Jo Blanden and Stephen Machin

Educational inequality and the expansion of UK higher education

Article (Accepted version) (Refereed)

Original citation:
Blanden, Jo and Machin, Stephen (2004) *Educational inequality and the expansion of UK higher education.* Scottish Journal of Political Economy, 51 (2). pp. 230-249. ISSN 0036-9292

DOI: 10.1111/j.0036-9292.2004.00304.x

Educational Inequality and the Expansion of UK Higher Education

Jo Blanden* and Stephen Machin*

July 2003
September 2003 – Revised

* *Department of Economics, University College London and Centre for Economic Performance, London School of Economics*

Abstract

In this paper we explore changes over time in higher education (HE) participation and attainment between people from richer and poorer family backgrounds during a time period when the UK higher education system expanded at a rapid rate. We use longitudinal data from three time periods to study temporal shifts in HE participation and attainment across parental income groups for children going to university in the 1970s, 1980s and 1990s. The key finding is a highly policy relevant one, namely that HE expansion has not been equally distributed across people from richer and poorer backgrounds. Rather, it has disproportionately benefited children from relatively rich families. Despite the fact that many more children from higher income backgrounds participated in HE before the recent expansion of the system, the expansion acted to widen participation gaps between rich and poor children. This finding is robust to different measures of education participation and inequality. It also emerges from non-parametric estimations and from a more detailed econometric model allowing for the sequential nature of education choices with potentially different income associations at different stages of the education sequence.

JEL Keywords: Educational Inequality; Family Income; Education Sequences.

JEL Classification: I2.

Acknowledgements

We would like to thank the Sutton Trust and the Treasury Evidence Based Policy Fund for financial support and the Editors for a number of helpful comments.

1. Introduction

The UK Higher Education (HE) System has expanded massively in recent decades, with student numbers rising from 400,000 in the 1960s to 2,000,000 at the turn of the new century (Greenaway and Haynes, 2003). One in three now participate in higher education as compared to one in sixteen at the start of the 1960s. Many commentators believe this expansion to be a good thing since increased HE raises skill levels thereby contributing positively to national productivity. Moreover, it is sometimes argued that increased educational opportunities are associated with greater equality of opportunity as more university places offer greater potential for the advancement of students from poorer backgrounds.

In this paper we study the distributional consequences of HE expansion. We ask whether one does indeed see the expansion providing more opportunities for low income children to get into HE or whether it acted to reinforce already existent inequalities in access to higher education. We report strong evidence in the direction of the latter. That is to say, the HE expansion has not been equally distributed across people from richer and poorer backgrounds. Rather, it has disproportionately benefited children from relatively rich families. Despite the fact that many more children from richer backgrounds participated in HE before the recent expansion of the system, the expansion has actually acted to significantly widen participation gaps between rich and poor children.

These findings have implications for the Government's continuing policy of increasing the number of students in higher education to 50 percent by 2010. Recently discussion about the distribution of HE expansion has moved forward in the public debate. Indeed, the current Secretary of State for Education, Charles Clarke, stated on

BBC news that if he had to choose between fulfilling the 50 percent target for participation and getting "a much better class basis" amongst those currently enrolling, "I would choose the latter" (BBC News, 18 December 2002). Moreover, the previous Minister, Estelle Morris, recognized the importance of this, saying the following in October 2001:

> Our pledge to increase participation is one of this Government's highest priorities….Universities are not a birthright of the middle classes. None of us can defend the position where five times as many young people from professional backgrounds enter higher education compared with those from unskilled and manual backgrounds - 73-74% compared with 13-14% - and when that gap has not narrowed in recent time. (Department for Education and Skills, 2001)

It is therefore crucial to understand as much as possible about increased inequality in higher education participation. It is also important to check the robustness of our findings to different measures and specifications. In this paper we concentrate on a number of aspects of the inequality of educational expansion using three data sources: the National Child Development Study; the British Cohort Study; and the British Household Panel Survey. These enable us to present evidence on young people who attended university in the late 1970s, the late 1980s/early 1990s and the mid-to-late 1990s.

We first outline results demonstrating that family income displays a closer association with degree attainment in more recent time periods. In doing so, we explore issues on how to best specify the HE-income relation, finding that increases in higher education inequality are robust to different ways of using the available income information. We also report results from non-parametric specifications to enhance our understanding of how associations between income and the probability of degree attainment have changed throughout the income distribution. The next issue we explore is

the robustness of the findings to a different measure of educational attainment, whether people are in full-time education by age 19. Finally we present results from econometric models allowing for different income associations at different levels of the education sequence and explore how these associations may have altered as HE expansion occurred.

The structure of the remainder of the paper is therefore as follows. Section 2 presents information about the growth in student participation and describes associated policy changes. In addition, this Section gives details of the relevant existing literature. Section 3 describes the data we use, whilst Section 4 presents our substantive results, including a number of robustness checks and a discussion of the implications of our main findings. Section 5 ends with conclusions.

2. Background

2.1 The Expansion of Higher Education in the UK

Student numbers in HE have quadrupled in the UK since the 1960s. Figure 1 shows the Department for Education and Skills (DfES) higher education age participation index, which measures the proportion of young people in HE, between 1960 and 2001. It contrasts the pattern of change in this index with the growth in staying on beyond the compulsory school leaving age. The Figure shows sharp increases in both from 1960 onwards. The staying on series appears to have been on a fairly steadily increasing path (although is subject to cyclical variations) from the start of the series through to the mid-1980s. From the late 1980s there appears to be a step-change as staying on rates rise much faster, from 51 percent in 1988 to a new plateau of around 70 percent in the late 1990s and early 2000s. It appears likely that this rise was a consequence of the

introduction of the General Certificate of Secondary Education (GCSE) in 1988 and the consequent improvement in exam results. This issue is considered more fully in Blanden et al. (2003).

The increase in university participation is also very rapid. There was a sharp expansion in the 1960s, where the age participation index doubled from 6 to 14 percent. It then rose marginally from this level through until the late 1980s, after which it grew even more rapidly than the 1960s change. By 2001 it had reached 33 percent, rising up from under 20 percent at the start of the 1990s.

The factors that lie behind the growth of higher education participation in the UK are complex. A discussion is given in Kogan and Hanney (2000, Chapter 3). In part, the rise in participation was demand-led as students responded to the changes in the economy and the shift towards service industry jobs. Widening wage differentials between graduates and non-graduates, especially in the 1980s (Machin 1996, 1999, 2003) likely played a role here and it seems likely that HE participation may have been linked to perceived changes in economic incentives, at least amongst some groups.

The speed of growth was substantially accelerated by the policy decisions made by successive Conservative administrations. The then Education Secretary, Kenneth Baker, established the principle of university financing following the student: "This would encourage universities to increase their income by attracting more students and providing them with an incentive to expand at lower cost" (Baker 1993: 234). The most fundamental change, however, was the end of the binary divide in the early 1990s which put the former polytechnics under the same funding arrangements as the universities and created the flexibility for the sector to respond to rising demand.

The cost of the recent rapid growth in participation has in part been met by a reduction in the generosity of student support arrangements. A summary of the total effects of these changes is given in Figure 2, which is taken from Goodman and Kaplan (2003). 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 were eroded. The real value of maintenance grants was slowly reduced (as is shown clearly in Figure 2) and in 1987 student eligibility for unemployment and housing benefit was lost.

However, the most significant changes in higher education support came in 1990, just as the rise in participation accelerated. The Conservative Government had to find a way of balancing the rising costs of increased student numbers and in 1990 maintenance grants were frozen. These began to be phased out in favour of subsidised loans that would be available to all students. As Callender (2003) 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).

However, this change failed to stem the increasing cash crisis in the sector and the 1997 Dearing Report led to further changes. Students were expected to contribute £1000 a year to help with the cost of their fees, the maximum loan was increased and a new income-contingent loan repayment system was put in place. At the time of writing the

Government is once again on the verge of further reforms to student financing with a substantial rise in fees of up to £3000 proposed. Concerns about the impact of this change on the participation of students from poorer backgrounds have been countered by the Government with an Access Regulator and the reintroduction of maintenance grants for some students. Whilst the intention is laudable, current estimates of a maximum grant of around £1000 a year seem modest at best.

2.2 Related Literature

Our focus will be on the changing relationship between income and higher education participation and attainment in the UK. Once one scrutinizes the literature it becomes clear that there is really very little work on the question of temporal change, despite there being a huge literature on education and income at a point in time. A lot of this cross-sectional work concerns itself heavily with modeling and conceptual difficulties in education regressions that include income as an independent variable (for example, Mayer 1997). We do not consider this here, but instead we just review the limited number of pieces of work with more relevance for studying changes over time.

Kane (1999) has looked at college attendance and family income in the US, 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 12^{th} grade than those in the top income quartile, even controlling for test scores in 8^{th} 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. This is confirmed by descriptive analysis shown in Acemoglu and Pischke (2001), where attendance at a four year college rose by 15 percentage points between 1972 and 1992 amongst individuals in the richest quartile compared with 8 percentage points for the poorest quartile.

The only UK analysis over time we know of looks at associations between education and parental social class. 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.

In this paper it is important to note that we are concerned with the interface between parental income and individual economic and educational outcomes. In a related, and very sizable, sociology literature on cross-generation correlations between individual and parent outcomes (e.g. Erikson and Goldthorpe, 1992) it is very common to consider links between social class and education (or to consider the persistence of social class across generations). We believe it more important to concentrate on income as this makes the metric much clearer, particularly as over decades the composition of social class groupings has significantly changed with coincident shifts in occupational structure.

3. Data Sources

The principal data issue that emerges for our study is the requirement to match up data on children's education with the income of their parents. There are two main sources that one can draw upon, household level data that contain information on all household members and longitudinal data that enables one to match up children with parents over different time periods. To study HE the household level surveys are, unfortunately, of little use as the majority of HE students do not live in the family home. Thus we use only longitudinal data in this paper.

We make extensive use of the two main British cohort studies, the National Child Development Study (NCDS) and the British Cohort Study (BCS), and create a third 'cohort' using the British Household Panel Survey (BHPS). The NCDS and BCS cohort studies both follow birth populations of a single week (from March 1958 for the NCDS, from April 1970 for the BCS), obtaining rich information about their lives and achievements at several points through childhood and into adulthood. The NCDS has survey information available at ages 7 (in 1965), 11 (1969), 16 (1974), 23 (1981), 33 (1991) and 42 (2000). The BCS is very similar and has data at cohort ages 5 (in 1975), 10 (1980), 16 (1986), 26 (1996) and 30 (2000). Family income information is obtained from the two samples when the cohort members are 16 and we also use information on family structure (number of siblings and whether there is a father figure in the household) from the age 16 sweeps of the data.

Whilst the NCDS and BCS are similar in many respects, the education variables we use are obtained in different ways for the two cohorts. The NCDS is better placed than the BCS to provide data on intermediate outcomes. In 1978 all the cohort members'

previous educational institutions were contacted to provide information about their exam results. This gives us very good information about A level (or Higher grade for Scotland) achievement. The NCDS cohort is also surveyed at age 23 from which we are able to discover their history of post-school full-time education and whether they have obtained a degree or not. We are interested in degree attainment at this age to enable comparison with data from the British Household Panel Survey. In contrast to the NCDS, the BCS had a rather unsatisfactory postal survey at age 26 and then was fully surveyed at age 30. It is from the age 30 data that we take the education data. As well as asking individuals about their current education level and labour market status this survey also obtains a full labour market history since age 16 and records the dates that all qualifications were obtained. This enables us to learn about age left school, A levels obtained and degree achievement by age 23.

The longitudinal cohort data is very useful for considering the transition into higher education. However, the cohorts are regrettably a little out of date, giving us information only on young people attending university in the early 1980s and early 1990s. This does not allow us to examine the implications of funding changes over the 1990s or explore the consequences of rises in exam attainment and staying on that followed the introduction of the GCSE in 1988. In fact, it is a great pity that a further study was not started around 1980. To attempt to fill this gap we supplement the cohorts with information 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. To be comparable with the cohort data we wish to observe family income at age 16. However 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 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.[1] One advantage of the BHPS is that the annual data enables us to be confident about the intermediate educational outcomes.[2] For example, we can find out about the A level (and equivalent) achievement by looking at information from the wave after individuals turn 18.

4. Results

4.1 Descriptive Analysis

Table 1 presents some descriptive analysis of patterns of higher education inequality and how it has altered over time. The Table shows the proportion of young people who acquire a degree by age 23 broken down by parental income groups (the top quintile, the middle 60 percent and the bottom quintile) from the three cohorts, in 1981, 1993 and 1999 respectively.

[1] 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.

[2] Due to its relatively small sample size and the longitudinal matching to income data at earlier ages, the representativeness of the BHPS sample is an issue. We have compared with a sample of 23 year olds from the Labour Force Survey and with the full sample of 23 year olds from the BHPS. In terms of gender mix the samples are very similar. In terms of education it seems that the estimation sample has slightly higher education levels than the full population.

The numbers in the Table very clearly demonstrate wide gaps in degree acquisition by income group. In 1981, for example, 20 percent of children from the top income quintile had a degree by age 23, whereas the comparable number was only 6 percent in the bottom quintile. One natural metric of gauging the extent of educational inequality is the gap between the top and bottom quintiles. In 1981 this was 14 percentage points which (as the standard errors in parentheses show) was strongly significant in statistical terms. Of course, this is not the only measure of educational inequality one can use and below we consider a number of others, and also study changes throughout the income distribution.

The main focus of this paper is on changes through time and the numbers in Table 1 show a very sharp increase in higher education inequality between 1981 and 1999. The top-bottom quintile measure of inequality rises considerably through time, from 14 percent in 1981, through to 30 percent by 1993 and up to a huge 37 percentage points by 1999. The magnitude of these changes is large and demonstrates a considerable widening of the gap between the university attainment of the richest and poorest in the two decades our data spans. The standard errors for these changes show that the rise in educational inequality was strongly significant between 1981 and 1993, a little less precisely determined between 1993 and 1999 (largely due to relatively small sample sizes in the BHPS), and strongly significant over the full eighteen years between 1981 to 1999. The descriptive analysis therefore uncovers a very big, statistically significant, change in the association between income and degree attainment between the early 1980s and late 1990s.

This is the key finding of this paper. In the era of higher education expansion children from richer families raised their HE participation by more than those from poorer families. Despite the fact that many more children from higher income backgrounds participated in HE before the recent expansion of the system, the expansion has acted to widen participation gaps between rich and poor children. Given the significance of this finding, and its potential policy relevance, we need to subject it to more rigorous testing and probing. This is what we now turn to.

4.2 Specification of the Higher Education – Income Relationship

We next move to estimates based upon statistical models that relate degree acquisition to parental income. The starting point is a probit model relating the probability of having a degree by age 23, the 0-1 variable D, for person i in cohort c to their parent's log income, Y, and a set of control variables Z:

$$D_{ic} = \alpha_c + \beta_c f(Y_{ic}) + \gamma_c Z_{ic} + \varepsilon_{ic}$$

where f(.) denotes the functional form for parental income, which is the independent variable of interest and ε is an error term.

The main modeling issue that arises concerns the specification of f(.). One possibility, as in the descriptive analysis of Table 1, is to consider income quintiles. Thus the estimating equation becomes:

$$D_{ic} = \alpha_{1c} + \sum_{j=2}^{5} \beta_{1jc} Q_{jic} + \gamma_{1c} Z_{ic} + \varepsilon_{1ic}$$

where the Q_j variables are dummy variables for quantiles of the log income distribution, in this case quintile dummies (leaving out the lowest quintile, j = 1, as the reference group).

Due to the discrete nature of the dependent variable, the marginal impact of Q_5, the top quintile dummy, from a probit model is $\psi_c = Pr[D_{ic}=1| Q_{5ic} =1, Q_{4ic} = 0, Q_{3ic} = 0, Q_{2ic} = 0] - Pr[D_{ic}=1| Q_{5ic} =0, Q_{4ic} = 0, Q_{3ic} = 0, Q_{2ic} = 0] = \Phi(\alpha_{1c} + \beta_{15c} + \gamma_{1c}Z_{ic}) - \Phi(\alpha_{1c} + \gamma_{1c}Z_{ic})$, where $\Phi(.)$ is the standard normal cumulative distribution function. Of course, for a model with no Z controls this will simply be the measure of educational inequality defined as the gap between the top and bottom income quintile that we considered in Table 1. In terms of changes over time, say across cohorts c and c', then a measure of changing educational inequality over time is $\Delta\psi_{c'c} = \psi_{c'} - \psi_c$ (for which we also calculate appropriately bootstrapped standard errors).

Table 2 thus reports estimates of educational inequality, and its changes over time, from statistical probit models where the functional form for f(.) is taken to be the set of quintile dummy variables. Panel A of the Table includes no control variables and therefore reproduces the descriptive numbers from Table 1, with $\Delta\psi_{c'c}$ rising by a strongly significant .23 between 1981 and 1999. Panel B then includes a basic set of family characteristics (sex of child, family composition and parental age). These additions change the magnitude of the estimates very little and serve to slightly enhance, though very moderately, the patterns found in the unconditional models.

The specification in Panel C of the Table adds test score quintiles for reading and maths at age 11 (NCDS) and age 10 (BCS). Unfortunately this data on test scores is only available for the first two cohorts, but is one of the big advantages of these data sources. This is because the 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 line of thinking, the addition of controls for ability should substantially

reduce the remaining educational inequality. This is certainly the case, with the estimate of ψ_c falling from .14 to .06 in the NCDS and from .30 to .18 in the BCS. But it is really very interesting that the fall is of similar magnitude across cohorts.[3]

Therefore the pattern of rising degree-income relations is not damaged by the inclusion of test scores, as the rise in educational inequality $\Delta\psi_{c'c}$ is estimated as a strongly significant .12, or 12 percentage points. Thus conditional upon family characteristics and test scores, the probability of getting a degree at age 23 was 12 percentage points higher for young people in 1993 as compared to 1981. It is obviously a pity that this exercise cannot be repeated for the BHPS, however we can assert that it would take a very large shift in the relationships between degree, ability and family income for the addition of the ability controls to account for the change in the association between income and degree up to the late 1990s.

In Table 3 we consider the robustness of these findings to specifying f(.) in different ways. We consider three further possibilities:

i) log income (Y), so the equation becomes: $D_{ic} = \alpha_{2c} + \beta_{2c}Y_{ic} + \gamma_{2c}Z_{ic} + \varepsilon_{2ic}$;

ii) decile dummies, so the equation becomes: $D_{ic} = \alpha_{3c} + \sum_{j=2}^{10} \beta_{3jc}Q_{jic} + \gamma_{3c}Z_{ic} + \varepsilon_{3ic;}$

iii) quartile dummies, so the equation becomes: $D_{ic} = \alpha_{4c} + \sum_{j=2}^{4} \beta_{4jc}Q_{jic} + \gamma_{4c}Z_{ic} + \varepsilon_{4ic.}$

[3] Blanden et al (2003) supplement the controls used here for the first two datasets with additional controls for parental education and interest in the child's education. The purpose of this is to study intergenerational transmissions in more detail and to complement the test scores by providing measures of the child's home environment that will be correlated to both educational outcomes and family income, thereby moving the association between income and attainment closer to what would be observed if all other characteristics of the family were held constant. The temporal changes in educational inequality are robust to the introduction of these controls.

Notice for the decile and quartile cases, as with the earlier quintile estimates, the omitted reference group is the lowest dummy variable (j = 1). So the comparison of interest will concern measuring educational inequality as top-bottom decile and top-bottom quartile of the income distribution.

Table 3 shows the results using the same specification as in Panel B of Table 2. For all measures one detects a rise in educational inequality over time. The log(income) specification reveals a rising sensitivity of degree acquisition to log(income) over time and the cross-cohort rise is sizable at .14. Regarding the finer gradation of the quantile dummies (i.e. using decile dummies), the rise in educational inequality is larger when one goes to a finer gradation. It is smaller, and still statistically significant, for the broader quartile definition. Thus, under different functional form assumptions we show there to have been a sizable, and significant, increase in educational inequality at the HE level over time.

For all the results reported to date a natural question to ask, which is one very frequently considered in the cross-sectional literature on education-income relations, is whether income coefficients (for whatever functional form) are contaminated by measurement error. Our key result is the rising income sensitivity through time and to negate this, then it must be the case that measurement error is greater in the NCDS than it is in the later data. In other words, there would need to be a greater attenuation bias in NCDS, meaning no rise in the income coefficients across the cohorts. We have carried out various calibration exercises to look at this and have concluded that one would need an implausibly large additional amount of measurement error in NCDS as compared to

the other two data sources to offset the rise.[4] As such this gives us considerable confidence that the pattern of temporal changes observed in the relationship between education and income are genuine.

4.3 Non-Parametric Analysis

A natural extension of what we have reported to date is to consider non-parametric estimates of the association between income and the probability of obtaining a degree. This is estimated using the Nadaraya-Watson kernel regression as described in Blundell and Duncan (1998). The relationship of interest is between the probability of obtaining a degree and log family income (dropping subscripts for convenience):

$$\Pr(D) = g(Y) + e$$

The aim of the estimator is to replace g(Y) with a local estimator of the conditional mean. This can be done by a function $\hat{g}_h(Y)$ as follows:

$$\hat{g}_h(Y) = \frac{\sum_{i=1}^{n} D_i K((Y_i - Y)/h)}{\sum_{i=1}^{n} K((Y_i - Y)/h)}$$

where h is the bandwidth (measuring the size of the interval to be averaged over) and K is the chosen kernel function.[5]

[4] For example, under the assumption that the income data in the BHPS and BCS were completely accurate then the measurement error in the NCDS would need to be very high at 38 percent and 36 percent respectively to close the gap to the margins of statistical significance (i.e. a p-value of .05 on the temporal change). This rises to 47 and 55 percent to drive the cross-cohort increase to zero. More detailed calibrations, making various assumptions about differential measurement error across cohorts, are available from the authors on request.

[5] Our reported results use the Gaussian kernel $K(u) = 1/\sqrt{2\pi \exp(-u^2/2)}$. The precise form of kernel should not matter much in practice as long as it gives high weight to observations close to Y and low weight to those far away. One advantage of the Nadaraya-Watson estimator in our case is that no particular distributional assumptions (except for mean of zero) need to be imposed on the errors making the estimator appropriate for discrete dependent variables like degree attainment.

Figure 3 shows the kernel regressions across the three cohorts. The first panel compares the NCDS and BCS. The relationship between income and degree attainment is clearly steeper for the BCS, with very little increase in the probabilities of gaining a degree between the two cohorts for those with low incomes but a substantial increase at higher income levels. The second panel shows the overall change between the NCDS in 1981 and the BHPS in the late 1990s. This panel shows a steeper income gradient at lower levels of income in the BHPS than in the NCDS, whilst income mattered more for degree attainment for high levels of income in the NCDS. We can explain this pattern intuitively by saying that, as the vast majority of individuals from well off families now go to university, higher income beyond a certain threshold level now makes less difference than it did in the past.

4.4 Different HE Outcome Measure

The results presented so far show strongly that degree attainment has become more closely linked to family income as participation in higher education has expanded. Table 4 explores changes in education-income associations for an alternative measure of higher education: being in full time education at age 19. An advantage of using this measure is that it is available for more individuals in the BHPS as they are measured at younger ages. This enables us to use a larger sample to check on the patterns found so far.

Table 4 shows the marginal effect of being in the top income quintile relative to the bottom quintile on the probability of remaining in full-time education at 19, with the same three specifications as were given for degree attainment in Table 2. The age 19 measure corresponds to the second year after A levels are usually taken, so for individuals who have taken the academic route this should be synonymous with

university participation, even in a case when they have taken a gap year or retaken some exams. Results for this outcome are similar to those we found for degree attainment, although the increase in educational inequality is a little muted. For example, in the Panel B specification with basic controls, the rise in ψ_c is .176 (with associated standard error of .052) as compared with .221 (.059) for the degree by 23 outcome. The reader may wonder about the extent to which this difference is a consequence of the different measure and how much of this is due to the different sample. For the same samples the estimate of the rise in ψ_c for the full-time education at age 19 variable (again for the Panel B specification) is estimated to be .202 (.062). This slight fall is unsurprising when one realises that the full-time education at 19 variable not only measures higher education participation, but also full-time participation in lower level courses. It would be ideal if we could check these patterns for the outcome of whether young people are in university at age 19, but unfortunately this information is not available for the BCS.

4.5 Education Sequences

The final approach we adopt explicitly acknowledges the sequential nature of education. This approach has some common ground with the US modelling of education sequences in Cameron and Heckman (1998, 2001) who set out to investigate the importance of current (short-term) family income on an individual's decision to pursue two or four year college because of credit constraints. They set up a sequential model of educational development through adolescence as a series of choices to pursue continued education. Each decision is influenced by prior decisions and attainment, so allowing family income and background factors to have distinct influences at each stage. Cameron and Heckman also introduce observed prior ability from IQ type test scores as a control for ability. They

conclude that family income is important in terms of attainment by age 17 and the decision whether or not to complete high school, but not on the decision to attend college conditional on attainment and high school completion. This confirms the earlier US findings of Mare (1980) who finds that the association between grade transition and socio-economic background declines sharply as individuals move through the education system.

Table 5 shows cross-cohort results from models where education is modeled as a sequence of outcomes to the next stage by estimating the association between income and each outcome just for those who have passed the previous hurdle. We consider three sequential (and conditional) education outcomes: staying on after the compulsory school leaving age for everyone; achieving two or more A levels (or equivalent qualifications) conditional upon staying on; and degree acquisition conditional upon achieving two or more A levels and staying on.

The upper panel of the Table reports log(income) coefficients (and associated standard errors) at these different points of the education sequence. There are several points of interest. First, in the NCDS and BCS cohorts the income associations tend to become smaller at later stages of the education sequence. This is in line with the US evidence reported in Cameron and Heckman (1998, 2001). However, there remains a significant income association at degree level, even once one conditions on A level achievement. This says that income matters at HE level even after sorting at A level has taken place.

Second, and probably most important, this declining relationship is not seen in the BHPS and one sees numerically larger marginal effects at the A level and degree stage

for people attending university in the late 1990s. Again the degree conditional upon A level income coefficient remains statistically significant. This reinforces the earlier findings of increased inequality in education arising from the HE expansion from much more stringent econometric models that condition upon earlier educational achievement (and therefore net out inequalities at those earlier stages).

The lower panel of the Table reports models from the NCDS and BCS that additionally control for test scores. The inclusion of these amounts to a very stringent test of the finding that there are income effects at each education level. Nevertheless the results reported show that at all stages significant income effects at degree level remain even when we condition on whether individuals have passed the previous stage and their earlier ability. As such it is reassuring that the significant income association at degree level remains when one does condition on test scores. It is unfortunate that we are not able to extend this method to the BHPS due to not having test score data. However, it is clear that substantial changes must have occurred in the relationships for our findings for the BHPS to be changed substantially when the results for the other two cohorts remain significant.

4.6 Implications

Increased inequality in HE participation and attainment has implications for other aspects of inequality, both for the generation experiencing the extra inequality and, if education-income relations continue through time, for future generations. On the former it is well documented that graduates earn more than non-graduates and that this wage differential has widened in the recent past, especially in the 1980s (Machin, 1996, 1999, 2003). The experience of the 1980s and 1990s pointed to an important increase in employer demand

for graduates, even though there were more of them, and this tended to raise wage inequality (Schmitt, 1995; Machin and Van Reenen, 1998). This generates a concern that wage returns to university qualifications becoming more concentrated amongst people from richer families can act to bolster and reinforce inequality.

This means that the strengthening of education-income relations through time has important implications for intergenerational inequality. Solon (2003) demonstrates that an increased relationship between parental income and education will lead to an increase in intergenerational immobility. In a simple version of his model there are two generations, t and t-1. In generation t labour market earnings W are a function of human capital H so that $W_t = \phi_t H_t + u_t$, where u_t is a random error term. If children's human capital accumulation then relates to parental income we can write $H_t = \psi_t W_{t-1} + v_t$ (v_t being an error term). One can combine the wage and human capital equations to generate an intergenerational mobility function, $W_t = \beta_t W_{t-1} + \omega_t$ where $\omega_t = \phi_t v_t + u_t$ and the parameter $\beta_t = \phi_t \psi_t$. measures the extent of intergenerational mobility, with a higher β_t depicting greater persistence in earnings across generations, or less intergenerational mobility.

The extent of intergenerational immobility, β_t , will be higher if there are higher returns to human capital for children (ϕ_t is higher), or if children's human capital becomes more sensitive to parental earnings (ψ_t is higher). Evidence in Blanden et al (2002) from the NCDS and BCS cohorts shows that the increased link between education and family income that occurred across these two birth cohorts did in fact lead to a fall in intergenerational mobility. If the intergenerational relation is measured in a given period by a statistical regression $W_t = \delta + \theta Y_{t-1} + \xi_t$ where W_t is log(labour market earnings) in

generation t, Y_{t-1} is log(parental income) in generation t-1 and ξ_t is an error term in the regression function, the intergenerational mobility parameter θ for sons from that study is estimated to be .095 (standard error = .031) higher for 1970 birth cohort as compared to the 1958 birth cohort.[6] For daughter-father comparisons there is a rise of .059 (.031).[7]

Therefore strengthening HE-income relations have implications for the within and between generation inequality of economic outcomes. It is, of course, too early to study these relations for our third BHPS cohort, but this will be an important future research question.

5. Conclusions

In the UK the higher education sector massively expanded in terms of student numbers in the last quarter of a century. In this paper we explore the distributional consequences of this expansion focusing on how educational inequality – defined as higher education participation and attainment across different family income groups – has moved through time. The results are clear and show that, over this period, HE expansion has not been equally distributed across people from richer and poorer backgrounds. Rather, it has disproportionately benefited children from relatively rich families. Despite the fact that many more children from higher income backgrounds participated in HE before the recent expansion of the system, the expansion acted to widen participation gaps between rich and poor children.

This finding emerges from the analysis of longitudinal data from three time periods that enables us to study temporal shifts in HE by parental income for children

[6] The NCDS estimate is .166 (.020) and this rises to .260 (.024) for the BCS.
[7] The cross-cohort rise is from .168 (.022) to .227 (.022).

going to university in the 1970s, 1980s and 1990s. The increase in HE inequality is robust to the consideration of alternative measures of education participation and inequality definitions. The same result also emerges from non-parametric estimations and from a more detailed econometric model allowing for the sequential nature of education attainment with potentially different income associations at different stages of the education sequence.

References

Acemoglu, D. and S. Pischke (2001) 'Changes in the Wage Structure, Family Income, and Children's Education', European Economic Review, 45, 890-904.

Baker, K. (1993) The Turbulent Years. My Life in Politics. London: Faber and Faber.

Blanden, J., A. Goodman, P. Gregg, and S. Machin (2002) 'Changes in Intergenerational Mobility in Britain', Centre for the Economics of Education Discussion Paper No. 26, London School of Economics, forthcoming in M. Corak (ed.) Generational Income Mobility in North America and Europe, Cambridge University Press.

Blanden, J., P. Gregg and S. Machin (2003) 'Changes in Educational Inequality', Centre for the Economics of Education Discussion Paper, forthcoming.

Blundell, R. and A. Duncan (1998) 'Kernel Regression in Empirical Microeconomics', Journal of Human Resources, 33, 62-87.

Callender, C. (2003) 'Student Financial Support in Higher Education: Access and Exclusion', in M. Tight (ed.) Access and Exclusion: International Perspectives on Higher Education Research, Elsevier Science, London.

Cameron, S. and J. Heckman (1998) 'Life Cycle Schooling and Dynamic Selection Bias: Models and Evidence for Five Cohorts of American Males', Journal of Political Economy, 106, 262-333.

Cameron, S. and J. Heckman (2001) 'The Dynamics of Educational Attainment For Black, Hispanic and White Males', Journal of Political Economy, 109, 455-99.

Department for Education and Skills (2001) Estelle Morris' Speech 'Key Challenges of the Next Decade' at London Guildhall University, 22nd October.

Erikson, R. and J. Goldthorpe (1992) The Constant Flux: A Study of Class Mobility in Industrial Societies, Oxford: Oxford University Press.

Glennerster, H. (2001) 'United Kingdom Education 1997-2001', Centre for the Analysis of Social Exclusion CASE Paper 50.

Goodman, A. and G. Kaplan. (2003) '"Study Now, Pay Later" or "HE for Free"? An Assessment of Alternative Proposals for Higher Education Finance'. Institute for Fiscal Studies Commentary No. 94.

Grawe, N. (2002) 'The Three-Day Week of 1974 and Measurement Error in NCDS and FES Data Sets', Mimeo.

Greenaway, D. and M. Haynes (2003) 'Funding Higher Education in the UK: The Role of Fees and Loans' Economic Journal, 113, F150-F167.

Kane, T. (1999) The Price of Admission: Rethinking how Americans Pay for College, Brookings Press.

Kogan, M and S. Hanney (2000) Reforming Higher Education, Jessica Kingsley Publishers, London.

Machin, S. (1996) 'Wage Inequality in the UK', Oxford Review of Economic Policy, 12(1), 47-64.

Machin, S. (1999) 'Wage Inequality in the 1970s, 1980s and 1990s', in R. Dickens, P. Gregg and J. Wadsworth (eds) The State of Working Britain, Manchester University Press.

Machin, S. (2003) 'Wage Inequality Since 1975', forthcoming in R. Dickens, P. Gregg and J. Wadsworth (eds) The Labour Market Under New Labour.

Machin, S. and J.Van Reenen (1998), 'Technology and changes in skill structure: Evidence from Seven OECD Countries', Quarterly Journal of Economics, 113, 1215-1244.

Mare, R. (1980) 'Social Background and School Continuation Decisions', Journal of the American Statistical Association, 75, 295-305.

Mayer, S. (1997) What Money Can't Buy: Family Income and Children's Life Chances, Harvard University Press.

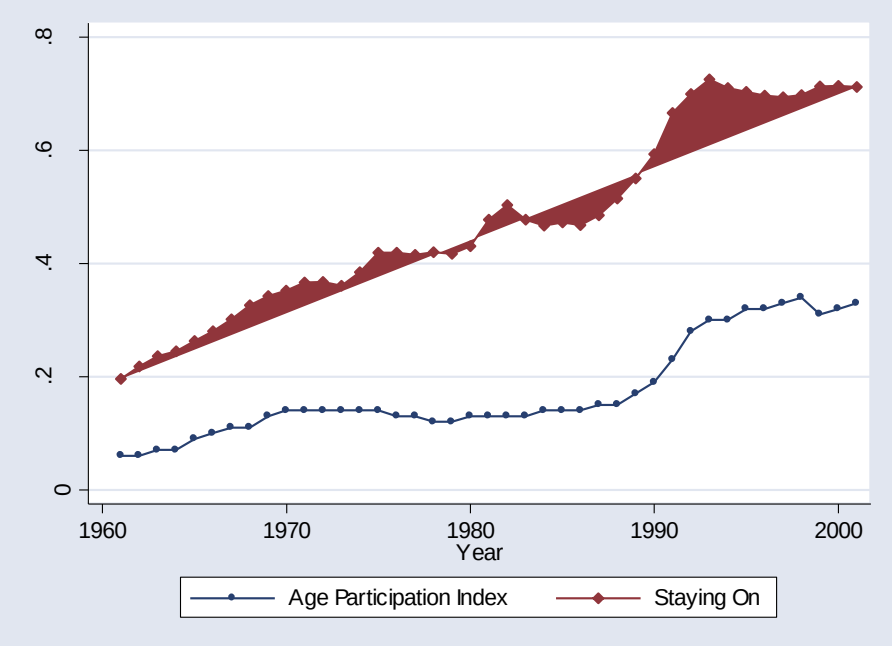
Micklewright, J. (1986) 'A Note on Household Income in NCDS3', City University NCDS User Support Group Working Paper 18.

Schmitt, J. (1995) 'The Changing Structure of Male Earnings in Britain, 1974-88', in R. Freeman and L. Katz (eds.) Differences and Changes in Wage Structures, University of Chicago Press.

Solon, G. (1992) 'Intergenerational Income Mobility in the United States', American Economic Review, 82, 393-408.

Solon, G. (2003) 'A Model of Intergenerational Mobility Variation over Time and Place', forthcoming in M. Corak (Ed.), Generational Income Mobility in North America and Europe, Cambridge University Press.

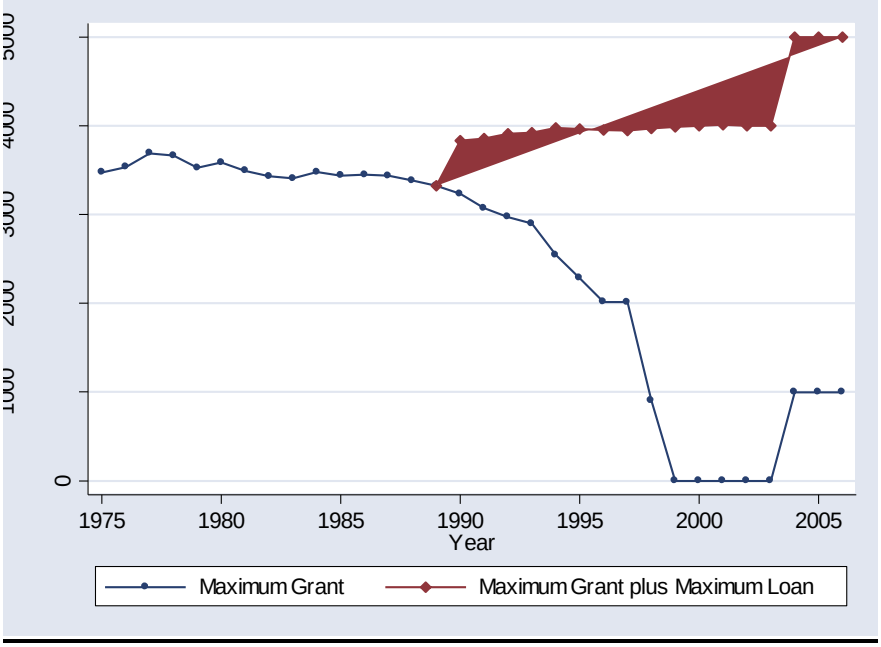
Figure 1: Changes in Education Participation



Notes:

1. Staying on rates from DfES series. We thank Damon Clark for providing these numbers.
2. The 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 Student Support

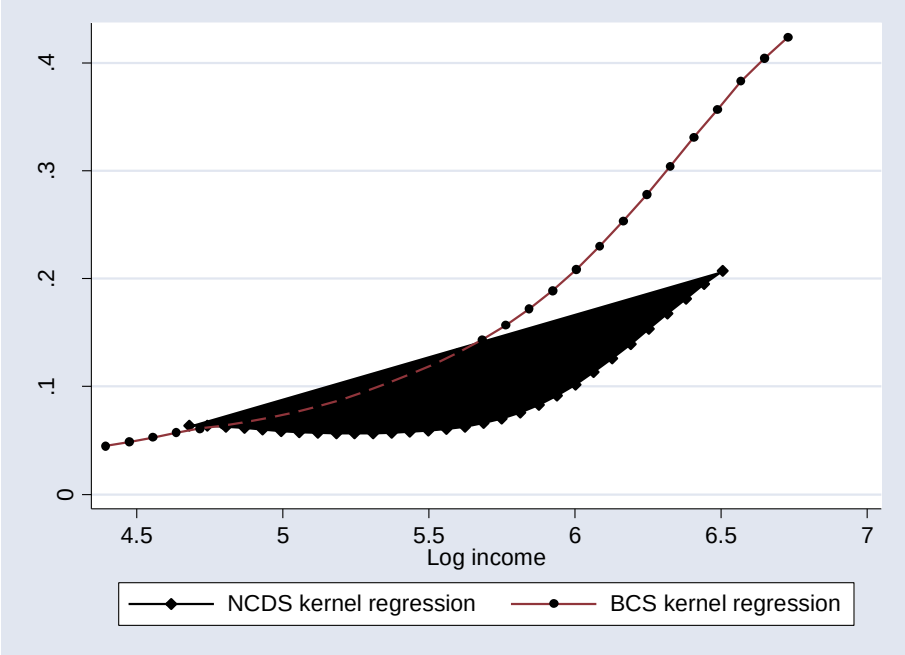


Notes:

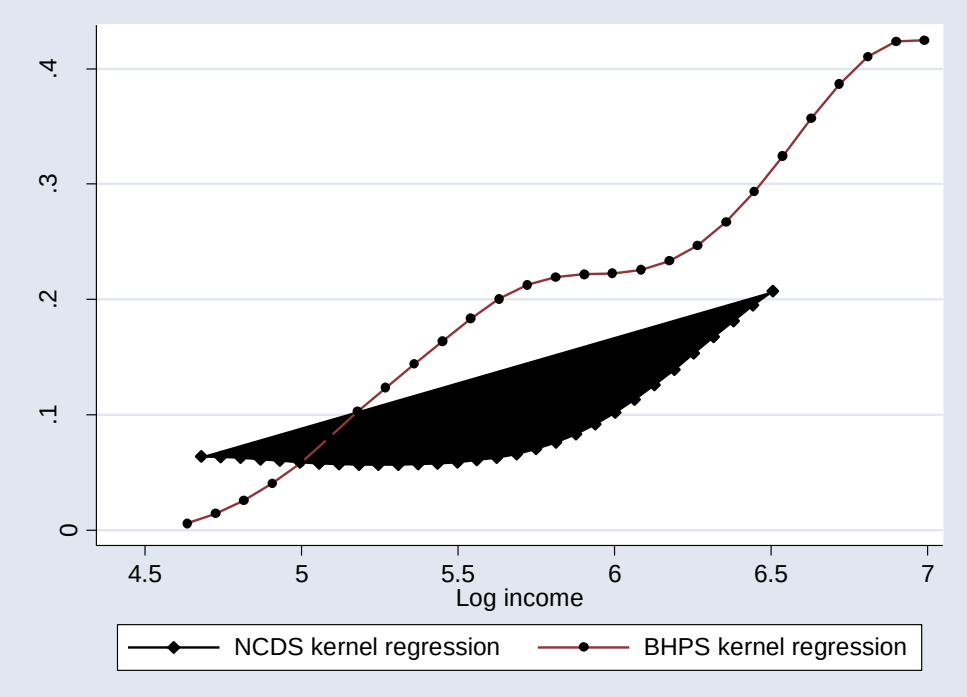
1. Source: Goodman and Kaplan (2003).
2. Grant levels are those which apply for students with full eligibility. Loan amounts are for first year students living outside London and away from home.

Figure 3:
Non-Parametric Estimates of Higher Education-Income Associations, NCDS, BCS and BHPS

NCDS and BCS



NCDS and BHPS



Notes:
These kernels are estimated using a Gaussian kernel and bandwidth of .25.

Table 1: Degree Acquisition by Age 23 and Parental Income

	Degree Acquisition by Age 23			
	Lowest 20 percent	Middle 60 percent	Highest 20 percent	Educational Inequality
NCDS 1981	.06	.08	.20	.14 (.01)
BCS 1993	.07	.15	.37	.30 (.02)
BHPS 1999	.09	.23	.46	.37 (.05)
Change 1981-1993	.01	.07	.17	.15 (.02)
Change 1993-1999	.02	.08	.09	.07 (.06)
Change 1981-1999	.03	.15	.26	.23 (.06)

Notes:

1. Sample sizes are NCDS: 5706 BCS: 4706, BHPS: 580.
2. The year we establish degree attainment is 1999 on average for the BHPS. For the NCDS and BCS all individuals need to have graduated by 1981 and 1993 respectively.
3. Standard errors in parentheses.
4. Rows and columns may not add up precisely due to rounding.

Table 2: Changes in Higher Education-Income Associations, Specifications With Quintile Dummies

	Degree Acquisition by Age 23			Changes Over Time		
	(1)	(2)	(3)	(4)	(5)	(6)
	NCDS, 1981	BCS70, 1993	BHPS, 1999	(2) – (1)	(3) – (2)	(3) – (1)
A. No Controls						
Top Quintile	.144	.299	.371	.155	.072	.226
	(.013)	(.018)	(.054)	(.022)	(.057)	(.056)
B. Basic Controls						
Top Quintile	.143	.295	.365	.152	.070	.221
	(.013)	(.0180)	(.057)	(.022)	(.060)	(.059)
C. Basic Controls, Plus Test Scores						
Top Quintile	.061	.183		.122		
	(.012)	(.018)		(.022)		

Notes:

1. Sample sizes as for Table 1.
2. Marginal effects are derived from probit models of staying on beyond 16 on dummy variables for quintiles of family income as described in the text of the main body of the paper.
3. Bootstrapped standard errors in parentheses.
4. Basic controls are sex, parental age bands, number of siblings, no father figure at age 16.
5. Test scores are the quintile dummies for maths and reading scores at age 11/10.
6. Changes over time may not add up precisely due to rounding.

Table 3: Changes in Higher Education-Income Associations, Different Income Measures

	Degree Acquisition by Age 23			Changes Over Time		
	(1)	(2)	(3)	(4)	(5)	(6)
	NCDS, 1981	BCS70, 1993	BHPS, 1999	(2) – (1)	(3) – (2)	(3) – (1)
Basic Controls						
Log(Income)	.113	.213	.253	.100	.040	.140
	(.011)	(.012)	(.037)	(.016)	(.039)	(.039)
Top Decile	.193	.375	.446	.182	.071	.253
	(.021)	(.026)	(.073)	(.033)	(.077)	(.076)
Top Quartile	.125	.264	.335	.139	.072	.210
	(.012)	(.016)	(.050)	(.020)	(.053)	(.051)

Notes: As for Table 2.

Table 4: Changes in Higher Education-Income Associations, Different Measure of Educational Attainment

	In Full-Time Education at Age 19			Changes Over Time		
	(1)	(2)	(3)	(4)	(5)	(6)
	NCDS, 1977	BCS70, 1989	BHPS, 1997	(2) – (1)	(3)– (2)	(3) – (1)
A. No Controls						
Top Quintile	.192	.274	.381	.082	.107	.189
	(.015)	(.018)	(.049)	(.023)	(.052)	(.051)
B. Basic Controls						
Top Quintile	.191	.270	.368	.079	.097	.176
	(.016)	(.018)	(.050)	(.023)	(.053)	(.052)
C. Basic Controls, Plus Test Scores						
Top Quintile	.101	.155		.054		
	(.014)	(.019)		(.024)		

Notes: As for Table 2, except the BHPS sample size is 873.

Table 5: Sequential Models of Educational Attainment

	Log(Income) Coefficients At Different Points in the Education Sequence		
	(1)	(2)	(3)
A. Basic Controls	NCDS	BCS70	BHPS
Staying On	.243	.306	.187
	(.020)	(.017)	(.051)
2 A Levels or Equiv | Staying On	.131	.188	.213
	(.033)	(.024)	(.058)
Degree | 2 or More A Levels &	.138	.170	.242
Staying On	(.048)	(.039)	(.072)
	(4)	(5)	
B. Plus Test Scores	NCDS	BCS70	
Staying On	.133	.218	
	(.021)	(.017)	
2 A Levels or Equiv | Staying On	.061	.120	
	(.034)	(.024)	
Degree | 2 or More A Levels &	.105	.129	
Staying On	(.049)	(.039)	

Notes: Estimates are obtained from sequential probit models. Standard errors in parentheses. See text for further explanation. Sample sizes are as follows: NCDS Staying on 5706, 2 or More A Levels | Staying On 1621, Degree | 2 or More A Levels & Staying On 751; BCS Staying on 4706, 2 or More A Levels | Staying On 2179, Degree | 2 or More A Levels & Staying On 921; BHPS Staying on 531, 2 or More A Levels | Staying On 400, Degree | 2 or More A Levels & Staying On 290.