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RATES OF RETURN TO SCHOOLING AND THE QUALITY OF EDUCATION IN ENGLAND AND WALES

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Abstract

Raising the quality of education has been one of the main objectives of the current government in Britain. By devoting more resources to the education sector, it is expected that pupils will achieve higher educational attainment by the time their years of compulsory schooling ends. This study attempts to assess the effect that the quality of schooling has on the subsequent labour market outcomes of a cohort of individuals who received their secondary education in the 1970s. In the first stage of the statistical analysis, an earnings equation is estimated for those in employment at age 33 which produces an estimate of the return to schooling for each local education authority (LEA) in England and Wales. It is found that the return to schooling varies across LEAs, ranging from 6% to 18%. For the second part of the analysis, these LEA-specific returns are regressed on variables capturing the mean level of school quality in each LEA. The results provide little evidence that measures of quality, such as the pupil-teacher ratio, influence the return received for each year of schooling. Some evidence is found, however, that segregating pupils according to ability is beneficial on average since the greatest returns to schooling are observed in LEAs offering selective schools.

JEL Classification: C23, J31, J24, I21

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1. Introduction

The quality of education received by pupils during their years of schooling has become one of the key political issues in the UK over the last decade. The Labour government came to power in 1997 with a commitment to raising standards within the education system. In July 2000, as part of a three year public spending review, the government announced that schools, colleges and universities would receive an additional £12 billion in the years leading up to 2004. This injection of funds is anticipated to raise education spending in real terms by 6.6% per year in the four year period stretching to 2004. Some of the benefits of the policy are also expected to be felt in the short term with a typical secondary school in England seeing its direct funding from central government increase by £20,000 in the financial year 2001/02. Along with this increase in funding, however, the government has set new educational attainment targets to be met by the Department for Education and Employment. By the year 2004, at least 38% of pupils in all Local Education Authorities should obtain a minimum of five GCSE qualifications at grades A*-C.[1] This recent policy announcement would therefore appear to be based on a belief that increased funding raises the quality of education received by pupils, enabling them to achieve superior results in the exams that accompany the end of compulsory schooling. Higher educational attainment may then be expected to improve the position of individuals in the labour market, either in terms of raising the probability of finding suitable employment, or increasing potential earnings.

[1] These figures were reported in the *Financial Times*, July 19th 2000.

This paper attempts to assess the likely effectiveness of the recent government policy proposal by looking at past experience within England and Wales. Data from the National Child Development Study (NCDS) is used to determine whether individuals who received higher quality secondary education in the 1970s are associated with higher earnings twenty years later. Finding evidence for a link between the quality of education and earnings would suggest that directing more resources to schools may be an effective policy for improving the labour market status of individuals.

Economic studies of school quality have tended to concentrate on the effects that variables such as the number of pupils per teacher and expenditure per pupil have on earnings in the labour market. The manner in which quality is believed to affect earnings, however, is an area of debate. One of the most established findings from research undertaken within many countries is the existence of positive rates of return to schooling. These studies offer estimates of the average rate of return for all individuals included within the relevant sample. It is possible, however, that individuals receiving high quality education earn a rate of return above the average.

The first approach for analysing the effects of quality hypothesises that quality increases the value of each additional year of schooling, creating a steeper earnings-schooling profile. A second, alternative, approach incorporates the measures of quality as additional explanatory variables within a standard wage equation. In this framework, higher quality shifts the earnings-schooling profile upward. Both of these approaches have been applied to US data to provide evidence for the existence of relatively strong quality effects. Recent studies in the UK by Dearden *et al* (1998) and Harmon and Walker (2000) have followed the second approach for the NCDS cohort. The results from these studies have not detected any significant wage effects associated with the quality of education received. The statistical analysis presented in this study also uses the NCDS as its primary source of data but examines the evidence for the first methodology, where quality affects earnings through the rate of return to schooling.

In order to test the hypothesis that the quality of education systematically affects the return to schooling, an empirical methodology is adopted that is essentially a simplified version of Card and Krueger's (1992) two stage regression approach. For the first stage, the NCDS data is used to estimate a conventional earnings equation for individuals aged 33, but where separate estimates of the return to schooling are obtained for each of the LEAs in England and Wales in which the cohort members could have been educated. The second stage then involves regressing these estimated returns on a set of variables relating to the average quality of education within each of the LEAs. An attempt is also made within the second stage to control for other factors which may influence the return to schooling, such as whether the LEA segregates pupils according to ability and the average income of parents within the LEA. The results obtained from estimating the first stage by OLS suggest that there is considerable variation in the returns to education across LEAs, ranging from 6.3% to 18.5%. In the second stage of the statistical analysis, standard measures of quality, such as the pupil-teacher ratio, teacher salary, and expenditure per pupil are found to exert no significant effects on the LEA-specific returns obtained from the first stage. Some evidence is found, however, to support the idea that segregating students according to their ability is beneficial to all students since LEAs practicing selection are found to have a higher return to schooling.

2. Empirical Approaches for Analysing the Effects of School Quality

The effect that school quality has on an individual's educational performance and subsequent earnings is not a new area of study within labour economics. It is a subject, however, that has been revisited in recent years, particularly in the US where the existence of large panel data sets enables individuals to be tracked from the time of their schooling to dates later in their working lives. With such data it becomes possible to assess the effects that the quality of education received by an individual has on their earnings in the labour market. Fewer studies of the effects of quality exist in the UK, partly because there are fewer sources of data on earnings and school quality that can be matched together. Existing UK studies of the effects of quality have followed the approach of including a set of variables capturing the quality of schooling within a conventional Mincerian earnings equation. Using this methodology, Dearden *et al* (1998) and Harmon and Walker (2000) generally find that the standard quality variables, such as the pupil-teacher ratio and expenditure per pupil, exert no significant effects on earnings for a sample of 33 year old workers.[2] In some of the early empirical work undertaken in the US, however, this methodology has provided evidence for the existence of relatively strong quality effects. For example, Rizzuto and Wachtel (1979) find that state-specific measures of expenditure per pupil and teacher salary have a positive influence on wages, although the effect of the pupil-teacher ratio was found to be less conclusive.

When including measures of quality as additional explanatory variables in an earnings equation, it is hypothesised that higher quality affects earnings by shifting the entire earnings-schooling relationship upwards. An alternative way for higher school quality to increase subsequent earnings would occur if higher quality raised the rate of return to schooling. In this

[2] The measures of quality used within these studies generally relate to the mean quality of the schools within each individual's LEA, although some school-specific measures are also included.

case, the impact of quality is to alter the slope of earnings-schooling profile. In the US, a number of studies have incorporated this secondary wage enhancing effect into the analysis by including an interaction term between years of schooling and quality. The evidence from these studies, however, is mixed with Betts (1995) failing to detect any significant quality effects either as a result of shifting the earnings-schooling profile or altering its slope. One of the main features of Betts' study is that quality is measured at the level of the school attended by each individual rather than as an average for all schools within a particular state. Measuring quality in this way reduces the bias associated with using aggregated data within an individual wage equation and also eliminates any errors caused by individuals not being educated in their state of birth.[3] Including school-specific measures of quality, however, may introduce an additional source of bias arising from unobserved family characteristics. Certain family characteristics that increase earnings may also be positively correlated with the school-specific measures of quality, generating an upward bias in the estimated quality effects. Altonji and Dunn (1996) attempt to eliminate this source of bias when working with school-specific measures of quality by looking at the differences in earnings and quality among siblings, who are assumed to be associated with the same family background characteristics. Using this technique, Altonji and Dunn find relatively strong evidence for the existence of quality effects. Teacher salary, expenditure per student, and an index capturing overall quality were all found to exert a positive wage level effect, although the results relating to the interaction with schooling effects were less conclusive.

The most commonly referred to study testing the hypothesis that quality affects the rate of return to schooling is by Card and Krueger (1992). Unlike the studies by Betts (1995) and

[3] A common assumption adopted in the US literature for assigning the quality data to each individual is that individuals are educated in their state of birth.

Altonji and Dunn (1996), a two stage empirical methodology is developed. In the first stage, a conventional earnings equation is estimated, but which separates the rate of return to schooling into two separate components. The first component relates to the state of birth, where it is assumed that the individual received their education. The second part of the return is specific to the region in which the individual currently resides. Within this framework, the state of birth specific returns to education are identified by observing two or more individuals currently residing in different regions, but who were educated in different states. Similarly, the region of residence specific returns may be estimated from those who were educated in the same state, but who live in different regions. If everybody remained in the state in which they were educated, it would not be possible to separately identify these two components contributing to the rate of return to schooling. In the second stage of their analysis, Card and Krueger attempt to determine whether the estimated returns to education attributable to the state of birth obtained from the first stage may be explained by the variation in mean school quality across states. The results from the second stage revealed that when entered individually, the pupil-teacher ratio, term length, and teacher salary all had the expected effect on the return to schooling and were significant. When these variables were entered collectively, however, only the pupil-teacher ratio and teacher salary continued to exert significant effects on the return to schooling in the anticipated direction.

3. Empirical Methodology

The empirical studies referred to in the previous section suggest that there are a number of alternative approaches for looking at the way school quality affects earnings. The two existing UK studies that use the NCDS follow the approach where quality is envisaged as influencing the intercept term within the earnings equation. The empirical analysis presented in this study also relies on the NCDS for its main source of data, but uses an approach that is essentially a simplified version of Card and Krueger's two stage methodology. In the first stage of the statistical analysis, estimates of the rate of return to education are obtained for each of the Local Education Authorities (LEAs) in England and Wales. The second stage then involves regressing these estimated rates of return on variables capturing the level of quality within each LEA. Unlike the existing UK studies, therefore, where quality affects the intercept of the earnings-schooling relationship, this two stage approach hypothesises that quality raises the slope of the earnings-schooling profile. The present study also differs from previous UK work in that all of the measures of quality included in the second stage refer to average values within each LEA. The studies by Dearden *et al* (1998) and Harmon and Walker (2000) include a mixture of both school-specific and LEA-specific measures of quality when estimating their wage equations.

3.1 Estimating LEA-specific Returns to Schooling in England and Wales

The equation estimated for the first stage of the analysis is given by equation (1):

$$\ln y_i = \alpha_0 + \alpha_1 REGION_i + \delta X_i + \beta_1 (S_i \times LEA1_i) + ... + \beta_{148} (S_i \times LEA148_i) + \varepsilon_i . \qquad (1)$$

This equation is similar to that estimated by Card and Krueger in that it contains interactions between the level of schooling and dummy variables indicating the 148 different LEAs in England and Wales. For each individual *i*, therefore, only one of the 148 terms in parentheses takes a positive value and will equal their years of schooling. Unlike Card and Krueger's first stage equation, however, equation (1) does not identify a specific component of the return to schooling that is attributable to the regional labour market that the individual is currently employed in. Instead, any effect that the current region of residence (*REGION*) has on earnings enters through the intercept term.

The equation estimated in order to obtain the LEA-specific returns to schooling is therefore an extended version of the equation typically used in order to obtain a single estimate of the mean rate of return for a sample of individuals. There already exists an extensive literature concerned with estimating the rate of return to schooling in the presence of various sources of bias. In recent years, some researchers have argued that there is a general tendency for the biases associated with omitted ability, endogeneity and measurement error to offset each other, meaning that the initial OLS estimate of the return to schooling may, after all, be reliable (Card 1999, Dearden 1999a). Most studies, however, still find that the final estimate of the return to schooling lies below the initial OLS estimate. For example, Dearden (1999b) finds that the initial 7.2% estimate of the return to schooling falls to 4.8% after controlling for ability, but then rises to 5.5% when the earnings equation is estimated by instrumental variables. With extensive research having already been undertaken on estimating the returns to schooling for the NCDS cohort, this study does not seek to present further evidence on the extent to which various sources of bias influence the return to schooling. Instead, the first stage of the statistical analysis estimates (1) by OLS in order to establish the extent to which the return to schooling varies across LEAs in England and Wales.

3.2 Estimating the Effects of Quality on the LEA-specific Returns to Schooling

Having obtained OLS estimates of the return to schooling for each of the LEAs in England and Wales, the second stage of the statistical analysis involves examining whether the quality of education is an important factor in determining an LEA’s rate of return. In order to do this, equation (2) is estimated where the 148 LEA-specific returns (β_l) obtained from the first stage are regressed on measures of school quality within the LEA:

$$\beta_l = \theta + \gamma_1 Q_l + \gamma_2 TYPE_l + \gamma_3 NBHOOD_l + \gamma_4 FAMILY_l + \gamma_5 AREA_l + \mu_l \,. \qquad (2)$$

In this equation, Q contains a set of variables capturing the average level of quality among the secondary schools within each LEA, while γ_1 is the relevant vector of quality effects to be estimated. The measures of quality included are mean pupil-teacher ratio, expenditure per student and teacher salary. It would be expected that the coefficient associated with the pupil-teacher ratio is negative, while the other two quality measures are anticipated to positively affect the return to schooling. Further variables relating to the type of schools contained within an LEA are included in the term *TYPE*. It may be the case that after controlling for quality, single sex schools are associated with a higher return to education than mixed schools. An LEA that places 100% of pupils into single sex schools may then be observed as having a higher rate of return than another LEA that is identical with respect to the standard measures of quality, but that only operates mixed schools. Including a measure of the percentage of pupils in an LEA that attend single sex schools may then capture the extent to which the segregation of students according to gender influences the performance of all pupils within an LEA, holding quality constant. The other variable included within *TYPE* is the proportion of pupils within an LEA who attended a grammar school. This variable is designed to capture the extent to which segregating pupils according to their ability is beneficial to all students within an LEA. It is often argued that educating individuals in groups with similar ability generates peer effects, raising the performance of both low ability and high ability pupils. The proportion of individuals attending grammar schools may then be interpreted as the extent to which an LEA segregates pupils according to their ability and the corresponding effect that this selection process has on all pupils within an LEA.[4]

[4] Dearden *et al* (1998) argue that attending a grammar school is a signal of higher ability and so should be included in the individual's earnings equation in order to obtain unbiased estimates for the coefficients associated with the quality variables. When regressing LEA-specific returns on control variables measured at the LEA level as in equation (2), however, the interpretation of grammar school attendance differs. LEAs with a higher proportion of pupils attending grammar schools does not necessarily reflect a higher level of mean ability within the LEA. If the distribution of ability across LEAs is similar, the proportion attending grammar schools will represent the proportion of the individuals in the upper part of the ability distribution who are educated separately.

Equation (2) also includes a set of variables *NBHOOD* designed to capture any local environment factors that may influence the return to education. As discussed by Dolton and Vignoles (1996) and Dearden *et al* (1998), local authorities with a greater level of deprivation among its population tend to receive higher levels of funding. Under these circumstances, a relatively deprived LEA may be observed with higher expenditure per pupil, but, as a consequence of pupils living in deprivation, be associated with a lower rate of return to education. Part of the additional funding received by deprived LEAs may be used to provide free school meals, meaning that not all of the extra expenditure per pupil can be linked to the quality of education received. For this reason, the percentage of pupils within an LEA receiving free school meals is included as a measure of deprivation. By including this variable in equation (2), it is possible to estimate the effect that higher expenditure per pupil has on the return to education after allowing for any expenditure differentials that exist between LEAs as a result of differing levels of deprivation. Any additional factors affecting rates of return arising from geographic location are captured by the term *AREA*, which is a set of ten regional dummy variables indicating the region of the country in which the LEA is located.[5]

A potential problem with estimating equation (2) is that the coefficients associated with the quality variables may be biased if variables that are correlated with both the return to education and the level of quality are omitted. An example of such a variable is family income, which may raise a pupil's rate of return to education and also influence quality if high income parents select schools with, for example, a lower pupil-teacher ratio. Family effects of this nature would then be expected to lead to the coefficients attached to the quality variables

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[5] There are only 10 regions in which the LEAs may be located since only those in England and Wales are considered. In equation (1), eleven regions are identified since individuals may currently reside in Scotland although they received their education in England or Wales.

being overstated. The extent of this bias, however, is generally believed to be particularly strong when quality is measured at the school level. This is because high income parents are likely to select the highest quality school within the LEA in which they currently live. If parents are able to choose the best schools in their existing LEA, it is less likely that high income parents will locate themselves in a different LEA where the average quality of schools is higher. Under these circumstances, average family income within an LEA may not be highly correlated with the average quality of education in the same LEA. The potential bias associated with omitting family background variables, therefore, may not be too serious when estimating an equation like (2) where quality is measured at the LEA level rather than at the school level. Despite this, some additional variables capturing family effects measured at the LEA level (*FAMILY*) are included within the second stage. These variables relate to the mean monthly income of parents within an LEA and the mean educational attainment of parents.

4. Description of the Data

The main source of data used within this study is the National Child Development Study (NCDS), which is a longitudinal survey of individuals born in the UK during the first week of March 1958. There have been five follow up surveys that were undertaken when the cohort members were aged 7, 11, 16, 23, and 33 years. The fifth sweep, taken at age 33, was used to provide some of the key variables necessary for the estimation of equation (1). For the dependent variable, the measure of earnings is usual gross weekly income received by full-time employees. This sweep of the NCDS was also used to construct dummy variables indicating the number of employees at the current workplace (*SIZE*), marital status (*MARRIED*) and union membership (*UNION*). The number of hours worked in the current job (*HOURS*) and years of labour market experience (*EXP*) are the final variables included in the vector *X* in equation (1).[6] Eleven dummy variables are also constructed from sweep five of the NCDS to indicate the current region of residence (*REGION*).[7]

The other two important variables on the right-hand-side of (1) relate to the number of years of schooling and the LEA in which the cohort member received their secondary education. Information relating to the LEA is available in the third sweep of the NCDS, which is taken at age 11 and, therefore, just at the point when the individual is due to start their secondary schooling. The measure of schooling used in the estimation of equation (1) is the age at which the individual started their first job. Human capital theory predicts that individuals will devote a certain proportion of their life to investing in new skills on a full-time basis, and then divide their time between investment and earning a wage. The point at which an individual first enters the labour market may therefore be viewed as an approximation for the number of years devoted to full-time education. Measuring schooling in this way is not consistent with the way that this variable is defined in most of the schooling literature. Generally, schooling is measured either from a diary recording an individual's activity in each month (Dearden 1999b), or by assigning a value based on the highest qualification that the individual is observed as holding. There are two potential problems with using the date of labour market entry as a measure of schooling. Firstly, an individual may experience a spell of unemployment between leaving school and starting their first job. In this case, the date of entry will overstate the quantity of education. Secondly, after entering the labour market, workers may gain additional qualifications, which may positively affect earnings but would

[6] Actual labour market experience is calculated by summing the total duration of the time spent in jobs up to the age of 33 years.

[7] In the fifth sweep of the NCDS, there is a relatively high number of missing observations relating to standard region at age 33. In order to maximise the sample size when estimating equation (1), individuals with no regional data available at age 33 were assigned the standard region that they reported in sweep four if they did not change address between sweeps four and five.

not be captured by the measure of schooling. Due to these concerns, equation (1) is also estimated using a more conventional measure of schooling based on the individual's activity in each month, but it is found that there is little change in the results obtained when this alternative measure is used in place of the one based on entry dates.

For the estimation of the second stage of the statistical analysis, it was necessary to obtain a set of variables, *Q*, capturing the average level of quality across the schools contained within each LEA. As in the existing UK studies, the measures of quality used are the pupil-teacher ratio (*PTR*), expenditure per pupil (*EXPEND*), and teacher salary (*SAL*). Data for these variables was obtained from the education statistics produced by The Chartered Institute of Public Finance and Accountancy (CIPFA) in 1970 and assigned to members of the NCDS cohort according to their LEA at the time of the second sweep of the NCDS, taken in 1969 when the cohort was aged 11.

Equation (2) also identifies a set of variables relating to the type of schools contained within each LEA, *TYPE*. These variables include the proportion of pupils within each LEA that attended a grammar school and the proportion attending a single sex school. In order to obtain the data for these variables, it was necessary to refer to the information contained within the NCDS itself. At age 11, it was possible to identify 12,652 individuals who received their education in the 148 LEAs commonly identified by both CIPFA and the NCDS.[8] For each of these individuals, it was possible to derive a set of dummy variables indicating whether the individual attended a comprehensive, secondary modern, or grammar school when they were

[8] The NCDS identifies LEAs for Scotland, the Isle of Man, the Isles of Scilly, Guernsey and Jersey which are not present in the CIPFA statistics. LEAs in Greater London are also treated differently with CIPFA identifying more authorities then NCDS. Overall, it was possible to identify 148 LEAs that were equivalent between CIPFA and NCDS.

aged 16. By taking the mean value of these dummies for all of the individuals educated within a particular LEA, it was possible to determine the proportion of individuals within that LEA attending each type of school. Table 1 shows that, on average, 61% of pupils attended a comprehensive school within their LEA, while 26% and 12% attended secondary modern and grammar schools respectively. Using a similar technique it was also possible to determine the proportion of individuals attending a mixed school (*MIXED*) in addition to the proportion attending either an all boys (*BOYS*) or an all girls school (*GIRLS*). The figures in Table 1 reveal that 75% of pupils attended a mixed school and 25% attended a single sex school.

The third set of variables that were derived in order to estimate equation (2) relate to local environment factors within each of the LEAs. In particular, the proportion of pupils who received free school meals at age 11 is included as a measure of social deprivation. Like the school type variables described above, this variable is derived from the NCDS by constructing a dummy variable indicating whether each individual received free school meals and then taking the average for all of the individuals within each of the LEAs. As may be seen in Table 1, the percentage of pupils receiving free school meals ranged from 0% to 46%, with the average being 11%. The other variable included within the group of local neighbourhood characteristics is the population density within each LEA in 1970, *POP*. This variable is obtained from the CIPFA Education Statistics and is measured as the total LEA population per acre.

The final group of variables summarised in Table 1 relate to the mean family characteristics of pupils within each LEA. These variables are again derived from the sample of 12,652 individuals extracted from the NCDS. For each individual it was possible to calculate the net monthly income received by their parents, which could then be averaged across all the individuals educated within a particular LEA, giving the variable *FAMINC*. In addition, the variables *MEDUC* and *FEDUC* measure the mean education attainment of the pupils' mothers and fathers in each local authority. These two variables are constructed from an index with the value one representing the lowest educational attainment and the value 10 representing the highest attainment. Further details concerning the derivation of the family characteristics variables are given in Appendix B.

5. Results

For the sample of 12,652 males and females known to have been educated in one of the 148 LEAs in England and Wales, data for the additional variables required to estimate the first stage earnings equation was merged in for each individual. By 1991, when the NCDS cohort was aged 33 years, earnings data was only available for 2866 full time male employees at that time. No earnings data was observed for any individuals educated in four of the local authorities, meaning that only 144 LEAs were now represented within the sample.[9] Incorporating the data for the date of labour market entry reduced the sample size to 2413, with 143 LEAs being represented.[10] Missing observations on the amount of experience accumulated by age 33 further reduced the size of the sample to 2307 workers. It was then only possible to derive the standard region of residence at age 33 for 1576 males. As a consequence of missing regional data, individuals from a further five LEAs were excluded from the sample.[11] For the sets of dummy variables relating to establishment size, marital status and union membership, separate categories were identified for those with missing

[9] LEA numbers 85,92,107 and 116 were no longer represented.

[10] Due to missing data on the date of entry, no individuals educated in LEA 126 remained.

[11] The five LEAs lost are numbers 13,18,43,110 and 121. Missing observations for standard region at age 33 were recoded to equal the standard region at age 23 if the individual did not report changing address between 1981 and 1991. Doing this prevents LEA128 being unrepresented in the final sample.

values rather than eliminating them from the final sample. Overall, therefore, the final sample of individuals extracted from the NCDS consisted of 1576 men who received their secondary education in 138 of the LEAs in England and Wales.

5.1 Estimates of the LEA-specific returns to schooling

Equation (1) was estimated for the sample of 1576 male employees who were known to have been educated in 138 of the LEAs in England and Wales. Tables 2 and 3 below present some of the results obtained from the OLS estimation of this equation, where years of schooling (*S*) is measured as the age at which the individual started their first job.

The results shown in Table 2 suggest that most of the variables included within the set of explanatory variables, *X*, have the expected influence on earnings. The more hours worked per week (*HOURS*) and the higher the number of employees at the current place of work (*SIZE2-5*) significantly increase earnings at age 33. Each additional year of actual labour market experience (*EXP*) also exerts a significantly positive effect on earnings, but at a diminishing rate. This is consistent with the findings of many studies that observe the existence of an earnings-experience profile that is concave. Being married (*MARRIED*) is found to significantly raise earnings, although being a member of a union (*UNION*) is observed as having a negative effect. Most of the coefficients associated with the regional dummy variables are found to be insignificant, although those living in the South West, the South East, or London have significantly higher earnings than those living in the default category of the North.

Equation (1) produces estimates of the return to schooling for 138 of the 148 LEAs in England and Wales. Table 3 presents a summary of these LEA-specific returns. A full listing of the local authorities and their individual estimated returns to schooling are provided in the Appendix A. All but one of these LEA-specific returns are positive, ranging from 6.3% in LEA10 (Blackburn) to 18.5% in LEA21 (Rochdale), and are all highly significant. In performing a test of the potential equality between these two coefficients, an F statistic of 3.24 implies that the null hypothesis of equality may be rejected at the 10% level. The only negative estimate of the return to schooling is associated with LEA57 (Northamptonshire), although this coefficient is found to be statistically insignificant. The figures in Table 3 show that the mean rate of return is 10%, which is also approximately equal to the median, represented by LEA2 (Lancashire). Overall, 96 out of the 138 LEA returns are within the range 9.1% to 11.0%. Given the distribution of the estimated returns to education across England and Wales described in Table 3, the second part of the statistical analysis attempts to determine whether differences in the quality of education play a role in determining the variation in these LEA-specific returns.

5.2 The Effects of Quality on the LEA-specific Returns to Schooling

The second stage of the statistical analysis involves the estimation of equation (2) where the LEA-specific returns to schooling obtained from the first stage are regressed on variables relating to the average level of school quality within each LEA. Additional control variables relating to the type of schools contained within each LEA, neighbourhood characteristics, and mean family wealth are also included in the estimation of equation (2). Table 4 presents the results obtained from estimating various versions of equation (2) which differ with respect to the number and type of control variables included. The dependent variable consists of the 137 positive LEA-specific returns to schooling obtained from the first stage, where the returns are expressed as a percentage. Due to concerns arising from using the estimated LEA-specific returns as the dependent variable in the second stage, equation (2) is estimated by weighted least squares with the weights being the inverse sampling variances of the estimated schooling coefficients obtained from the first stage. This estimation technique attaches more weight to the LEA-specific returns that were estimated with greater precision in the first stage.

In the first column of Table 4, the estimated LEA returns are regressed on only the three main measures of quality. It may be seen that the pupil-teacher ratio (*PTR*) has the anticipated negative effect on the rate of return, although is statistically insignificant. Contrary to expectations, both expenditure per pupil (*EXPEND*) and average teacher salary (*SAL*) are both found to negatively affect the return to education, with the effect of teacher salary being significant at the 5% level. One potential reason for the observation of insignificant quality effects arises from the likely correlation between the quality variables, particularly between the two expenditure measures. Equation (2) was therefore re-estimated with the inclusion of the pupil-teacher ratio and either teacher salary or expenditure per pupil, but this was found to have little effect on the quality effects reported in column 1.[12]

The second column of Table 4 introduces two additional variables reflecting the type of schools contained within each LEA. It may be the case that for a given level of quality, LEAs that place a higher proportion of its pupils in single sex or grammar schools are associated with a higher rate of return. This is because segregating pupils according to their gender or ability may alter the performance of all pupils within school. The results presented in column 2 suggest that LEAs with a high proportion of its pupils attending grammar schools (*GRAM*) are associated with significantly higher returns to education, holding the level of quality constant. This may provide some evidence to support the view that segregating pupils

[12] A regression that included *PTR* and *SAL* produced coefficients and *t*-ratios of -0.127 (0.985) and -0.057 (3.043) respectively, while regressing the estimated returns on *PTR* and *EXPEND* produced results of -0.044 (0.339) and -0.215 (2.051) respectively.

according to their ability is, on average, beneficial to individuals within the LEA. For the other school type variable, however, the proportion of pupils attending a single sex school (*BOYS*) appears to exert little effect on the return to education, suggesting that segregation by gender is not as effective as segregation by ability.

The coefficients reported in column 1 of Table 4 may be biased due to the omission of additional variables that are correlated with both the return to schooling and quality. One possible variable is the proportion of pupils receiving free school meals, which is interpreted as a measure of social deprivation. LEAs with a relatively deprived population may be observed with greater expenditure per pupil which may be used to fund the provision of free school meals. If pupils in such LEAs are also associated with weaker performance in school, lower rates of return may be observed in LEAs with high expenditure per pupil. Failure to control for such levels of deprivation may then cause the coefficients associated with the quality variables to be biased downward. It may be seen in column 3 of Table 4, however, that after controlling for the proportion of pupils receiving free school meals (*MEALS*), there is little change in either the magnitude or statistical significance of the quality coefficients.

The estimated quality effects could also be biased if variables capturing family background are omitted from equation (2). If parents with high income or educational attainment select the highest quality schools for their child to attend and are able to improve their child's educational performance through other channels, the quality effects estimated in column 1 of Table 4 may be overstated. This source of bias is likely to be most pronounced when including measures of quality and family background that are specific to individual pupils since parents are able to choose the best school for their child. When looking at quality and family background variables measured as LEA averages, however, the potential for biased quality effects is likely to be reduced. This is because high income parents are more likely to select the highest quality schools within their existing LEA, rather than locating themselves in an LEA where the average quality of schooling is higher. Column 3 of Table 4 includes three family background control variables that are measured as LEA averages- mother's educational attainment (*MEDUC*), father's educational attainment (*FEDUC*), and family income (*FAMINC*). Mean family income is found to positively affect the return to education and is significant at the 10% level, but the opposing effects associated with parental education are both statistically insignificant. After controlling for these variables, it may be seen that there is little alteration in the coefficients associated with the three measures of quality, suggesting that the omission of family background variables in columns 1 and 2 does not generate biased quality effects.

The final column in Table 4 introduces a set of area variables indicating the standard region in which each of the LEAs is situated.[13] These variables are designed to capture any other additional local environment factors affecting rates of return that are not covered by the neighbourhood variables included in column 3. The inclusion of these variables lowers the magnitude and statistical significance of the coefficients attached to the pupil-teacher ratio and teacher salary variables, suggesting that the exclusion of regional controls in columns 1-3 may introduce a source of bias into the quality effects. At a significance level of 5%, an *F*-test rejects the hypothesis that the additional area controls are jointly insignificant, meaning that the inclusion of these variables does significantly raise the explanatory power of the model compared to that estimated in column 3.[14] Those LEAs located within the Northern region

[13] The eleventh standard region identified in the earnings equation, Scotland, is not applicable here since only LEAs located in England and Wales are considered.
[14] The *F*-statistic is 3.28 which has a *p*-value of 0.0013.

(*AREA2*), the North Midlands (*AREA4*), and the Midlands (*AREA9*) are associated with a higher rate of return to education relative to the excluded North Western region.

5.3 Additional Estimations

The results from estimating the two stages of the statistical analysis presented in sections 5.1 and 5.2 were obtained using the date of labour market entry for the measure of years of schooling. In order to check the robustness of the estimated coefficients reported in Tables 2 to 4, the two stages were re-estimated using the alternative measure of schooling described in section 4. The alternative measure involves interacting the number of years spent in education up to age 23 with the LEA dummy variables, and then including a set of nine dummy variables capturing the highest qualification obtained between ages 23 and 33.[15] Separating educational attainment in this way may be appropriate since the return to any education accumulated in later years is unlikely to be determined by the LEA in which the individual was educated at age 11. The results from estimating equation (1) using this alternative measure of schooling were found to be similar to the results shown in Tables 2 and 3. LEA21 (Rochdale) was again found to be associated with the highest rate of return of 19.1%, while LEA10 (Blackburn) had the lowest return of 7.1%. The mean rate of return across the 138 LEAs was found to be 10.4%, which is comparable with the mean value of 10.0% obtained when schooling was measured by the date of labour market entry. In the second stage of the analysis, the coefficients and statistical significance of the quality measures were also found to be similar to those shown in Table 4, column 1. For example, the coefficient associated with the pupil-teacher ratio was estimated to be -0.112 with a *t*- ratio of 0.870.[16] Despite the fact that the measure of schooling used in estimating the model in section 5.1 is

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[15] See Appendix B for a description of these dummy variables.

[16] For *SAL* and *EXPEND*, the coefficients and *t*-ratios were -0.042 (1.914) and -0.007 (0.556) respectively.

unconventional, the results obtained are not substantially altered when an alternative measure of educational attainment is used in the analysis.

The results presented in sections 5.1 and 5.2 are produced from estimating the various equations of the statistical framework using a sample of 1576 males. In order to examine the effect that school quality has on the return to education among females, the equations were re-estimated for a sample of women extracted from the NCDS. By following exactly the same steps as for men, a sample of 760 females was constructed who were educated in 130 of the 148 LEAs in England and Wales. The mean LEA rate of return was found to be 8.1%, ranging from 0.8% in LEA54 (Lincoln) to 23.4% in LEA21 (Rochdale). In the second stage, however, the magnitude of the quality effects were found to be almost zero and none were close to statistical significance. One of the problems in repeating the statistical analysis for women is that the sample size is relatively small since at age 33 some women will be out of the labour force for child raising purposes. When estimating the first stage of the statistical analysis, therefore, a selection term should be included for those who are observed as being in employment at age 33. For completeness, the first stage earnings equation should also contain the number of years of non-participation accumulated by age 33 as an explanatory variable alongside the number of years of labour market experience.

6. Conclusion

The quality of education in the UK has become one of the main political issues in recent years. It is widely believed that more resources need to be directed towards the education system in order to raise the performance of students and improve their subsequent prospects within the labour market. Evidence from the US would appear to offer some support for this view in that some studies have detected a link between the quality of education and labour market earnings. For the UK, however, recent studies undertaken using the NCDS have found no evidence to support the view that the quality of education positively affects earnings. In these studies, measures of quality are included as additional explanatory variables within a conventional earnings equation. This approach hypothesises that higher quality raises earnings for a given level of educational attainment. There are alternative ways, however, for modelling the influence that school quality has on future labour market earnings. The empirical analysis undertaken in this study also uses the NCDS, but follows a different approach to the existing UK literature. A simplified version of Card and Krueger's (1992) approach is followed where individual estimates of the rate of return to schooling are obtained for each of the local education authorities in England and Wales. These estimated returns are then regressed on three measures of quality and a set of additional variables capturing the environment within each LEA. Within this framework, therefore, the effect that quality has on labour market earnings is believed to operate through the rate of return to education. The quality of education may then be seen as altering the slope of the earnings-schooling relationship rather than its vertical positioning.

The results obtained from the first part of the statistical analysis finds that the rate of return to education does significantly vary across LEAs. For males, the rate of return is found to range from 6.3% to 18.5%, with the mean value across all LEAs being 10.0%. In the second stage, however, no evidence is found for the existence of significant quality effects operating in the anticipated direction. The effects that the pupil-teacher ratio and expenditure per pupil have on rates of return are found to be insignificant. In some specifications of the model, average teacher salary is actually found to exert a significantly negative influence on an LEA's rate of return to schooling. The inclusion of additional LEA control variables, such as the composition of schools, the level of deprivation, and family wealth appear to have little effect on the magnitude and statistical significance of the quality effects. It is difficult, however, to fully control for local environment factors due to a lack of data relating to the LEA level, which weakens the second stage of the analysis. By including regional dummies, it would appear that the region in which the LEA is located does play a role in determining the return to education. The inclusion of these variables also reduces even further the effect that quality has on the LEA-specific returns. This may imply that there are additional geographic factors which are important in explaining the returns to education, and which are also correlated with the level of quality.

The results from this study would therefore appear to reinforce the findings of existing studies of the effects of school quality on labour market outcomes using the National Child Development Study cohort. Previous research has indicated that measures of school quality exert little direct impact on earnings, whereas the results presented in this study also suggests that quality does not have an indirect effect on future earnings operating through the rate of return to schooling. This may imply that policies aimed at raising the quality of education, such as recruiting additional teachers in order to lower class sizes, would be expected to be ineffective in terms of raising labour market prospects. It is important to recognise, however, that the NCDS cohort received their secondary education during the 1970s and any relationship that existed between the quality of their education and future earnings may not hold for those currently within the education system. As in the existing UK research on the effects of quality, this study has examined the extent to which the quality of secondary education influences subsequent labour market earnings. It may well be the case, however, that higher quality education exerts a greater impact on individuals during their years of primary education.

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TABLE 1

Summary Statistics for the Measures of Quality

Control Group	Variable Name	Mean	SD	Minimum	Maximum
Q	*PTR*	18.08	1.03	13.5	20.3
	SAL (£)	101.69	7.68	83.21	133.81
	EXPEND (£)	170.37	13.73	133.72	218.67
TYPE	*MIXED*	0.75	0.21	0.17	1
	BOYS	0.12	0.12	0	0.50
	GIRLS	0.12	0.12	0	0.63
	*NCDSCOMP**	0.61	0.35	0	1
	*NCDSSEC**	0.26	0.26	0	1
	*NCDSGRAM**	0.12	0.13	0	0.67
NBHOOD	*MEALS*	0.11	0.07	0	0.46
	POP (pop/acre)	8.77	7.79	0.06	40.08
FAMILY	*FAMINC* (£)**	305.64	37.86	152.67	428.46
	FEDUC	3.88	0.45	3	5.33
	MEDUC	3.92	0.41	3	5.67

Notes

1. *Q* variables capture pupil-teacher ratios at 16 and 11, teacher salary, and expenditure per pupil.
2. *TYPE* variables give the proportion of individuals within an LEA attending mixed, boys, girls, comprehensive, secondary modern, and grammar schools respectively.
3. *NBHOOD* variables relate to the proportion of individuals at 11 receiving free school meals in an LEA, and population density within the LEA.
4. *FAMILY* variables include mean family income, and mean educational attainment of fathers and mothers within an LEA (captured by an index ranging from 1 to 10).
5. * denotes mean calculated from 147 LEAs as no data was available for LEA 85.
   ** denotes mean calculated from 147 LEAs as no data was available for LEA 116.
6. A full description of the variables is given in Appendix B.

TABLE 2

OLS Estimation of Equation (1)

Variable	**Coefficient**	**t-ratio**
HOURS	0.010	(6.271)
EXP	0.067	(2.460)
EXP^2	-0.002	(1.535)
SIZE2 (11-25)	0.147	(2.340)
SIZE3 (26-99)	0.141	(2.733)
SIZE4 (100-499)	0.287	(5.350)
SIZE5 (500+)	0.273	(5.065)
MARRIED	0.133	(4.552)
UNION	-0.074	(2.721)
REGION2 (N.West)	0.014	(0.124)
REGION3 (Yorkshire)	0.068	(0.768)
REGION4 (W.Midlands)	-0.067	(0.551)
REGION5 (E.Midlands)	0.023	(0.250)
REGION6 (E.Anglia)	-0.009	(0.087)
REGION7 (S.West)	0.191	(2.057)
REGION8 (S.East)	0.334	(3.851)
REGION9 (London)	0.326	(3.402)
REGION10 (Wales)	0.060	(0.238)
REGION11 (Scotland)	0.117	(0.735)
LEA-specific returns	see Table 3	
R-squared	0.297	
F	17.90	
N	1576	

Notes

1. Dependent variable is log weekly gross pay at age 33 (1991).
2. *t*-ratios are shown in parentheses and are calculated from robust standard errors.
3. Excluded cases are: living in the North (*REGION1*) and those in firms with 1-10 employees (*SIZE1*).
4. Dummies are also included for missing observations on firm size, marital status and union membership.

TABLE 3

Summary of the 138 LEA-specific Returns from Equation (1)

Number of positive estimated rates of return:	137	
Number of negative estimated rates of return:	1	(LEA57: Northamptonshire)

Mean rate of return:	0.100	
Highest positive return:	0.185	(LEA21: Rochdale)
Lowest positive return:	0.063	(LEA10: Blackburn)
Median:	0.0996	(LEA2: Lancashire)

Number of LEA-specific returns in the range:

less than 0.081	12
0.081 – 0.090	11
0.091 – 0.100	52
0.101 – 0.110	41
0.111 – 0.120	14
0.121 – 0.130	4
more than 0.130	4
Total	138

TABLE 4

Estimation of Equation (2)

Control Group	Variable	(1)		(2)		(3)		(4)	
Q	*PTR*	-0.144	(1.066)	-0.079	(0.578)	-0.088	(0.565)	0.017	(0.112)
	SAL	-0.052	(2.247)	-0.054	(2.347)	-0.056	(2.243)	-0.026	(0.921)
	EXPEND	-0.005	(0.424)	0.002	(0.131)	0.003	(0.253)	-0.002	(0.190)
TYPE	*BOYS*	-		0.103	(0.105)	0.058	(0.054)	0.862	(1.384)
	GRAM	-		1.851	(2.079)	1.648	(1.794)	1.467	(1.682)
NBHOOD	*MEALS*	-		-		1.160	(0.687)	0.487	(0.282)
	POP	-		-		0.006	(0.432)	0.008	(0.556)
FAMILY	*MEDUC*	-		-		-0.640	(1.527)	-0.386	(0.939)
	FEDUC	-		-		0.521	(1.381)	0.581	(1.542)
	FAMINC	-		-		0.005	(1.666)	0.003	(0.845)
AREA	*AREA2*	-		-		-		1.147	(2.999)
	AREA3	-		-		-		0.406	(1.040)
	AREA4	-		-		-		1.009	(2.400)
	AREA5	-		-		-		0.614	(1.504)
	AREA6	-		-		-		0.253	(0.599)
	AREA7	-		-		-		-0.413	(1.007)
	AREA8	-		-		-		-0.251	(0.571)
	AREA9	-		-		-		1.170	(3.207)
	AREA10	-		-		-		0.093	(0.171)
	constant	18.58	(4.463)	16.22	(3.816)	15.12	(2.989)	10.23	(1.933)
	R-squared	0.077		0.112		0.156		0.326	
	F	3.69		3.31		2.33		2.98	
	N	137		137		137		137	

Notes

1. Dependent variable is the coefficient on $(S \times LEA_l)$ multiplied by 100.
2. *t*-ratios are in parentheses.
3. Estimation is by weighted least squares – see text for details.

APPENDIX A

List of LEAs and Estimated Rates of Return to Schooling from Equation (1)

LEA	Name	Return
1	Cheshire	0.105
2	Lancashire	0.100
3	Southport	0.104
4	Wigan	0.097
5	Birkenhead	0.091
6	Chester	0.092
7	Stockport	0.097
8	Wallasey	0.073
9	Barrow-in-Furness	0.095
10	Blackburn	0.063
11	Blackpool	0.100
12	Bolton	0.102
13 **	Bootle	
14	Burnley	0.096
15	Bury	0.084
16	Liverpool	0.112
17	Manchester	0.100
18 **	Oldham	
19	Preston	0.110
20	Warrington	0.100
21	Rochdale	0.185
22	St Helens	0.106
23	Salford	0.140
24	Cumberland	0.101
25	Durham	0.100
26	Northumberland	0.098
27	Westmorland	0.121
28	York, N. Riding	0.099
29	Carlisle	0.096
30	Darlington	0.107
31	Gateshead	0.112
32	South Shields	0.102
33	Sunderland	0.101
34	Hartlepool	0.109
35	Newcastle	0.108
36	Tynemouth	0.098
37	Tees-side	0.119
38	York, E. Riding	0.093
39	York, W. Riding	0.101
40	Kingston-upon-Hull	0.096
41	Barnsley	0.084
42	Bradford	0.096
43 **	Dewsbury	
44	Doncaster	0.129
45	Halifax	0.111
46	Huddersfield	0.097
47	Leeds	0.098
48	Rotherham	0.085
49	Sheffield	0.103
50	Wakefield	0.091
51	York	0.104
52	Derbyshire	0.101
53	Leicestershire	0.107
54	Lincoln, Holland	0.123
55	Lincoln, Kesteven	0.114
56	Lincoln, Lindsey	0.095
57	Northamptonshire	-0.003
58	Nottinghamshire	0.102
59	Rutland	0.106
60	Derby	0.105
61	Leicester	0.116
62	Grimsby	0.099
63	Lincoln	0.105
64	Northampton	0.105
65	Nottingham	0.108
66	Bedfordshire	0.098
67	Luton	0.103
68	Cambridge, I. of Ely	0.111
69	Essex	0.102
70	Hertfordshire	0.094
71	Huntingdon, P'boro'	0.095
72	Norfolk	0.096
73	Suffolk East	0.121
74	Suffolk West	0.104
75	Great Yarmouth	0.095
76	Norwich	0.105
77	Ipswich	0.106
78	Southend-on-Sea	0.092
79	Kent	0.093
80	Inner London	0.094
81 +	Outer London	0.094
82 +	Bexley, Bromley	0.101
83 +	Formerly Middlesex	0.100
84 +	Formerly Surrey	0.074
85 *	Newham, W. Ham	
86	Croydon	0.110
87	Surrey	0.101
88	East Sussex	0.086
89	West Sussex	0.095
90	Canterbury	0.138
91	Brighton	0.094
92 *	Eastbourne	
93	Hastings	0.094
94	Berkshire	0.093
95	Buckinghamshire	0.101
96	Dorset	0.105
97	Oxfordshire	0.083
98	Hampshire	0.093
99	Isle of Wight	0.081
100	Reading	0.098
101	Oxford	0.079
102	Bournemouth	0.097
103	Portsmouth	0.080
104	Southampton	0.088
105	Cornwall	0.093
106	Devon	0.094
107 *	Gloucestershire	
108	Somerset	0.089
109	Wiltshire	0.092
110**	Exeter	
111	Plymouth	0.085
112	Bristol	0.080
113	Gloucester	0.102
114	Bath	0.094
115	Torbay	0.109
116*	Radnor	
117	Brecon	0.070
118	Carmarthen	0.076
119	Glamorgan	0.090
120	Monmouth	0.099
121**	Anglesey	
122	Caernarvon	0.085
123	Cardigan	0.080
124	Denbigh	0.098
125	Flint	0.100
126 *	Merioneth	
127	Montgomery	0.070
128	Pembroke	0.095
129	Cardiff	0.107
130	Merthy Tydfil	0.075
131	Swansea	0.112
132	Newport	0.150
133	Herefordshire	0.092
134	Shropshire	0.102
135	Staffordshire	0.102
136	Warwickshire	0.107
137	Solihull	0.111
138	Worcestershire	0.109
139	Burton-upon-Trent	0.117
140	Warley	0.101
141	Stoke-on-Trent	0.102
142	Walsall	0.114
143	West Bromwich	0.099
144	Woverhampton	0.099
145	Birmingham	0.112
146	Coventry	0.113
147	Dudley	0.113
148	Worcester	0.092

Notes

1. Unable to estimate LEA return for men due to missing earnings data, or entry age (LEA126).
2. ** Unable to estimate LEA return for men because of missing regional data in 1991.
3. + For these LEAs, NCDS and CIPFA differ. Bexley and Bromley are identified individually in CIPFA whereas in NCDS they are combined. For the mapping in of the CIPFA quality measures, the average of Bexley and Bromley was taken. For Outer London the average CIPFA values for Barking, Ealing, Harringey, Havering, Redbridge and Waltham Forest are used. Formerly Middlesex is the average of Barnet, Brent, Enfield, Harrow, Hillingdon and Hounslow. Formerly Surrey consists of Merton, Richmond, Sutton and Kingston, which are all individually identified in the CIPFA data.

APPENDIX B

Description of Variables

Variables within the earnings equation:	
LNPAY	Usual gross weekly pay in 1991 job (dependent variable)
S	Age at which first job started; or total years in education between 16 and 23
SIZE1-9	Number of employees at current place of work; *SIZE1*=1-10, *SIZE2*=11-25, *SIZE3*=26-99, *SIZE4*=100-499, *SIZE5*=500+, *SIZE9*=unavailable
MARRIED	Equals one if reported being married in 1991; *MARMISS*=1 if unknown
UNION	Equals one if reported being union member in 1991; *UNIMISS*=1 if unknown
REGION1-11	Region of residence in 1991; 1=North, 2=North West, 3=Yorkshire and Humberside, 4=West Midlands, 5=East Midlands, 6=East Anglia, 7=South West, 8=South East, 9=London, 10=Wales, 11=Scotland
LEA1-148	Local authority at age 11; see previous Appendix A for coding information
ABILITY1-10	Ten dummy variables indicating score on verbal and non verbal tests taken at age 11. Maximum score is 80, which is split into ten ranges of scores
Variables within the quality equation:	
PTR	Number of pupils per teacher in LEA in the year ending March 1970
SAL	Average teacher salary in LEA in 1970
EXPEND	Total expenditure per pupil in LEA in 1970
POP	Population per acre in LEA in 1970
GRAM	Proportion of individuals attending grammar schools within LEA in 1974
BOYS	Proportion of individuals attending all boys schools within LEA in 1974
MEALS	Proportion of children receiving free school meals in LEA at age 11 (1969)
FAMINC	Mean family net income in LEA in 1974. Derived from mother's, father's, and other sources of income. Each source of income is given as a number reflecting a particular range of earnings e.g. £0-17. Midpoints of these ranges were used to construct an overall measure of monthly income in £ for each cohort member. The average was then taken for those living in each LEA.
MEDUC	Mean educational attainment of mother in LEA. This is derived from an NCDS variable taking a value between 1 (left school at under 13 years of age) and 10 (left education beyond age 23)
FEDUC	Mean education attainment of father in LEA. Derived as above.
AREA1-10	Dummy variables indicating region of the country in which the LEA at age 11 was located; 1=North Western, 2=Northern, 3=East and West Riding, 4=North Midlands, 5=Eastern, 6=London and South East, 7=Southern, 8=South West, 9=Midlands, 10=Wales
Variables used in the additional estimations:	
S	Number of years spent in full time education between ages 16 and 23
QUAL0-9	Highest qualification obtained between ages 23 and 33; 0=no qualifications, 1=CSE, 2=O Level, 3=GCSE, 4=A Level, 5=Scottish qualification, 6=RSA, C&G, 7=Professional qualification, 8=Degree, 9=Other