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Paul Gregg
Jan O. Jonsson
Lindsey Macmillan
Carina Mood

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Department of Quantitative Social Science, Institute of Education, University of London
20 Bedford Way, London WC1H 0AL, UK

Understanding income mobility: the role of education for intergenerational income persistence in the US, UK and Sweden

Paul Gregg[1], Jan O. Jonsson[2], Lindsey Macmillan[3] and Carina Mood[4]

Abstract

A growing number of studies in several countries over the past twenty years have documented the persistence in incomes across generations, and much of the current literature is seeking to understand the processes driving intergenerational mobility and how these differ across time periods and across countries. Education is commonly seen, just as in sociological studies of social mobility or status attainment, as the key driving force of intergenerational associations. In this paper we study the role of education for intergenerational income associations in three countries over time, and across the life-span of sons. We pay particular attention to issues of life-cycle bias and measurement error in modelling income mobility in a comparative setting. To explore the role of education, we utilise a three-stage framework that decomposes the intergenerational elasticity into three parts: the relationship between income and education, the returns to education, and the direct relationship between parental income and their child's income in the next generation after controlling for education. We find that the US and the UK have high levels of income persistence (low mobility) across generations while Sweden is more moderate. Levels of educational inequality are surprisingly similar in all three countries with the majority of the difference between the US/UK and Sweden working through unequal returns to education and, more strikingly, inequality of opportunities for people with similar educational qualifications.

JEL classification: J62, J13, J31

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[1] Department of Social and Policy Sciences, University of Bath (P.Gregg@bath.ac.uk)
[2] Nuffield College, Oxford University and Swedish Institute for Social Research, Stockholm University (janne.jonsson@nuffield.ox.ac.uk)
[3] Corresponding author: Department of Quantitative Social Science, Institute of Education, University of London (L.Macmillan@ioe.ac.uk)
[4] Institute for Future Studies, Stockholm and Swedish Institute for Social Research, Stockholm University (carina.mood@iffs.se)

1. Introduction

In the literature on intergenerational economic mobility, the US is often considered an outlier, exhibiting a strong association between parents' and children's incomes – the low mobility being a paradox for a country that for many epitomizes the ideal of 'a land of opportunity'. We can think of patterns of intergenerational inequalities as being shaped by the joint product of economic returns to assets such as education, and inequalities in family origin effects in producing these assets (e.g., Blanden et al. 2007; Breen and Jonsson 2007). With its high levels of income inequality (OECD, 2011), the position of the US might therefore be suspected to be determined by great income differences in the filial generation, magnifying the (possibly quite weak) family origin effects on income-producing assets such as educational qualifications.

The UK, on the other hand, has traditionally been seen as giving undue weight to circumstances of birth, but has also, during the last decades, come to be the European case most similar to the US when it comes to income inequality. Both these countries, with their reputation of being unequal, could be contrasted to Sweden, a highly equal society, purportedly because of a relatively weak importance of the family of origin in combination with very small income inequalities. However, so far there is little hard evidence from directly comparative studies to ascertain the degree of validity in these descriptions. Is the US a low mobility society, and if so, is this produced by high economic returns despite a weak effect of family origin? Is the UK similar to the US, or is it closer to its EU associate, Sweden? Can we confirm the high-mobility status of Sweden, and, if so, is this position due to weak origin effects (i.e., great equality of opportunity) or due to lower returns to education?

We address these questions in a comparative study of parent-to-son income mobility in the US, UK, and Sweden. A number of existing cross-country studies (Corak 2004, Bratsberg et al. 2007, Blanden 2011) have synthesised individual country studies that fundamentally differ across various domains, potentially leading to sizable variations in biases of estimated mobility. We go a long way to making the data as comparable as possible from the outset. In doing so, we pay particular attention to issues of (a) measurement error and transitory variation in family income, where we average on the parental side, using the extensive Swedish data to estimate full childhood family incomes; and of (b) life-cycle variations in earnings for sons, measured across ages for different cohorts.

The role of education as a mediator of mobility, famously studied by Blau and

Duncan (1967), was developed theoretically by Becker and Tomes (1986) who discussed how education is an investment, open to better off parents to aid their children's life chances. The potential of education to act as such a mediator was further explored by Solon (2004) who explicated the potential for governments to invest progressively in education by channelling resources to poorer families to offset the impact of family background. A contribution of our paper is to estimate the role of education in accounting for country differences in intergenerational income mobility. We follow the idea that mobility (measured as the elasticity) can be divided into three components: (1) the association between socioeconomic origin (here, parental income) and educational attainment; (2) the association between educational qualifications and income; and (3) the partial association between family income during childhood and own income, controlling for qualifications – what can be viewed as the influence of the family of origin for those at given levels of education (Breen and Goldthorpe, 2001; Blanden et al. 2007; Breen and Jonsson 2007).

Decomposing the intergenerational elasticity into these three parts, we find that the first is surprisingly similar in our three countries; that the second is stronger in the US and weakest in Sweden; and that the third is much weaker in Sweden than in either the UK or US. Taken together, we can verify the comparatively low intergenerational income mobility between parents and sons in the US: When measuring parental income around child age 16 and child income around age 40, the elasticity is 0.37, as compared to 0.31 in UK and 0.21 in Sweden. These numbers are however heavily attenuated by transitory incomes and measurement error, which can be corrected for in the Swedish case, increasing the elasticity from 0.21 to 0.33. Our estimates suggest that similar adjustment would bring the elasticity in the US to (at least) around 0.60 and in the UK to around 0.5.

Our decomposition makes it possible to point to two reasons for the low mobility in the US: The economic returns to education are high, and the socioeconomic origin bestows substantial income advantages also upon those at given levels of education. Hence, although inequality in educational attainment is not particularly great in the US, inequality of opportunity still is, because the advantage of coming from a high-income family extends beyond the educational qualifications observable in our data – a finding that is robust to models including fine-graded measures of education and also of indicators of ability. The UK is definitely more similar to its transatlantic liberal-economy partner than to its EU partner, Sweden, exhibiting similar patterns to the US in terms of both educational inequality and returns to education. The reason that Sweden stands out as the most mobile society is, perhaps surprisingly, not because of an egalitarian school system or the low returns to higher

education, though this does make a contribution. Instead, the main reason for the high income mobility in Sweden is due to something that could be seen as a "meritocratic" effect: the intergenerational persistence is limited to the part that is transmitted via the educational qualification system. Our further analyses suggest, though this must be seen as tentative results, that it is in particular the importance of family income for those at the lowest educational levels that produces this. Unveiling the mechanisms behind the part of the family income effect that is not captured by educational qualifications is, although central for addressing the issue of inequality of opportunity, outside of our scope, but we end the paper with a discussion about the potential role of wage setting institutions, school quality, and social networks.

2. Literature

While the study of social mobility and the role of education in the mobility process has been a mainstay in the sociological literature for at least 50 years (e.g., Duncan and Hodge 1963), the recent upsurge in the economics literature has brought renewed attention to the issue of intergenerational persistence and how to account for it, focusing primarily on income mobility (e.g., Corak 2004; Bowles, Gintis, Osborn Groves 2005; Black and Devereux 2011; Ermisch et al., 2012).

Recent research has taken two major avenues to shed light on the processes behind. One has been to go deeper into alternative mediators of family income, for example, educational qualifications, and cognitive and non-cognitive skills (e.g., Osborn Groves 2005; Blanden et al.2007, Mood et al.2012). The over-arching conclusion from this literature is that the "family income effect" can be broken down to several paths – different assets and characteristics of parents and children (including, importantly, those that are typically unobserved in our data) account for parts of the income persistence across generations.[5] Of these, however, the most essential (observable) ones appear to be educational qualifications and ability (measured as IQ, literacy and numeracy test scores, and the like). Consequently, it is also these mediators that have been studied most actively in previous research, both in the social class mobility tradition (Ishida, Müller, and Ridge 1995; Breen and Goldthorpe 2001), and in the income mobility approach (e.g., Blanden et al. 2007; Mood et al. 2012), and it is also education that is our own focus (and we will also complement these analyses by using

[5] We are not making any claims about causality here. It is likely that school achievement, ability, and non-cognitive skills to some extent are endogenous to family income, but they are probably also influenced by other characteristics of parents that are correlated with income (such as abilities and qualifications).

ability).

The other avenue that recent research has taken to increase the understanding of income mobility is to compare mobility rates across countries. Meta-analyses by Solon (2002), Corak (2006), d'Addio (2007), Björklund and Jäntti (2009), Black and Deveraux (2011), and Blanden (2013) have sought to find a pattern in the reported country estimates. Some results appear robust, such as the ranking of the US and UK (both high persistence), and the Nordic countries, including Sweden (low persistence). In general, it seems that high-inequality countries also have stronger income persistence across generations (Blanden 2011), a result in line with the theoretical models of Solon (2004). However, cross-country studies in this field are complicated by the severe restrictions to comparability that accrue to the existing, secondary, data-sets. For example, the relative ranking of the US and UK differs depending on, among other things, data-set, age-restrictions, and income measure (cf. Blanden's preferred elasticities of 0.41 for the US and 0.37 for UK, with Corak's preferred 0.47 for the US and 0.50 for UK).[6] In one of the studies that is most rigorous in trying to make data-sets comparable, Jäntti et al. (2006) report substantially higher persistence in the US than the UK (elasticities being 0.52 and 0.36, respectively), and even lower figures for the Scandinavian countries (where Sweden's elasticity is estimated to 0.21).

We learn from these studies that comparability is necessary to strive towards but difficult to achieve. It is our belief that we are able to improve on comparability one more notch in order to further reduce the risk that country rankings depend on the inbuilt differences in data. But bias in intergenerational elasticities across countries is not only a matter of having similar definitions of income, similar cohorts and ages, and so forth: it is also a matter of estimating family income and filial income with precision, correcting for transitory income shocks and measurement errors. This is developed in the methodology section, where we explain how we take these issues into account throughout the analysis.

3. Methodology

Intergenerational mobility and measurement issues

The estimate of mobility is based around the coefficient β from the regression (1) where the dependent variable is the log of earnings of an individual in adulthood and the explanatory

[6] These (relatively small) differences are not trivial in their consequences. When Corak's cross-country results in 2010 found its way to an OECD report (via d'Addio 2007) it led Britain's Secretary of State for Education Michael Gove to exclaim: *"Those who are born poor are more likely to stay poor and those who inherit privilege are more likely to pass on privilege in England than in any comparable country"*.

variable is the log of income of the parents of the individual in childhood. The standard economics literature had used fathers' earnings as the measure for the first generation but more recently research has moved towards focusing on the resources available to a child throughout their childhood, shifting the focus towards parental income. The coefficient β therefore gives the elasticity between the parental income during childhood and the individual's adult earnings. If the correlation is zero then there is full intergenerational mobility; the income of the parents has no influence on the child's future earnings. If the intergenerational elasticity is one, there is complete immobility; the income of the parents fully determines the child's later earnings.

$$\ln Y_i^{Child} = \alpha + \beta \ln Y_i^{Parent} + u_i \quad (1)$$

Alternatively, intergenerational income mobility can also be considered by the correlation coefficient, as shown in (2). Given that the elasticity measures the relationship between two distributions often decades apart it can be useful to adjust the coefficient by the variance of the dependent variable as well as the explanatory variable.

$$r = Corr_{\ln Y^{Parent}, \ln Y^{Child}} = \beta \left(\frac{SD(\ln Y^{Parent})}{SD(\ln Y^{Child})} \right) \quad (2)$$

This measure removes differences in inequality (understood as the spread in incomes) across country and time by scaling the elasticity to create a measure of positional mobility. Measuring both the elasticity and the correlation therefore allows researchers to assess the contribution that differences in inequality make to the observed patterns of mobility.

One of the main issues with previous international studies has been the lack of comparability of data across countries. Central to this concern is how different studies deal with the issue of measurement error when estimating mobility. Any 'point-in-time' family income measure is likely to be measured with error and include unobserved transitory shocks, biasing mobility estimates downwards towards zero. Solon (1992) introduced the idea of averaging across a number of periods of income to control for, although not eradicate, the downward bias due to measurement error.

A further substantive concern in comparative studies is the age at which earnings and income are measured. This issue, highlighted by Haider and Solon (2006), is driven by the

fact that age-earnings profiles are steeper for individuals with more human capital. Therefore, measures of earnings at younger ages are likely to give downwardly biased estimates of the level of β as individuals' returns have not yet been realised. Haider and Solon (2006) and Böhlmark and Lindquist (2006) show how the estimated lifetime income is affected by using single years earnings as proxies, and suggest that earnings measures around age 40 give the best approximation. However, they note that patterns are not constant across cohorts and gender, and probably not across countries.

The optimal point for measurement of intergenerational elasticities and correlations will most likely also vary, not only because of the age when we estimate lifetime income for children, but also because of the differences in the variance in parental and child income across cohorts and periods. This is illustrated in Figure 1, where we show cohort differences in elasticities for given ages for Sweden, where we have high frequency data for several cohorts. Although there is a plateau in estimated intergenerational economic persistence for all three cohorts, the age at which this plateau commences has steadily become younger across time moving from around age 36 to 30 (this is not the case for the intergenerational correlations, however, meaning that the change across cohorts in Figure 1 is driven by changes in the relative variances of parental and child incomes). Because of the potential differences in the optimal point for estimation, in our result section we present estimated elasticities at several ages from 26 through to 49 for all cohorts of data to allow for the possibility that patterns across age may not be similar across the three countries.

Decomposing intergenerational mobility

To move beyond measurement issues and begin to think about drivers of intergenerational persistence we use the methodology laid out by Solon (2004) and utilised by Blanden, Gregg and Macmillan (2007), Mood et al. (2012), and more recently in a similar comparative study by Blanden et. al. (2013). The focus is on the transmission mechanisms of mobility: those characteristics that are both related to family income and that have a return in the labour market. For comparability across countries, we focus primarily on educational attainment.

The first stage involves analysing educational inequality directly. The education of an individual has a fixed relationship with the parental income as shown in regression (3)

$$ed_i^{Child} = \alpha + \lambda \ln Y_i^{Parent} + \varepsilon_i \qquad (3)$$

The second stage involves analysing the labour market value of education in terms of later earnings, conditional on a direct income effect, as shown in regression (4)

$$\ln Y_i^{Child} = \alpha + \gamma ed_i^{Child} + \delta \ln Y_i^{Parent} + u_i \quad (4)$$

Substituting (4) into (5), conditional on the assumption $Cov(\varepsilon_i^{ed}, u_i) = 0$ and collecting terms we have

$$\ln Y_i^{Child} = \alpha + (\gamma\lambda + \delta) \ln Y_i^{Parent} + (\gamma\alpha) + u_i \quad (6)$$

From this we can observe that the elasticity, β, can therefore be decomposed into two distinct components

$$\frac{\partial \ln Y_i^{Child}}{\partial \ln Y_i^{Parent}} = \beta = \gamma\lambda + \delta \quad (7)$$

First, the 'through education component' which is the product of the relationship between education and family income and the returns to education in the labour market. Second, an unexplained 'direct income component' capturing the relationship between income and earnings, not accounted for by the level of education of an individual.

4. Data

A range of data sources are used to consider patterns in intergenerational mobility and the role of education across the US, the UK and Sweden and across time. This analysis is restricted to sons only as dealing with the labour market participation and fertility decisions of women adds too much complexity to the analysis. In the US, the National Longitudinal Surveys of Youth from 1979 (NLSY 1979), of those born 1958-1965, is used to consider mobility in the US, as in Levine and Mazumder (2002). Given that this is the only longitudinal dataset for which the individuals are old enough to capture reliable returns to education, this is the sole data used for this country.[7] In the UK, we use the two British birth cohorts commonly used in the UK for mobility analysis, the NCDS (1958) and the BCS

[7] Previous studies have used the NLS 66 survey. However, this is problematic as the parental income is reported by the sons' and does not appear robust to fathers' reported family income for those that can be linked. This error in reporting would lead to a downward bias on estimates of the intergenerational elasticity.

(1970), as in Blanden et al. (2007). The data for Sweden come from registers covering the entire population, and different compilations of these data have been used in previous works (e.g., Mood et al. 2012).

The National Longitudinal Survey of Youth is a nationally representative survey of around 13,000 individuals who were born in the United States between January 1st 1957 and December 21, 1964 and therefore aged 14-22 in 1979. They were followed yearly up until 1994 and biannually since. The original sample consists of three sub-samples; a cross-section sample of 6,111 youths designed to be nationally representative of all non-institutionalised civilians living in the USA in 1979, a supplementary sample of minority and economically disadvantaged individuals for sub-sample analysis and a military sample. For the purpose of this analysis we focus on the nationally representative cross-section sample using custom designed sampling weights to control for the complex nature of the survey.

The National Child Development Study (NCDS) is a birth cohort study of all those born in Britain in a particular week in 1958. Likewise, the British Cohort Study is a study of all individuals born in Britain in a given week in 1970. The NCDS obtained data at birth and ages 7, 11, 16, 23, 33, 42, 46 and 50 for children born in a week in March 1958. The BCS originally included all those born in Great Britain between 4th and 11th April 1970. Information was obtained about the sample members and their families at birth and at ages 5, 10, 16, 26, 30, 34 and 38.

The Swedish data come from register sources covering the entire population, primarily tax registers, educational registers, Censuses, and the enlistment register (test scores). Information from different registers is matched (also longitudinally) using a unique personal identifier, and information for parents and children is matched using a multigenerational link.[8] We here use the cohorts born 1958, 1965 and 1972, with matched information on parental incomes during childhood and own earnings when adult. Each cohort contains 40,000-50,000 father-son pairs.

Income and earnings measures

The older NLSY79 provides a continuous measure of the parents' total family income in 1978 before any taxes or deductions. The cohort members are on average age 16 when this

[8] These procedures are standard and of high quality; they are possible because all Swedish registers contain the same personal identifier. The matching was done by Statistics Sweden following approval from a vetting board. All analyses on the Swedish data were done via Statistics Sweden's micro-data online system on anonymized data.

measure is collected.[9] This is used as the main income measure for comparability across cohorts and is therefore deflated to 2001 prices. Family income data is also available in 1979 and so an average can be taken to create a more permanent income measure. Parental income data is available at age 16 in both of the British birth cohort studies. In the NCDS the data is banded for mother's earnings after tax, father's earnings after tax and other income after deductions, with a sum of the midpoints of all three categories used as a final broadly continuous measure. As all of the other income data are collected before taxes and deductions a transformation is implemented to the bands from net to gross income using information from the Family Expenditure Survey (FES) in the survey year (1974). In the BCS, parental income before taxes and deductions is derived from banded data. We generate continuous income variables by fitting a Singh-Maddala (1976) distribution to the banded data using maximum likelihood estimation. This is particularly helpful in allocating an expected value for those in the open top category. In both studies the income measures are deflated to 2001 prices. These measures have been used on a number of occasions and a great deal of work has been done already to test their robustness and comparability (Blanden, Gregg and Macmillan, 2013, Appendix A). A repeat of income data for another period is not available in the NCDS cohort studies but is available at age 10 (1980) in the BCS cohort. An average income from two periods can therefore be constructed for the NLSY79 and BCS70 cohorts. Both the point-in-time and the average income measures are logged for the analysis[10].

In keeping with previous studies, the earnings of sons in adulthood are used as the dependent variable throughout this analysis. To consider the trends in mobility when assessed at different stages of the son's life-cycle, earnings at various ages are observed across the data sources. In the NLSY, earnings are measured in 1988 when the average age of the cohort members is 27, 1994 at age 33, 2000 at age 39 and 2010 at age 49. As with the parental income measures, the earnings measures are deflated to 2001 prices. Comparable earnings information for the British data is available in the NCDS at age 33, 42 and 50 and in the BCS at age 26, 34 and 38. Those with no earnings are removed and the earnings distributions are logged for the analysis. Self-employed sons are also excluded from our analyses, as there are concerns over their reported wages.

For Sweden, income data for parents are available from 1968 and onwards, and earnings data are available for children from 1990 to 2007. For the 1958 cohort, we can thus

[9] Cohort dummies are included throughout the analysis in the US to account for the fact that the NLSY79 are born across an eight-year period unlike our traditional birth cohorts.

[10] In the case of averaged incomes, we use the log of the average income and not the average of the log incomes throughout the analysis.

observe parental incomes for child ages 10-18, and sons' earnings from age 32 to 49, for the 1965 cohort we have parental incomes for child ages 3-18 and sons' earnings for ages 25-42, and for the 1972 cohort we observe parental incomes for the entire childhood (0-18) but sons' earnings only up to age 35. To match the UK and US data, we use total gross parental income as measured at child ages 10, 16 and 17, and child earnings measured at ages 27, 34, 41 and 49. All income and earnings data are annual and measured per calendar year. Zero incomes and earnings are coded to missing, and self-employed sons are excluded. Incomes and earnings are top-coded at four standard deviations from the mean, in order to down-weight the impact of a small group with extremely high values. All incomes and earnings are expressed in their log form.

One source for concern in our analysis is the issue of sample selection in the UK data. In the US and Sweden, the data contain the adult son's annual earnings over the previous year, regardless of the current employment status. There is a long left tail of low earnings in both data sources for people who only work for parts of the year. In the UK data, the individuals' pay and the length of their pay period are observed only for those in employment at the time of the survey. Those who are out of work are thus excluded, and we do not observe the same long left tail of low earnings. We have considered a number of options for dealing with this issue and have chosen to make two adjustments to bring our samples closer together. First, in the UK data, we adjust our wage data for the months spent in work in the previous year, before earnings are reported. This creates an annual earnings measure, taking into account spells out of work within the year. Second, to bring the samples in the US and Sweden more in line with the UK data[11] we trim the tail of the annual earnings in the US and Sweden below the 2nd percentile of earnings. Analysis of work patterns for the individuals dropped from our sample in these countries suggests that these people spend the majority of the year out of work in the year that earnings are reported and so are assumed to be similar to the individuals missing from the UK sample.

Educational attainment measures

When comparing across the countries there are obvious difficulties in creating comparative educational attainment measures. The US literature on the topic is much more focused around the additional benefit of an extra year in education given the more generic qualification received for completion of high school and obtaining a Bachelors degree. The UK literature

[11] The alternative is imputing earnings for the missing UK sample but we believe this will complicate the picture here for international comparisons.

in comparison focuses more on its own qualifications based system, for example, the number of GCSEs at grade A-C and the number of A-levels. Breen and Jonsson (2005) discuss the issues with a 'years of schooling' measure arguing that this measure tends to conflate changes in the marginal distributions with the expansion of education not being accounted for. There is also some concern that there is a higher rate of return to education in the US for those who have dropped out of the system previously.

We have chosen to construct a four category highest educational attainment measure. The categories for the US are: drop-out/GED; High School Graduate; Associates; Bachelors.[12] For the UK, the corresponding categories are: less than O levels; O levels; A-levels; Degree. For Sweden, the educational categories are: comprehensive school; short upper secondary education; long upper secondary/short post-secondary education; university education. Education is measured around the age 24-25 in the US and UK, and in Sweden it is measured in the population educational register of 2007 (or earlier if the individual is missing in 2007). This year is chosen as the educational register has improved over time, meaning that the latest available educational record is the most reliable one.

Tables 1 and 2 summarize all of the available information for analysing the relationship between family income, educational attainment and earnings.

5. Results

Table 3 and Figure 2 present comparative estimates of intergenerational income mobility across countries for one available cohort in the US, two in the UK and three in Sweden from the period 1958 to 1972. In the Table we report both elasticities and correlations. A number of features stand out from these estimates. First, there is a clear ranking of mobility across the countries when using comparable measures of family income at 16 and earnings at around 40, with Sweden exhibiting far greater mobility, the UK in the middle and the US with the lowest mobility. Second, the US intergenerational elasticity when measured at younger ages is even higher than for prime age groups for the other countries, and while in the UK and Sweden there is evidence of these estimates turning down around age 50, this is not apparent in the US.[13] The result is thus that the higher intergenerational persistence in the US compared to the other countries is more pronounced at young and older ages.

[12] Analysis of the NSLY79 showed that those who obtain a GED look more similar to drop-outs in terms of labour-market returns than high school graduates as found by Cameron and Heckman (1998) and hence these groups are included together.

[13] None of the cohorts considered are observed when moving into ages where health related incapacity and early retirement become serious issues that may shift these patterns.

Third, the alternative correlation measure, which adjusts for changes in inequality across generations, produces lower estimates of persistence (except in the UK 1970 cohort). This means that a part of the elasticities is accounted for by the fact that the variance in sons' earnings is greater than the variance in family income. This, in turn, depends to some extent on the measures (earnings are market rewards, which are smoothed by various kinds of benefits to produce the somewhat more equal gross income measure), but also reflects increasing income inequality over generations.[14] However, while lower, the intergenerational correlations reveal patterns across ages, countries and cohorts that are very similar to those of the elasticities. This is an important and novel finding, suggesting that the lower mobility in the US is not, as could be surmised, because of a particularly rapid change in income inequality across generations. Fourth, in the UK, intergenerational persistence increases between the cohorts born in 1958 and 1970 at all comparative ages (as noted in Blanden et al., 2004), while in Sweden there is little evidence of change across cohorts (there is no cross-cohort comparison available in the US).

Correcting for measurement error and transitory income shocks in family income

A concern for comparing these estimates across countries is the mis-measurement of family income and the resulting attenuation bias. This bias can arise either from temporary fluctuations in income or reporting errors in the data. The data used here come from very different sources: the Swedish from administrative tax and benefit records, whilst the UK and US data come from surveys. It is highly likely then that there will be different levels of reporting error in the data which could lead to differential attenuation bias in the estimated levels of persistence.

A common approach (Solon, 1992, Dearden, Machin and Reed, 1997) to address such attenuation bias is to average incomes over two or several years to move closer to a measure of entire childhood family income. Table 4 presents estimated intergenerational elasticities across countries for cohorts where we are able to average across more than one data point of family income in childhood. In the Swedish data we can in fact observe an almost complete family history of incomes through childhood. This can give an unbiased estimate of

[14] We can say with certainty that in the Swedish data, where we could test this, the fact that the correlation is lower than the elasticity is primarily because of an increase in the variance in income across generations, and only marginally attributable to the difference in measures. We should be a bit cautious about interpreting the difference across countries in the between-generation income inequality, however, as these measures are not (as explained in the data section) comparable, and thus the variance inferred from data that are in some cases banded, and in all cases truncated.

intergenerational persistence by averaging incomes across all years of the study person's childhood. As long as we believe that the administrative data has no systematic reporting bias across families from different parts of the income distribution, such averaging will remove any transitory variation in incomes and the associated attenuation bias.

For the US and the UK we have income measures from only two points in time, and these are at different intervals across childhood: in the US we observe parental income at ages 16 and 17, and in the UK at ages 10 and 16. Whilst in both cases we are averaging over two years, the different combination of ages observed probably removes different amounts of transitory income variations. For example, given that in the US the data points are observed in consecutive years, any transitory income shocks which have some persistence over two years will not be removed. By comparison, in the UK case with two data points observed six years apart, there is likely to be less persistence in transitory shocks, giving a better proxy for permanent childhood income.

Utilising the flexibility of the Swedish data we can explore how much of a difference averaging over these different windows makes. Considering estimates of intergenerational persistence at age 41 for the 1965 Swedish cohort, where we have full childhood income history[15], we can explore the impact of moving from a point-in-time estimate of family income at age 16 to one averaged across pairs of years observed in the UK and US data and onto the full childhood period. The estimated elasticity at age 41 observed in Table 3 was 0.21 for this 1965 cohort of Swedish data using family income at age 16 only. Taking the average of income at ages 16 and 17, as is available in the US data, produces an increase in the estimated elasticity to 0.24 (11% increase). In the US the coefficient increases from 0.37 to 0.43 (15% increase). Taking an average of income at ages 10 and 16 in the Swedish data, as is available in the UK data, produces an increase in the estimated persistence from 0.21 to 0.27 (26% increase). The corresponding increase in the UK data is from 0.31 to 0.44 (45% increase). Overall, this suggests that averages over adjacent years removes less bias than averages over years further apart, and it also looks like the correction is greater in the UK and US as compared to Sweden, which probably is due to the nature of the data – in particular, that the measurement error is greater in survey data.

Using the Swedish data, we can average family income across the childhood and thereby remove any transitory variation in incomes and the associated attenuation. Permanent

[15] Actually these results use averaged income from ages 3 to 18 from the Swedish data as the middle cohort data starts at age 3. There is no meaningful difference in using income averaged over age 3-18 or 0-18 in the younger cohort (1972).

childhood income in Sweden (ages 3-18) gives an estimated elasticity of 0.33, so the point-in-time estimate of family income at age 16 (0.21) represents around two thirds of the true estimate.[16] The estimates using average income at age 16 and 17 are around 70% of this unbiased estimate. For the correlation the same two-period average represents 86% of the true picture. Therefore averaging across two income observations from neighbouring years is not a good approximation of total childhood income – it removes just under one third of the attenuation bias from the elasticity using a point-in-time measure. When considering patterns observed in the richer Swedish data, we infer that the more limited US data can only remove a relatively small fraction of the attenuation bias.

If we assume a similar degree of attenuation bias in all countries, adjustment based on the Swedish numbers would move the elasticity for total childhood income in US up in the region of 0.60, and for the UK to around 0.55.[17] However, we would expect more measurement error in the US and UK data compared to Sweden given the differences in data collection, so these numbers are more likely underestimates than overestimates of the true elasticity.

For the correlation the attenuation biases are far smaller. Applying the same re-scaling based on the Swedish patterns to estimate the correlation between total childhood income and earnings around age 40 we get a correlation of 0.39 for the US and 0.36 for the UK, which are both clearly higher than the corresponding Swedish correlation of 0.23.

Altogether, the conclusion we arrive at while attempting to correct for attenuation bias is that the US and the UK are similar in terms of mobility, and both are much less mobile than Sweden. In addition, our results from this exercise suggest that the "true" level of intergenerational persistence in income is not only higher than point-in-time reports of family income would lead us to believe (which has been pointed out in many studies), but also quite a bit higher when the figure is based on information from the whole childhood income.

The role of education

We have so far established a clear picture of two countries with very high persistence (low mobility), the UK and the US, compared to a country, Sweden, with more moderate

[16] Very similar results apply to the later Swedish cohort, where we also have permanent childhood income when considering earnings at age 35, the last year available. The individual age at which childhood income is observed makes little difference in the middle Swedish cohort but in the younger cohort there is a tendency for both the elasticity and correlation to be higher at older ages (15 through to 18) and hence the attenuation bias to be a little less marked.

[17] This estimate of the elasticity in the US matches the result in Mazumder (2005).

persistence (higher mobility). An important contribution of this analysis is that the result is based on consistent measures of incomes and earnings accounting for life-cycle bias and measurement error. Our next contribution is to unpack the mobility process, and thereby add to the knowledge considering the role that (a) education inequalities and (b) wage returns to education play in intergenerational income persistence across these three countries. Can the high mobility in Sweden be explained by low levels of inequality of educational attainment, or by small returns to educational credentials? Are the reasons for the low mobility in the US the same as in the UK?

We begin by exploring the patterns of returns to education across the countries. For the remainder of this analysis, we focus on the three most comparable cohorts, one from each country, which can provide us with estimates that take into account the issues discussed above. Table 5 and Figure 3 describe the wage returns to education groups for each country using the BCS (1970) for the UK, the 1965 cohort for Sweden and the NLSY (1957-1965) in the US. As described in the data section we have developed a fourfold categorisation of education for each country that is as far as possible comparable, although Sweden does have a far larger portion of its male workforce in category 3 (long upper secondary education for Sweden and UK; associate degree for US) than the other countries, and less in the lowest attainment category. The results indicate the percentage increase in earnings at a given age associated with achieving the given level of educational attainment compared to the baseline category (HS graduate, O-level, Short Upper Secondary).

Table 5 shows that differences in returns are evident earlier in the life course in the US (age 26). Young people with few qualifications experience severe wage penalties in their early employment experiences compared to those who complete high school. In the UK, differential returns are muted compared to the US at young ages and in Sweden there are negative returns to high education at young ages (higher education is normally finished at a higher age in Sweden and so we may not expect returns to be realised in the labour market at this age[18]).

By age 33/34, there is a clear ranking in terms of the returns to degree attainment with the US having the highest return followed by the UK and then Sweden. There is also a clear distinction in returns to the lowest qualifications between the UK and the US (lower returns, higher penalties) and Sweden (more similar to the baseline category). By age 40 the US has

[18] Education is (for most people) measured in 2007, so at the youngest age some may not even have completed their education yet.

pulled further away from the UK in terms of returns to degree attainment. Sweden and the UK look more similar in terms of returns to degree attainment although there is not the same penalty to low levels of education in Sweden compared to the UK and the US. To compare overall levels of inequality in returns to attainment, we consider differences between returns to the highest and lowest educational attainment at each age within each country. Figure 3 plots the inequality in wage returns across the life-cycle. The US exhibits the highest levels of wage inequality followed by the UK and Sweden.

Turning next to how socially patterned educational attainment is across the countries, Table 6 reports the association between log family income and children's highest educational level. The interpretation is the effect of a doubling of average family income on the probability of being in each one of the education groupings compared to the other three categories. Figure 4 summarizes these results by showing the differences between the income gradients for the top and bottom education categories for each country. There are striking similarities in the educational inequalities across the countries. In each country the chances of getting a degree are around 20 percentage points higher for a doubling of average family income. Conversely, the chances of early dropping out of education or falling into the lowest education attainment category are around 10 percentage points lower compared to any of the other three categories for a doubling of average family income. The difference in the income effect on the risk of having the highest vs. the lowest educational level in Figure 4 is therefore 0.30 to 0.35 in all three countries. If anything, the overall family income gradient for Sweden is higher than the estimate for the US and UK because of the relatively strong negative estimate for shorter upper secondary education, which in turn is probably a consequence of the accentuated vocational content at this level of education.

Given the similarities in educational inequality and the moderate differences in wage returns to these qualifications it is unlikely that education is the key driver of the differences in intergenerational persistence across the countries. Table 7 and Figure 5 report the formal decomposition outlined in equations 3 to 7 above. The results for earnings at around age 40 (which, as we have seen, is regarded as optimal by Haider and Solon (2006)), demonstrate that the transmission of inequality across generations that is flowing through education is very similar in all three countries. There is slightly less persistence through education in Sweden (0.10 of the total elasticity compared to 0.11 in the UK and 0.12 in the US), and given the patterns revealed in Tables 5 and 6 we would assume that these small differences originate in the wage returns rather than in educational inequalities. As the differences in wage returns are more marked at younger ages so are the importance of education to

intergeneration inequalities overall.

We conclude that the lower mobility in the US is not due to higher returns to education; nor that the favourable position of Sweden can be explained by more equal access to higher education. In fact, education is, according to our results, not the important trigger of differences in income mobility across countries that is commonly believed. Instead, the big differences across countries arises in the part of the parent-to-son income elasticity *not* going through education: it is inequalities in earnings *within education group* that are dramatically more socially patterned in the UK and US compared to Sweden.

It is conceivable that the rather crude education measures that we use for comparability drive this result. We consider this issue by moving away from comparable measures of education to fully-saturated models (as used in Blanden et al., 2007 and Mood et al., 2010) including further measures of available education information and related variables observed in each country's data. Importantly, this includes the results of test scores for literacy and numeracy as well as measures of ability present in all three countries, but expressed in rather different forms and measured at different ages (see Appendix for details). These educationally saturated models, although not directly comparable, are intended to find out whether increasing the education information radically changes the total persistence through education in any country. The results in Figure 6 (see Appendix Table A1 for underlying figures comparable with Table 7) do show more intergenerational inequality flowing through education (including ability) in all three countries and this is somewhat more marked in the US. However, the central result holds: The large differences in intergenerational inequalities between the UK and US compared to Sweden are not flowing through education.

As a final thought experiment in Table 8 we explore where in the education distribution the earnings returns to family background differ across countries. We consider the base category of High School graduation/ O levels/ short upper secondary education and report differences in the intergenerational elasticity at each education level compared to the base. Around age 40 a doubling of family income results in 34 percent higher wages in the US within this education group. For the UK this association is slightly lower at 29 percent and falls to 14 percent in Sweden. At this given level of basic educational attainment, family background matters far less in Sweden than in the other countries. For the lowest educational group in US and Sweden, the difference in the impact of family background on earnings is similar to the base case, whereas in the UK the lowest educated have a higher elasticity (though the difference is not statistically significant). For the highest achieving group, those

with bachelor's degrees or higher, the role of family background is somewhat higher in Sweden and lower in the US. The main difference between the US and UK and Sweden in terms of how family background matters for a given level of educational attainment, is focused on the lowest educational attainment group.

6. Conclusion and discussion

We asked whether the (purportedly) low intergenerational income mobility for sons in the US could be understood by the substantial return to education, while, perhaps, the importance of family income for educational attainment was relatively small. We compared the US elasticity and correlation with UK and Sweden, further asking whether UK, as a high-inequality society in Europe, would be similar to the US; and whether the egalitarian Sweden would perhaps show lower educational inequality as well as lower returns to education.

Our contribution in this study is not only to unpack the income persistence across countries in answering these questions, but to pave the way for this decomposition by paying extraordinary attention to making our data-sets comparable (and given the generic differences in the data, there is a limit also in our case). In addition, we were able to use the flexible and very large Swedish data-set for estimating elasticities for full childhood income histories, thereby making a serious attempt to overcome bias in family income due to transitory income and measurement error. On the child side, we were also able to compare the estimates in our three countries at similar ages for similar cohorts, thereby maximizing comparability.

We could verify that the ordering of countries was the expected, with US exhibiting the highest persistence, UK following at some distance, while Sweden clearly being the country with greatest equality of opportunity (supporting the results in Jäntti et al. 2006, among others). These country differences remained the same both when we used elasticities and correlations. Correcting for attenuation bias on the parental side leads us to estimate elasticities to (at least) 0.60 for US, 0.48-0.55 for UK, and 0.33 for Sweden. But this ranking cannot be explained by the anticipated partial effects involving education. In fact, educational inequality (as reflected in the gradient of family income on completed level of education) is fairly similar across our three countries, and while the return to education is higher in the US, this does not help much in accounting for inter-country differences. All in all, education appears as an important mediator of income across generations, but cannot explain the differences between the US, UK, and Sweden. Instead, the crucial role is played by the family income influence on sons' earnings at given levels of education.

Because we worried that this result may come about because we failed to measure education in sufficient detail, or did not manage to construct a measure that was sufficiently comparable, we fitted "saturated" models where we controlled for national-specific, detailed educational variables, and in addition for ability/test results. This changed the results somewhat, but did not change the story. The big difference between our countries lies in the ranking of the "non-meritocratic" element that pushes children of more fortunate families to more rewarded labour market positions than their peers: both in the US and UK this is common, whereas in Sweden the expected income at a given qualification level is almost independent of the family of origin.

There is a tendency, albeit our US and UK data are too sparse to make a strong case, that this "non-meritocratic" mechanism is more accentuated at lower levels of education. This would be consistent with results showing that the big difference between the US and UK on the one hand, and Scandinavian countries on the other, lies in the lower tail of the family income distribution – children from these homes are particularly likely to end up with similarly low incomes themselves in the US, while children in the bottom origin quintile are more upwardly mobile in Scandinavia (Jäntti et al 2006). This seems to be the case also when one moves to the outer end of the income distribution where poor children in both UK and US end up with very low incomes themselves, while children from the Scandinavian countries are more sheltered from sharing their parents' misfortune (Bratsberg et al. 2007; Jonsson, Mood, Bihagen 2010).

There could be several explanations for this result, and for our related finding that family income is more effective at lower levels of education in the US, in relative terms. One is that the school quality is higher for those with lower education in Scandinavia, meaning that those with minimum schooling are not far behind other children, and that they also are a homogenous group in terms of skills; another that the strong labour unions and collective bargaining set a relatively high "minimum" wage also for those with the least qualifications; and yet another that in the US especially, wage discrimination on the basis of race or ethnicity may be prevalent, leading to lower mobility for minority groups at the lower levels of education, who are on average poorer than their majority group peers. Of course, it could also be that social networks are more important for finding a good job in the US and UK, and that family income (or its correlate) reflects such networks, but one would then have expected this to be equally important for those at higher levels of education.

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Table 1 Descriptive statistics of log income and log earnings in the US, the UK and Sweden

	Country	*US*	*UK*		*Sweden*		
	Cohort	**NLSY79 (1957-1965)**	**NCDS (1958)**	**BCS (1970)**	**Birth cohort 1958**	**Birth cohort 1965**	**Birth cohort 1972**
26/27							
	Parental inc 16 (sd)	10.76 (.68)		9.87 (.59)		12.58 (.48)	12.80 (.45)
	Av. inc 16, 17 (sd)	10.84 (.60)				12.58 (.45)	12.82 (.43)
	Av. inc 10, 16 (sd)			9.91 (.44)		12.57 (.42)	12.71 (.38)
	Earnings (sd)	10.02 (.76)		9.27 (.50)		11.78 (.71)	11.89 (.80)
33/34							
	Parental inc 16 (sd)	10.79 (.67)	9.81 (.44)	9.82 (.59)	12.48 (.54)	12.58 (.48)	12.80 (.45)
	Av. inc 16, 17 (sd)	10.85 (.60)			12.52 (.51)	12.59 (.45)	12.82 (.43)
	Av. inc 10, 16 (sd)			9.88 (.44)	12.44 (.45)	12.57 (.42)	12.71 (.38)
	Earnings (sd)	10.30 (.68)	9.89 (.50)	10.17 (.57)	12.06 (.57)	12.22 (.61)	12.38 (.55)
38/41							
	Parental inc 16 (sd)	10.79 (.67)	9.81 (.45)	9.85 (.60)	12.48 (.53)	12.58 (.47)	
	Av. inc 16, 17 (sd)	10.84 (.59)			12.52 (.51)	12.59 (.45)	
	Av. inc 10, 16 (sd)			9.88 (.44)	12.45 (.45)	12.57 (.41)	
	Earnings (sd)	10.63 (.65)	10.03 (.66)	10.40 (.59)	12.32 (.56)	12.48 (.54)	
49							
	Parental inc 16 (sd)	10.79 (.67)	9.81 (.44)		12.49 (.53)		
	Av. inc 16, 17 (sd)	10.85 (.59)			12.53 (.51)		
	Av. inc 10, 16 (sd)				12.45 (.45)		
	Earnings (sd)	10.58 (.85)	10.38 (.62)		12.53 (.53)		

Table 2 Descriptive statistics of highest education level in the US, the UK and Sweden

Country	***US***	***UK***		***Sweden***		
Cohort	**NLSY79 (1957-1965)**	**NCDS (1958)**	**BCS (1970)**	**Birth cohort 1958**	**Birth cohort 1965**	**Birth cohort 1972**
Drop out/< O-level/Comprehensive	13.3	22.4	19.1	18.3	10.7	8.2
HS graduate/O-level/Short upper secondary	54.6	33.2	37.3	38.7	43.9	31.8
Associates/A-levels/Long upper, short post-sec	5.8	33.4	17.7	26.5	28.9	35.5
Bachelors/University qualification	26.2	11.1	25.9	16.5	16.5	24.5

Notes:

1 Across all three sources the sample consists of those with valid observation of parental income at 16 and earnings at age 34. For Sweden education is the highest education recorded 1990-2007

Table 3 Intergenerational elasticities and correlations in the US, the UK and Sweden for Gross Income and Earnings, for males in different ages and cohorts

Country	***US***	***UK***		***Sweden***		
Cohort	**NLSY79 (1957-1965)**	**NCDS (1958)**	**BCS (1970)**	**Birth cohort 1958**	**Birth cohort 1965**	**Birth cohort 1972**
26/27						
Elasticity	0.298 (.028)		0.183 (.022)		0.063 (.006)	0.122 (.008)
Correlation (r)	0.249 (.023)		0.213 (.026)		0.042 (.004)	0.068 (.005)
N	1,589		1,416		53,436	48,565
33/34						
Elasticity	0.263 (.028)	0.184 (.024)	0.259 (.022)	0.167 (.005)	0.207 (.006)	0.191 (.006)
Correlation (r)	0.242 (.025)	0.162 (.021)	0.267 (.023)	0.157 (.005)	0.160 (.004)	0.157 (.005)
N	1,448	2,152	1,691	43,730	51,492	47,700
38/41						
Elasticity	0.372 (.029)	0.272 (.031)	0.307 (.026)	0.200 (.005)	0.213 (.005)	
Correlation (r)	0.340 (.026)	0.186 (.021)	0.314 (.027)	0.188 (.005)	0.188 (.004)	
N	1,320	2,211	1,266	41,981	50,428	
49						
Elasticity	0.426 (.040)	0.194 (.034)		0.182 (.005)		
Correlation (r)	0.315 (.028)	0.137 (.024)		0.184 (.005)		
N	1,120	1,709		40,777		

Notes:

2 Elasticities and correlations from regressions of log of sons gross annual earnings at age given on log of family income at 16.
3 Self-employed sons excluded.
4 Zero incomes excluded in both generations.
5 Incomes above 4 sd's top-coded and lowest 2 percent excluded in Sweden
6 Top and bottom 2 percent of incomes excluded in US
7 Lowest 2 percent of earnings excluded in Sweden and the US
8 Standard errors in parenthesis.
9 The intergenerational correlation in the NLSY79 is lower than the commonly accepted 0.4, as this estimate uses parental income from only 1978 for comparability across countries. Averaging across more periods of parental income increases this coefficient as expected – see Table 4.

Table 4 Intergenerational coefficients and correlations in the US, the UK and Sweden for gross family income and sons' earnings, using two-period average income in different ages and cohorts

Country	***US***	***UK***	***Sweden (average inc at 16 and 17 – US)***			***Sweden (average inc at 10 and 16 – UK)***		
Cohort	**NLSY79 (1957-1965)**	**BCS (1970)**	**Birth cohort 1958**	**Birth cohort 1965**	**Birth cohort 1972**	**Birth cohort 1958**	**Birth cohort 1965**	**Birth cohort 1972**
26/27								
Elasticity	0.352 (.038)	0.235 (.035)		0.065 (.007)	0.130 (.008)		0.043 (.007)	0.125 (.009)
Correlation (r)	0.252 (.027)	0.197 (.029)		0.041 (.004)	0.070 (.005)		0.025 (.004)	0.060 (.005)
N	1,185	1,119		52,915	48,130		52,417	47,877
33/34								
Elasticity	0.367 (.040)	0.341 (.035)	0.175 (.005)	0.229 (.006)	0.209 (.006)	0.206 (.006)	0.248 (.006)	0.245 (.006)
Correlation (r)	0.291 (.029)	0.260 (.026)	0.158 (.005)	0.169 (.004)	0.164 (.005)	0.167 (.005)	0.172 (.004)	0.173 (.005)
N	1,097	1,352	42,864	50,993	47,284	39,490	50,546	47,015
38/41								
Elasticity	0.427 (.043)	0.444 (.040)	0.213 (.005)	0.236 (.005)		0.261 (.006)	0.268 (.006)	
Correlation (r)	0.332 (.030)	0.328 (.030)	0.193 (.005)	0.197 (.004)		0.211 (.005)	0.211 (.004)	
N	985	1,014	41,165	49,951		37,973	49,482	
49								
Elasticity	0.507 (.050)		0.194 (.006)			0.242 (.006)		
Correlation (r)	0.330 (.033)		0.187 (.005)			0.209 (.005)		
N	843		39,988			36,874		

Notes:

1. Elasticities and correlations from regressions of log of sons gross monthly earnings (yearly in Sweden) at age given on log of family income average at two points in time.
2. Standard errors in parenthesis.
3. The intergenerational correlation in the NLSY79 uses average parental income across 1978 and 1979
4. The intergenerational correlation in the BCS uses average parental income across 1980 and 1986
5. Self-employed sons excluded.
6. Incomes above 4 sd's top-coded and lowest 2 percent excluded in Sweden
7. Top and bottom 2 percent of incomes excluded in US
8. Lowest 2 percent of earnings excluded in Sweden and the US

Table 5 Wage returns to levels of education in the US, the UK, and Sweden, for males of different ages and cohorts

	US 1957-65	UK 1970	Sweden 1965
26/27			
Drop out / < O-level / Comprehensive	-0.240 (.064)	-0.129 (.045)	-0.049 (.010)
HS graduate / O-level / Short upper second	Base	Base	Base
Associates / A-levels / Long upper, short post	0.170 (.089)	0.057 (.046)	0.000 (.007)
Bachelors / University qualification	0.133 (.049)	0.146 (.040)	-0.282 (.009)
33/34			
Drop out / < O-level / Comprehensive	-0.162 (.061)	-0.231 (.047)	-0.068 (.009)
HS graduate / O-level / Short upper second	Base	Base	Base
Associates / A-levels / Long upper, short post	0.159 (.078)	0.101 (.047)	0.140 (.006)
Bachelors / University qualification	0.393 (.045)	0.306 (.043)	0.208 (.008)
38/41			
Drop out / < O-level / Comprehensive	-0.193 (.064)	-0.172 (.055)	-0.067 (.008)
HS graduate / O-level / Short upper second	Base	Base	Base
Associates / A-levels / Long upper, short post	0.059 (.083)	0.143 (.055)	0.164 (.005)
Bachelors / University qualification	0.469 (.047)	0.350 (.048)	0.354 (.007)
49			
Drop out / < O-level / Comprehensive	-0.175 (.088)		
HS graduate / O-level / Short upper second	Base		
Associates / A-levels / Long upper, short post	0.122 (.104)		
Bachelors / University qualification	0.639 (.059)		

Notes:

1. Standard errors in parenthesis
2. Samples size, NLSY: N=1,185, 1,097, 985, 843. BCS: N=1,119, 1,352, 1,014. Sweden: N=52,417, 50,546, 49,482
3. Returns from a multivariate regression of annual earnings at given age on categorical education

Table 6 Family income gradients in education in the US, the UK and Sweden, for males in different cohorts

US 1957-65		UK 1970		Sweden 1965	
Drop out	-0.124 (.019)	< O-level	-0.128 (.024)	Comprehensive	-0.086 (.003)
HS graduate	-0.104 (.030)	O-level	-0.038 (.034)	Short upsec	-0.235 (.005)
Associates	0.031 (.014)	A-level	0.054 (.024)	L up/Sh post	0.114 (.005)
Bachelors	0.195 (.026)	Bachelors	0.233 (.029)	University	0.207 (.004)
N	985	N	1,014	N	49,482

Notes:

1. Standard errors in parenthesis.
2. Income gradients from separate bivariate regressions of categorical education dummies on family income in childhood. The base category is therefore all other education categories.
3. Average income at age 10 and 16 in Swedish data. Income gradients from average income at age 16 and 17 are -0.078, -0.190, 0.099 and 0.169 restricting the sample to earnings at 41.

Table 7 Accounting for intergenerational persistence in the US, the UK and Sweden, for males in different ages and cohorts

	US 1957-65	UK 1970	Sweden 1965
26/27			
Total through education	0.062	0.057	-0.052
Total not through education	0.290	0.178	0.095
Total persistence	*0.352*	*0.235*	*0.043*
33/34			
Total through education	0.099	0.103	0.065
Total not through education	0.268	0.238	0.183
Total persistence	*0.367*	*0.341*	*0.248*
38/41			
Total through education	0.117	0.112	0.097
Total not through education	0.310	0.332	0.171
Total persistence	*0.427*	*0.444*	*0.268*
49			
Total through education	0.168		
Total not through education	0.339		
Total persistence	*0.507*		

Notes:

1. Samples size, NLSY: N=1,185, 1,097, 985, 843. BCS: N=1,119, 1,352, 1,014. Sweden: N=52,417, 50,546, 49,482
2. Total through education is the sum of the product of Table 5 and 6.
3. Total not through education from direct impact of income on earnings and any missing dummies.
4. Total mobility corresponds to estimated elasticities from Table 4.
5. The Swedish estimates are from averaged income at 10 and 16. Corresponding estimates from average income at 16 and 17 and earnings at age 38/41: Through education 0.083, Not through education 0.153, Total persistence, 0.236.

Table 8 Within education inequality in the US, the UK and Sweden, for males in different ages and cohorts

	US 1957-65	UK 1970	Sweden 1965
38/41			
HS graduate / O-level / Short upper second	*0.343 (.053)*	*0.293 (.068)*	*0.137 (.009)*
Drop out / < O-level / Comprehensive	-0.059 (.110)	0.091 (.101)	-0.023 (.020)
Total persistence	*0.284*	*0.384*	*0.114*
Associates / A-levels / Long upper, short post	-0.443 (.176)	0.146 (.142)	0.055 (.014)
Total persistence	*-0.100*	*0.439*	*0.192*
Bachelors / University qualification	-0.112 (.094)	0.044 (.111)	0.090 (.015)
Total persistence	*0.231*	*0.337*	*0.227*

Notes:

1. Standard errors in parenthesis.
2. Samples size, NLSY: N=1,185, 1,097, 985, 843. BCS: N=1,119, 1,352, 1,014. Sweden: N=52,417, 50,546, 49,482
3. Estimates from regression of log annual earnings on average parental income, categorical education dummies and interactions between family income and education categories.
4. Coefficients from interactions. Education levels 1, 3 and 4 are deviations from the base category, education level 2.

Figure 1 Estimates of intergenerational elasticities in Sweden across the life-cycle

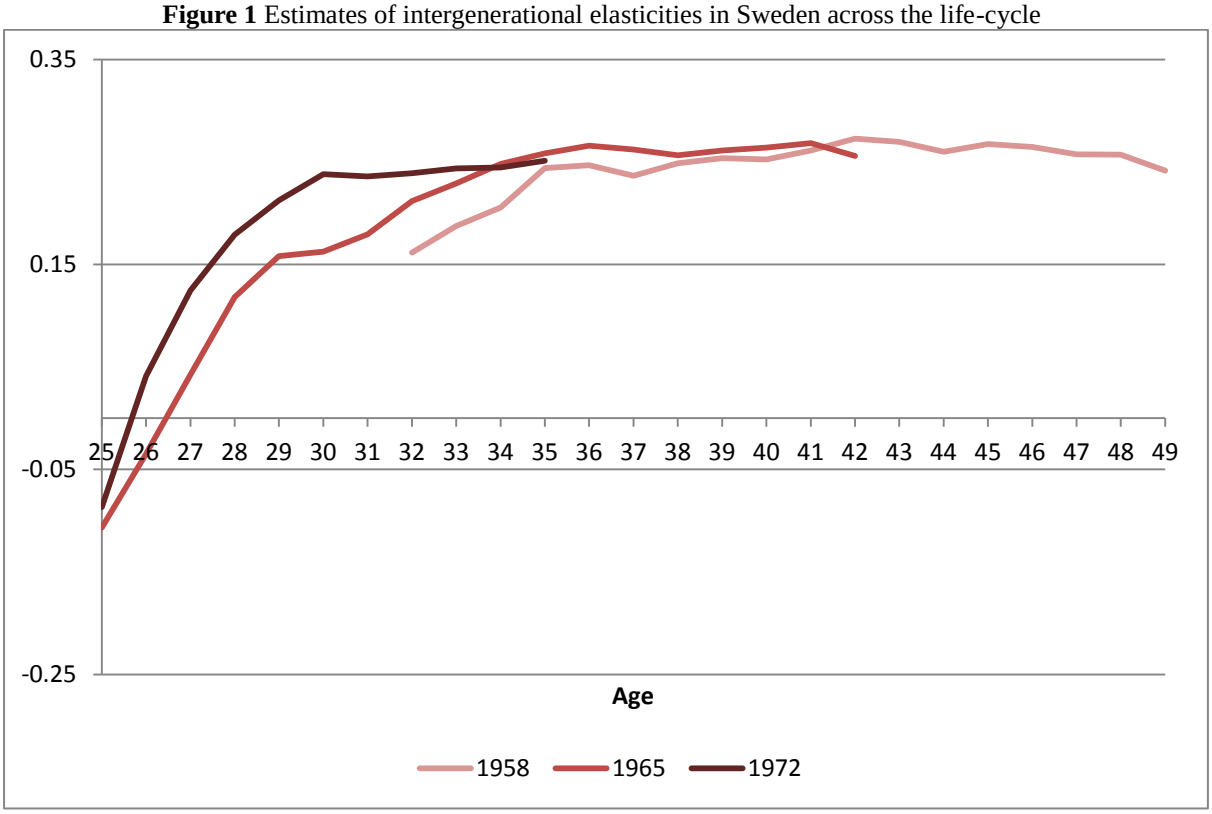


Figure 2 Estimates of intergenerational elasticities in the US, the UK and Sweden across the life-cycle

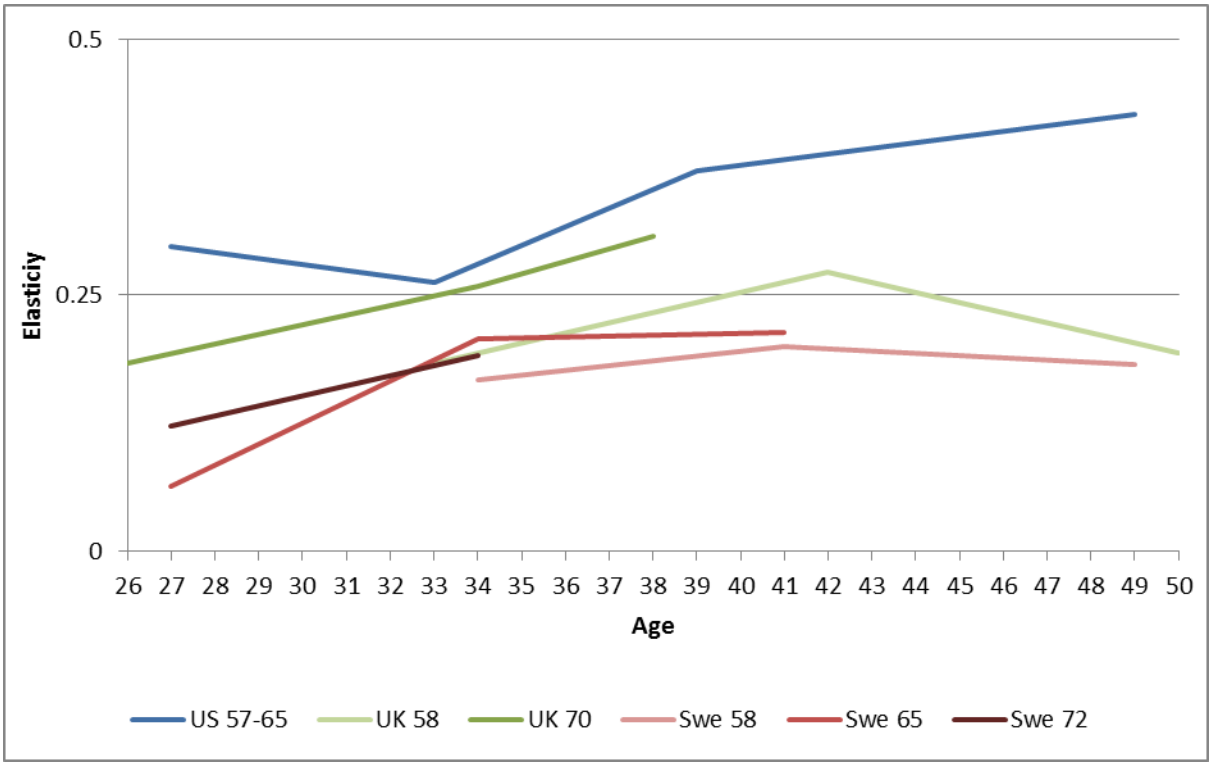


Figure 3 Inequality in wage returns for top vs. bottom education category in the US, the UK and Sweden across the life-cycle

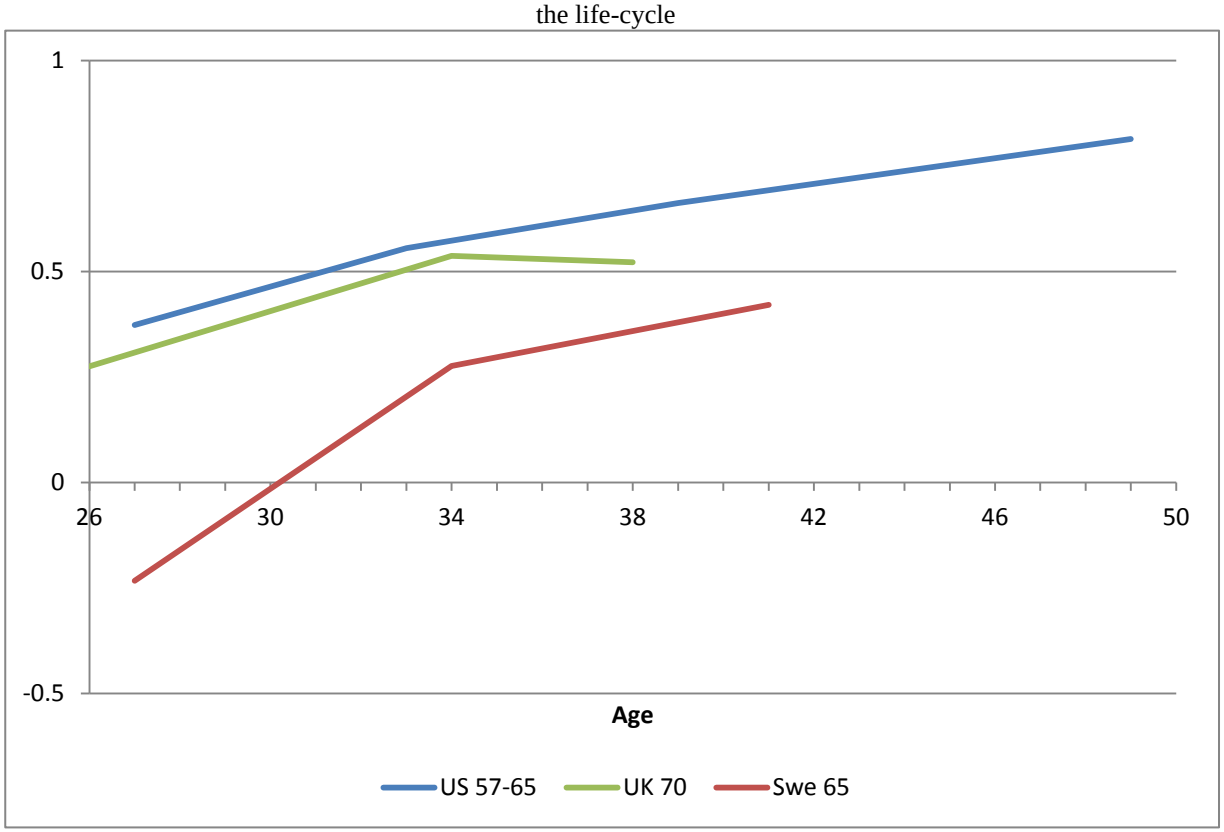


Figure 4 Difference in family income gradient in top vs. bottom education category in the US, the UK and Sweden at age 38/41

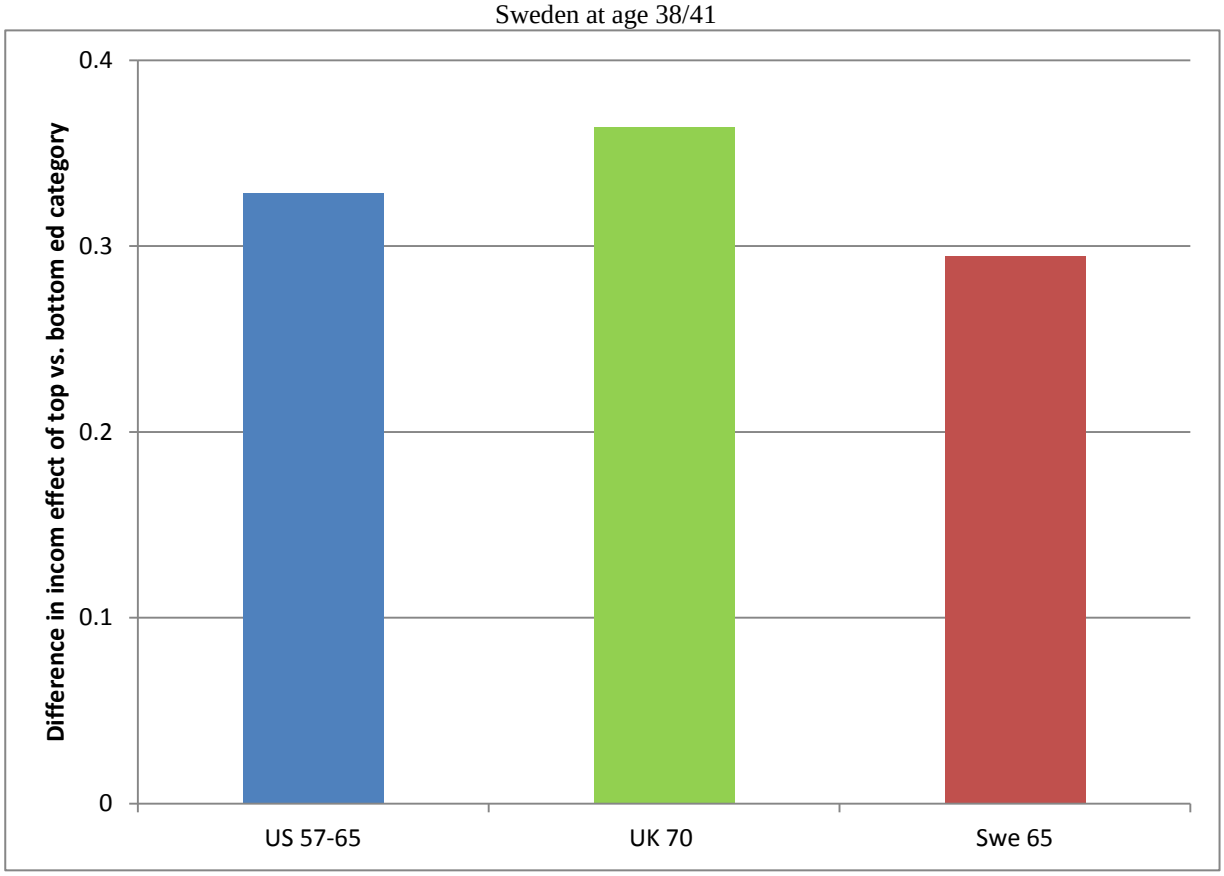
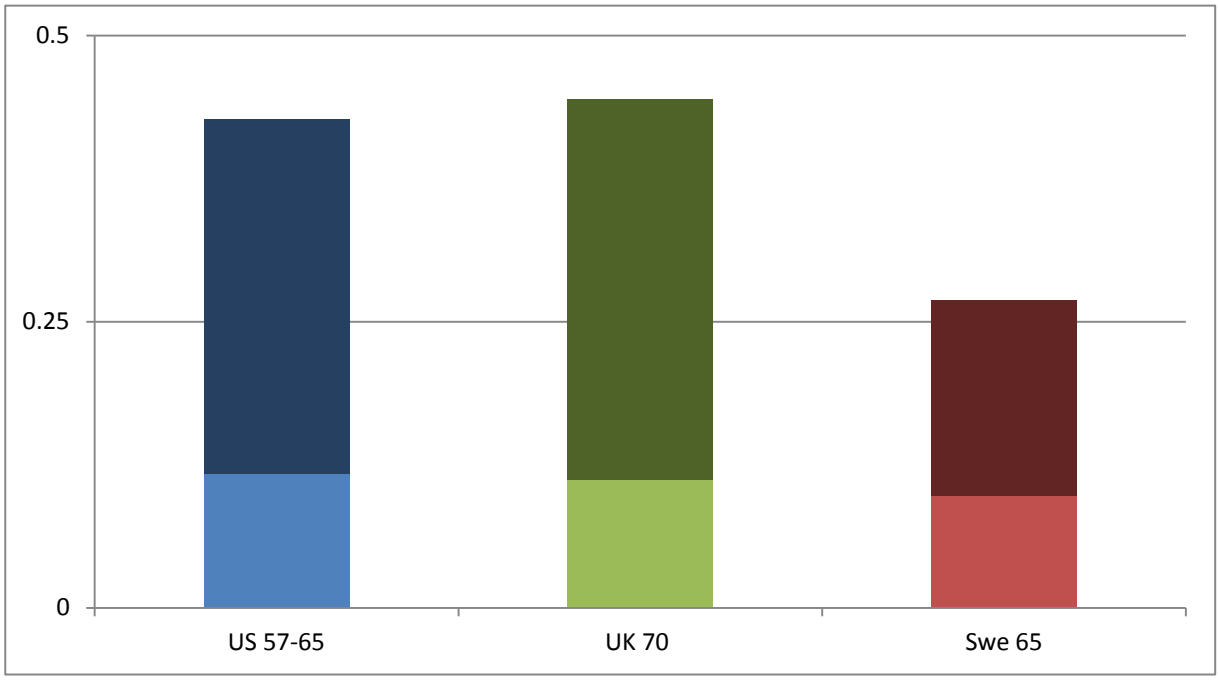


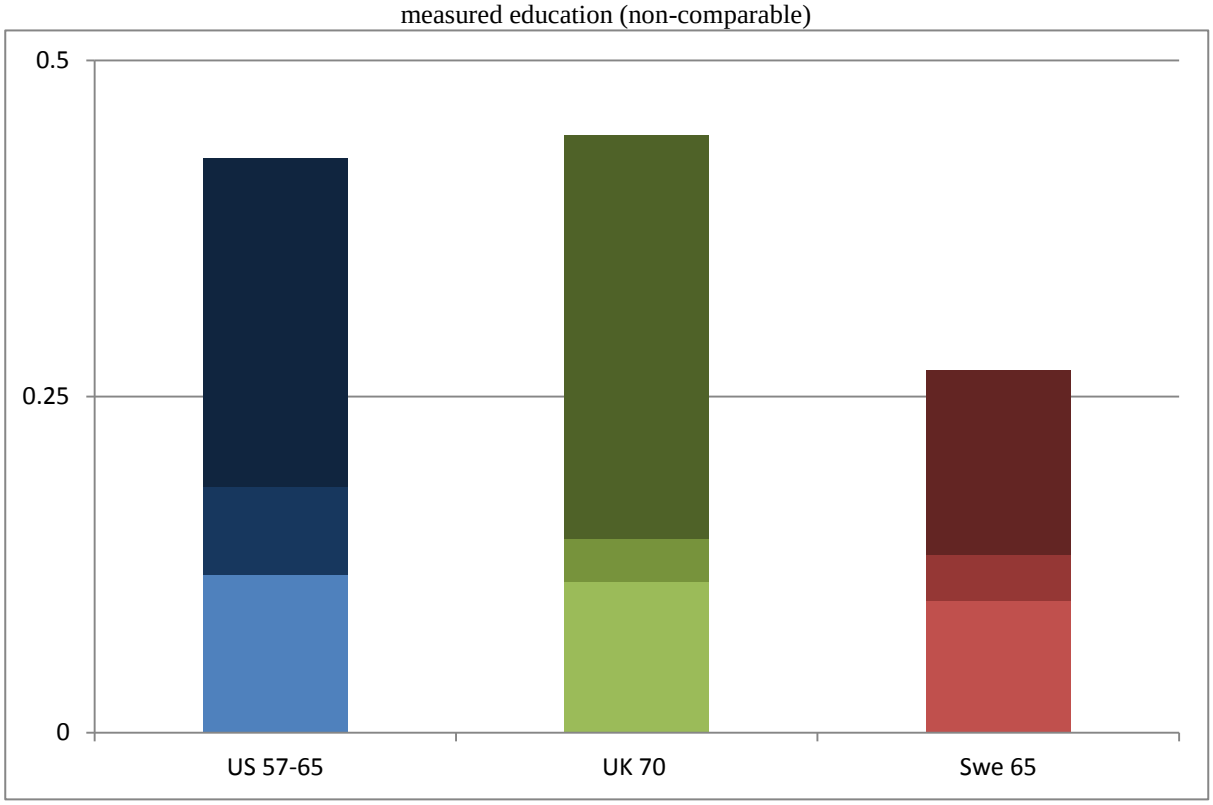
Figure 5 Total elasticities at age 38/41 in the US, the UK and Sweden, and proportion accounted for by education



Notes:

1. Dark shaded region = direct family income effect.
2. Light shaded region = persistence through education

Figure 6 Total elasticities at age 38/41 in the US, the UK and Sweden, and proportion accounted for by fully measured education (non-comparable)



Notes:

1. Dark shaded region = direct family income effect.
2. Combined lighter shaded region = persistence through full measured (non-comparable) education
3. Light shaded region = persistence through education and ability (country-specific measures)

Appendix

Saturated education models

We consider whether unmeasured education, given the crude education measures that we use for comparability, drive our main findings by including further measures of education and test scores available in the data. In the US data there is limited additional education information over and above our four categories of highest education completed. We therefore condition on these plus a standardised measure of the Armed Forces Qualification Test (AFQT) from when the cohort member is 17 which is the combined score from arithmetic reasoning, work knowledge, paragraph comprehension and numerical operations. These tests form part of the Armed Services Vocational Aptitude Battery (ASVAB) test, which is used to decide on the appropriate level of entry to the Armed Services. In the UK, in addition to our highest education category we also condition on standardised reading, maths and ability test scores measured at age 11, the number of GCSEs grade A*-C obtained, the number of A-levels obtained, staying on decisions at 16 and 18 and degree attainment. In Sweden we condition on 48 dummies combining the field and level of education and standardised measure of the enlistment test at age 18, combining reasoning, verbal comprehension, spatial ability and technical understanding.

Table A1 Accounting for intergenerational persistence in the US, the UK and Sweden, for males in different ages and cohorts, using fully saturated education models, including measures of ability

	US 1957-65	**UK 1970**	**Sweden 1965**
26/27			
Total through education	0.087	0.067	-0.038
Total not through education	0.265	0.168	0.081
Total persistence	*0.352*	*0.235*	*0.043*
33/34			
Total through education	0.164	0.169	0.101
Total not through education	0.203	0.172	0.147
Total persistence	*0.367*	*0.341*	*0.248*
38/41			
Total through education	0.183	0.144	0.131
Total not through education	0.244	0.300	0.137
Total persistence	*0.427*	*0.444*	*0.268*
49			
Total through education	0.229		
Total not through education	0.278		
Total persistence	*0.507*		

Notes:

1. Samples in the NLSY; N=1185, 1097, 985, 843. BCS; N=1119, 1352, 1014, Sweden; N=52417, 50546, 49482
2. Total not through education from direct impact of income on earnings.
3. Total mobility corresponds to estimated elasticities from Table 4