

Changes in Educational Inequality

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Abstract

This paper looks at changes over time in the extent of educational inequality – defined as educational attainment by people from higher relative to lower income backgrounds. It draws upon household and longitudinal data sources in both the UK and US to look at this highly policy relevant question. The data shows a sharp rise in educational inequality over time in the UK, but with the stage of the education sequence mattering. In particular the rapid expansion of higher education seen in the recent past in the UK disproportionately benefited children from relatively affluent backgrounds. The international comparisons show different patterns of change in the association between education and family income over time in the UK relative to the US. We link these findings on changes in educational inequality to the literature on intergenerational mobility, arguing that international differences in educational systems matter for the extent of economic and social mobility across generations.

Keywords: education, family income, education sequences, education systems, intergenerational mobility

JEL Classification: I2

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1. Introduction

Education has long been seen as having the potential to increase opportunity and promote social mobility. Equality of access to education is seen by many as key to advancing children from less well-off backgrounds in order to break generational cycles of deprivation and encourage economic growth. Indeed, people from across the political spectrum advocate education as a means to foster equality of opportunity and as a crucial building block in the development of a fair and just society.

In this context the extent to which family income acts as a key factor determining educational attainment is important. It matters for questions to do with equality of opportunity, for questions of child welfare and for broader questions of fairness in society. Yet, despite the existence of a large body of work on the role of income as a determinant of education at a point in time (Mayer, 1997), we lack insight into the extent to which the importance of income has altered through time. This lacuna is highly pertinent as the question is so closely linked to whether government should subsidise the education of children from lower income backgrounds, an issue that has become increasingly prominent since Tony Blair's Labour government came to power in 1997 proclaiming "Education, education, education".

Recent decades have seen sharp increases in educational attainment and post-compulsory participation in the UK. It therefore seems important to consider whether these increases have been evenly distributed amongst children and young people from different socio-economic groups. We address this question in this paper and find a clear answer, certainly at the higher education level, of "No". Rather, educational inequality – measured by the sensitivity of education to parental income – has increased over time.

Increased educational inequality matters both within and between generations. Studies of intergenerational mobility – the extent to which economic or social success or failure persist across generations - have emphasised the importance of educational attainment as a transmission mechanism underpinning the extent of mobility. If the children of richer parents are more successful in terms of educational attainment this is likely to lead to them also having higher earnings later in life. Indeed, evidence based on birth cohort data for the UK in Blanden et al (forthcoming) shows there to have been a sharp fall in intergenerational mobility over time in a comparison of children born in 1958 (who went through the education system in the 1960s, 1970s and early 1980s) as compared to children born in 1970 (who went through education in the 1970s, 1980s and early 1990s).¹

In this paper we provide a detailed study of temporal changes in the associations between family income and educational attainment in the UK. We also consider the same issue in the United States, where the extent of intergenerational mobility does not seem to have shifted over time (Mayer and Lopoo, forthcoming). As well as being useful in helping develop a better understanding of the intergenerational mobility debate, studying the US gives useful comparative insight into the changes we observe in the UK. This is important given differences in education policy and education systems across the two countries, especially with respect to the funding of education for children from low-income families.

These issues have been increasingly moving into the spotlight of government policy. A current target of the UK government is to get one half of all young people to attend university by 2010. One might seriously question the validity of moving

¹ For example, if the intergenerational relation is measured in a given period by a statistical regression $W_t = \alpha + \beta Y_{t-1} + \epsilon_t$ where W_t is log(labour market earnings) in generation t , Y_{t-1} is log(parental income) in generation $t-1$ and ϵ_t is an error term in the regression function the intergenerational mobility parameter β for sons is .095 (standard error = .031) higher for 1970 birth cohort as compared to the 1958 birth cohort.

towards such a target, without first carefully considering how the distribution of educational opportunities among students from different income groups has moved through time. For instance, the current Secretary of State for Education, Charles Clarke, has gone on record stating that if he had to choose between the 50 percent target and getting "a much better class basis" in the 43 percent who were currently going to university, "I would choose the latter" (BBC news, 18 December 2002).

Low attendance rates at university of people from poor families is even more starkly illustrated by numbers from the Universities and Colleges Admissions Service showing that, in 2000, under 3 percent of undergraduates came from council estates, a figure that had barely changed from the 2.4 percent of 1994. This is, of course, made still more relevant by the recent White Paper on higher education that proposes a substantial increase in student fees. Proponents of this policy argue that larger loans with income-contingent repayments can ameliorate the link between parental income and participation. However, if poorer students are more uncertain about benefits or more debt-averse than their richer counterparts, or if affluent parents subsidise their children allowing them to complete and leave university with less debt, then increases in student contributions have the potential to further increase educational inequalities.

The empirical work presented in this paper draws upon a variety of data sources for both the US and UK. We study changes in the association between parental income and education participation or attainment using two types of data. First we use cross sectional household level data in order to study young people still living in their family home. This enables us to look at representative samples of young people and their parents to discover how parental income interplays with the chances of remaining in post-compulsory schooling in the UK and on high school graduation in the US. As well as being based on representative samples, the advantage

of this approach is that we are able to use long running surveys to look at changes in educational inequality over a reasonably long time period. The second kind of data we use studies people at older ages (many of whom have left the family home) using longitudinal surveys to match up their educational outcomes with data on parental income.

Much of the existing literature on education and family income is concerned with modelling difficulties, especially the identification of income effects as distinct from the effects of other characteristics correlated with income. The advantage of the longitudinal data we use is that we are able to control for a number of these factors, such as parental education and, in some cases, measures of the young person's ability. Nevertheless, even using data as rich as we do, this may leave some unobserved heterogeneity remaining. To a certain extent the focus of this paper on changes exempts us from part of this discussion. If we believe the level of unobserved heterogeneity and its relationship with income is relatively constant through time, then we can say something about the way that the effect of income is changing even if we cannot be confident about the cross-sectional magnitudes. However, in order to strengthen our conclusions we also report a number of robustness tests exploring how measurement error and potential endogeneity of income may affect the results. Nevertheless, we do not push our arguments too far and must accept that our main focus has to be to describe changes in educational inequality rather than evaluating what the impact of a pound's extra income on education, and its distribution, would be at different points in time.

The remainder of the paper is structured as follows. Section 2 presents some background, motivational material explaining changes in the distribution of education and income that have occurred in the US and UK in the last two or three decades.

Section 3 follows with a description of the data upon which we base our empirical analysis. Section 4 provides our key findings on changes in educational inequality through time, including some examination of the robustness of these findings. We end in Section 5 with conclusions.

2. Background

By way of introduction to the more substantive results that follow, this section details the main trends that have occurred in the US and UK in educational attainment and family income in the last several decades. We also outline some of the important policy changes in the UK and US.

Schooling Systems and Changes in Educational Outcomes

Figure 1 shows the rapid expansion of education participation seen in the UK in recent years. It reports the Department for Educational and Skills higher education age participation index since 1960 and the proportion staying on after the compulsory school leaving age since the late 1970s. The Figure shows higher education (HE) participation was at low levels at the start of the 1960s, with around 6 percent of the 18 to 19 year old age cohort then participating in higher education. This rose to around 14 percent by the mid 1970s, before dropping back a little in the late 1970s. Most of the 1980s saw small increases in higher education participation but the expansion from the late 1980s thereafter was very rapid indeed. By the year 2000 HE participation reached one in three.

The timing of the rapid increase seems in line with the reform of the age 16 examinations system that took place in 1988 with the introduction of the General Certificate of Secondary Education (GCSE). In that year the GCSE became the public examination taken by pupils at school leaving age (at age 16), and it represented

something of a departure from the previous O (Ordinary) levels system (see Gipps and Stobart, 1997).

The O level system tended to impose a ceiling on how many people could achieve a given grade and therefore on how many people passed the exam (i.e. achieved grade A to C). Since the reform a higher proportion of the age group takes GCSEs than took O levels. Furthermore GCSEs moved away from a pure examination assessment to introduce (an often substantial) coursework assessment. The focus of the reform was to shift from separating children into high and low education streams and away from norm-referenced exams where relative performance most matters. Indeed, in the GCSE system the use of criterion-referenced assessment means everyone (at least in theory) could achieve the top grade.

That the examination system reform stimulated a rise in post-compulsory participation seems to be confirmed by the very sharp rise in staying on rates that occurred from the late 1980s. Figure 1 confirms that staying on after the compulsory school leaving age had begun to rise through the 1980s, with a rise from 36 percent of 17/18 year olds² in 1979, up to 44 percent by 1988. The pace of change accelerates in the 1990s with a step change resulting in the staying on rate rising to 73 percent by 2001. This large rise appears to be a consequence of the ending of the rationing system of post-compulsory education which had historically operated in the UK. That this exam reform could potentially have had different impacts across the parental income spectrum is clear. In the empirical work we present later we do indeed find that temporal patterns of educational inequality appear to have been altered by the examination reform at school leaving age.

² We look at a cohort of 17/18 year olds as we will know whether they have stayed on after the compulsory school leaving age.

In the US the completion of high school is the major secondary school milestone. This occurs after the completion of 12 years of schooling at around age 18. In addition, completion of high school does not necessarily coincide with the end of compulsory schooling. States have the jurisdiction to set their own lower and upper compulsory schooling ages and they range from 7 to 16 in Alabama, Idaho and Montana (amongst others) to 5 to 18 in the District of Columbia, New Mexico and Virginia.

Figure 2 gives information about the proportion of people completing high school in the US, and of those, the proportion having some college education, or acquiring a bachelor's degree. The graph shows a steady rise in high school graduation in the 1970s (from 77 percent in 1971 to 85 percent by 1977) that was followed by a much smaller increase after 1977 with 88 percent of young people graduating from high school by 1998. College enrolment and achievement had two distinct periods of increase. The percent of high school completers with some college rose by 10 percentage points over the 1970s (of course, because this is conditional on high school completion this understates the aggregate increase). Through the 1980s the trend is flat and then a further rise in college attendance occurs through the 1990s. Trends for achieving a bachelor's degree are similar to those having some college education, but are more muted with the rise in the 1990s being smaller. This, coupled with no increase in high school graduation, tells us that the increase in academic achievement was concentrated more on the middle of the academic spectrum.

Changes to Higher Education Financing

The UK higher education funding system has experienced substantial changes in the last five years after the Dearing Report established, for the first time in several decades, that home students should pay a proportion of their tuition fees. This trend

towards self-financing has accelerated with the proposals in the recent White Paper. Here we give details of HE funding changes from the 1970s to the present day.

From 1977 to 1984 UK university students experienced the highest levels of state support ever. Many students received a means-tested maintenance grant to cover living costs and fees were paid by their local education authority. In addition, students could also make use of the social security system: receiving housing benefit to help with the cost of living off campus and unemployment benefit during vacations. Through the 1980s these privileges began to be eroded. The real value of maintenance grants was slowly reduced and in 1987 student eligibility for unemployment and housing benefit was lost.

However, the sea change in higher education support came in 1990. The Conservative Government had a desire to increase higher education participation and therefore had to find some way to balance rising costs. In 1990 maintenance grants were frozen and began to be phased out in favour of subsidised loans that would be available to all students. As Callender (forthcoming) points out this shifted the public subsidy of student living costs purely from a large subsidy benefiting lower income students to a less generous subsidy benefiting all students (the majority of which are from affluent families).

In response to the findings of the Dearing Committee in 1998 the maximum available loan was increased substantially to cover the new £1000 a year tuition contribution that must be paid by all but the poorest students, and the previous mortgage-style loans system was replaced with income-contingent payments. This has, however, failed to solve the funding shortage faced by higher education. Greenaway and Haynes (2003) demonstrate that, as participation doubled from 1980 to 2000, funding per student halved. This is clearly unsustainable and at the time of

writing it appears that the Government is going to allow Universities to increase their fees to up to £3000 a year. This, and the cost of maintenance, will be met by even larger loans, to be paid back as a proportion of income after the graduate's earnings exceed £15,000. This is likely to be accompanied by increased support for students from lower income backgrounds, although current proposals of £1000 a year look modest at best.

As was mentioned in the introduction, the increased emphasis on loans may have a negative impact on the participation of lower income groups if lower income is associated with lower or more uncertainty about expected benefits or greater debt aversion. Callender (2003) looks at a survey of prospective students' attitudes to risk. She finds that social class background is a predictor of attitudes to debt. Dividing the sample into three groups depending on the extent of their anti-debt attitudes, Callender finds that 40% of those from the lowest socio-economic groups have the strongest anti-debt views compared with 28% of those from high socio-economic groups. She also reports evidence on the relationship between debt aversion and university entrance. Those with debt-tolerant attitudes are one and a half times more likely to have applied to enter higher education as those with anti-debt attitudes.

A new initiative to promote participation beyond age 16 among those from lower-income groups is the Educational Maintenance Allowance. This is targeted at 16-18 year olds and the programme offers a payment of around £30 a week for eligible full-time students aged between 16 and 18. It is to be rolled out nationwide in September 2004. Evaluation of ten pilot areas indicates that the programme has so far raised the participation of eligible young people by 6 percentage points (Ashworth et al, 2002); the size of any spill-over of this policy on participation in higher education

will be known soon. However, the positive effect of the programme so far indicates that income constraints do operate in affecting post-compulsory participation choice.

For the US, Kane (1999) and McPherson and Shapiro (1999) explore recent funding changes for US universities in some detail. In the US the funding system has remained broadly similar since the mid 1970s. Essentially there are three main approaches to easing the financial burden of college on low-income students³: public colleges, subsidized loan programmes and mean-tested Pell grants. At public colleges the costs of tuition are substantially subsidised at state level. However, as access to state colleges is based on ability and academic achievement these subsidies are likely to benefit higher income more than lower income students as more high income students achieve the entry requirements. Stafford loans provide those judged to be in financial need with subsidised loans for education where interest payments are made by the federal government while the student remains in college. The programme is also available to those not judged in financial need, but without the interest subsidy. In both cases the amount available through these programmes is substantially lower than average tuition fees. The most obviously targeted form of assistance is the Pell Grant programme. Awards from this programme are substantial and in fact exceed tuition charges at public colleges for average students with family incomes of less than \$20,000.⁴

The main change through the 1980s and 1990s was increased fiscal stringency by federal and state governments that led to a large increase in the fees payable by students and their families. In addition, between 1976 and 1985 the annual borrowing limit for Stafford loans was fixed in nominal dollars at \$2,500 despite substantial increases in both the real and nominal price of tuition. In light of the aid available to

³ There are additional state-level grants and some assistance available through Colleges themselves. However the factors we focus on here are those responsible for the majority of aid.

⁴ Kane (1999) page 91.

low income families we might expect this to affect those with middle incomes more severely than those with low incomes. However Kane (1999) argues that the financial aid through Pell Grants has little impact on the enrolment decisions of low-income students because the complex application process means that only infra-marginal students apply. The fees payable at the local college are a much more transparent gauge of the cost of college for low-income students, and Kane finds this group to be particularly price-sensitive.

McPherson and Shapiro (1999) note that, as fiscal constraints eased from the mid-1990s, the majority of new aid programmes have not been targeted on the basis of need. This includes federal tax credits for higher education, reductions in fees and non-means tested programmes like Georgia's Hope scholarship. Dynarski (2000) evaluates the Georgia programme and finds that it exacerbates the gaps in college enrolment between high and low income students. If this pattern continues it is clear that the future situation for low-income students can only worsen relative to their better off peers.

It appears then, that over our period of interest, US college attendance was rather more costly in general for students and their families than it was in the UK. However, in the US more consistent effort was made towards reducing the cost of college for those with low incomes, with an emphasis placed upon substantial needs based aid. Conversely, in the UK, as participation rose less attention was given to the needs of those from less privileged backgrounds.

Changes in Family Income Inequality

Figures 3 and 4 show changes in inequality for families with children, based upon data from the UK Family Expenditure Survey and the US Current Population Survey. Figure 3 shows a very sharp increase in income inequality for families in the

UK (this was documented extensively in Gregg, Harkness and Machin, 1999). The Figure shows the evolution over time of the 10th, 50th and 90th percentiles of the log real income distribution where each percentile is indexed to 1 in 1968. As such it shows income growth at each of the percentiles. After not much change in the 1970s the Figure shows the, by now familiar, pattern of no real income growth at the 10th percentile for most of the post 1979 period. Only right at the end does the 10th percentile income start to grow in real terms. On the other hand there is significant growth at the median (of over 40 percent) and very substantial growth (of over 60 percent) at the 90th percentile.

Figure 4 shows the same information for the US. Here the growth in inequality for families with children was even more pronounced, but takes a different form with much less real income growth at each percentile. In the UK the growth in inequality was driven by stronger income growth for those at the top, in the US the change is driven more by a reduction in real income for those at the bottom of the distribution. By 1994 the family income of those at the 10th percentile was less than 50 percent of its 1968 level while for those in the 90th percentile it was nearly 40 percent higher. Since the mid-1990s however, real income has been growing at a faster rate for the 10th percentile, reducing inequality somewhat through the latter half of the mid-1990s.

Changes in the Association Between Educational Achievement and Family Income

While there has been a substantial body of research looking at links between educational achievement and parental income at a point in time, there has been much less work considering changes in this association over time. Recently Acemoglu and Pischke (2001) use changes in family income inequalities between US states to identify the effect of family income on college attendance, and find these to be substantial. Kane (1999) also looks at college attendance and family income, taking

care to control for different levels of college preparedness as students leave high school. He finds significant effects of income on enrolment with students in the lowest family income quartile being 12 percentage points less likely to be enrolled in college two years after 12th grade than those in the top income quartile, even controlling for test scores in 8th grade and parental education level. Comparing this group, drawn from the class of 1992, with a sample from the class of 1982 from the High School and Beyond Survey Kane finds that the increase in enrolment for those from high and middle income families was not matched by students from further down the income distribution.

The only UK analysis over time looks at education and parental social class (there is no work to our knowledge looking at income). Glennerster (2001) reports Social Trends data on higher education participation and parental social class for the UK in the 1990s, showing a sharp relative increase in participation by those from higher social classes. For example, between 1991/2 and 1998/9 the percentage of children from professional parents going on to higher education rose from 55 to 72 percent. On the other hand comparable percentages for children from unskilled parents went from 6 to 13 percent over the same time period.

3. Description of Data Sources

Household Surveys

To analyse cross-time patterns for younger students we draw upon household data, utilising the Family Expenditure Survey (FES) for the UK and the Current Population Survey (CPS) for the US. The FES is an annual household survey of about 6000 households per year. We look at net income measures in our empirical work on the grounds that it is net income that is the appropriate measure if one is thinking about

resources available for investment in children. Information on education was first reported in the FES in 1978 and so our analysis is based upon annual cohorts of 17/18 year olds from then onwards. As people of this age typically live in the family home we can thus link their education to their family income⁵, to their other characteristics and to those of their parents. This procedure gives us representative samples of around 420 17/18 year olds matched to their parents per year. This is a fairly small sample size so we group several adjacent years together when considering changes over time.

For the US we use household data from the Current Population Survey. This has been used to examine the effect of family background on attainment in several studies including Kane (1994) and Black and Sufi (2002). We follow Black and Sufi (2002) in using the March supplement rather than the October supplement in order to more accurately check the family relationships between household members. As high school graduation is the most important milestone in the US education system we model the relationship between the completion of grade 12 (in essence high school graduation) and gross family income at age 19 (net income is not available in the CPS).

British Cohort Data

We also use British birth cohort data to provide a longitudinal picture of how educational outcomes relate to family background. The National Child Development Study (NCDS) consists of the birth population of a week of March 1958 with follow-up samples at cohort member ages 7, 11, 16, 23, 33 and 42. The British Cohort Study (BCS) is very similar in style, covering a full birth population in a week of April 1970 with data collected at ages 5, 10, 16, 26 and 30.⁶ This means that the BCS young

⁵ Family income is defined in both the FES and CPS as household income less the child's own income.

⁶ The cross-cohort comparison of intergenerational mobility in Blanden et al (forthcoming) used these data. The NCDS data have also been used to look at intergenerational mobility in earnings (Dearden,

people took their school exams in 1986 and are therefore one of the last year-groups to go through the O level system prior to the introduction of GCSEs. As well as being similarly structured, the questions asked in the two cohorts are frequently identical. In cases where they are not we do our best to make variables as comparable as possible. The use of cohort data allows us to follow the sequence of education decisions for a representative sample of cohort members in a way that is not possible from even rich cross-sectional sources. In this respect our approach is closest to that followed by Mare (1980) or Cameron and Heckman (1998) who look at sequential models of education using US cohort data.

The cohort data provides detailed information on people and their families over time, but unfortunately they are also rather dated. In order to look at changes after the introduction of GCSEs and to begin to get an idea of the implications of the expansion of higher education over the 1990s we also create a third pseudo cohort from the British Household Panel Survey (BHPS). The BHPS began in 1991 with a sample of 5500 households. All individuals over 15 years old were asked to provide extensive information including details of income and education. Individuals were then contacted in subsequent years and followed through the panel (adding new respondents from the household as they reached 16); we have data so far for eleven waves up to 2002.

The structure of this data is not as good for observing educational transitions as the cohorts. For example, to observe individuals from age 16 to 23, they must be present for 8 years of the panel, which, given the number of waves of data currently available, limits us to looking at only four waves worth of 16 year-olds. We therefore try to maximise our sample via a number of methods. In case of missing income

Machin and Reed, 1997) and the transmission mechanisms that may underpin it (see Gregg and Machin, 1999, 2000, Hobcraft, 1998, or Kiernan, 1995).

measures at age 16 we also allow family income to be observed at 15 or 17, and allow the graduation outcome to be observed at 22 if the individual is not retained through the sample until 23.⁷

In order to render the information on degree attainment comparable across all data sources we study degree attainment in the NCDS from the data taken at age 23 and use information on the year when a degree was obtained in the BCS (reported at age 29) to limit the outcome to people who obtained their degree before 1993.

4. Results

Patterns of Participation and Achievement By Income Group

Table 1 presents descriptive statistics for the UK and US household data on family income, staying on beyond the school leaving age (for both countries) and high school graduation (for the US). The education information re-confirms the patterns already shown in the Figures discussed above. There is a strong rise in post-compulsory participation in the UK, whereas attainment and participation remain essentially unchanged for the US. The standard deviations of family income (given in parentheses) confirm the strong rise in income inequality found in both countries.⁸

Table 2 provides summary statistics on the three longitudinal data sources we use to look at educational outcomes in the UK. Once again the sharp rise in staying on rates is evident, as is a similarly dramatic rise in the proportion of young people achieving a degree by age 23. Also noticeable is the fact that the proportion of those who stay on who then go on to get a degree by age 23 has remained broadly constant.

⁷ 23 is a better age to observe whether individuals have obtained a degree as many individuals who do not begin their studies at 18 and have taken longer courses will be missed if the data is taken any earlier.

⁸ The standard deviation of family income in the US rises sharply between 1992-1994 and 1995-1997. This is due to a change in the way top-coded incomes are treated in the US. This will not pose a problem in our analysis however, as we concentrate on splitting income into quintiles.

This finding emphasises the sequential nature of the UK education system, and because of this we concentrate on the degree achievement of those who have already taken the decision to stay on at school. This enables us to separate changes in associations with income by stage of the education sequence, in a similar way to Mare (1980) and Cameron and Heckman (1998).

Table 3 reports information on the proportion of 17/18 year olds who stayed on after the minimum school leaving age in the UK between 1977 and 2000. It reports staying on rates broken down across the parental income distribution, showing the proportion that stayed on for the top and bottom fifths and middle sixty percent for each time period. We also show the difference between the staying on rates of those in the highest versus the lowest quintiles. We term this “educational inequality” and it provides the focus for much of our analysis.

The Table makes it clear that the staying on rate is considerably higher for children from the upper part of the income distribution. For example, in the 1977-79 time period, 54 percent of children with parents in the upper fifth of the income distribution stayed on at school, as compared to 26 percent from the bottom fifth, a gap of 28 percentage points. Even by the last period, 1998-2000, a strong income related gap of 26 percentage points remained, with 90 percent of the highest quintile children staying on as compared to 64 percent of the lowest quintile children.

These broad comparisons conceal a very interesting pattern across time, with distinct differences emerging in two clear periods. These are shown in the bottom two rows of the Table. In the period before GCSE introduction the income gaps in staying on rates actually widened, by a statistically significant 13 percentage points. In other words there was an increase in educational inequality.

However, between 1986-1988 and the most recent period, growth was much faster at the bottom of the income spectrum with considerable gains for the lowest quintile since the introduction of GCSEs. The staying on rate rose by 34 percentage points for this group between 1986-1988 and 1998-2000. This led to educational inequality falling by 14 points over the second period. Over the full period for which we have data these two movements tended to cancel each other out, with there being essentially no change in educational inequality over the full period 1977-2000. This is shown in the bottom right cell of the Table.⁹

One may naturally think that the reforms that turned around the income gaps in staying on rates, stemming the tide of rising income related educational inequality, may have had similar effects on higher education attainment as well. Table 4 shows proportions achieving a degree for individuals who stayed on past the compulsory school leaving age by income group. Results are presented for three points in time from the cohort data, the early 1980s, the early 1990s and the late 1990s.

Once more there is evidence of a significant cross-sectional income gap between the attainment of individuals from the richest and poorest income groups. In addition, between 1981 and 1993 there is a definite increase in educational inequality, similar to the one we found for the staying on decision. These changes led to a statistically significant 14-point rise in educational inequality. More recent changes are rather difficult to pinpoint owing to the small sample size available from the BHPS. However, in general, the rises appear to be more evenly distributed across income groups. Nevertheless, despite the small sample, we can say for sure that

⁹ One might worry that including 18 year olds in the sample can bias the sample over time as the composition of this age group staying at home may change. We would like to focus on 17 year olds but this leaves us with a rather small sample in the FES (although results are broadly comparable, especially after the introduction of the GCSE). To attempt to check this further we have also looked at General Household Survey data in a similar way where we can (net income is only available after 1984) and once again find that educational inequality falls after 1988.

educational inequality in degree attainment is considerably larger in 1998 than it was in 1981.

Our findings, therefore, show an increase in educational inequality in higher education even for those who have passed the barrier and stayed on at school after 16. This is an important result. Some recent discussions about the importance of financial constraints for higher education participation have begun to emphasise the importance of earlier attainment in determining the social mix at university (for example Greenaway and Haynes, 2003). The implication of this is that increased access is an issue for primary and secondary school policy, not higher education. However, our results seem to suggest that increased participation and attainment beyond 16 failed to carve out an opening through to HE for children from low income backgrounds.

Our results therefore show strengthening associations between HE participation and family income. This brings into question the view that HE access matters less, since it is indicative of an important rising inequality effect. This seems to have acted to effectively shut low income children out of higher education, and in doing so significantly raised educational inequality at this level, despite the contrasting patterns seen at earlier stages of the education sequence.

Tables 5 and 6 repeat this exercise for the United States. Table 5 shows the proportions graduating from high school by family income quintile from the CPS. Once again income is related to the probability of graduating from high school, in the most recent period available, 1998-1999, the graduation rate in the lowest family income quintile was 64 percent compared with 93 percent in the top group, corresponding to a statistically significant gap of 29 percent. The changes over time are, however, much less marked in the US. As has already been noted, the rate of high school graduation in the US has remained fairly flat since the late 1970s. In the

final rows of the Table the data is divided into the same two periods as we considered for the UK data. Between 1977-1979 and 1986-1988 the overall graduation rate rose slightly, but the rise appears to be fairly neutral across income groups. In the latter period high school graduation rates fell for all income groups and this seemed to be slightly concentrated on those from lower income backgrounds. Those in the lower quintile experienced a 6-percentage point fall compared with a 1-percentage point fall for the richest group. However this moderate increase in educational inequality over time is not statistically significant.

Table 6 is taken from the National Centre for Educational Statistics and presents the proportion of college completers in education in the October after they leave high school. It is clear that college completion varies substantially by income group with more than a thirty point gap in the completion rates of the poorest and richest high school graduates. Our main interest is, of course, in changes over time. In the first period the proportion of high school graduates attending college rose similarly for all income groups. In the second period, however, the lowest quintile raised its participation by 11 percentage points compared with 10 for the middle-income group and only 4 for the richest. There is thus something of a fall in educational inequality, although the point-in-time gaps remain large. Unfortunately, as we only have the data in aggregate form it is not possible for us to calculate if this change is statistically significant. But, despite the large income gaps in education at a point in time, it does imply that the continued provision of scholarships for low income children who do manage to get to college in the US acts to counter possible increases in educational inequality due to increased income inequality.

Statistical Estimates From Household Data

In Table 7 we add to the analysis presented so far by attempting to model the association between education and income while controlling for some of the factors that we think will be related to both. We present two sets of results: in the first we control for the young person's sex, the number of siblings they have, and parents' age; in the second we additionally add parental education in order to assess the potential importance of intergenerational correlations of education as a transmission mechanism in the link between income and education.

Column (1) shows marginal effects for the top parental income quintile from probit models of staying on beyond the school leaving age for the UK. The reported marginal effects are the conditional analogue of our earlier educational inequality measure, calculated from the following regression model of the staying on decision, S , for person i in period t :

$$S_{it} = \beta_{11t} + \beta_{12t}Q_{2it} + \beta_{13t}Q_{3it} + \beta_{14t}Q_{4it} + \beta_{15t}Q_{5it} + \gamma_{1t}Z_{it} + \varepsilon_{1it}$$

where Q_j is the j^{th} parental income quintile (leaving out the lowest quintile, Q_1 , as the reference group), Z is a set of control variables and ε is an error term. As S is a discrete 0-1 variable, the staying on equation is estimated by probit methods and the conditional educational inequality measure is computed in period t as $\psi_t = \Pr[S_{it}=1 | Q_{5it}=1, Q_{4it}=0, Q_{3it}=0, Q_{2it}=0] - \Pr[S_{it}=1 | Q_{5it}=0, Q_{4it}=0, Q_{3it}=0, Q_{2it}=0] = \Phi(\beta_{11t} + \beta_{15t} + \gamma_{1t}Z_{it}) - \Phi(\beta_{11t} + \gamma_{1t}Z_{it})$, where $\Phi(\cdot)$ is the standard normal cumulative distribution function. This measures the increase in the probability of an individual staying on in education given that his/her parents are in the top quintile rather than the bottom quintile, all other things held constant (the reported estimates are evaluated at the means of the other controls, Z). We are interested in how this has changed through time, by drawing a comparison between period t and t' ($t' > t$). Thus our measure of

changing educational inequality over time is $\Delta\psi_{t'} = \psi_{t'} - \psi_t$. We report estimates of $\Delta\psi_{t'}$, with bootstrapped standard errors, from our estimated models in the results Tables.

It is evident that the results from the statistical models follow a similar pattern to those found in the raw data. In the first column (that does not include parental education) the probit coefficients for the highest quintile of parental income clearly rise from 1977-1979 to 1986-1988 and fall again after this point. The initial rise in educational inequality is statistically significant, while the later fall is on the margins of significance.

We next amend the model to additionally control for parental education. The estimating model now becomes

$$S_{it} = \beta_{21t} + \beta_{22t}Q_{2it} + \beta_{23t}Q_{3it} + \beta_{24t}Q_{4it} + \beta_{25t}Q_{5it} + \theta_{2t}PED_{it} + \gamma_{2t}Z_{it} + \varepsilon_{2it}$$

with PED measuring parental education. We do this since we are interested in seeing what role the intergenerational transmission of education may play in explaining the temporal pattern of results. If one thinks in a simple omitted variables bias framework, then we would expect cross-sectional income coefficients to be biased upwards by the omission of parental income (this is because there is a positive intergenerational correlation, $\text{Corr}(S_{it}, PED_{it})$), and a positive correlation between the top parental income quintile and parental education, $\text{Corr}(Q_{5it}, PED_{it})$. However, if the intergenerational correlation in education shifts over time (i.e. $\text{Corr}(S_{it}, PED_{it})$ rises), then one may see more of a change in the coefficient estimate on the highest quintile dummy variable and therefore on educational inequality.

This does in fact appear to be the case as inclusion of parental education tends to dampen down the pattern of rising, then falling, inequality as shown by the smaller estimates of ψ_t in column (2) of the Table. This suggests that intergenerational

correlations in education do explain part of the temporal pattern of change. The reason therefore why the pattern of rising, then falling educational inequality is dampened down by controlling for parents' education is that there is a stronger intergenerational correlation in education at the time when one sees the greatest level of education gaps between the poor and the rich.¹⁰

The decision to stay on at school can also be seen as a labour supply choice. If this were the case then a possible criticism of our results so far is that they fail to account for the different labour market environments faced by different cohorts of young people as they take this decision. Perhaps the rise in participation that we are putting down to a GCSE effect is simply a consequence of a particularly poor labour market outlook for young people in the late 1980s. In order to test this we have included regional youth unemployment rates for the sample of individuals within England. Not surprisingly in our opinion, we find that this makes almost no difference to the family income effects we find.

In the right-hand panel of Table 7 we show models of attainment on income for the US, where we focus on whether individuals complete twelfth grade. In the raw data we failed to find any significant pattern in terms of changes over time. This is confirmed in the multivariate models reported in Table 7. There is evidence that educational inequality rose by a small amount in the period from 1986-1988 to 1998-1999, but as with the UK results, this is mainly driven by a rise in inequality at the very end of the century. Unlike the UK results this is unaffected by whether or not one controls for parental education. Therefore, any bias in ψ_t from omitting parental education appears to be effectively constant over the various cross-sections.¹¹

¹⁰ That is, $\text{Corr}(S_{it}, \text{PED}_{it})$ larger in the middle period 1986-88 where ψ_t is highest (see Blanden, 2003, for more detail).

¹¹ This squares up well with the notion that intergenerational mobility has not altered much through time in the US (Mayer and Lopoo, 2002).

Due to our interest in inequality we have to date focused on education gaps between people from the highest income quintile as compared to those from the lowest income quintile. But it is also worth stating that changes in the sensitivity of education to parental income also emerge from statistical models that use different functional forms for parental income. For example, for the UK results the estimated marginal effect of $\log(\text{income})$ rises from .184 (standard error = .029) in 1977-79 to .225 (.031) in 1986-88 and then falls back to .175 (.029) in models that do not condition on parental education. For those that do condition on parental education, the marginal effect rises from .099 (.029) to .142 (.031) to .110 (.030). In the US one cannot reject the null hypothesis of no change in the marginal effect of $\log(\text{income})$ over time.

Statistical Estimates From Cohort Data

In order to assess the reliability of our findings from the FES we also use the cohort data to model the connections between parental income and an individual's propensity to stay on at school or college. The basic estimating model (with controls) for cohort member i in cohort c is:

$$S_{ic} = \beta_{11c} + \beta_{12c}Q_{2ic} + \beta_{13c}Q_{3ic} + \beta_{14c}Q_{4ic} + \beta_{15c}Q_{5ic} + \gamma_{1c}Z_{ic} + \varepsilon_{1ic}$$

We are now interested in cross-cohort comparisons of educational inequality and so compute $\psi_c = \Pr[S_{ic}=1 | Q_{5ic}=1, Q_{4ic}=0, Q_{3ic}=0, Q_{2ic}=0] - \Pr[S_{ic}=1 | Q_{5ic}=0, Q_{4ic}=0, Q_{3ic}=0, Q_{2ic}=0] = \Phi(\beta_{11c} + \beta_{15c} + \gamma_{1c}Z_{ic}) - \Phi(\beta_{11c} + \gamma_{1c}Z_{ic})$ and then consider the change between cohorts c and c' . If c' is the later cohort (BCS) and c denotes the earlier cohort (NCDS) then our measure of changing educational inequality over time is now $\Delta\psi_{c'c} = \psi_{c'} - \psi_c$.

In Table 8 we report the estimates of educational inequality, and its change over time, from this model. We present several variants in order to illustrate how

adding controls affects our results. Panel A shows results from a model with no controls. The results are extremely similar to those found for the FES. There is a strong, statistically significant rise in educational inequality between the first two cohorts, followed by a strong significant fall between the second and third. In this case, and even more so than in the FES, these two changes are of almost exactly the same magnitude and completely offset each other. Panel B of the Table shows the same marginal effects, and their temporal changes, but derived from models conditioning on number of siblings, sex and parental age. Adding these controls does not change the results in a qualitative sense.

Panel C then adds test scores for reading and maths at age 11 (NCDS) and age 10 (BCS) to the model for only the first two cohorts, as unfortunately this information is not available for the BHPS. Transmission of ability across generations is seen by many as an obvious route leading to higher attainment amongst children of better off parents. According to this argument the addition of controls for ability should substantially reduce the remaining educational inequality. It does, lowering it from .24 to .11 in the NCDS and from .38 to .26 in the BCS. Nevertheless in both cases the marginal effect of parental income remains statistically significant. The temporal rise between the cohorts is also remarkably stable at .15 irrespective of whether or not one conditions on test scores.¹²

Table 9 reports estimates of statistical models of degree attainment, DEG, conditional upon staying on. The estimating model for cohort member i in cohort c thus becomes:

$$[DEG_{ic}|S_{ic} = 1] = \beta_{21c} + \beta_{22c}Q_{2ic} + \beta_{23c}Q_{3ic} + \beta_{24c}Q_{4ic} + \beta_{25c}Q_{5ic} + \gamma_{2c}Z_{ic} + \varepsilon_{2ic}$$

¹² Galindo-Rueda and Vignoles (2003) use these test scores as an indicator of meritocracy, and detail how their influence on later outcomes has changed compared with the influence of social class. As they acknowledge, the extent to which this is a valid exercise depends on the influence of family background on development up to age 10.

We estimate conditional models as we wish to emphasise the potentially different education-income associations at different stages of the education sequence (although it is worth noting that unconditional degree acquisition models do show the same pattern of changes in educational inequality through time: see Blanden, 2003).

Panel A of Table 9 includes no controls and, as such, reproduces the descriptive statistics from Table 4, showing a significant rise in educational inequality between the first and second cohorts. This rise is dampened down a little once we control for other factors, particularly when we control for test scores, but the change remains statistically significant. Similarly, due to the small samples in the BHPS, the estimates of the rise in educational inequality for the entire time period (in the final column) are only on the margins of statistical significance. But the magnitude of the rise is numerically large and educational inequality at the higher education stage has clearly gone up by a lot. The sharp rise in degree acquisition has very markedly become more heavily concentrated upon people from better off families as time has progressed. As such, it is clear that the improved opportunities seen at the staying on stage since GCSE reform have not led on to more equality at HE stage.

The Role of Parental Education and Interest in the Cohort Data

In similar vein to the household level analysis, we have also looked at the role parental education can play as a transmission mechanism. This again involves adding parental education data to the statistical models but in the NCDS and BCS cohorts we can actually do better than for the household data as we also have measures of parental interest in children's education during their formative years (these are taken from survey information on teacher's perception of parental interest in education and at cohort member age 11 for the NCDS and age 10 for the BCS).

Table 10 adds measures of parental education and involvement, separately and jointly, to the earlier specifications. There is evidence that they matter in that they reduce the cross-sectional measures of educational inequality. They also moderate the change over time, tending to render increases in educational inequality less significant statistically. Parental interest and education explain around 10 percent of the cross-cohort rise in the sensitivity of staying on to parental income and somewhere between 20 percent (if education and involvement are entered separately) and 30 percent (if entered together) of the cross-cohort rise in the sensitivity of degree acquisition to income. It thus seems that significant intergenerational correlations in education do form a part of the story of rising educational inequality.

Robustness Checks

In this sub-section we consider two issues to do with possible bias that have received a lot of attention in the cross-section literature on education and income - measurement error and the potential endogeneity of income. Our focus is somewhat different to a lot of work in this area as we are interested in changes over time and not in contemporaneous correlations between education and income *per se*. Thus any bias due to measurement error/endogeneity is not a concern if its magnitude does not shift over time. As we have already stated in the introduction to the paper, the nature of our data and institutional settings means our main focus has to be to describe observed patterns of changes in educational inequality rather than attempting to evaluate the structural impact of income on education. The robustness checks should therefore be viewed in terms of checking the key findings and patterns in the data.

1) Measurement Error in Parental Income

We address possible measurement error in two different ways. For the UK Family Expenditure Survey data we not only have data on parental income but also on

consumption. We thus follow other influential work (like Blundell and Preston, 1998) that treats consumption as a proxy for permanent income on the grounds that spending power better measures longer term income. We thus look at differences in the staying on results based upon consumption, rather than income, quintiles.

For the cohort data we do not have consumption data so adopt an alternative approach. A common method of addressing measurement error in income is to average income across several years, therefore smoothing variations due to error and transitory shocks and obtaining a more permanent measure of income (this is a commonly used procedure in the intergenerational mobility literature: see Solon, 1999). Unfortunately only the BCS and the BHPS have a measure of income at more than one point in time (at cohort member age 10 for BCS and annually for the BHPS).

Table 11a shows FES staying on results using consumption quintiles and also shows comparable results on the same sample for income quintiles. It seems that the consumption data fulfils its role as a proxy for permanent income as in all cases educational inequality is greater when measured by consumption than when measured by income.¹³ However, educational inequality measured from consumption data shows a very similar temporal pattern to that which we have observed so far. Educational inequality rose from the late 1970s to the introduction of the GCSE and then began to fall. The one difference in the results obtained in Table 11a for consumption is that there appears to have been less of a fall in inequality in the last period 1998-2000 than we find when looking at income alone.

Table 11b shows the consequences of averaging income data in the BCS and BHPS. Because of sample sizes becoming very small in the BHPS we can only feasibly do this to study changes over time for the staying on outcome. We model the

¹³ An alternative way to think about this is that, once one has a 'better' income measure (i.e. one less contaminated by transitory fluctuations), the coefficient on the highest quintile dummy rises as the coefficient was previously attenuated by measurement errors in income.

relationship between staying on and income by both educational inequality and linear regressions of staying on and income. The use of the averaged data acts to strengthen the results already found in that the cross-sectional marginal effects rise for both measures. Moreover, the changes over time remain similar, suggesting little distortion in the cross-cohort pattern of results. As such measurement error does not seem to be very problematic for this study.¹⁴

2) Instrumental Variable Estimates

The issue of potential endogeneity is more difficult, both conceptually and from a practical modelling perspective. This is because one needs to find an instrumental variable for income. The criteria for a legitimate instrument is that it be correlated with parental income, but exerts no effect on education other than operating through income.

As noted earlier, and as is widely known, the period under study was a period of rising income and wage inequality. Labour market researchers have stressed that a key factor behind rising inequality is technological change which, it is argued, has contributed significantly to widening wage and income gaps (Berman, Bound and Machin, 1998; Katz and Autor, 1999; Machin and Van Reenen, 1998). A key part of this is that workers in industries characterised by technical changes and more innovative activity have received wage and income payoffs. We thus draw on this work to implement an Instrumental Variable strategy that uses industry computer usage (drawn from the British Social Attitudes Surveys) to instrument parental income. The validity of this rests on the argument that technology has been a factor driving inequality but that remains independent of child education.

¹⁴ Our data have not allowed us to explore the degree of measurement error in the NCDS. This is something discussed more fully in Blanden et al (forthcoming). The main worry is that the coincidence of the data collection with the Three-Day Week may have resulted in more measurement error here than in the BCS. Grawe (2000) convincingly, and reassuringly, demonstrates this to be essentially unimportant.

For the staying on decision the two equation system (with supplementary controls, Z) we estimate is:

$$\text{Stage 1:} \quad \log(Y_{ic}) = \lambda_{1c} + \lambda_{2c}\text{TECH}_{jc} + \tau_c Z_{ic} + \eta_{ic}$$

$$\text{Stage 2:} \quad S_{ic} = \pi_{1c} + \pi_{2c}\log(\hat{Y}_{ic}) + \rho_c Z_{ic} + \zeta_{ic}$$

The first stage is a reduced form relating $\log(\text{income})$, $\log(Y)$, of the cohort member to technical change measures for parents working in industry j and the control variables Z (η is an error term). The equation uses $\log(\text{income})$ as we only have one instrument and therefore cannot look at all income quintiles with a single instrument.

The second stage then incorporates the predicted value from stage 1, $\log(\hat{Y}_{ic})$, so as to implement the Instrumental Variable (IV) procedure. There is also an analogous two equation system for the degree acquisition models.

Table 12 shows the results. It shows staying on and degree acquisition models for the BCS and BHPS data (as we do not have industry data for parents in the NCDS cohort). The Table shows Ordinary Least Squares and Instrumental Variable estimates for comparison. Not surprisingly, the IV estimates have large standard errors attached to them, but they are reassuring in that the quantitative changes over time in $\log(\text{income})$ marginals seem robust to the instrumenting.¹⁵ Of course, this is no more than a robustness check, but it is suggestive that the qualitative patterns of changes over time in the sensitivity of education to parental income seem to be genuine ones.¹⁶

¹⁵ The first stage regressions do show industry computer usage to be positively correlated with parental income. In the BCS the coefficient of industry computer use in a regression of \log income is .482 (.063) and in the BHPS the equivalent is .756 (.094).

¹⁶ One criticism of our approach might be to say that parental computer use is connected to home computer use and therefore directly promotes children's educational attainment. However this would be only likely to introduce a positive bias in the later period as having a home computer would be very uncommon in the 1980s. As results for the staying on equation remain lower for the BHPS than the BCS we feel able to dismiss this concern.

5. Conclusions

In this paper we have examined the scale of changes over time in the extent of educational inequality – defined as educational participation and attainment by people from higher relative to lower income backgrounds. We draw upon household and longitudinal data sources in both the UK and US to look at this highly policy relevant question. Our findings show a sharp rise in educational inequality over time in the UK, but with the stage of the education sequence mattering. In particular, whilst we find that parental income became more important for the staying on at school decision in the 1980s this pattern reversed in the 1990s after the examinations system was reformed.

One might naturally think that this may then have had a knock-on effect on higher education. In fact we find no evidence of this. Inequality in access to higher education and to getting a degree rose sharply through the 1980s, and continued to rise in the 1990s as higher education participation and attainment became a lot more sensitive to family income than in the past. Put alternatively the sharp expansion of HE very much disproportionately benefited people from relatively richer backgrounds. Of course, given that this is the first stage of the education process where one has to pay sizable sums of money, then it may not be surprising that this is where family origin matters most, particularly in an era of rising income inequality.

The results are also interesting in that they are consistent with the notion that changes in education policy can amplify or dampen the ability of rising income inequality to influence educational outcomes. This seems clear from several features of the results we report. First, the switch from O levels to GCSE in the UK reversed the education-income relation that was actually strengthening as inequality rose prior to the examination system reform. Second, this dampening of changes in the

education-income sensitivity comes about if adequate provision is made for means tested grant/subsidies and scholarships for low income children are present. This is borne out by the fact that the US has such a system of grants and subsidies for low income students and that, for the period we study, the availability of such grants did not diminish. This is in line with the idea that, even though point-in-time income gaps in education are sizable, the continued provision of these has actually acted to offset the feature of rising income inequality that would otherwise have raised the sensitivity of education to parental income. Thus one sees little change in educational inequality, despite the rise in income inequality, in the US.

On the other hand, at the higher education level in the UK, changes in financing policy reduced the financial support available to those from low income families and one sees a very sharp rise in educational inequality at that level. The increasingly regressive UK HE financing policy, via its removal of subsidies targeted towards people from poorer families, therefore seemed to have an amplifying effect on the education-income relation. This matters a lot from a policy perspective since the move to GCSE seemed to have opened the door for more poor children to go further on in the education system, yet a combination of rising inequality and policies that reduced access to financing for poorer children actually combined to have the opposite effect and raised educational inequality at the higher education level.

By showing different patterns in the connection between education and family income over time in the UK relative to the US, the results of this paper show that education systems and the policies that shape them seem to matter. Of course this does mean that suitably designed education policies can have scope to counter educational inequality. This does have particular relevance in terms of higher education in contemporary Britain in the light of the current student finance debate. It

demonstrates that it is crucially important to understand how poorer students will react to increased loans and what provisions policy can make to ensure they are prevented from being further excluded in future.

Moreover differences in education systems may have longer-term consequences. Our work here shows intergenerational links between education of children and parents play a role as a transmission mechanism. Some of our other recent work (Blanden et al, forthcoming) has linked the increased sensitivity of education to parental income that occurred between the NCDS (in the late 1970s and early 1980s) and BCS (late 1980s and early 1990s) to a sharp fall in the extent of intergenerational mobility in Britain. Over the same time period in the US it seems that the continued provision of scholarships for low-income children held down the relation between education and income despite rising inequality. During that time period in the US there seems to have been little change in intergenerational mobility (Mayer and Lopoo, forthcoming) reinforcing the evidence of a link between shifts in educational inequality and temporal movements in the extent of economic and social mobility across generations.

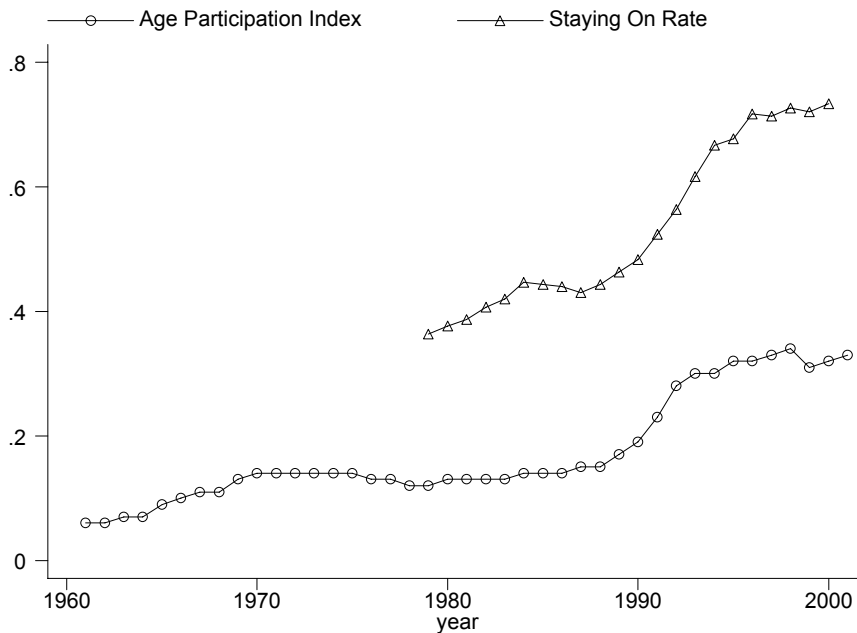
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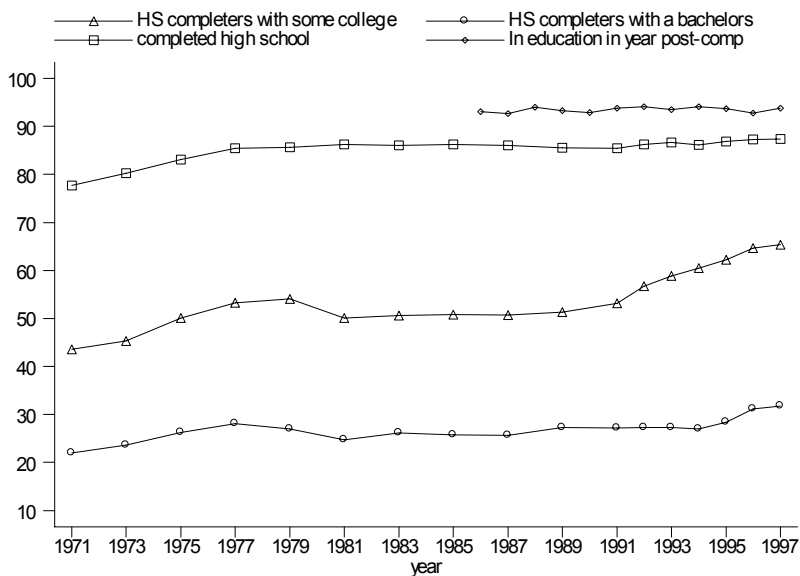
Figure 1: Changes in Educational Participation, UK



Notes:

1. Staying on rates calculated as proportion of Family Expenditure Survey cohort of 17/18 year olds still in full-time education. Source: own calculations.
2. Higher education age participation index is the number of young (under 21) home initial entrants expressed as a proportion of the averaged 18 to 19 year old population. Source: DFES.

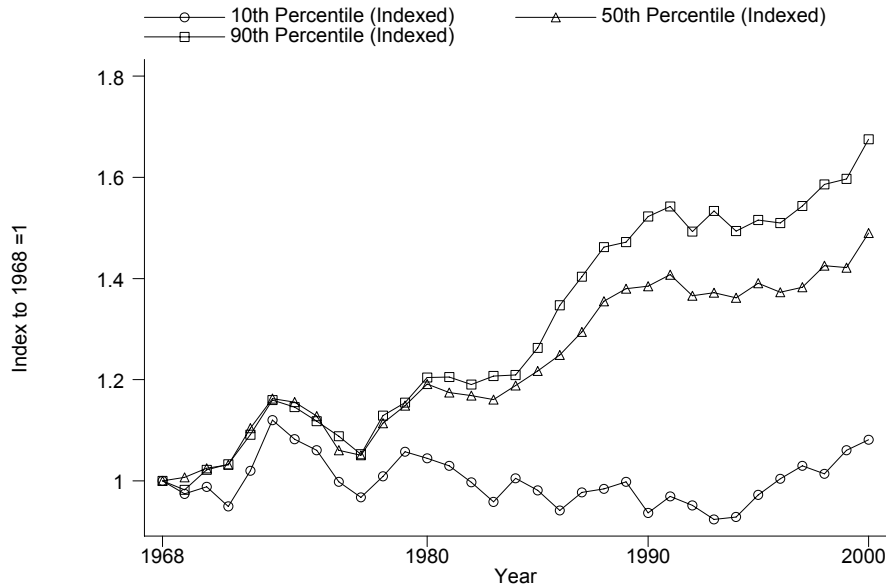
Figure 2: Changes in Educational Participation, US



Notes:

Source: The National Center for Education Statistics, USA, website and own calculations from the CPS for the post-compulsory schooling figures.

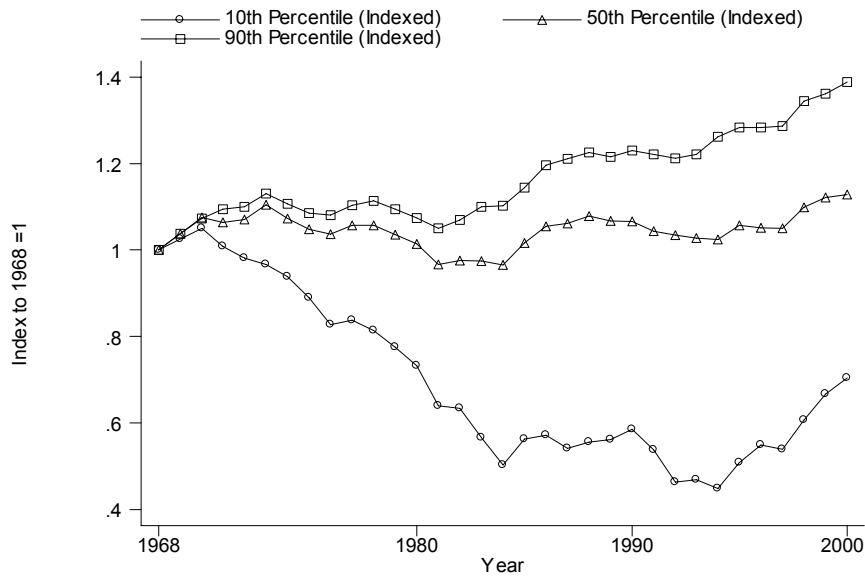
Figure 3: Changes Over Time in the Distribution of Log(Real Income) For Families With Children, UK



Notes:

1. Own calculation from Family Expenditure Surveys of 1968 through 2000.
2. Sample is all non-pensioner families with children.
3. Figures are based on net real income.

Figure 4: Changes Over Time in the Distribution of Log(Real Income) For Families With Children, US



Notes:

1. Own calculation from Current Population Surveys of 1968 through 2000.
2. Sample is all non-pensioner families with children.
3. Income is a gross measure as that is all that is available in the CPS.

Table 1: Descriptive Statistics for the UK and US

Time Period	UK			US			
	Stayed On	Family Income	Sample Size	Stayed On	Completed High School	Family Income	Sample Size
1977-1979	.38	352 (173)	1519	-	.81	65199 (40666)	5812
1980-1982	.42	354 (177)	1683	-	.82	59510 (37972)	6034
1983-1985	.44	401 (257)	1429	-	.82	61526 (41337)	5102
1986-1988	.47	459 (367)	1358	.93	.83	67758 (46326)	4383
1989-1991	.56	463 (290)	1127	.93	.82	64969 (44004)	4380
1992-1994	.68	486 (296)	978	.94	.81	62640 (43360)	3605
1995-1997	.73	505 (326)	972	.93	.81	70708 (67993)	3218
1998-2000*	.74	557 (371)	874	.94	.80	71840 (62297)	2244

Notes:

1. Calculations from UK Family Expenditure Survey (FES) and US Current Population Survey. Family income in the FES is measured in 2001 pounds per week. In the CPS it is 2001 dollars per year.
2. Standard deviations of income in parentheses.
3. *These figures refer to the 1998-1999 period in the US.
4. For the FES the time period is calculated on the basis of (survey year – 1) for 17 year olds and (survey year-2) for 18 year olds. This dates the observations to the year in which the individual was 16, making the data comparable with the cohort studies.
5. For the CPS the sample consists of all 19 year olds and the year is reported as (survey year – 1), the year in which they should have graduated.

Table 2: Descriptive Statistics, British Cohorts

	NCDS	BCS	BHPS
Year of Birth	1958	1970	1979.5 (3.20)
Stayed On	.291	.463	.723
Degree at 23	.098	.177	.293*
Degree at 23 Stayed On	.323	.342	.358
Net Family Income	320 (120)	328 (162)	496 (278)
Sample Size	6508	4707	1614

Notes:

1. *Sample size here is 307.
2. Incomes are in 2001 pounds.
3. Standard deviations are in parentheses.
4. “Stayed on” is defined as those who remain in full time education in the September after they turn 16.

**Table 3: Staying On Rates (Proportions) By Parental Income Group,
UK Family Expenditure Survey**

Time Period	Parental Income Group			Educational Inequality (Highest – Lowest)
	Lowest 20 percent	Middle 60 percent	Highest 20 percent	
1977-1979	.26	.37	.54	.28 (.04)
1980-1982	.33	.37	.57	.24 (.04)
1983-1985	.31	.43	.62	.31 (.04)
1986-1988	.30	.44	.70	.40 (.04)
1989-1991	.45	.55	.74	.29 (.04)
1992-1994	.60	.66	.83	.24 (.04)
1995-1997	.61	.72	.87	.26 (.04)
1998-2000	.64	.67	.90	.26 (.04)
Change 1977-1979 to 1986-1988	.04	.07	.16	.13 (.06)
Change 1986-1988 to 1998-2000	.34	.23	.20	-.14 (.06)
Change 1977-1979 to 1998-2000	.38	.30	.36	.02 (.06)

Notes:

1. “Staying on” is defined as individuals who left school after age 16.
2. Sample is a cohort of 17/18 year olds drawn from FES. Total sample size across all time periods is 9994.
3. Standard errors are in parentheses.
4. Quintiles are derived from the net family income of sample individuals less their own earnings.

**Table 4: Proportions with a Degree by 23 Conditional upon Staying On,
British Cohort Data**

	Parental Income Group			Educational Inequality (Highest –Lowest)
	Lowest 20 percent	Middle 60 percent	Highest 20 percent	
NCDS 1981	.26	.28	.43	.17 (.02)
BCS 1993	.18	.29	.49	.31 (.03)
BHPS 1999 (Ave)	.14	.34	.58	.44 (.09)
Change 1981 to 1993	-.07	.01	.06	.14 (.04)
Change 1993 to 1999	-.03	.05	.08	.13 (.09)
Change 1981 to 1999	-.12	.06	.15	.26 (.09)

Notes:

1. Sample size is 1911 for the first cohort (National Child Development Study, NCDS), 2180 for the second cohort (British Cohort Study, BCS) and 190 for the third cohort (British Household Panel Survey, BHPS).
2. Standard errors are in parentheses.
3. Quintiles are derived from the net family income of the cohort member less their own earnings.
4. Numbers in the change column may not be internally consistent within the table as they are computed before rounding takes place.

Table 5: High School Completion (Proportions) By Income Group, US Current Population Survey

Time Period	Parental Income Group			Educational Inequality (Highest –Lowest)
	Lowest 20 percent	Middle 60 percent	Highest 20 percent	
1977-1979	.64	.83	.93	.29 (.02)
1980-1982	.64	.84	.93	.29 (.02)
1983-1985	.66	.84	.94	.28 (.02)
1986-1988	.65	.85	.94	.29 (.02)
1989-1991	.62	.85	.94	.32 (.02)
1992-1994	.62	.83	.94	.32 (.02)
1995-1997	.61	.83	.92	.31 (.02)
1998-1999	.59	.82	.93	.34 (.03)
Change 1977-1979 to 1986-1988	.01	.02	.01	.00 (.03)
Change 1986-1988 to 1998-1999	-.06	-.03	-.01	.05 (.04)
Change 1977-1979 to 1998-1999	-.05	-.01	.00	.05 (.04)

Notes:

1. Sample is of cohorts of 19 year olds drawn from the CPS.
2. Total sample size across all time periods is 36,235.
3. Standard errors are in parentheses.
4. Income quintiles are based on the gross family income less the child's own income.

Table 6: Proportion of High School Completers Ages 16-24 Enrolled in College in the October After Leaving High School, US

Time Period	High School Completers in College			
	Lowest 20 percent	Middle 60 percent	Highest 20 percent	Educational Inequality (Highest – Lowest)
1977-1979	.30	.44	.65	.35
1980-1982	.33	.45	.68	.35
1983-1985	.36	.48	.73	.37
1986-1988	.38	.51	.73	.35
1989-1991	.45	.56	.73	.28
1992-1994	.44	.57	.79	.35
1995-1997	.47	.60	.81	.34
1998-2000	.49	.61	.77	.28
Change 1977-1979 to 1986-1988	.08	.07	.08	.00
Change 1986-1988 to 1998-2000	.11	.10	.04	-.07
Change 1977-1979 to 1998-2000	.19	.17	.12	-.07

Notes:

1. Source: National Center for Education Statistics, USA, website (www.nces.ed.gov/quicktables/).
2. As this data is provided in aggregate form we are unable to estimate standard errors.

Table 7: Education and Family Income, UK and US Household Data

	UK – Staying on Beyond Age 16			US – High School Graduation		
	(1)	(2)		(3)	(4)	
	No parental education	Controls for parental ed		No parental education	Controls for parental ed	
	Educational Inequality	Educational Inequality	Sample Size	Educational Inequality	Educational Inequality	Sample Size
1977-1979	.257 (.040)	.130 (.037)	1519	.183 (.015)	.107 (.015)	5812
1980-1982	.219 (.040)	.094 (.039)	1683	.195 (.015)	.113 (.015)	6034
1983-1985	.300 (.038)	.175 (.038)	1429	.168 (.015)	.093 (.016)	5102
1986-1988	.388 (.040)	.237 (.043)	1358	.186 (.017)	.110 (.017)	4383
1989-1991	.280 (.050)	.147 (.050)	1127	.230 (.019)	.141 (.019)	4380
1992-1994	.219 (.051)	.070 (.057)	978	.208 (.019)	.122 (.016)	3605
1995-1997	.225 (.049)	.100 (.052)	972	.215 (.021)	.125 (.021)	3318
1998-2000*	.271 (.055)	.166 (.056)	874	.238 (.025)	.174 (.027)	2244
Change 1977-1979 to 1986-1988	.133 (.056)	.107 (.069)		.003 (.023)	.003 (.023)	
Change 1986-1988 to 1998-2000	-.117 (.068)	-.071 (.057)		.056 (.030)	.064 (.032)	
Change 1977-1979 to 1998-2000	.014 (.068)	.036 (.067)		.055 (.029)	.067 (.031)	

Notes:

1. The marginal effects are derived from probit models of the educational outcome on dummy variables for quintiles of family income. Educational inequality is defined as $\Pr[\text{Stay On} | \text{Top Income Quintile}] - \Pr[\text{Stay On} | \text{Bottom Income Quintile}]$.
2. The column (1) and (3) specifications include controls for the sex of the individual, the number of children in the household and parents age.
3. The column (2) and (4) specifications additionally control for parental education.
4. We also control for whether the individual is classified as nonwhite in the US models. Standard errors in parentheses.
5. *These figures refer to the 1998-1999 period in the US.
6. Also see notes for Tables 3 and 5.

Table 8: Staying On and Family Income, British Cohorts

	Staying On Beyond Age 16					
	(1)	(2)	(3)	(4)	(5)	(6)
	NCDS 1974	BCS 1986	BHPS 1996	Change (2) – (1)	Change (3)-(2)	Change (3)-(1)
A. No Controls						
Educational Inequality	.238 (.018)	.384(.021)	.235 (.037)	.146 (.027)	-.149 (.041)	-.003 (.039)
Sample Size	6508	4707	1614			
B. Controls for family size, sex, no dad and parents' age						
Educational Inequality	.242 (.019)	.388(.021)	.211 (.035)	.145 (.029)	-.176 (.041)	-.031 (.040)
Sample Size	6508	4707	1614			
C. Specification B plus controls for test scores						
Educational Inequality	.114 (.016)	.259(.023)		.145 (.033)		
Sample Size	6508	4707				

Notes:

1. Marginal effects are derived from probit models of staying on beyond 16 on dummy variables for quintiles of family income. Educational inequality is defined as $\Pr[\text{Stay On} \mid \text{Top Income Quintile}] - \Pr[\text{Stay On} \mid \text{Bottom Income Quintile}]$.
2. Test scores measure the child's quintile in the distribution of maths and reading scores at age 11 for the NCDS and 10 for the BCS.
3. Bootstrapped standard errors in parentheses.
4. Quintiles are derived from the net family income of the cohort member less their own earnings.

Table 9: Degree Acquisition and Family Income, British Cohorts

	Degree By Age 23 Stayed On					
	(1)	(2)	(3)	(4)	(5)	(6)
	NCDS 1981	BCS 1993	BHPS 1999	Change (2) – (1)	Change (3) – (2)	Change (3) – (1)
A. No Controls						
Educational Inequality	.173 (.034)	.310 (.031)	.437 (.092)	.137 (.047)	.127 (.083)	.264 (.097)
Sample Size	1893	2180	240			
B. Controls for family size, sex, no dad and parent's age						
Educational Inequality	.170 (.036)	.302 (.032)	.437 (.091)	.132 (.049)	.135 (.097)	.267 (.098)
Sample Size	1893	2180	240			
C. Specification B plus controls for test scores						
Educational Inequality	.105 (.034)	.207 (.033)		.102 (.048)		
Sample Size	1893	2180				

Notes:

1. Marginal effects are for probit models of degree attainment by age 23 for a sample of individuals who stayed on beyond the school leaving age. Educational inequality is defined as $\Pr[\text{Degree If Stay On} \mid \text{Top Income Quintile}] - \Pr[\text{Degree If Stay On} \mid \text{Bottom Income Quintile}]$.
2. Controls are as for Table 8.
3. Quintiles are derived from the net family income of the cohort member less their own earnings.

Table 10: Controlling for Parental Education and Interest

	Staying On Beyond Age 16		
	(1)	(2)	(3)
	NCDS 1974	BCS 1986	Change (2-(1))
Specification B plus parental education			
Educational Inequality	.121 (.017)	.269 (.024)	.148 (.029)
Sample Size	6508	4707	
Specification B plus parental interest			
Educational Inequality	.145 (.018)	.296 (.023)	.150 (.030)
Sample Size	6508	4707	
Specification B plus parental education and interest			
Educational Inequality	.075 (.017)	.206 (.024)	.132 (.030)
Sample Size	6508	4707	
	Degree by Age 23 Stayed On		
	(1)	(2)	(3)
	NCDS 1981	BCS 1993	Change (2-1)
Specification B plus parental education			
Educational Inequality	.103 (.040)	.215 (.034)	.112 (.053)
Sample Size	1893	2180	
Specification B plus parental interest			
Educational Inequality	.117 (.037)	.235 (.034)	.117 (.050)
Sample Size	1893	2180	
Specification B plus parental education and interest			
Educational Inequality	.073 (.039)	.172 (.034)	.099 (.052)
Sample Size	1893	2180	

Notes:

1. As for Tables 8 and 9.
2. The parental interest variables control for the interest level of both parents at age 10/11. In the BCS the question asks whether each parent a) is uninterested b) has little interest c) has moderate interest or d) is very interested. The NCDS is grouped rather differently into a) little interest b) moderate interest c) very interested or d) over concerned. The responses are therefore grouped to three categories a) little or no interest b) moderate interest c) very interested / over concerned.

Table 11a: Examining the Effect of Measurement Error in Income: The FES

	UK – Staying on Beyond Age 16		
	(1)	(2)	
	Consumption	Income	
	Educational Inequality	Educational Inequality	Sample Size
1977-1979	.300 (.037)	.267 (.075)	1507
1980-1982	.284 (.042)	.241 (.040)	1669
1983-1985	.349 (.037)	.311 (.045)	1419
1986-1988	.407 (.042)	.400 (.049)	1332
1989-1991	.373 (.053)	.294 (.053)	1111
1992-1994	.333 (.049)	.227 (.054)	970
1995-1997	.279 (.050)	.223 (.055)	961
1998-2000	.353 (.059)	.269 (.056)	861
Change 1977-1979 to 1986-1988	.107 (.056)	.133 (.089)	
Change 1986-1988 to 1998-2000	-.054 (.072)	-.131 (.074)	
Change 1977-1979 to 1998-2000	.053 (.070)	.002 (.093)	

Notes:

1. Models exclude observations where families appear to be spending more than 4 times their income or less than 10 %.
2. Controls are included for sex, age of parents and number of siblings as in Table 7 column (1).

**Table 11b: Examining the Effect of Measurement Error in
Income: BCS and BHPS – Staying On**

	Stayed On					
	(1) BCS 1986	(2) BHPS 1998	(3) Change (2)-(1)	(4) BCS 1986	(5) BHPS 1998	(6) Change (5)-(4)
	Age 16 Income	Age 16 Income		Average of Age 10 and 16 income	Average Age 10-16 income	
No Controls						
Educational Inequality	.381(.024)	.194 (.063)	-.187 (.068)	.410 (.023)	.227 (.054)	-.183 (.059)
ln(income)	.308 (.019)	.123 (.038)	-.184 (.043)	.409 (.023)	.177 (.044)	-.232 (.050)
Sample Size	3755	459		3755	459	
Specification B						
Educational Inequality	.366 (.026)	.272 (.033)	-.094 (.042)	.397 (.029)	.324 (.023)	-.073 (.033)
ln(income)	.316 (.020)	.138 (.041)	-.178 (.045)	.405 (.024)	.183 (.046)	-.221 (.052)
Sample Size	3755	459		3772	459	

Notes:

1. As for Tables 8 and 9. Marginal effects for ln(income).
2. Note that the BHPS year is 1998 (as compared to 1996 in earlier Tables) due to the need for income data at earlier child ages.

Table 12: Robustness Checks on Potential Endogeneity Using Industry Technical Change as an Instrumental Variable

	Stayed On					
	Ordinary Least Squares			Instrumental Variables		
	(1) BCS 1986	(2) BHPS 1996	(3) Change (2)-(1)	(4) BCS 1986	(5) BHPS 1996	(6) Change (2)-(1)
No Controls						
ln(income)	.290 (.017)	.118 (.020)	-.172 (.026)	.595 (.142)	.239 (.088)	-.357 (.167)
Sample size	3619	1370		3619	1370	
Specification B						
ln(income)	.288 (.016)	.108 (.019)	-.180 (.026)	.511 (.155)	.338 (.069)	-.173 (.170)
Sample Size	3619	1370		3619	1370	
	Degree Stayed On					
	Ordinary Least Squares			Instrumental Variables		
	(1) BCS 1993	(2) BHPS 1999	(3) Change (2)-(1)	(4) BCS 1993	(5) BHPS 1999	(6) Change (2)-(1)
No Controls						
ln(income)	.246 (.024)	.303 (.076)	.058 (.080)	.446 (.172)	.575 (.316)	.128 (.036)
Sample Size	1711	191		1711	191	
Specification B						
ln(income)	.238 (.025)	.273 (.081)	.035 (.085)	.371 (.198)	.610 (.345)	.239 (.402)
Sample Size	1711	191		1711	191	

Notes

1. As for Tables 8 and 9.
2. The instrumental variable used is the head of the household's mean industry computer use, obtained from the British Social Attitudes Surveys 1985, 1987 and 1990.