income mobility is smaller for father and mother to son and daughter-in-law than for father and mother to daughter and son-in-law. This

holds for the whole income distribution as well as for the earnings distribution. At the top end of the income distribution—P99.9-100—the elasticities for parents and their daughter and son-in-law are not significant in contrast to that of parents and their son and daughter-in-law, where the elasticity is as high as 0.763. This coefficient is the second highest of all coefficients found in this study, indicating that at a family level there is a very high degree of economic persistence between generations among the rich in Denmark.

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Table 1. *Descriptive statistics for earnings and total income. Father-married-child/child-in-law, and father-couple – child-couple. 1,000 DKK. 2008-prices.*

		Mean	St.dev.	Min.	P10	P50	P90	P95	P99	Max.
Father-married son, n=135,785 and 164,155										
Earnings:	Father	358.4	217.82	0.6	192	313	407	552	696	8,799
	Son	471.6	346.12	0.1	272	396	523	722	917	38,416
Income:	Father	365.7	263.16	0.2	181	314	412	564	724	12,821
	Son	512.3	427.62	0.0	285	425	563	785	1,008	41,869
Father-married daughter, n=132,307 and 172,800										
Earnings:	Father	352.4	221.09	1.1	188	310	401	540	681	17,219
	Dau.	312.9	137.84	0.8	193	292	357	443	531	6,651
Income:	Father	358.8	274.51	0.1	175	310	405	553	706	24,909
	Dau.	337.9	180.15	0.0	204	313	388	484	579	34,262
Father- son-in-law, n=58,890 and 69,997										
Earnings:	Father	358.7	229.50	1.6	197	314	406	546	691	17,219
	Son-in-law	475.0	336.93	0.1	275	401	529	724	912	25,332
Income:	Father	368.9	288.75	1.0	190	318	414	562	721	24,909
	Son-in-law	518.2	412.21	0.2	290	432	572	792	1,011	25,297
Father- daughter-in-law, n=86,600 and 113,245										
Earnings:	Father	360.7	220.23	0.7	193	315	409	556	701	8,799
	Da.-in-law	305.3	134.18	2.0	187	285	349	435	520	6,695
Income:	Father	368.5	269.01	1.0	182	315	414	569	734	10,955
	Da.-in-law	332.5	159.70	0.0	202	309	381	476	570	8,937
Father and mother- son and daughter-in-law, n=110,755 and 117,609										
Earnings:	Parents	463.5	239.62	0.7	238	434	548	696	829	8,799
	Son/spouse	742.7	398.85	4.0	446	675	839	1,082	1,294	38,418
Income:	Parents	516.2	292.81	28.8	275	474	591	759	924	11,604
	Son/spouse	855.4	501.44	36.5	541	756	947	1,233	1,496	42,241
Father and mother - daughter and son-in-law, n=92,343 and 97,474										
Earnings:	Parents	464.3	240.71	0.9	245	437	547	690	815	17,219
	Da/spouse	745.9	370.11	3.6	450	680	843	1,086	1,301	25,548
Income:	Parents	517.0	298.91	38.7	283	478	591	752	907	25,072
	Da/spouse	858.2	463.83	36.5	546	762	952	1,237	1,506	24,860

Table 2. *Earnings and income elasticities for father and children and children-in-law. Spline regression.*

	$P_{0\text{-}25}$	$P_{25\text{-}50}$	$P_{50\text{-}75}$	$P_{75\text{-}90}$	$P_{90\text{-}95}$	$P_{95\text{-}99}$	$P_{99\text{-}99.9}$	$P_{99.9\text{-}100}$
Earnings								
Son	0.022**	0.304**	0.413**	0.243**	0.281**	0.220**	0.162**	-0.076
Daughter	0.018**	0.241**	0.264**	0.181**	0.148**	0.012	0.038	-0.239**
Married son	0.016**	0.323**	0.430**	0.236**	0.256**	0.239**	0.111**	0.135
Married daughter	0.017**	0.236**	0.265**	0.179**	0.139**	0.023	0.093*	-0.328**
Son-in-law	0.008	0.241**	0.286**	0.187**	0.147*	0.099*	0.141*	-0.249*
Daughter-in-law	0.017**	0.213**	0.193**	0.079**	0.01	0.041	0.01	-0.308*
Total income								
Son	0.065**	0.390**	0.428**	0.345**	0.252**	0.288**	0.199**	0.466**
Daughter	0.038**	0.331**	0.319**	0.243**	0.173**	0.094**	0.089**	0.037
Married son	0.040**	0.350**	0.446**	0.355**	0.252**	0.310**	0.070*	0.879**
Married daughter	0.025**	0.327**	0.317**	0.250**	0.184**	0.067**	0.138**	-0.05
Son-in-law	0.006	0.314**	0.329**	0.226**	0.177**	0.077*	0.175**	-0.209*
Daughter-in-law	0.029**	0.319**	0.200**	0.175**	0.034	0.051*	-0.086*	-0.219*

* 0.05<p<0.10. ** 0.01<p<0.05. *** p<0.01

Table 3. *Earnings and income elasticities for mother and children and children-in-law. Spline regression.*

	$P_{0\text{-}25}$	$P_{25\text{-}50}$	$P_{50\text{-}75}$	$P_{75\text{-}90}$	$P_{90\text{-}95}$	$P_{95\text{-}99}$	$P_{99\text{-}99.9}$	$P_{99.9\text{-}100}$
Earnings								
Son	0.013**	0.033**	-0.065**	0.295**	0.328**	0.277**	0.236**	-0.131
Daughter	0.013**	0.061**	0.018	0.325**	0.354**	0.178**	0.299**	-0.014
Married son	0.011**	0.030*	-0.060**	0.350**	0.258**	0.374**	0.132*	-0.054
Married daughter	0.010**	0.077**	0.018	0.313**	0.425**	0.220**	0.288**	0.029
Son-in-law	0.01	0.007	-0.02	0.292**	0.260*	0.062	0.162	-0.018
Daughter-in-law	0.014**	0.045**	-0.002	0.239**	0.276**	0.167**	0.111	0.251
Total income								
Son	0.019**	0.229**	-0.347**	0.448**	0.348**	0.293**	0.274**	0.094
Daughter	0.019**	0.168**	-0.153**	0.434**	0.361**	0.232**	0.220**	-0.006
Married son	0.018**	0.187**	-0.281**	0.498**	0.258**	0.378**	0.190**	0.14
Married daughter	0.015**	0.157**	-0.124**	0.438**	0.360**	0.268**	0.293**	-0.075
Son-in-law	0.016**	0.060**	-0.136**	0.347**	0.213*	0.208**	0.160*	-0.049
Daughter-in-law	0.015**	0.041**	0.004	0.345**	0.177**	0.210**	0.077	0.17

* 0.05<p<0.10. ** 0.01<p<0.05. *** <0.01

Table 4. *Correlations[1] between second generation husband's and wife's income. Separately for earnings and total income. Quantile regression.*

	q=0.25	q=0.50	q=0.75	q=0.90	q=0.95	q=0.99	q=0.995
Earnings.							
Son and daughter-in-law	0.155***	0.157***	0.153***	0.120***	0.096***	0.027	0.021
Daughter and son-in-law	0.070***	0.113***	0.152***	0.196***	0.212***	0.202***	0.200***
Total income.							
Son and daughter-in-law	0.280***	0.258***	0.214***	0.135***	0.104***	0.035	0.004
Daughter and son-in-law	0.164***	0.199***	0.224***	0.249***	0.245***	0.188***	0.165***

* 0.05<p<0.10. ** 0.01<p<0.05. *** p<0.01.

[1]All calculations based on father-son and father-daughter samples controlled for age in the regression analyses.

Table 5. *Earnings and income elasticities for first and second generation families. Pooled incomes. Spline regression.*

	OLS	$P_{0\text{-}25}$	$P_{25\text{-}50}$	$P_{50\text{-}75}$	$P_{75\text{-}90}$	$P_{90\text{-}95}$	$P_{95\text{-}99}$	$P_{99\text{-}99.9}$	$P_{99.9\text{-}100}$
Earnings									
Son and wife	0.187***	0.064**	0.268**	0.273**	0.404**	0.325**	0.220**	-0.052	0.259**
Daughter and husband	0.167***	0.055**	0.260**	0.214**	0.390**	0.266**	0.085*	0.119*	-0.154
Total income									
Son and wife	0.256***	0.137**	0.233**	0.364**	0.448**	0.285**	0.264**	0.014	0.763**
Daughter and husband	0.223***	0.118**	0.211**	0.344**	0.376**	0.299**	0.123**	0.216**	0.018

* 0.05<p<0.10. ** 0.01<p<0.05. *** p<0.01