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Family Income and Education in the Next Generation: Exploring income gradients in education for current cohorts of youth

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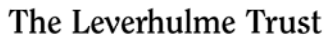

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Abstract

The relationship between the incomes of the family a child is growing up in and the education level the child obtains has been of great interest to researchers for a number of reasons. Firstly, this gives us a measure of educational inequality in its own right and secondly, because the relationship between family income and education is also one of the key drivers of intergenerational income mobility across time in the UK and gradients in life chances across a range of other domains. This paper explores the evolution of the relationship between family income and education for a group of cohorts from those born in 1958 to those born in 1991/92. The range of educational relationships we can measure obviously depends on the age of the child. For older cohorts, who we observe as finished in education, we can measure the full range of educational outcomes up to degree level and their relationship with family income. For younger cohorts who are in earlier stages of education, we can measure test scores and GCSE results but not later educational outcomes.

Keywords: Intergenerational mobility, children, education

JEL Classification: J62, J13, J31

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1. Introduction and previous literature

The relationship between the incomes of the family a child is growing up in and the education level the child obtains has been of great interest to researchers for a number of reasons. Firstly, this gives us a measure of educational inequality in its own right and secondly, because the relationship between family income and education is also one of the key drivers of intergenerational income mobility across time in the UK (Blanden, Gregg and Macmillan, 2007) and gradients in life chances across a range of other domains.

There have been a number of recent studies exploring whether family income actually influences a child's educational attainment or rather is just a marker for many other aspects of social (dis-)advantage, such as parents education level, social class etc. Dahl and Lochner (2008) exploit the introduction of the Earned Income Tax Credit in the US, Milligan and Stabille (2006) explore the variation in child benefits across time and Canadian provinces and Gregg et al. (2009) use fathers' job displacement. All of the studies suggest that sustained income shocks do impact on child educational outcomes and Oreopolous et al. (2008) and Gregg et. al. (2009) suggest that this also influences intergenerational mobility.

Likewise there have been a large number of studies assessing whether a person's education actually does impact on outcomes or whether it is instead reflecting other underlying abilities and attitudes. A number of studies have considered what happens when the school leaving age is raised in order to attempt to identify a causal relationship between education and outcomes. For example, Meghir and Palme (2005), Oreopoulus (2006) and Dickson (2009) explore the impact on a person's earnings as an adult, Black et. al (2008) look at teen pregnancy and Orepolous and Page (2006) look at a person's children's education. Again, all of these studies suggest that educational attainment has a direct causal influence on life chances.

Given the evidence that income causally impacts education and education causally impacts outcomes, the strength of the relationship between family background and a child's educational attainment represents the extent to which adult outcomes mirror the individual's childhood circumstances and is thus an indicator of equality of opportunity. This may mean that an individual who is born into a poor family faces life-long penalties regardless of their own abilities or effort. For this reason, this is currently a highly topical area in the UK where

the notion of 'opportunity for all' has been cited as a central policy goal by all three major political parties and most recently in the Milburn Commission.

There has been a large literature centred on the measurement of mobility and more recently on both international comparisons and cross-cohort comparisons for the UK. The broad consensus is that in international terms, the UK has a low level of mobility (Solon, 2002, Corak, 2006), rivalled only by the United States, and that across cohorts, the UK's level of intergenerational income mobility declined between cohorts born in 1958 and those born in 1970 (Blanden et. al., 2004). For policy makers one of the main problems when attempting to think about intergenerational mobility is the need for individual level data over a large number of years. To capture an intergenerational elasticity, information is needed on the individual's family socio-economic status in childhood and on the individual's own socio-economic status in adulthood. Previous research from the cohort studies provides evidence on the levels of mobility for children growing up in the 1970s and the 1980s. Policy makers wishing to assess the impact of recent policy innovations on social mobility will therefore have to wait at least another decade until the children experiencing these policy innovations have reached an age in the labour market where their own financial circumstances are fully apparent.

This research will therefore estimate the relationships between family income and education for a group of cohorts from those born in 1958 to those born in 1991/92. This in itself is a valuable addition to the current literature given the variety of data sources that we use. The range of educational relationships we can measure obviously depends on the age of the child. For older cohorts, who we observe as finished in education, we can measure the full range of educational outcomes up to degree level and their relationship with family income. For younger cohorts who are in earlier stages of education, we can measure test scores and GCSE results but not later educational outcomes. However, these test scores are known to be strong predictors of later educational attainment.

In the next section we lay out our modelling approach in more detail. In section 3 we discuss the data sources used before presenting our results in section 4. Section 5 offers conclusions.

2. Methodology

The main objective in this paper is to say something about the changing relationship between family income and educational outcomes across a range of cohorts. The relationship of interest for examining the association between the family income of the child and their educational attainment is captured by λ in the following regression where Ed_i is a range of measures from test scores to degree attainment. The parental income variable is logged to ensure that the relationship is constant across the distribution of income; a 10% increase in the standard of living is the same for a family in the 10th percentile of the income distribution compared to the 90th percentile.

$$Ed_i = \alpha + \lambda \ln Y_i^{Parents} + \delta age_i + \pi age_i^2 + \varepsilon_i \quad (1)$$

Quadratic age controls for the parents are included to adjust for life-cycle biases in family income.

3. Data

For this analysis, we use the two British birth cohorts, the NCDS (1958) and the BCS (1970), as in Blanden et al. (2007). In addition, we introduce three younger cohorts using data from the BHPS (those born from 1975-1980 (BHPS 1), those born from 1981-1986 (BHPS 2) and those born from 1987-1989 (BHPS 3)) and two additional cohorts; from the Longitudinal Study of Young People in England (LSYPE), a national survey of those born in 1989/1990, and from ALSPAC, a Bristol based birth cohort for children born 1991/1992.

British Cohort Data

We use information from the two mature publicly accessible British cohort studies and later on two cohorts of youths currently with data available up to around age 16. The British Cohort Study is a study of those born in 1970 and the National Child Development Study is a study of those born in 1958. Both cohorts began with around 18,000 children, although as we shall see our final samples are considerably smaller than this. The younger cohorts are the Longitudinal Study of Young People in England (LSYPE or often called Next Steps) and the Avon Longitudinal Study of Parents and Children (ALSPAC).

The National Child Development Study (NCDS) obtained data at birth and ages 7, 11, 16, 23, 33, 42 and 46 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 and 34. Educational attainments were obtained from information provided at ages 16, 23 and 33 in the NCDS and ages 16, 26 and 30 for the BCS sample. This includes detailed information on the number of exams passed (both GCE O level and CSE). Information on educational achievements beyond age 16 is also available at these ages. The GCSE measure we construct is the number of O-levels graded A-C obtained by the cohort member and the A-level measure is the total number of A-levels obtained where an A/S level counts for half an A-level. The two staying on variables are dummies to capture staying on decisions at 16 and 18 and the degree measure is also a dummy to measure degree attainment. In addition information on all periods of labour market and educational activity from age 16 to 24 can be derived from an additional work history data source, available for every month from age 16 to 42 (NCDS) and 16 to 30 (BCS). This information is used to generate the measure of labour market attachment which is the proportion of months from leaving full time education to age 24 when the individual is not in education, employment or training.

Parental income data is available at age 16. In the NCDS the data is banded for mother's earnings, father's earnings and other income, with an average of the midpoints of all three categories used as a final broadly continuous measure. In the BCS, parental income is derived from information obtained at age 16. We generate continuous income variables by fitting a Singh-Maddala distribution to the data using maximum likelihood estimation. This is particularly helpful in allocating an expected value for those in the open top category. We then adjust the income variable to a net measure and impute child benefit for all families.

When we look to bring in younger cohorts by comparing the relationship between income and earlier test scores, information is available in the NCDS at ages 7 and 11 and the BCS at age 10. The reading, maths and IQ tests are broadly comparable across the cohorts from ages 11 and 10 respectively with an additional reading measure at age 7 used from the NCDS for comparability with a similar measure from ALSPAC. All test scores in the cohorts are administered by the cohort studies and standardised to mean 0, standard deviation 1 for comparison.

When we consider the relationship between education and family income we can present results for male and female children combined as we would expect the education experiences of males and females to be similar. Furthermore the income measure is standardised as with all other income measures to mean 0, standard deviation 1. This is to ensure that changes in income inequality across the cohorts or small changes in the variance in income due to minor definitional or reporting differences will not drive the results.

The British Household Panel Study

The British Household Panel Study (BHPS) is not a birth cohort. It tracks a representative sample of 10,000 households and all members of the original households are then followed including any children after leaving the family home. Hence, the BHPS can track small numbers of children who reach age 16 in any year through to adulthood but as these samples are small we pool a number of years to create cohort windows of people entering in waves 1-6 (BHPS 1) that are born in 1975-1980, those entering in waves 7-12 (BHPS 2) that are born in 1981-1986, and those entering in waves 13-16 (BHPS 3) that are born in 1987-1990.

For the first BHPS cohort, BHPS 1, we can observe educational attainment measures constructed in the same way as the cohort studies, and the proportion of time since leaving full-time education that they have spent not in education, employment or training, comparable with the two birth cohorts. For the second cohort, BHPS 2, we can observe all individuals' educational attainment until the age of 20 along with their family income when they enter the study at age 16. As we do not observe them later than 20 there is no information on their labour market attachment and the degree variable also includes individuals who are at university but have not yet necessarily completed their degree. All other measures remain consistent with previous cohorts. The third BHPS cohort, BHPS 3 - those born 1987-1990, started secondary school under the new Labour Government of 1997 and currently we can observe them all until the age of 17. We can therefore use measures of educational attainment between 16 and 17 but no further.

The family income of the parents is observed when the study children enter the survey at age 16. The family income measure is taken from the 'Derived current and annual net household income' dataset, an unofficial supplement to the derived gross income variables released with the BHPS. The income measure is adjusted to monthly income, logged and standardised for

comparability. Given that the study children do not enter the panel until age 16 we have no comparable early test scores available for these three cohorts.

The Longitudinal Study of Young People in England

The LSYPE is a panel of young people aged 13 and 14 in 2004 and so were born in 1989 and 1990. These individuals were beginning junior school in 1997 with the change in Government and have thus been exposed to national policy developments in the New Labour period. This will include the Literacy and Maths Hours and tax credits, as well as the falls in child poverty and the relatively tight labour market that occurred over this period. The panel follows the young people and their families with data currently available up to wave 3, 2006. These individuals are comparable with our third cohort of BHPS individuals as they have just finished their GCSEs.

In terms of educational attainment, administrative data from Key Stage 4 is used to create a total number of GCSEs level A*-C measure and information from wave 4 on the main activity of the young person is used to create a dummy indicator for staying in education post 16. Given concerns that grade inflation might affect the relationship between family income and educational attainment over time, more restrictive measures of GCSE attainment are also used for robustness checks. The problem is that if there is grade inflation, the distribution of grades will get more compressed around the top of the distribution because the top of the scale is capped and this will cause lower attaining groups to appear to catch up with higher attaining ones. Measures of attainment that are more demanding will have lower means at all parts of the distribution when expressed as dummy variables and thus aren't so prone to this problem. The measures, which are comparable with measures constructed in the BCS, include the total points score, a dummy variable for obtaining 5 A*-C grades and a dummy variable indicating those who have obtained 5 A*-C grades including maths and English.

The income measure is created using data from wave 1, when the cohort members are 14. The original family income measure in the LSYPE is gross banded income including benefits. The measure is coded to monthly income and the measure is transformed from gross to net using information from the Family Resources Survey (FRS 2004). There are a large number of bands in the LSYPE with only two individuals falling into the open top category so a Singh-Maddala transformation is unnecessary in this case. An interval regression technique is then used instead to distribute the families within each band. As with all income

measures the measure is logged and standardised to mean 0, standard deviation 1. A number of robustness tests are carried out to assess the impacts of using different methods to create comparable income measures which are discussed in the results section. Given that the LSYPE is a study of young people in England, robustness tests are also carried out on the significant results for sub-samples of the other cohorts from England only.

Unlike in the BHPS, we can also observe earlier outcomes for these individuals as administrative data has been linked into the study including Key Stage 2 test scores. We can therefore extend our analysis to include the relationship between family incomes and test scores for this cohort of individuals, as with the cohort studies. Key Stage 2 scores are constructed using the discrete level obtained and adjusting for the marks within each level to create a 'fine point's score' for both reading and maths. These scores are then standardised to mean 0, standard deviation 1.

Avon Longitudinal Study of Parents and Children

ALSPAC is a birth cohort of children born in the region of Avon from 1991 to 1992, making them a very similar age to those in the LSYPE. Due to data backlogs data is currently only available for these individuals up to the age of 11, so there is no information available on later educational attainment. Information is available however for Key Stage 2 test scores and an IQ clinic measure. The IQ measure from ALSPAC is slightly earlier than that from the cohorts at age 8 but as IQ measures are seen as a more permanent measure of intelligence this may not be a major concern. The maths and reading scores are taken from the Key Stage 2 individual test marks in the same way they are derived in the LSYPE. As with the cohort studies and LSYPE, the three scores are standardised to mean 0, standard deviation 1. To ensure that there are no concerns over differences between the tests administered by the cohort studies and the key stage tests which children may be 'taught to' we also include a reading test administered in an ALSPAC clinic at age 7. This is again standardised to mean 0, standard deviation 1. The correlation between the reading test at 7 and that of the reading component of key stage 2 at 11 is high, with a correlation coefficient of 0.6766.

The income measure from ALSPAC is taken from banded household net income at age 11 and put through the same Singh-Maddala process as that which is used to deal with banded income in the cohort studies. The measure is then logged before being standardised to mean 0, standard deviation 1. Robustness tests using income at 10 from the BCS show that

education and test score income gradients using earlier income measures are comparable given high levels of persistence in income.

Table 1 summarizes all of the available information for analysing the relationship between family income, educational attainment and test scores.

4. Results

The relationship between family income and educational attainment

We start by showing the patterns of the number of GCSE A* to C grades achieved for each cohort we can consider. Table 2 shows this information by family income quintile. As has been widely observed there has been a steady increase in numbers of O levels / GSCEs secured across the cohorts. The NCDS cohort sat O levels (the pre-cursor to GCSEs) in 1974 when a large proportion of the cohort would have entered into selective education. Although most schools moved to be comprehensives by 1974, those attending secondary moderns (and former secondary moderns) were much less likely to be entered for O levels at this time. In this cohort the average child got just over 2 A-C O levels. The cohort of the BCS sat O levels (also known as GCEs and CSEs where the top grade is equivalent to a GCSE grade C) in 1986 and on average pupils obtained just under 4 O levels or top CSEs. This was just before the implementation of reforms laid out by Sir Keith Joseph which moved the examination system from one where essentially a fixed proportion of students could get any particular A-C grade (around one third) to there being a fixed line over which any number could pass. The subsequent increase in the proportion getting higher grades has led to concerns over grade inflation, where it has been argued that exam standards are falling.

The BHPS 1 cohort sat the new combined GCSEs from 1991 to 1996, after a period of rapid increase in GCSE attainment which has continued since at a slower rate. This generation was now achieving 5 ½ GCSE A-Cs. The BHPS can add new five year cohort data here: a second and third more recent BHPS cohort born between 1981 and 1986 (BHPS 2) and 1987 to 1990 (BHPS 3) who were achieving an average of 6 GCSEs A*-C grades per pupil. The LSYPE cohort, tracked since they were 14, has just turned 17 and whilst we have GCSE results for those taken at 16 in the academic year 2005/2006, this cohort lacks any information regarding

those sitting the exams at ages 17+. This means the mean number of GCSEs A*-C grade students achieve in the LSYPE cohort is a little below that of the preceding BHPS cohorts.

In what follows next we explore how the attainment gaps have changed across these different cohorts. So we need to get an idea of the direction of any bias that may arise from this lack of exam data for those sitting additional GCSEs at age 17+ in the LSYPE. The Department of Children, Schools and Families (DCSF) reports on the proportion of young adults obtaining 5 or more A*-C grade GCSEs as the required level 2 attainment at ages 16 to 19 in 2007. These figures will include vocational qualifications can also be ranked as level 2 attainments. The figures from DCSF, shown in table 3, suggest that level 2 attainment increases through to age 19. The rise by age 17 is primarily through GCSEs obtained rather than two year vocational courses and this extension adds another 9% of students achieving 5+ A*-C GCSEs. Crucially here the FSM-Non-FSM gap (the only measure of family background) narrows by 1.5 percentage points as most of those already achieving 5+ passes go on to level 3 courses (mainly A-Levels) but some of those just missing this benchmark do further exams. Furthermore, information from wave 4 of LSYPE, on the main activity of the young person, can shed further light on the likely direction of this bias. For those young people who report in wave 4 that they are staying on at school or college full time to study for GCSEs, the average family income at 14 was just £1432.66 per month compared to the sample average of £1841.35. Hence the bias from missing later GCSE exam information for the most recent cohort is likely to overstate the relationship between family background and educational attainment as later information reduces the gap between higher and lower income children.

Table 2 shows how, as well as a rise in the average number of passes, there were increasing numbers of passes for all quintiles of income. However, between the NCDS and BCS this occurred more slowly for the poorest income group (1 extra A-C pass) than for the middle (1.5 passes) and for the top quintile (2 passes). Since then, increases in pass rates were slightly faster at the middle (1.4 extra passes) and bottom (1.2) than at the top (1) between the BCS and first of the BHPS cohorts. This pattern has continued through the available BHPS data.

Table 4 shows the univariate relationships between family income, all education qualification levels and the proportion of time spent not in education, employment or training (NEET) before age 24 for each cohort, where the data is available. Across all five cohorts, those

individuals from better off families did better at every stage of educational attainment than their less well off counterparts and were less likely to spend a proportion of their early labour market experiences as a NEET. The number of GCSEs A-C, the number of A-levels achieved and attachment to the labour market variables are estimates using OLS, and our staying on post-16, post-18 and degree measures are estimates using the Linear Probability Model (LPM).

The strength of the relationship between family income and educational outcomes increased between those born in 1958 and 1970 for all six outcomes considered. As an example using standardised income to net out any effect from rising wage inequality, a doubling of family income in the NCDS was associated with an individual being 6% more likely to gain a degree, whereas in the BCS the same increase saw an individual being 11% more likely to gain a degree. The BHPS cohorts suggest this was around 9%for those born in the late 1970s and early 1980s.

The BHPS data is based on far smaller data and so the results need to be assessed with care. Table 5 reports tests of significant changes in the coefficients across various cohort comparisons. Column 3 indicates that the increase in the relationship between income and education in the BCS compared to the NCDS is significant for every education level and for the early labour market experience. For the BCS a doubling in income in both cohorts was associated with a gain of one more GCSE at A-C level than their NCDS counterparts. The picture through the BHPS cohorts and the LSYPE is of moderate reduction in the gradient of GCSE scores by family background and more dramatically for staying on at age 16. The relationship between income and education shows no significant changes between those born in the BCS and those born just 5-10 years more recently in the BHPS 1 cohort (born from 1975-1980 – in the second panel of table 5), with nearly all the coefficients being negative but small in magnitude and insignificantly different from the BCS relationships. So the picture is one of stability for those two cohorts born in the 1970s and attending secondary school in the 1980s and early 1990s. However, the relationship between the proportion of time spent not in education, employment or training became significantly more graded by income across these two cohorts. A 100% increase in family income in the BCS would reduce the proportion of time spent not in education, employment or training by under 2% between leaving full time education and the age of 24, but the same increase for the BHPS 1 cohort would reduce this time by more than three times the magnitude, over 6%. This is in

line with much of the work done on NEETs recently and indicates that this is a group of individuals who are still in need of a lot of help as they are increasingly constrained by their family background**.**

The second BHPS cohort, those born from 1981-1986, shows another small reduction in the income gradients associated with most educational attainment outcomes considered (the exception being staying on at age 18) compared with the earlier BHPS1 cohort. Whilst the coefficient for the number of A-C grades achieved at GCSE level has come down markedly from the BCS (panel 4, table 5), the large standard errors associated with the small BHPS sample make it hard to judge if this is a true effect rather than sampling. If both the BCS and BHPS 2 cohort were to experience a doubling of their income, the gap in the number of A-C graded GCSEs between poorer and more affluent children would be 0.34 smaller in the later cohort than for individuals born in 1970. This cohort was aged 16 between 1997 and 2002 and as such its secondary education straddles both Conservative and the New Labour governments. An even smaller third cohort of individuals born from 1987 to 1990, BHPS 3, which would have started secondary school under the new Labour government, exhibits a very similar pattern to the previous BHPS cohort and hence a similar decrease in the social gradient of those obtaining A-C graded GCSEs (panel 6, Table 5) relative to the BCS. However, even combining the two later BHPS cohorts to increase sample size still leads to imprecision in the estimates.

The much larger LSYPE cohort who were born towards the end of the BHPS 3 sample (1989-90) and who would have experienced their junior schooling and secondary schooling under New Labour further show similar gradients as the last two BHPS cohorts but here the results are now statistically significant. Column 6 of Table 4 and the final panel of Table 5 show that the coefficient on standardised family income for the LSYPE is in the same range as the BHPS 2 and BHPS 3 cohorts but the standard errors are now much smaller and suggest that a doubling of family income induces a 0.93 increase in the number of GCSEs graded A-C compared to 1.13 in the BCS and 0.72 in the old NCDS. The levelling off of the later BHPS data for children born 1981-1990[1] and the LSYPE is reassuring and suggests that income gradients in GCSEs have begun to return to the days of the early 1970s. As noted above, the LSYPE can not yet take into account those (re-)taking GCSEs at age 17 who are more often

[1] The coefficient when combining BHPS 2 and BHPS 3 is 0.9777 (0.188)

drawn from poorer families. Hence, this relatively small reduction in the family income gradient with respect to GCSE passes may understate the full picture.

Data on staying on decisions post age 16 are also available across all cohorts and table 4 illustrates that the pattern of a decrease in the income gradient for those born after 1980 as seen for GCSEs is replicated here. Across the BHPS cohorts, BHPS 1 again looks very similar in magnitude to the BCS with a reduction in the income gradient kicking in for those born 1980-1986 and 1987-1990[2]. Again, the magnitude of the standard errors prevents any findings of significant differences for these two cohorts and the BCS (panels 4 & 6, table 5) but a doubling of family income in the BCS led to a 13% higher chance of staying on post 16 compared to only 8% in the BHPS 2 and BHPS 3 cohorts, a reduction of 5% in the income gradient. For the larger LSYPE cohort this difference is more pronounced with a 9% statistically significant reduction in the income gradient from that of the BCS (panel 7, table 5). This is indicative of the widening access to post-16 education seen above with 76% of individuals in the LSYPE cohort opting to stay on in full time school or college post 16, showing that staying on post 16 is becoming a route that the majority of individuals now take, regardless of their family background.

The data on further educational qualifications is only available up to BHPS 2 given the current age of the younger cohorts. From the data available, there is little suggestion of progress in patterns of the number of A levels secured and degree participation since the BCS cohort as shown in panel 4 of Table 5. Hence the patterns suggest that family background is becoming less important in determining attainment at age 16, where the number securing GCSEs graded A-C has risen sharply and allowed access to further education, but remains significant at post-16 education levels.

Robustness to Alternative Measures

The evidence presented so far suggests an equalising in educational opportunities across family background at age 16 allowing greater access to post-16 education but no equalisation beyond age 17, albeit for older cohorts as the members of the most recent cohorts are not yet

[2] The coefficient of staying on post 16 on income for the combined BHPS 2 and BHPS 3 group is 0.0979 (0.022) which is statistically significantly different from the corresponding BCS coefficient at a 10% level of significance.

old enough to report this information. Given the importance of the findings, additional robustness checks need to be carried out to ensure that we can be confident of the results presented here.

First, we explore other data sources that can provide some information on the changing relationship between family background and educational attainment but do not contain full income data. These are the Youth Cohort Studies which contain social class rather than income but have a good time span, and second administrative data on child progress (National Panel Database) which has Free School Meals (FSM). This is a low income proxy as FSM apply to children who are eligible (though do not necessarily take up) these free meals on the basis of their parents entitlement to the major out of work benefits (Job Seekers Allowance, Income Support and Incapacity Benefit). An issue with both of these data sources is that social class sizes and the proportion of the population entitlemed to FSM are not constant across time and hence populations of different sizes are being compared.

Tables 6 and 7 report official DCSF published findings on level 2 attainment by FSM status and social class from these two extra sources of information. Table 6 reports information on 5+ A*-C GCSEs between FSM and non-FSM children born from 1986 to 1992 who hence overlap with the BHPS3 and LSYPE cohorts described above. Consistent with the pattern reported above, we see the growth in the proportion achieving good GCSEs across both groups but at a slightly faster rate among the FSM group. Expressed as the odds ratio of achieving 5+ GCSE passes then this declines rapidly from 2.3 times more likely among non-FSM than FSM children to 1.7 times by 2008. Table 7 uses information from the slightly more informative YCS, given that it covers the BCS period and all the cohorts considered since then. It shows level 2 attainment by measures of head of households' social class. There is a break in the series in 1999 when a new class measure was introduced but both measures can be observed for that year. This shows a rise in the proportion achieving good GCSEs between cohorts born in 1972 and 1977, though the odds ratio remains broadly stable, in line with the stability between the BCS and BHPS1 cohort. This plateaued for those born up to 1981 before falling sharply for cohorts born between 1983 and 1990. This timing completely coincides with the later BHPS data and LSYPE data shown in Table 4. There is a very high gradient in GCSE attainment across income groups for cohorts born in the 1970s who reach 16 in the late 1980s and early 1990s before declining markedly for those born in the 1980s who leave school from 1997 onwards.

There must be some concern that this is driven by changes in examinations rather than underlying ability, literacy or numeracy skills. There has been a widespread concern that rising pass rates stem from Grade Inflation which pushes more people into top grade categories. This would tend to narrow the observed income gradient as a greater proportion of more affluent children will have already achieved a high number of A-C grades. So we need to look at alternative measures not subject to this problem. One approach is to use more restrictive measures of GCSEs. Appendix Table A1 replicates the main result for the BCS and LSYPE of a declining social gradient in aged 16 educational attainment using the total points score, which is a more continuous measure of GCSEs with no cut-off point at grade C, as points are assigned to all grades obtained. The coefficients indicate a significant decrease in the additional points associated with a doubling of family income for those born in 1970 compared to 1989/90. However, the increasing numbers getting the top grades means this measure still has problems. LPM estimates of obtaining five A*-C grades, and five A*-C grades including maths and English, indicate that a doubling of family income in the BCS is associated with an increase in the probability of hitting these targets by around 15 percent, compared to around 10 percent in the LSYPE. All decreases between the cohorts are significant at a 95 percent confidence level or higher. As the mean for those achieving 5+ A-C grades including maths and English is around ten percentage points lower than for any 5 A-Cs, the similarity of the two measures is reassuring that capping is not the source of the narrowing of attainment gaps.

A more informative way to determine whether these findings are driven by changes in underlying ability and literacy and numeracy skills rather than changes in examinations is to examine data on IQ, literacy and numeracy scores and their relationship with family background across the cohorts. The relationship between family income and educational attainment can be expanded further back into the cohort member's childhood to consider the relationship between family income and test scores. Blanden et. al. (2007) found that these test scores measured at the beginning of secondary school are strong predictors of earnings at thirty and that the majority of the effects work through later educational attainment. These test scores can be therefore thought of as an early proxy for later educational attainment.

This data is not available in the BHPS and is limited in the LSYPE but there is an additional ALSPAC birth cohort of children born in the old Avon area around Bristol in 1991/2, which

can offer some insight here. Using comparable standardised reading and maths tests for the NCDS, BCS, LSYPE and ALSPAC for children aged 10/11, Table 8 documents the mean test scores across the income quintiles. In addition, we have measures of IQ available in the NCDS, BCS and ALSPAC cohorts at ages 11, 10 and 8 respectively but not for the LSYPE. The mean score gap between the top and bottom income quintiles was 57 points for IQ, 52 for Maths, and 56 for Reading in the NCDS. These had risen to 81ppts, 84ppts and 88ppts respectively in the BCS, in line with the widening gaps in qualifications observed earlier. In the LSYPE these had fallen back to 65ppts and 68ppts for maths and reading respectively and in ALSPAC to 75ppts for IQ and 76ppts for maths and reading.

Table 9 documents the change in the univariate relationship with standardised family income across the four cohorts and reports regression coefficients for these gradients. As with educational attainment, the NCDS is far less socially graded than the BCS in terms of test scores. An individual experiencing a 100% increase in family income, or moving from the 10^{th} to the 50^{th} percentile of the income distribution is on average likely to score one fifth of a standard deviation higher on all three test scores. In comparison, the same income change in the BCS would increase test scores by one third of a standard deviation. These increases are statistically significant across the two cohorts (Panel 1 of Table 10).

The LSYPE and ALSPAC test scores are however consistent with a decrease in the social gradient in test scores for younger cohorts with a significant decline in the relationship between family income and test scores from the BCS to both younger cohorts (panels 2 and 3 of Table 10). The social gradients in the two cohorts appear similar to those of the NCDS cohort and panel 4 of Table 10 indicates there is no significant difference between the NCDS and ALSPAC. The additional ALSPAC clinically assessed reading test at 7 exhibits a similar magnitude to the reading at 7 test in the NCDS and similar patterns of a decrease in the social gradient from that of the BCS. This suggests that it is not the fact that age 11 reading and maths tests are derived from administrative data rather than school based assessments that is driving the differences. IQ tests in ALSPAC are also undertaken in study clinics rather than being school based. This further supports the notion of a reversal in fortunes of those from lower income families**.**

Robustness of Income measures and Attrition

As we use data from a number of different sources it is important that these are all comparable. A lot of work has been carried out previously on the comparability of the income measures in the NCDS and BCS (see Blanden, 2004, Blanden et. al, 2008). As the main findings here focus on the BCS and LSYPE, appendix Table A2 documents the different income gradients associated with using different measures of income for these two cohorts.

The two main issues are over the technique used to turn the raw banded income into continuous data and the transformation from gross income to net income required in both sources. The BCS has 11 bands of income data with 5% in the open top category. The LSYPE has 92 bands of data with 0.01% in the open top category. The Singh-Maddala transformation that is applied to the BCS banded data is a useful way of assigning those in the open top category within the band. As there are so few in the top category of the LSYPE it is not necessary to apply this transformation. As can be seen from Table A2, the BCS results show that using mid-points of the bands or an interval regression technique instead of the Singh-Maddala transformation produces very similar coefficients. The interval regression technique is favoured as it weights an individual's position within a band and so, given there is little to choose between methods, this is the method chosen for the LSYPE.

Both the BCS and LSYPE are transformed from gross to net family income using the FES (1986) for the BCS and the FRS (2004) for the LSYPE for households with children aged 10 to 16. Gross and net household incomes are observable in these data sources and therefore the average ratio for each band is used to impute a net income amount. In both cohorts the transformation increases the relationship between family income and the total number of GCSEs when using non-standardised income. When the income is standardised, this deals with much of the associated differences in variation from applying this transformation and the results in the BCS are almost identical. In the LSYPE the net standardised income measure produces coefficients slightly below those from using a gross income measure.

Given that the LSYPE income measure is from the first wave of the study, there may be concerns that there is attrition by age 16 in the NCDS and BCS that cannot have occurred in the LSYPE. Given that we would expect the attrition to be from lower income families, this could be driving the decline in the relationship between family background and educational attainment at 16 from the BCS to the LSYPE. Appendix tables A3 and A4 consider this issue with panel 1 of table A3 documenting the proportions of each of the father's social classes at

birth reporting income at 16 and not reporting income at 16, and panel 2 repeating this and including mother's class and parental education for the BCS. The main point to take from table A3 is that the attrition does not seem to be a particular problem in either cohort. It appears random across all social classes and education levels. For more stringent testing the LSYPE cohort were weighted by their probability of leaving the sample by their parent's education based on the findings from the BCS assuming similar patterns of attrition. Table A4 indicates that this makes no difference to the coefficient of the relationship between family income and the number of GCSEs grades A*-C obtained in the LSYPE.

A further concern was that the LSYPE is the Longitudinal Survey of Young People in England whereas the other data sources also contain individuals from the rest of the UK. To ensure that the results were not driven by this selection, the first row of Table 4 was replicated for the other data sources, restricting the samples to England only. As can be seen from table A5, this does not change the pattern at all. The significant decline in the relationship between family background and educational attainment at 16 remains for this restricted sample.

5. Conclusions and Discussion

The above information presents a strong picture that the gradient of educational attainment at age 16 by family background (income or class) has lessened between generations born in the 1970s and those born in the 1980s and early 1990s. The government based statistics on child attainment at age 16 are most commonly summarized by proportion of children receiving 5+ GCSEs grades A-C. This has been rising for nearly 20 years, from around 40% in the mid-1980s to nearly 60% by 2003 (the last year of our BHPS 2 sample). Whether this general rise in measured attainment reflects improved true attainment is disputed. Obviously as the proportion gets close to 100% any gradient must disappear but in the middle range seen here an expansion can still lead to larger increases in the top two quintiles than the bottom two.

The government-based data do not contain measures of family income, but there are two possible alternatives. The first is the Free School Meals eligibility, which applies to around 15% of children from among the poorest families, and the second is average attainment in schools with a higher or lower proportion of FSM eligible children. However, even for these measures the available data does not go very far back. It suggests a small closing of the attainment gap between FSM and non-FSM children in recent years and a more marked

closing of attainment gaps for schools serving a large proportion of FSM children. The Department of Children Schools and Families (DCSF) has used the Youth Cohort Studies to look at the relationship between social class and attainment at age 16 and suggest a narrowing of class gaps after 1997 (DCSF 2006 and Heath et al. 2009). Our data based on birth cohorts and the British Household Panel Survey confirms this pattern using income data.

The picture of an improvement in equality of opportunity in terms of educational attainment at age 16 is also mirrored in IQ and reading and maths test scores in two recent cohorts: LSYPE and ALSPAC. So for younger generations, the educational differences across family backgrounds at age 16 and in literacy and numeracy test scores at age 10/11 do appear to be equalising, but the picture for education after age 16 is less clear. Given the important role of education in accounting for levels of social mobility (Blanden et. al., 2007) there is a suggestion that this weakening of income gradients in educational attainment at age 16 may improve future mobility levels. However, the impact on future earnings remains to be seen and will depend on whether the returns to different aspects of education change across time. As GCSEs are becoming more common and less graded by family background their value in the labour market may also diminish.

Whilst the timing of the closing of GCSE attainment gaps can be dated quite closely to cohorts reaching age 16 since 1995-97 or born since the early 1980s, the picture for test score data is less clear as data is much less frequent but is in place for two cohorts born around 1990. At the degree level the picture of improvement in attainment gaps is far less clear. For obtaining a degree there has been some increase in the proportion of students from State schools and from poorer neighbourhoods in government statistics, however there is no evidence of an increasing proportion of students coming from lower social class groups. Whilst the most recent cohorts studied here have not yet reached university age, no significant improvement is apparent up to children born in 1981-86 and hence leaving secondary school around 1997-2002. Hence there is some evidence of a narrowing of attainment gaps at age 16 but for degree level the picture is not yet supportive of a similar conclusion.

The large scale investment in increasing spending on education as a share of GDP and attempts to reduce poverty and its effects on children since 1999 has been most heavily focused on younger children (Sure Start, free ½ nursery school places, class size reduction

and tax credits have all been focused on children aged under 11). The impact on these children in terms of educational attainment at 16 is still some years away. Although there has been increased investment in secondary school education and programmes, such as literacy and numeracy hours, which will have benefited children with the time frame of our samples. In terms of GCSE qualifications improvements were clearly visible in the cohort preceding these investments and probably have more to do with the reforms to age 16 qualifications introduced by Sir Keith Joseph which started to come into effect in 1986. These opened the way for a steady increase in the numbers of students achieving grades A-C since that date, but improved teaching and school quality have probably added to this dynamic. The reductions in income gradients and test scores, including IQ scores, suggest that this is not due to grade inflation in GCSEs but rather there has been a genuine reduction in educational inequalities for children leaving school since the early 1990s.

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Table 1 Observable data for second stage analysis

Data source	**NCDS**	**BCS**	**BHPS 1**	**BHPS 2**	**BHPS 3**	**LSYPE**	**ALSPAC**
Year of birth	**1958**	**1970**	**1975/80**	**1981/86**	**1987/90**	**1989/90**	**1991/92**
Family income (age)	√ (16)	√ (16)	√ (16-18)	√ (16-18)	√ (16-18)	√ (14)	√ (11)
IQ at 8/10/11	√	√					√
Reading at 7/10/11	√	√				√	√
Maths at 10/11	√	√				√	√
No. of GCSEs	√	√	√	√	√	√	
Staying on at 16	√	√	√	√	√	√	
No. of A-level's	√	√	√	√			
Staying on at 18	√	√	√	√			
Degree	√	√	√	√			
Early labour market	√	√	√				

Age at which family income is available in parenthesis

Table 2 Average number of O-levels or equivalent at grade A*-C by income quintile for NCDS, BCS, BHPS 1 (1975-80), BHPS 2 (1981-86), BHPS 3 (1987-1990) and LSYPE (1989-90)

	NCDS 1958	**BCS 1970**	**BHPS 1 1975-1980**	**BHPS 2 1981-1986**	**BHPS 3 1987-1990**	**LSYPE 1989/1990**
Inc quintile 1	1.6153	2.6693	3.9149	4.5952	4.6364	3.6972
Inc quintile 2	1.9673	3.2020	4.7485	5.8197	4.5672	3.9431
Inc quintile 3	2.2362	3.7363	5.1299	6.0083	6.1558	4.8232
Inc quintile 4	2.5081	4.4377	5.5538	6.2897	6.4746	5.7901
Inc quintile 5	3.6936	5.7410	6.7162	6.6220	7.2632	7.3534

Unconditional means by income quintile, boys and girls

Table 3 Proportion of FSM and non-FSM individuals obtaining 5 or more GCSEs or equivalent at grade A*-C for those born 1988-1991 by age in 2007

Age in 2007	**16**	**17**	**18**	**19**
Non-FSM	56.4	64.8	71.9	75.4
FSM	26.7	36.6	45.4	50.2
Difference	**29.7**	**28.3**	**26.5**	**25.2**
Ratio	**2.11**	**1.77**	**1.58**	**1.50**

Table 4 Relationship between standardised family income and education levels for NCDS, BCS, BHPS 1 (1975-80), BHPS 2 (1981-86), BHPS 3 (1987-90) and LSYPE (1989-90)

Variable	NCDS 1958	BCS 1970	BHPS 1 1975-1980	BHPS 2 1981-1986	BHPS 3 1987-1990	LSYPE 1989/1990
Number of O-levels (A*-C)	0.7165	1.1315	1.0647	0.7958	0.9880	0.9336
	[0.036]***	[0.046]***	[0.155]***	[0.258]***	[0.249]***	[0.035]***
N	*7841*	*5428*	*815*	*515*	*345*	*10935*
Stay on post – 16	0.0963	0.1360	0.1110	0.0846	0.0885	0.0463
	[0.006]***	[0.006]***	[0.019]***	[0.031]***	[0.029]***	[0.005]***
N	*7196*	*6420*	*964*	*583*	*386*	*8205*
Number of A-levels (any)	0.1618	0.4164	0.4703	0.4512		
	[0.010]***	[0.023]***	[0.075]***	[0.128]***		
N	*7841*	*3769*	*638*	*373*		
Stay on post – 18	0.0621	0.1047	0.0697	0.0730		
	[0.004]***	[0.006]***	[0.021]***	[0.033]**		
N	*7196*	*5529*	*946*	*568*		
Degree	0.0553	0.1158	0.0916	0.0884		
	[0.004]***	[0.006]***	[0.017]***	[0.033]***		
N	*7949*	*5520*	*932*	*484*		
Proportion time NEET	-0.0049	-0.0197	-0.0676			
	[0.002]***	[0.003]***	[0.009]***			
N	*5907*	*5546*	*949*			

Standard errors in parentheses, boys and girls, controls for parental age, parental age squared and gender
*** Indicates significance at the 99% confidence level, ** is significant at the 95% confidence level, and * indicates a 90% confidence level.
Family income is monthly net logged standardised family income. Income standardised to account for differential variation across cohorts.

Table 5 Cross-cohort tests of significant differences from table 4 results

Variable	NCDS 1958	BCS 1970	Cross-cohort Difference
Number of O-levels (A*-C)	0.7165 [0.036]***	1.1315 [0.046]***	0.4150 [0.058]***
Stay on post – 16	0.0963 [0.006]***	0.1360 [0.006]***	0.0397 [0.008]***
Number of A-levels (any)	0.1618 [0.010]***	0.4164 [0.023]***	0.2546 [0.021]***
Stay on post – 18	0.0621 [0.004]***	0.1047 [0.006]***	0.0426 [0.007]***
Degree	0.0553 [0.004]***	0.1158 [0.006]***	0.0604 [0.006]***
Proportion time NEET	-0.0049 [0.002]***	-0.0197 [0.003]***	-0.0147 [0.003]***

Variable	BCS 1970	BHPS 1 1975-1980	Cross-cohort Difference
Number of O-levels (A*-C)	1.1315 [0.046]***	1.0647 [0.155]***	-0.0669 [0.162]
Stay on post – 16	0.1360 [0.006]***	0.1110 [0.019]***	-0.0251 [0.021]
Number of A-levels (any)	0.4164 [0.023]***	0.4703 [0.075]***	0.0539 [0.073]
Stay on post – 18	0.1047 [0.006]***	0.0697 [0.021]***	-0.0349 [0.019]*
Degree	0.1158 [0.006]***	0.0916 [0.017]***	-0.0241 [0.018]
Proportion time NEET	-0.0197 [0.003]***	-0.0676 [0.008]***	-0.0480 [0.007]***

Variable	BHPS 1 1975-1980	BHPS 2 1981-1986	Cross-cohort Difference
Number of O-levels (A*-C)	1.0647 [0.155]***	0.7958 [0.258]***	-0.2689 [0.291]
Stay on post – 16	0.1110 [0.019]***	0.0846 [0.031]***	-0.0263 [0.036]
Number of A-levels (any)	0.4703 [0.075]***	0.4512 [0.128]***	-0.0191 [0.144]
Stay on post – 18	0.0697 [0.021]***	0.0730 [0.033]**	0.0033 [0.039]
Degree	0.0916 [0.017]***	0.0884 [0.033]***	-0.0032 [0.036]

Variable	BCS 1970	BHPS 2 1981-1986	Cross-cohort Difference
Number of O-levels (A*-C)	1.1315 [0.046]***	0.7958 [0.258]***	-0.3357 [0.239]
Stay on post – 16	0.1360 [0.006]***	0.0846 [0.031]***	-0.0514 [0.032]
Number of A-levels (any)	0.4164 [0.023]***	0.4512 [0.128]***	0.0349 [0.110]
Stay on post – 18	0.1047 [0.006]***	0.0730 [0.033]**	-0.0317 [0.028]
Degree	0.1158 [0.006]***	0.0884 [0.033]***	-0.0274 [0.031]

Variable	BHPS 1 1975-1980	BHPS 3 1987-1990	Cross-cohort Difference
Number of O-levels (A*-C)	1.0647 [0.155]***	0.9880 [0.249]***	-0.0767 [0.276]
Stay on post – 16	0.1110 [0.019]***	0.0885 [0.029]***	-0.0224 [0.034]

Variable	BCS 1970	BHPS 3 1987-1990	Cross-cohort Difference
Number of O-levels (A*-C)	1.1315 [0.046]***	0.9880 [0.249]***	-0.1436 [0.218]
Stay on post – 16	0.1360 [0.006]***	0.0885 [0.029]***	-0.0475 [0.030]

Variable	BCS 1970	LSYPE 1989/1990	Cross-cohort Difference
Number of O-levels (A*-C)	1.1315 [0.046]***	0.9336 [0.035]***	-0.1979 [0.060]***
Stay on post – 16	0.1360 [0.006]***	0.0463 [0.005]***	-0.0897 [0.007]***

Standard errors in parentheses, boys and girls, controls for parental age, parental age squared and gender
*** Indicates significance at the 99% confidence level, ** is significant at the 95% confidence level, and * indicates a 90% confidence level.

Table 6 Proportion of FSM and non-FSM individuals obtaining 5 or more GCSEs or equivalent at grade A*-C for those born 1986-1992

GCSE year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Birth year	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**
Non-FSM	53.7	55.2	56.1	58.9	61	62.8	67.0
FSM	23.0	24.4	26.1	29.9	31	35.5	40.0
Difference	**30.7**	**30.8**	**30.0**	**29.0**	**29.5**	**27.3**	**27.0**
Ratio	**2.33**	**2.26**	**2.15**	**1.97**	**1.95**	**1.77**	**1.68**

Source: www/dcsf/gov/uk - National Curriculum Assessment, GCSE and Equivalent Attainment and Post-16 Attainment by Pupil Characteristics, in England 2002-2008

Table 7 Proportion of individuals obtaining 5 or more GCSEs or equivalent at grade A*-C by parental occupation groupings for those born 1972-1990

GCSE year	**'88**	**'90**	**'91**	**'93**	**'95**	**'97**	**'99**	**'01**	**'03**	**'06**
Birth year	**'72**	**'74**	**'75**	**'77**	**'79**	**'81**	**'83**	**'85**	**'87**	**'90**
PARENTAL OCCUPATION (SEG)										
Managerial/Professional	52	58	60	66	68	69	70			
Other non-manual	42	49	51	58	58	60	59			
Skilled manual	21	27	29	36	36	40	45			
Semi-skilled manual	16	20	23	26	29	32	35			
Unskilled manual	12	15	16	16	24	20	30			
Top - Bottom	**40**	**43**	**44**	**50**	**44**	**49**	**40**			
Ratio of top / bottom	**4.3**	**3.9**	**3.8**	**4.1**	**2.8**	**3.5**	**2.3**			
PARENTAL OCCUPATION (NS-SEC)										
Higher professional							75	77	76	81
Lower professional							62	64	65	73
Intermediate							49	51	53	59
Lower supervisory							34	34	41	46
Routine							26	31	33	42
Top - Bottom							**49**	**46**	**43**	**39**
Ratio of top / bottom							**2.9**	**2.5**	**2.3**	**1.9**

Source: http://www.dcsf.gov.uk/rsgateway/DB/SBU/b000795/Bulletin_tables_final.xls. LSYPE, wave 4 and YCS, cohorts 4-13, sweep 1

Table 8 Average test score deviations from the standardised mean (0,1) by income quintile for NCDS, BCS, LSYPE (1989-90) and ALSPAC (1991-92)

Variable	NCDS 1958	BCS 1970	LSYPE 1989/90	ALSPAC 1991/92
IQ				
Inc quintile 1	-0.2332	-0.3262		-0.2554
Inc quintile 2	-0.0549	-0.0445		-0.1041
Inc quintile 3	0.0359	0.1124		0.2165
Inc quintile 4	0.0886	0.2350		0.2690
Inc quintile 5	0.3453	0.4965		0.5019
Maths				
Inc quintile 1	-0.2184	-0.3030	-0.2301	-0.3583
Inc quintile 2	-0.0511	-0.0712	-0.1925	-0.1038
Inc quintile 3	0.0059	0.0931	0.0026	-0.0093
Inc quintile 4	0.0777	0.2284	0.2027	0.2314
Inc quintile 5	0.3864	0.5379	0.4552	0.4099
Reading				
Inc quintile 1	-0.2198	-0.3409	-0.2193	-0.3558
Inc quintile 2	-0.0604	-0.0795	-0.1999	-0.1259
Inc quintile 3	0.0178	0.0987	0.0254	0.0376
Inc quintile 4	0.0615	0.2723	0.2277	0.2359
Inc quintile 5	0.3408	0.5461	0.4306	0.3963

Unconditional means by income quintile, boys and girls

Table 9 Relationship between standardised family income and cognitive test scores for NCDS, BCS, LSYPE (1989-90) and ALSPAC (1991-92)

Variable	NCDS 1958	BCS 1970	LSYPE 1989/90	ALSPAC 1991/92
IQ	0.1963	0.2791		0.2168
	[0.011]***	[0.013]***		[0.015]***
N	*7733*	*5476*		*4404*
Maths	0.2025	0.2874	0.1758	0.2261
	[0.011]***	[0.013]***	[0.010]***	[0.014]***
N	*7729*	*5485*	*9976*	*5419*
Reading	0.1937	0.3003	0.1662	0.2207
	[0.011]***	[0.013]***	[0.010]***	[0.013]***
N	*7732*	*5486*	*9895*	*5270*
Reading at 7	0.1451			0.1773
	[0.011]***			[0.014]***
N	*7111*			*4973*

Standard errors in parentheses, boys and girls, controls for parental age, parental age squared and gender

*** Indicates significance at the 99% confidence level, ** is significant at the 95% confidence level, and * indicates a 90% confidence level.

Family income is monthly net logged standardised family income. Income standardised to account for differential variation across cohorts. IQ at 11, 10 and 8 in the NCDS, BCS and ALSPAC respectively. Maths and reading measured at age 11 in all but the BCS (10).

Correlation between ALSPAC Key Stage reading at 11 and Clinic based Reading at 7 0.6766

Table 10 Cross-cohort tests of significant differences from table 14 results

Variable	NCDS 1958	BCS 1970	Cross-cohort Difference
IQ	0.1963	0.2791	0.0827
	[0.011]***	[0.013]***	[0.017]***
Maths	0.2025	0.2874	0.0849
	[0.011]***	[0.013]***	[0.017]***
Reading	0.1937	0.3003	0.1065
	[0.011]***	[0.013]***	[0.017]***

Variable	BCS 1970	LSYPE 1989/90	Cross-cohort Difference
Maths	0.2874	0.1758	-0.1116
	[0.013]***	[0.010]***	[0.017]***
Reading	0.3003	0.1662	-0.1341
	[0.013]***	[0.010]***	[0.017]***

Variable	BCS 1970	ALSPAC 1991/2	Cross-cohort Difference
IQ	0.2791	0.2168	-0.0623
	[0.013]***	[0.015]***	[0.020]***
Maths	0.2874	0.2261	-0.0613
	[0.013]***	[0.014]***	[0.019]***
Reading	0.3003	0.2207	-0.0795
	[0.013]***	[0.013]***	[0.019]***

Variable	NCDS 1958	ALSPAC 1991/2	Cross-cohort Difference
IQ	0.1963	0.2168	0.0205
	[0.011]***	[0.015]***	[0.019]
Maths	0.2025	0.2261	0.0235
	[0.011]***	[0.014]***	[0.018]
Reading	0.1937	0.2207	0.0270
	[0.011]***	[0.013]***	[0.018]
Reading at 7	0.1451	0.1773	0.0322
	[0.011]***	[0.014]***	[0.018]*

Standard errors in parentheses, boys and girls, controls for parental age, parental age squared and gender
*** Indicates significance at the 99% confidence level, ** is significant at the 95% confidence level, and * indicates a 90% confidence level.

Appendix

Robustness check on Educational attainment at 16

Table A1 Relationship between standardised family income and a range of O-levels or equivalent measures at 16

Variable	BCS 1970	LSYPE 1989/90	Cross-cohort Difference
Number of O-levels	1.1315 [0.046]***	0.9336 [0.035]***	-0.1979 [0.060]***
O-level point score	38.365 [1.965]***	31.97 [1.500]***	-6.3973 [2.7570]**
Five A*-C grades	0.1447 [0.007]***	0.0929 [0.005]***	-0.0517 [0.008]***
Five A*-C grades incl. eng + maths	0.1530 [0.009]***	0.1038 [0.005]***	-0.0493 [0.010]***

Standard errors in parentheses, boys and girls, controls for parental age, parental age squared and gender
*** Indicates significance at the 99% confidence level, ** is significant at the 95% confidence level, and * indicates a 90% confidence level.

Robustness check on comparability across income measures

Table A2 Relationship between various family income measures and the number of O-levels or equivalent at grade A*-C at 16 for the BCS and LSYPE

	Gross		Net	
Variable	**BCS 1970**	**LSYPE 1989/90**	**BCS 1970**	**LSYPE 1989/90**
Non-standardised income				
Singh Madalla	1.8619 [0.076]***		2.3081 [0.095]***	
N	*5428*		*5428*	
Mid-points	1.9566 [0.080]***	1.0835 [0.039]***	2.3530 [0.096]***	1.1571 [0.044]***
N	*5428*	*10925*	*5428*	*10925*
Interval regression	1.9453 [0.080]***	1.0838 [0.039]***	2.3340 [0.097]***	1.1581 [0.043]***
N	*5428*	*10935*	*5428*	*10935*
Standardised income				
Singh Madalla	1.1348 [0.046]***		1.1315 [0.046]***	
N	*5428*		*5428*	
Mid-points	1.1399 [0.046]***	1.0559 [0.038]***	1.1414 [0.046]***	0.9308 [0.035]***
N	*5428*	*10925*	*5428*	*10925*
Interval regression	1.1358 [0.047]***	1.0579 [0.038]***	1.1369 [0.047]***	0.9336 [0.035]***
N	*5428*	*10935*	*5428*	*10935*

Standard errors in parentheses, boys and girls, controls for parental age, parental age squared and gender
*** Indicates significance at the 99% confidence level, ** is significant at the 95% confidence level, and * indicates a 90% confidence level.

Robustness check on attrition in the NCDS and BCS compared to the LSYPE

Table A3 Proportions of Permanent indicators at birth for the full sample, those reporting income at 16 and those not reporting income at 16

NCDS

	Full sample	With income	Without income
Father's social class at birth			
Social class 1	4.53	4.06	4.99
Social class 2	12.96	11.74	14.14
Social class 3 NM	9.67	9.47	9.89
Social class 3 M	50.90	51.66	50.17
Social class 4	12.12	12.95	11.32
Social class 5	9.83	10.12	9.49
Total	16,468	8,006	8,430

Proportions by parental class at birth, boys and girls

BCS

	Full sample	With income	Without income
Father's social class at birth			
Social class 1	5.20	5.24	5.17
Social class 2	12.08	12.33	11.92
Social class 3 NM	12.20	14.03	11.03
Social class 3 M	47.83	47.10	48.29
Social class 4	15.68	15.05	16.08
Social class 5	7.01	6.25	7.50
Total	15773	6146	9627
Mother's social class at birth			
Social class 1 & 2	13.99	14.55	13.63
Social class 3 NM	44.69	47.27	43.03
Social class 3 M	8.03	7.43	8.41
Social class 4	31.27	29.12	32.66
Social class 5	2.01	1.63	2.26
Total	10476	4117	6359
Father's highest education level			
No quals	9.56	7.31	11.01
NVQ level 1 (left 15)	56.33	56.83	56.01
NVQ level 2 (left 16)	14.14	14.97	13.60
NVQ level 3 (left 17/18)	11.07	11.55	10.76
NVQ level 4/5 (left 19+)	8.90	9.34	8.62
Total	16213	6347	9866
Mother's highest education level			
No quals	7.86	5.65	9.24
NVQ level 1 (left 15)	58.15	57.83	58.35
NVQ level 2 (left 16)	16.46	18.21	15.37
NVQ level 3 (left 17/18)	11.59	12.01	11.32
NVQ level 4/5 (left 19+)	5.95	6.30	5.72
Total	17017	6552	10465

Proportions by parental class and education at birth, boys and girls

Table A4 Relationship between standardised family income and the number of O-levels or equivalent at grade A*-C at 16 for the LSYPE weighted by attrition by parental education from the BCS

Variable	Non-weighted	Weighted
Number of O-levels (A*-C)	0.9374	0.9377
	[0.035]***	[0.034]***
N	*10605*	*10605*

Non-weighted numbers only differ from table 9 as this sample requires parental education information
Standard errors in parentheses, boys and girls, controls for parental age, parental age squared and gender
*** Indicates significance at the 99% confidence level, ** is significant at the 95% confidence level, and * indicates a 90% confidence level.

Robustness check on sample for England only for NCDS, BCS and BHPS

Table A5 Relationship between standardised family income and the number of O-levels or equivalent at grade A*-C at 16 for a sample of those in England only in the NCDS, BCS and BHPS

Variable	NCDS 1958	BCS 1970	BHPS 1 1975-1980	BHPS 2 1981-1986	BHPS 3 1987-1990
Number of O-levels (A*-C)	0.7363	1.1591	1.1196	0.7755	0.8874
	[0.040]***	[0.051]***	[0.163]***	[0.270]***	[0.265]***
N	*6427*	*4576*	*725*	*455*	*304*

Standard errors in parentheses, boys and girls, controls for parental age, parental age squared and gender
*** Indicates significance at the 99% confidence level, ** is significant at the 95% confidence level, and * indicates a 90% confidence level.