Abstract

This paper considers mobility in and explanation of the position of children in the distribution of ability at different ages. Using the sub-samples of the BCS Cohort, it is found that 42 month ability rank provides a fairly stable guide to position in the distribution at age ten and that for girls, even the 22 month score is fairly stable. The paper then considers the question of the association of ability rank with the social background of children. It is found that children of women with degrees are substantially higher in the distribution than other children even at 22 months. By 42 months SES is also important, becoming still more important by age ten. A forecast equation for household income is developed. This is also found to be strongly associated with pre-school ability rank.

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Pre-school Educational Inequality?
British Children in the 1970 Cohort

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Pre-school Educational Inequality?

British Children in the 1970 Cohort

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1. Introduction

Tony Blair has famously made education the priority of his Government (along with education and education). Besides the economic growth and — who knows? — moral aspects of this emphasis, it plays a central role in the Government's thinking about inequality. Rather than increase the degree of re-distribution of income through the tax system it is to be understood that, alongside welfare reform, the Government wishes to reduce income inequality primarily through reducing educational inequality. The suggestion is that what has been called the 'primary distribution' of skills and abilities is the determinant of the 'secondary distribution' of earnings. From the perspective of human capital theory, education can be thought of as embodying productivity in individuals. Supporting individuals in developing their productivity then becomes the indirect vehicle for increasing their earnings. This lends policy interest to the question of the determination of educational outcomes and the associated search for variables that can operate as policy instruments. Yet numerous studies have shown the importance of social and economic background factors in determining educational outcomes.[1] There is, therefore, a clear reverse causality, the importance of 'secondary' social inequality in generating 'primary' educational inequality.

Moreover, economists have generally found that school quality variables are not significantly correlated with educational outcomes. (See, for example, Meghir, 1997, Hanushek, 1986). Far more important in the determination of children's educational performance are variables reflecting the interest taken by parents in the education of their children and the make-up of the child's peer group (Feinstein and Symons, 1997 and Robertson & Symons, 1996), together with other background variables such as occupational classification and parental education. These variables are much less obviously amenable to policy influence. In particular, parents are generally unwilling to sacrifice a better peer group for their child in order to benefit children from poorer backgrounds or with less-educated parents (although if Government policy can influence attitudes then doing so might be considerably cheaper than reducing class sizes, for example).[2] Moreover, Feinstein and Symons show a clear association between children's social background on the one hand and their peer group or the interest their parents take in their education on the other. This suggests that parental attitudes and peer groups can be thought of as aspects of social class, aspects that lead to the intergenerational transfer of educational differences and are not easily dealt with by education policy.

This emphasis on schooling is also made problematic by the fact that ability at age seven is often found to be the best ability control variable in earnings regressions. Meghir (1997), for example, finds that including later ability measures adds little to the explanation of earnings variance. This finding is based on evidence from the 1958 National Child Development Survey for which age seven is the earliest age at which ability measures are available. It may be that age seven ability is really operating as a proxy in these regressions for earlier unobserved ability.

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1. A useful summary of this literature is provided in Haveman and Wolf (1995)

2. See Robertson and Symons for a full discussion of the importance of peer groups and the difficulties in achieving a socially optimal allocation of children to schools.

Support for the forecasting power of early ability might come from psychological literature or from genetics, although with very different implications for social policy. For instance, it might be that very early parent-child interactions such as those described by Bowlby (1953) are much more important in the determination of ability than school age experiences. Differences in housing, family size, nutrition and education of parents could have profound early implications via effects on the quality of such interactions. Additionally, researchers have found clear social class differences in the way slightly older, pre-school children are taught in the home. Bee (1969), for example, found that middle-class mothers provided more intellectual stimulation than working class mothers, were much more goal-oriented in the way in which they responded to children and much more likely to compliment success rather than criticise failure. In such a world, ability might be quite firmly established before children entered school and policy instruments would have to be found that could influence pre-school children. An obvious candidate would be the wider provision of nursery school placements but a previous study (Feinstein *et al* 1998) found that, contrary to popular wisdom, pre-school placements can in fact reduce children's educational performance and that children benefit from time with other adults rather than premature exposure to large numbers of other children, particularly for long periods.

Alternatively, support for the thesis that early ability has strong explanatory power might be found from genetics although this offers even less obvious room for social policy intervention. Attempting to reduce income inequality by influencing the British schools system or other school-age measures would, in this latter scenario, at the very least be, extremely problematic.

Of course, in reality, as is shown below, ability is not fully determined prior to school entry. Two questions, therefore, emerge. Firstly, to what extent are early measures of ability correlated with later ability and qualifications? Secondly, if early ability is important in this sense, what determines it and how amenable are these determinants to policy influence? The 22 month and 42 month sub-samples of the 1970 Birth Cohort, also known as the British Cohort Survey (BCS), enable us to approach these questions.

2. The Data

The 1970 Birth Cohort is a longitudinal study of all British children born in the week from the 5th to the 11th of April, 1970. Essential to the current study is the fact that BCS children were given tests of educational development at all sweep ages. The tests are described in more detail below. Table 1 reports the ages at which the 1970 cohort have been sampled, together with sample numbers.

Table 1

Observations in first four sweeps of BCS

	Obs.	Test scores
Birth	17196	
22 month sub-sample	2457	2348
42 month sub-sample	2315	1401
5 years	13135	13135
10 years	15049	12403

Due to medical concerns about the effect of fetal malnutrition on brain cell proliferation, a sub-sample of BCS children were studied at 22 and 42 months. A ten percent random sample of all births was included together with those children who were considered to be most at risk from fetal malnutrition, numbers from each of these sub-groups within the 22 and 42 month sub-samples are given in Table 2.

Table 2
Number of observations in each sample sub-group

	Obs.	% sub-sample	% Full sample
22 months			
Control	1125	42.2	6.5
Twins	228	8.5	1.3
Post-mature-sample	748	28.0	4.3
Small for dates	567	21.2	3.3
42 months			
Control	1093	43.6	6.4
Twins	211	8.4	1.2
Post-mature-sample	676	27.0	3.9
Small for dates	527	21.0	3.1

Estimation of the mobility and explanation of test scores in the general population using data for these two sub-groups is likely to be biased if fetal malnutrition is linked to the development of brain activity, performance in educational tests and also to other social and economic variables. Two strategies are, therefore, adopted. Firstly where regression analysis was used, regressions were undertaken on each sub-group separately to test whether results varied from those for the control group. Generally it was found that there was no significant model estimation divergence between the sub-groups and the control group. Secondly, a weighted least squares procedure was used in regressions reported for the sub-sample as a whole, sub-group dummy variables controlling for membership of a particular sub-group.[3] These two strategies mean that results can be considered to be representative of the educational development of the wider population of children.

Another sampling issue is that only children from two-parent families were included in the sub-sample. This limits the representativeness of these results, particularly for those concerned with family breakdown. Nonetheless, bearing this exclusion in mind, analysis of these data should still shed light on the two questions of the importance and explanation of early ability differences between children of different social backgrounds.

3. Test Scores

At each age BCS children are assessed in terms of intellectual, emotional and personal development. By the time the children are age ten they could be asked to complete standard tests of reading and maths but at age five and particularly at the earlier ages the significance of the tests themselves must be in question. At 22 months the children were asked by the Health Visitors administering the survey to complete a range of different tasks such as pointing to their eyes to illustrate understanding of language, putting on their shoes, indicative of personal development, stacking cubes and drawing lines as tests of locomotor ability. At 42 months counting and speaking could be tested and further copying tests were administered such as drawing simple geometrical shapes. At age five copying was again assessed, together with tests of basic vocabulary.

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3. Observations are re-weighted by the formula $w_2 = w * w_1$ where w_1 and w_2 are the weights of randomly sampled and over-sampled observations and w is the ratio of observations in the sub-sample as a whole to the full BCS sample at birth, 0.142. (See Notes to Table 12.)

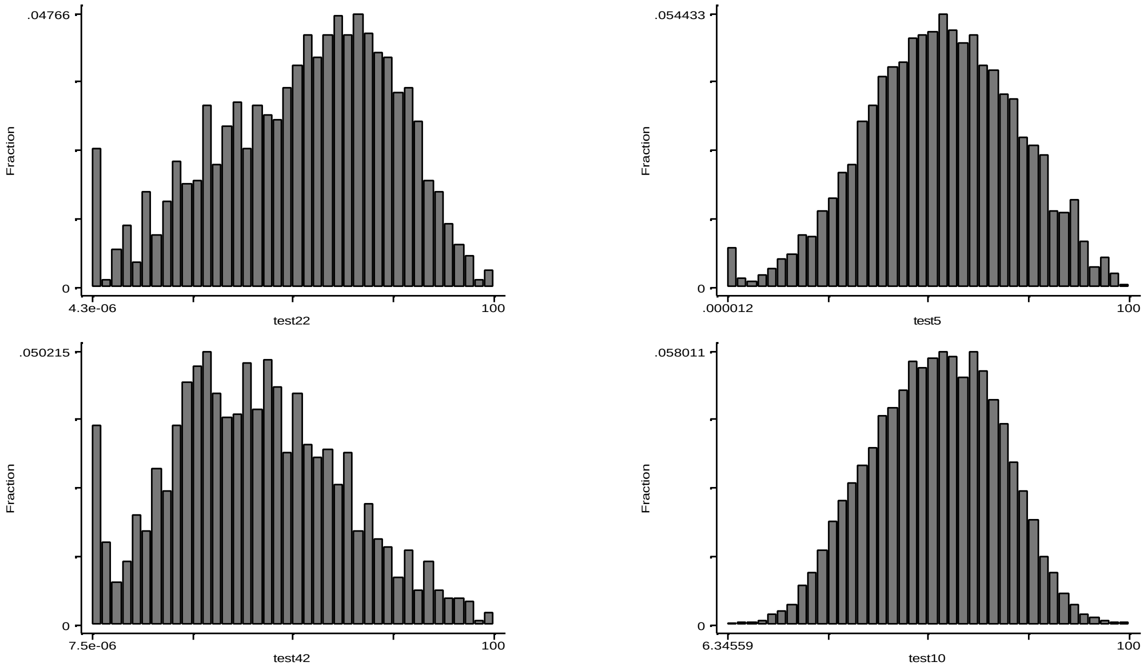
Test scores at each age were combined into a single score at each age by principal-components analysis. This simplifies the analysis. Table 3 reports the weights given to each component test in the score for each age. It can be seen that no individual component dominates, all scores contributing to maximisation of the variance of test outcomes. At age ten, reading is given a much greater weight than maths but the British Ability Scale is comprised of a large number of maths elements and this score weights more strongly than reading in the overall score at ten. Age sixteen BCS information is not used because of the low response to the Teachers' Questionnaire which unfortunately coincided with teachers' industrial action!

Table 3
Scoring coefficients from principal components for overall test scores

	22 month	42 month	5 years	10 years
Cube stacking	0.23			
Language use	0.29			
Personal dev.	0.35			
Drawing	0.23			
Counting		0.30		
Speaking		0.25		
Copying designs I		0.32		
Copying designs II		0.23		
Copying designs			0.33	
Vocab			0.31	
Profile drawing			0.27	
Reading				0.36
Maths				0.13
Picture language				0.16
British Ability Scale				0.42

Figures 1a-1d show histograms of the resulting individual scores.

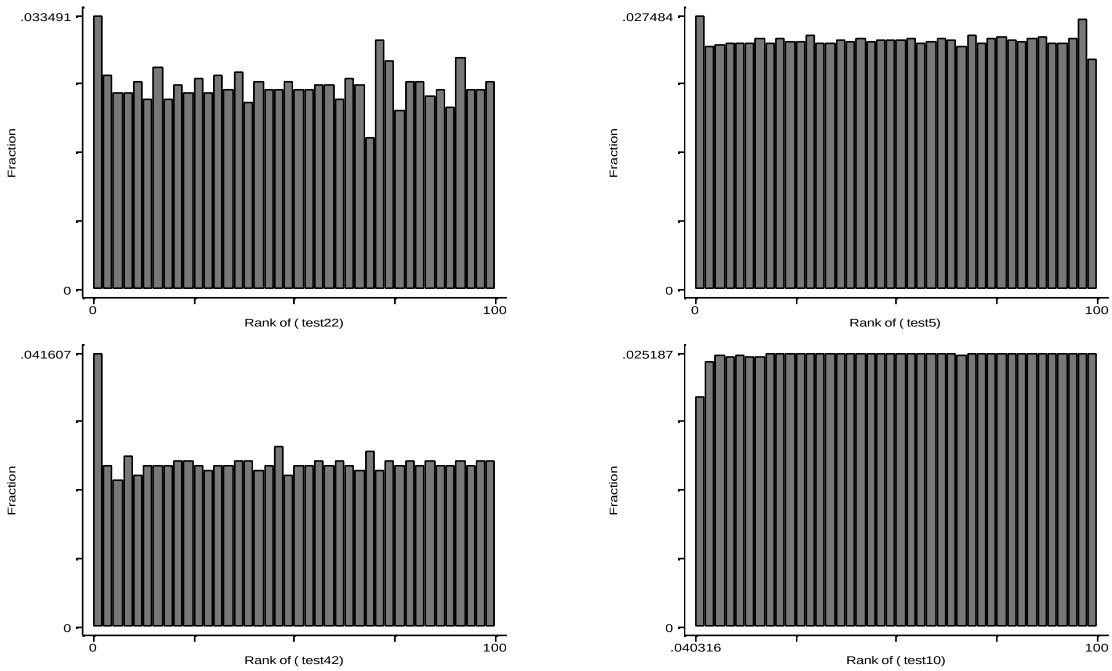
Figure 1a-1d
Histograms of test scores, 22, 42, 60 and 120 months



Given that our concern is with educational inequality, the children are then ranked in normalised reverse order, a rank of one for the lowest scoring child and a rank of one hundred for the child scoring highest.[4] This gives four outcome variables that reflect children's position in the distribution of hypothesised ability at the ages of 22, 42 months, 60 and 120 months. Histograms for these variables are given in Figures 2a-2d and it should perhaps be emphasised that although the rank varies between one and one hundred there are potentially as many positions within this range as there are children in each sweep who completed the tests.

Figure 2a-2d
Histograms of test ranks, 22, 42, 60 and 120 months

4. Children in special schools at age ten were excluded from the sample on the assumption that they represent different educational problems.



The final educational variable used is an ordinal measure of highest educational qualification as reported in the age 26 sweep of the BCS.[5] This is described in Table 4.

Table 4

Final educational outcome at age 26

Highest Qualification	Score	Obs	%
None	0	410	4.8
CSE	1	1521	18.0
Vocational	2	835	9.9
O' Level (GCSE/GCE)	3	2902	34.3
A' Level	4	710	8.4
Higher Education	5	380	4.5
Degree	6	1715	20.2

4. Mobility Within the Distribution of Scores Between Surveys

An immediate issue is the relation of the earlier test ranks to later ranks. This can be considered in two ways, raw correlation and mobility between percentiles. The first approach is to consider how the distribution of overall scores at an early age is correlated with the distribution at later ages. A correlation of zero would suggest that there was no relation at all, say, between rank at 22 months and rank at 42 months. This would indicate that early performance in tests was no guide to subsequent attainment, perhaps because children develop at very different rates, implying that early scores are

5. The position of vocational qualifications within this distribution is fairly arbitrary since the variable used provides no grading system. This positioning of vocational qualifications was decided on because it provided the best degree of correlation with age ten ability rank.

extremely unstable. The raw correlations between the summary test rank at each age are shown in Table 5.

Table 5
Correlation coefficients for rank positions at 22, 42, 60 and 120 months

Age in months		22	42	60	120
Age in months	22				
	42	0.38			
	60	0.27	0.41		
	120	0.31	0.46	0.48	
Final Qualification		0.11	0.29	0.34	0.55

Row 4 of Table 5 shows the correlation of test ranks at 22, 42 and 60 months with test rank at 120 months, increasing as children matured. However, it can also be seen from Table 5 that the big increase in raw correlation with 120 month attainment came between 22 and 42 months. The 22 month score was strongly correlated with the 42 month score, though less so with the 60 month and 120 month scores. The 42 month score, however, was almost as strongly correlated as the 60 month score with the 120 month score. Restricting the sample to the control group does not change this pattern.[6] The final row shows the strong correlation of 42 month rank with final educational outcome, although, the ten year rank is even more strongly correlated with final qualifications.

If observations are considered separately by gender, the picture changes slightly. Essentially, girls appear to develop more quickly than boys so that for girls the 22 month rank is nearly as well correlated as the 42 month rank with subsequent ability.[7]

Table 6 reports the raw correlation of the individual components of each age's test score with the test results at age ten.

Table 6
Raw correlation of individual test scores with scores at 120 months

6. The correlation of the five year rank with the ten year rank is marginally increased to 0.49, that of the earlier ranks with the ten year rank marginally reduced, 0.28 and 0.44.

7. For girls the correlation of final qualification with the 22 month rank is much higher at 0.17 and with 42 month rank lower at 0.22. The other gender difference is that the age ten rank is more highly correlated with final qualification for girls (0.62) than for boys (0.51).

	120 months		
	Reading	Maths	Overall Rank
22 month scores			
Cube stacking	0.21	0.10	0.23
Language use	0.22	0.11	0.22
Personal dev.	0.21	0.13	0.22
Drawing	0.16	0.15	0.17
42 month scores			
Counting	0.30	0.12	0.32
Speaking	0.31	0.16	0.31
Copying designs I	0.30	0.14	0.34
Copying designs II	0.25	0.10	0.25
60 month scores			
Copying designs	0.41	0.22	0.45
Vocab	0.33	0.17	0.39
Profile drawing	0.15	0.08	0.17

Note: As described in the text the overall rank at 120 months is computed by principal-component analysis, the four component scores being reading, maths, picture language test and the British Ability Scale.

Table 6 highlights the general finding that reading scores are more easily predicted than maths scores and also shows that the copying score at age five is more highly correlated than the vocabulary score with both reading and maths at age ten. At the earlier ages no single test dominates in terms of degree of association with subsequent scores, even, as with reading and vocabulary, in what one might expect to be related subjects. Cube stacking and language scores at 22 months are equally associated with reading at age ten, so are counting and speaking at 42 months. The 42 month speaking test score is more highly correlated than the counting score with maths at age ten. These correlations suggest that there is no particular connection between scores in tests of specific abilities at early ages and subsequent performance in more demanding tests of the same abilities. Rather, early test scores, particularly those at 42 months, appear to prefigure later ability, but in a more general manner. The development of attainment through childhood is not, in this way, akin to a time-series of observations of, for example, Gross Domestic Product, because the variable itself changes as children mature. This must be borne in mind in thinking about the childhood development of human capital and considering the series of data on rank at the four sweeps. However, the combined, overall test score does appear from these raw correlations to show considerable association with developing educational performance.

A second approach to the initial question of the stability of the distribution of scores as the children develop is to consider transition matrices. Table 7 reports mobility from quartile position at 22 months for all children in the full 22 month sub-sample. The first aspect considered is that of mobility in the full sub-sample including over-sampled observations, comparing this to mobility in the control group. A second issue discussed is the comparison of mobility amongst boys to that amongst girls.

Table 7
Quartile transition matrix for movements from position at 22 months to positions at 42, 60 and 120 months, percentages of the full 22 month sub-sample

	Quartile at 42 months (1170 children)				Quartile at 60 months (1954 children)				Quartile at 120 months (1649 children)			
	1st	2nd	3rd	Top	1st	2nd	3rd	Top	1st	2nd	3rd	Top
Quartile at 22 months												
1st	44.4 (1.5)	25.9 (1.3)	16.1 (1.1)	13.1 (1.0)	39.5 (1.1)	23.5 (1.0)	21.2 (0.9)	16.0 (0.8)	41.4 (1.2)	24.5 (1.1)	17.7 (0.9)	17.0 (0.9)
2nd	25.3 (1.3)	31.0 (1.4)	27.7 (1.3)	16.5 (1.1)	27.1 (1.0)	27.8 (1.0)	23.3 (1.0)	21.8 (0.9)	25.9 (1.1)	29.9 (1.1)	23.3 (1.0)	20.4 (1.0)
3rd	20.2 (1.2)	22.1 (1.2)	30.5 (1.3)	27.1 (1.3)	21.6 (0.9)	25.3 (1.0)	28.2 (1.0)	25.7 (1.0)	21.1 (1.0)	24.3 (1.1)	29.9 (1.1)	25.0 (1.1)
Top	10.1 (0.9)	21.0 (1.2)	25.7 (1.3)	43.3 (1.4)	11.8 (0.7)	23.5 (1.0)	27.3 (1.0)	36.6 (1.1)	11.6 (0.8)	21.4 (1.0)	29.1 (1.1)	37.6 (1.2)
Chi-squared: (dof=15)		6.3			4.2				10.2			
Indices of Mobility:												
Summation of leading diagonal and adjacent elements:												
Full sub-sample		0.76			0.71				0.73			
Control Group		0.76			0.70				0.68			
Bartholomew Index:												
Full sub-sample		0.93			1.03				1.00			
Control Group		0.95			1.06				1.09			
Bartholomew Squared Index:												
Full sub-sample		3.42			4.02				3.92			
Control Group		3.28			4.21				4.48			
Shorrocks Index:												
Full sub-sample		0.84			0.89				0.87			
Control Group		0.87			0.91				0.91			

Notes: Standard Errors are in brackets
The reported Chi-Squared Test is a test of the difference between transition matrices of the control group and full sub-sample.
The Bartholemew index is given by $\Sigma_i p_i \Sigma_j p_{ij} |i - j|$ where p_j denotes the proportion of children moving into quantile j from initial quantile i and p_i denotes the proportion of children in row i.
The Bartholemew squared index replaces cell weights $|i - j|$ by $(i - j)^2$. The Shorrocks' Index is given by (n - trace P)/(n-1) where P is the transition matrix.
The critical level at 5% for a chi-squared test with 15 degrees of freedom is 25.0

The first column shows that of the 25% of children scoring lowest at 22 months, 44% were still in the lowest quartile at 42 months. On the other hand, 13% had entered the top quartile. Of the top quartile, 43% were still in the top quartile at 42 months and 10% had fallen the bottom quartile. Clearly there is movement within the distribution over these twenty months but there is also evidence of some rigidity. By 60 and 120 months, even more children had made large movements across the distribution. For example, of those in the bottom quartile at 22 months, 35% were in the top of half of the distribution by age 10 and they were just as likely to be in the top quartile as the third quartile. Slightly fewer children had fallen the other way but such movements were far from rare. These transition matrices suggest considerable instability between the early score at 22 months and the position at subsequent ages while still indicating that the 22 month score does provide some guide to subsequent performance.

However, the degree of movement observed might be affected by the over-sampling of children at risk from fetal under-nourishment. If such children are hindered in early years but subsequently catch up, mobility will be over-stated in this sub-sample relative to that in the population. On the other hand, if such children are persistently affected, mobility might be under-stated. Chi-squared tests for contingency tables are applied and presented in the bottom section of Table 7. These suggest that there is no significant difference between the transition matrices for the full sub-sample and those for the control group. However, the contingency table approach weights all cell changes equally, ignoring the issue of mobility. In order to compare mobility in the full sub-sample and in the smaller, random control group a measure of mobility is required. A simple indicator is the proportion of children on the leading diagonal and in adjacent cells, a high score indicating immobility. Alternatively, the Bartholemew index (Bartholomew, 1973) weights cells by their distance from the leading diagonal, a high overall score indicating a large degree of mobility.[8] Shorrocks (1978) suggests a third index that, unlike the Bartholomew Index, satisfies the requirement of monotonicity while still ranging from zero to one where one denotes perfect mobility.[9]

The Batholemew and Shorrocks Indices in the bottom section of Table 7 suggest that there is marginally more mobility between 22 and 42 months in the control group than in the sub-sample as a whole. This suggests a degree of persistence in the effects of fetal under-nourishment to pre-school ages. The simple summation index, however, suggests equal mobility in the control group and in the sub-sample in terms of the probability of children maintaining their quartile position or moving only to the adjacent quartile. The reason for this divergence is that although a larger proportion of children in the control group than in the sub-sample maintain their position on the diagonal, many more also move to cells adjacent to the diagonal and so contribute to both indices. For present purposes, it is not obvious whether or not movement to cells adjacent to the leading diagonal represents mobility. Given the large degree of

8. The Bartholemew index is given by $\Sigma_i p_i \Sigma_j p_{ij} |i - j|$ where p_{ij} denotes the proportion of children moving into quantile j from initial quantile i and p_i denotes the proportion of children in row i.

9. The Shorrocks Index is given by (n - trace P)/(n-1) where P is the transition matrix. In fact, this index only satisfies the axioms of monotonicity, mobility and perfect mobility for those matrices that have a quasi-maximal diagonal. Shorrocks considers a transition matrix with equal rows to have perfect mobility and neglects that unlikely class of transition matrices where the probability of remaining in the same quantile is less than that of moving. See Shorrock (1978) for a discussion of the axioms of mobility and the assessment of indicators.

instability in scores at these ages, perhaps more interesting are movements from top to bottom and vice versa. Squaring the weights used in the Bartholomew Index adds extra emphasis to three- and two-quartile movements. The probability of such movements is higher in the full-sample than in the control group, suggesting that both persistence and extreme movements are more likely in the sub-sample than would be predicted for the wider population, between 22 and 42 months.

Between 22 months and the later ages, however, mobility is clearly higher in the control group, particularly by the adjusted Bartholomew Index. Thus, the over-sampling does appear to increase the probability of persistence in the quartile position. However, these indices fails to distinguish between movements from top to bottom and those the other way. Table 8 reproduces such movements from Table 7, introducing those for the control group.

Table 8
Selected cells from quartile transition matrices for movements from position at 22 months to positions at 42, 60 and 120 months, for the full 22 month sub-sample and the control group

		Quartile, %					
		42 months (1170 children)		60 months (1954 children)		120 months (1649 children)	
		Bottom	Top	Bottom	Top	Bottom	Top
Full sub-sample	Bottom	44.4	13.1	39.5	16.0	41.4	17.0
		(1.5)	(1.0)	(1.1)	(0.8)	(1.2)	(0.9)
	Top	10.1	43.3	11.8	36.6	11.6	37.6
		(0.9)	(1.4)	(0.7)	(1.1)	(0.8)	(1.2)
		42 months (534 children)		60 months (903 children)		120 months (764 children)	
		Bottom	Top	Bottom	Top	Bottom	Top
Control group	Bottom	41.8	12.8	38.3	15.9	36.6	19.4
		(2.1)	(1.4)	(1.6)	(1.2)	(1.7)	(1.4)
	Top	6.7	43.6	14.5	38.1	13.1	32.5
		(1.1)	(2.1)	(1.2)	(1.6)	(1.2)	(1.7)

Table 8 shows that the additional extreme mobility in the full sub-sample between 22 and 42 months was primarily from the top to the bottom of the distribution, not obviously explained by fetal under-nourishment unless there are delayed effects. In any case, this difference had been eroded by age five. As one would expect, the proportion of children remaining on the two cells of the leading diagonal presented in Table 8 falls as the destination age rises for both samples, although for the full sub-sample the increase in mobility is reversed slightly between age five and age ten.[10] Estimating transition probabilities from the control group, those in the bottom quartile at 22 months have a 36% probability of remaining there until at least age ten. 20%, however, will rise to the top quartile.

10. This is not an artefact of treating boys and girls together. The pattern holds when both boys and girls considered separately.

Table 9 reports similar transition matrices for children in terms of their 42 month quartile.

Table 9
Quartile transition matrix for movements from position at 42 months to positions at 60 and 120 months, percentages of the full 22 month sub-sample

	Quartile at 60 months (1170 children)				Quartile at 120 months (1954 children)			
Quartile at 42 months	1st	2nd	3rd	Top	1st	2nd	3rd	Top
1st	47.7 (1.4)	25.2 (1.3)	17.3 (1.1)	10.3 (0.9)	44.5 (1.6)	28.1 (1.4)	16.6 (1.2)	11.1 (1.0)
2nd	26.2 (1.3)	31.6 (1.3)	23.6 (1.2)	18.3 (1.1)	32.7 (1.5)	32.4 (1.5)	20.6 (1.3)	14.2 (1.1)
3rd	16.9 (1.1)	25.2 (1.3)	30.9 (1.3)	26.9 (1.3)	15.0 (1.1)	22.5 (1.3)	30.4 (1.4)	32.0 (1.5)
Top	9.3 (0.8)	17.9 (1.1)	28.2 (1.3)	44.5 (1.4)	7.9 (0.8)	17.0 (1.2)	32.4 (1.5)	42.7 (1.6)
Chi-squared: (dof=15)	6.3				10.3			
Indices of Mobility:								
Summation of leading diagonal and adjacent elements:								
Full sub-sample		0.78			0.80			
Control Group		0.75			0.79			
Bartholomew Index:								
Full sub-sample		0.89			0.88			
Control Group		0.93			0.91			
Bartholomew Squared Index:								
Full sub-sample		3.12			2.95			
Control Group		3.50			3.40			
Shorrocks Index:								
Full sub-sample		0.82			0.83			
Control Group		0.82			0.85			

Notes: See Table 7

The chi-squared test suggests that the matrices for the full-sample are unbiased by the over-sampling and only by the squared Bartholomew Index is there support for a difference in the degree of mobility, there being a greater number of large movements in the control group; 16% of those in the top quartile at 42 months, for example, had fallen to the bottom quartile by age 10 as opposed to the 8% shown in Table 9. For the full sub-sample, however, there is clear persistence of scores between 42 months and ten years and as one would expect, the position at 42 months seems to be more firmly fixed than that at 22 months. Nearly half of those in the bottom quartile were still in the bottom quartile at 5 years and 45% were still there at 10 years. Over 40% of the top quartile were still in the top quartile at 10 years. This was also true for those in the control group.

Given the gender differences in the correlation coefficients, particularly the fact that 22 month rank is a much better predictor of subsequent ability for girls than for boys, it might be expected that there would be more mobility from 22 months for boys than for girls. This is, in fact, marginally so. Between 22 months and 42 months the Squared Bartholomew Index is 3.4 for boys and 3.3 for girls. The big difference is that whereas only 40% of sub-sample boys maintained their position in the top quartile of all children, 47% of sub-sample girls did so. There were also more extreme movements between quartile at 22 months and that at five years. Overall, the chi-squared tests for gendered differences in the degree of mobility were not accepted for any transition matrix at 5%.

Taking the evidence of the mobility tables and the raw correlations, the score at 42 months appears to be a more stable indicator of underlying ability than that at 22 months but the 22 month score cannot be discounted as random and without forecasting power. For girls it is more stable than for boys.

5. The Association of Early Rank With Age Ten Educational Provision

Another aspect of the importance of early rank is that it influences subsequent educational provision. At age 10 (1980), 51% of BCS children were streamed in maths, 47% in reading. Streams were classified into three groups by teachers and the probability of being in the top or bottom streams for reading and maths, conditional on being in a streamed school were regressed on ability rank at the three prior ages. Results from these probit regressions are shown in Table 10. The final column of Table 10 reports a regression of the peer group in which the child is taught at age ten on prior ability. The Peer Group Index used here is taken from Feinstein & Symons (1997) and measures the social class and ability of class members as reported by teachers.

Table 10
Associations of early ability rank and educational provision at age 10

Age	High maths stream	Low maths stream	High reading stream	Low reading stream	Peer group quality
22 month rank/100	0.01 (0.2)	0.00 (0.1)	0.00 (0.1)	-0.11 (1.5)	0.1 (0.1)
42 month rank/100	0.26 (3.2)	-0.25 (3.4)	0.35 (3.8)	-0.30 (3.8)	2.7 (2.4)
5 year rank/100	0.34 (4.2)	-0.28 (3.8)	0.40 (4.4)	-0.19 (2.4)	3.0 (2.7)
Obs.	501	501	414	414	645
R^2	0.07	0.08	0.10	0.10	0.04

Notes: Coefficients reported in first four columns are marginal effects from probit regressions. The final regression is by OLS. The Peer Group Index ranged from 0-100 based on the social class and ability of class members as reported by teachers. t-statistics in brackets.

Evidently, 42 month ability is strongly associated with the educational opportunities provided to children, even conditioning on 5 year ability.[11] Children who are doing well at 42 months are likely to be placed in better classes. The fact that the 22 month rank is insignificant in these regressions should not be taken to imply that the experiences of children up to 22 months are not important. It may, rather, be that the 22 month rank carries less information about developing ability and that tests before 42 months are extremely unstable.[12]

The first question to be addressed in this paper was whether or not early measures of ability were correlated with later ability and qualifications. The mobility tables show that educational positions are far from being fixed before children enter school but we have also seen that pre-school ability is strongly correlated both with ultimate educational success and with the schooling opportunities made available to children.

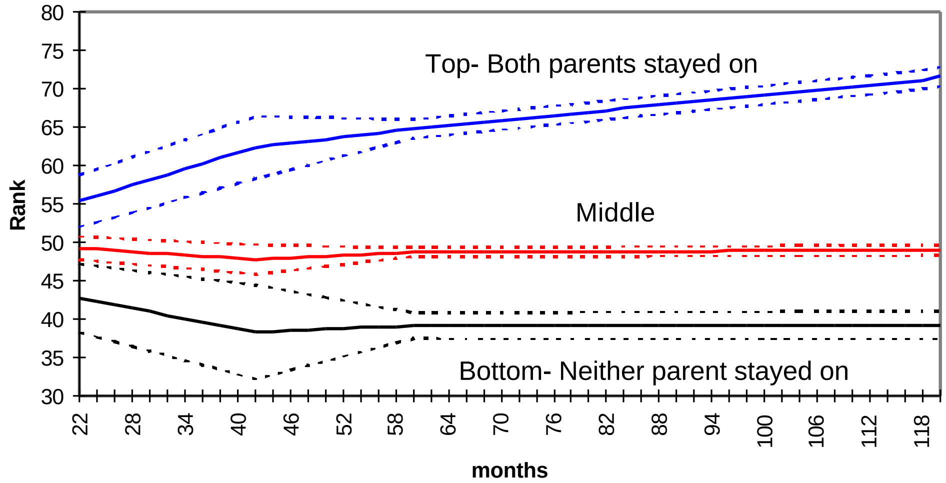
6. The Raw Association of Test Rank With Social Class

Having established the predictive correlation and persistence of positions in the distribution of pre-school ability, the second question to be addressed is the extent to which these positions are associated with aspects of social class. Figures 3a-3d map the average position of children from different social backgrounds in the distribution at the four survey ages. The dotted lines show the two standard error interval. Figures 3a and 3b show that whether children are grouped by the education of their parents or their parents' occupational classification (Socio-Economic Status, SES), there are already significant differences in test outcomes by 22 months. For example, children whose parents stayed on at school beyond the minimum leaving age are already fourteen percentage points higher up the distribution than those whom neither parent stayed on and seven points higher than those with one parent who stayed on.

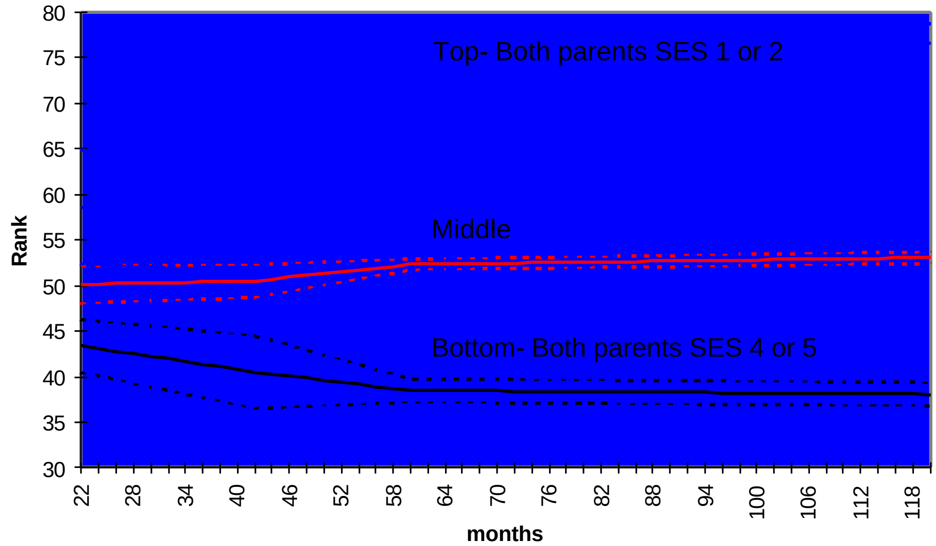
Figures 3a-3d
Average rank of test scores at 22, 42, 60 & 120 months

3a - By schooling of both parents

11. This remains the case even when parental education and occupational classification are introduced.
12. Although the raw correlation of the 22 month rank with later outcomes is greater for girls than for boys (See Footnote 7), the 42 month and five year ranks are still sufficient for explanation of the dependent variables in Table 10 for boys and girls taken separately.

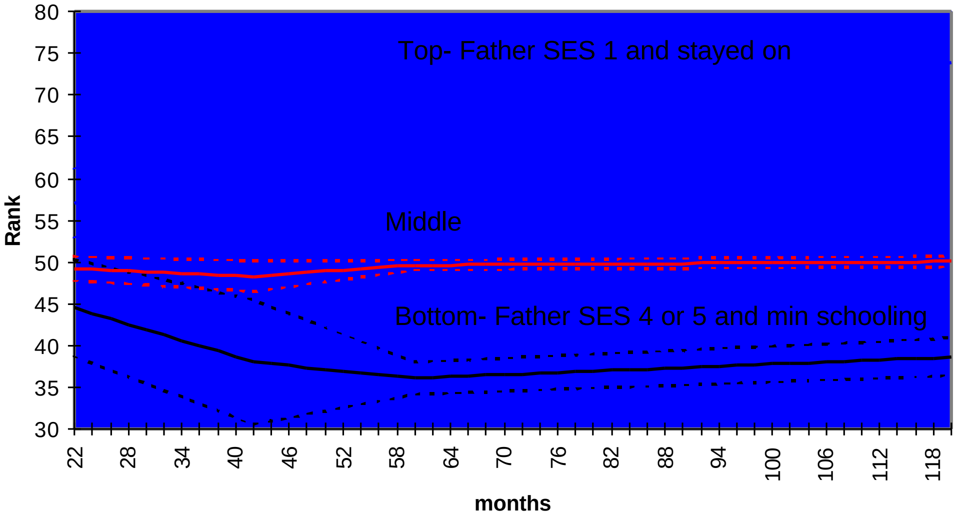


3b - By SES of both parents

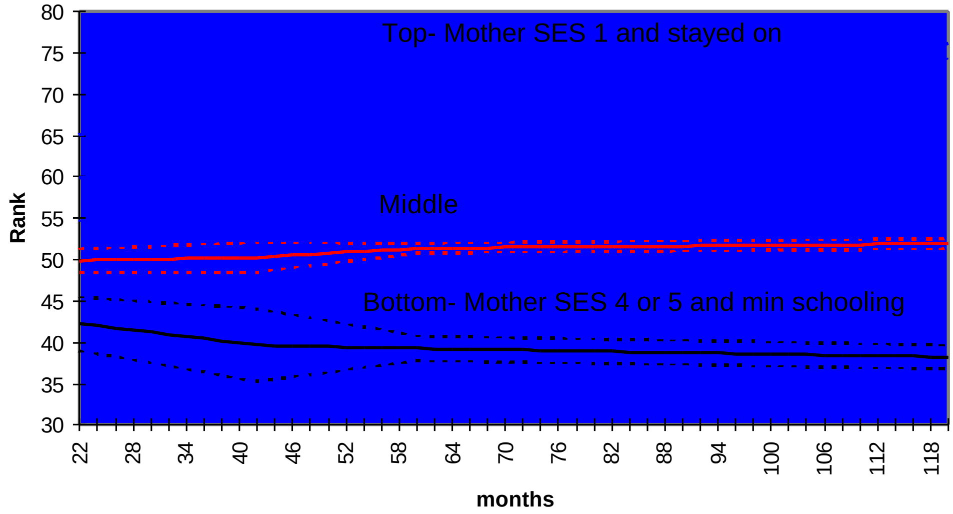


Concentrating instead on differences in the backgrounds of one parent only, Figures 3c and 3d show that whether the mother or father is selected, significant differences between children have already emerged. One interesting difference between Figure 3c and 3d is that where children are classified according to the education and occupational category of their mothers, the bottom group is already performing significantly worse in tests than the middle group, whereas this is not the case when the children are classified according to their father's social class. This provides some support for theories which emphasise the importance of early interactions between children and their dominant parent, normally mothers. Only later does the effect of fathers come in strongly. Nonetheless, by matching between parents or through the direct effect of fathers, children of fathers in the top group are already scoring significantly more highly than those in the middle group by 22 months. There is strong evidence here of extremely early social class associations. These might, of course, be genetically caused or the product of specific parenting skills.

3c - By SES and schooling of fathers



3d - By SES and schooling of mothers



The ability trajectories also show that as children mature, the social class association strengthens. Of course, the trajectories should not be considered as time-series even though they are mapped here over a time axis. This is done in order to highlight the way in which the most advantaged children start from a higher position in the distribution at 22 months and then move to steadily higher positions at later ages. The improvement in their position, moreover, is fairly steady and there is no obvious change induced by schooling. The decline in position of the least-advantaged children, however, does appear to slow after they have entered school, suggesting that schooling provides important opportunities for learning particularly for those from the worse end of the social class spectrum. However, social class, of course, has many facets and these raw associations say nothing about which aspect of social class is important. The simple occupational classification used in the ability trajectories is associated with almost every aspect of a child's upbringing. Appendix Table A1 reports basic statistics for the social class information available in the BCS. Table 11, on the following page, shows the associations of these general, background variables with the occupational classifications, reporting the results from twenty-seven regressions. The first column shows the dependent variable, each regressed on two dummy variables, indicating fathers in top or middle occupational classifications.

Table 11
Channels for SES effects, marginal effects from OLS and probit regressions

	Father's SES					
	1,2		3M, 3NM		Obs	R^2
	Est	t,z	Est	t,z		
1. Mother educ>min	0.38	29.4	0.07	6.1	12884	0.07
2. Father educ>min	0.56	41.1	0.17	14.3	12796	0.14
3. Mother's age	1.93	13.0	0.42	3.2	12792	0.02
4. No. of older sibs, 1970	-0.35	12.0	-0.18	7.5	17011	0.01
5. No. of younger sibs, 1975	-0.07	4.1	-0.02	1.4	12939	0.00
6. Weight at birth, 1970	0.15	15.4	0.09	11.6	16976	0.02
7. Weight , 1972	0.36	3.9	0.13	1.9	2310	0.01
8. Weight , 1973	0.65	5.3	0.21	2.2	2160	0.01
9. Height , 1975	1.68	12.4	0.70	6.0	12707	0.01
10. Multiple birth	0.02	0.8	0.01	1.0	2445	0.00
11. Postmature birth	-0.04	1.2	-0.00	0.1	2445	0.00
12. Small for dates	-0.10	3.7	-0.05	2.6	2445	0.01
13. Mother's interest in ed., 1980	0.78	24.9	0.21	8.0	11228	0.03
14. Father's interest in ed., 1980	1.27	38.8	0.62	21.5	11374	0.06
15. Mother full-time, 1972	-0.00	0.2	-0.01	0.9	2423	0.00
16. Mother part-time, 1972	0.02	0.7	0.01	0.5	2423	0.00
17. Mother full-time, 1973	-0.00	0.2	-0.01	0.9	2282	0.00
18. Mother part-time, 1973	-0.04	1.3	0.00	0.1	2282	0.00
19. Mother full-time, 1975	-0.02	3.2	-0.02	3.8	12939	0.00
20. Mother part-time, 1975	0.02	1.4	0.05	5.0	12939	0.00
21. Mother full-time, 1980	-0.01	0.6	-0.02	1.8	12611	0.00
22. Mother part-time, 1980	0.06	4.6	0.08	7.0	12611	0.00
23. Mother's Malaise score (0-23), 1975	-2.0	21.6	-0.7	9.1	12789	0.04
24. Lone mother, 1975	-0.03	7.4	-0.02	8.1	13135	0.02
25. Lone mother, 1980	-0.02	5.4	-0.02	6.6	13708	0.01
26. Telephone, 1975	0.43	35.3	0.21	20.5	12972	0.08
27. Persons per room, 1975	-0.24	26.3	-0.09	12.9	12812	0.05

Table 11 shows that children with parents in more manual occupations are likely to get less of what is generally found to be supportive of academic success and more of what is found to be bad. For example, as Haveman and Wolfe (1995) describe, family size and low parental education are almost universally found to be negatively associated with the educational attainment of children. Table 11 shows that working class children in the sample came from larger families with lower levels of parental education. Working class children are also likely to have lower levels of nutrition and hence birth weight and a greater likelihood of being small relative to gestation period. Douglas *et al* (1968) have described the negative effects of low nutrition and poor health on ability at age eight for the 1946 Cohort. Family breakdown is also more likely as is over-crowding. Again, many previous studies have found associations of poor housing with school age performance (See, for example, Davie *et al* 1972, Douglas, 1964).

Feinstein and Symons (1997) show that the interest parents take in their children's education is the major determining factor in their children's educational success, either as a proxy for educational inputs or as a direct determinant. Rows fourteen and fifteen show that parental interest is strongly correlated with social class. The mother's malaise score is an index of psychiatric well-being. Mortimore and Blackstone (1980) summarise evidence that the mother's psychological state is important to the early development of the child. Again, Table 11 shows that this factor in educational development works against children with fathers in lower SES groups.[13]

Finally, Table 11 shows that mothers married to men in the lower SES groups are also, generally, able to space their work episodes more sensitively to the educational and emotional needs of their children. Thus, for this 1970-1980 sample of mothers, working class mothers were more likely to be working full-time before the child had entered school and less likely to be working part-time although these associations are not statistically significant. Once the child had started school, top and particularly middle SES mothers were much more likely to be working part-time. Leibowitz (1974) found that the hours mothers spent with their pre-school children was significantly and positively associated with the subsequent IQ of their children. This is by no means, however, an invariant finding. Other researchers, Blau and Grossberg (1990), for example, found smaller effects of mother's labour market status and then only for mothers working in the first year of their child's life. Desai *et al* (1989) also only found negative effects for mothers working in the first year of their child's life and then only for boys from high income families. Much depends on the data set chosen, in particular the detail of information about the ways in which children spend time, and the model used. Nonetheless, Table 11 clarifies the point that working class mothers are those most unable to give up time for childcare in the early years of their children's lives.

Clearly, therefore, the raw association with social class masks a number of possible kinds of effect.

7. Aspects of Class Associated With Early Attainment

A simple approach to the question of what aspects of social class are most strongly associated with early attainment is that of a conditional expectation. No structural model is suggested and no claims of causality are made but the conditional expectation is suggestive of general patterns of association. As Rutter and Madge (1976) point out, although there is substantial evidence that material and social class factors influence the

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13. Since 24% of mothers scored zero or one on the malaise score, co-efficients of 2 and 0.7 imply quite large movements along the distribution of psychiatric well-being. They are also highly significant.

educational performance of children, many of the associations are indirect and the channels are unclear. Thus, although the quality of housing is clearly important in explaining the variance of schooling outcomes, it is entirely plausible that it acts as a proxy for unobserved schooling variables. That criticism is accepted here for all the dependent variables used below. Moreover, it is unclear whether and to what extent, the underlying processes are genetic, material, or psychological. The interest, however, lies in the question of whether there is segmentation of children by aspects of social class before they have even entered school.

Table 12 reports conditional expectations for attainment at 22 and 42 months in terms of some of the broad aspects of social class shown in Table 11. Weighted OLS is used to reduce the importance of over-sampled observations[14] but none of the conclusions described depend on sampling bias, transformations of the data or problems of discreteness or censoring.[15] For the reported regressions, observations were grouped across genders but separate regressions were also run. In those cases where the pattern was significantly altered, this is discussed in the text and footnotes.

Table 12
Conditional expectation - Test ranks regressed on background variables

	22 months		**42 months**	
	Est.	t	Est.	t
Girl=1	5.8	4.1	7.6	3.8
Mother educ > min.	0.5	0.3	3.0	1.3
Mother degree	12.4	2.3	14.1	2.2
mother’s age	0.2	1.3	0.2	0.6
Father educ. > min.	0.7	0.4	8.3	3.3
Father’s degree	4.2	1.7	0.3	0.1
Father’s age	-0.0	0.2	0.1	0.6
Father’s SES=1,2	1.6	0.7	8.5	2.4
Father’s SES=3M,3NM	-1.7	0.9	6.9	2.6
No. of older sibs.	-2.7	4.2	-4.2	4.1
No. of younger sibs			-2.4	1.2
One non-UK parent	-5.7	1.7	-5.7	1.2
Constant	-10.1	0.9	-122.6	3.9
Obs	1626		832	
R^2	0.06		0.14	

Notes: Observations are re-weighted by the formula $w_2=w*w_1$ where w_1 and w_2 are the weights of randomly sampled and over-sampled observations and w is the ratio of observations in the sub-sample as a whole to the full BCS sample at birth, 0.142. The number of observations is maintained at the level of unweighted OLS by the formula $n_1w_1 + n_2w_2 = n_r$ where n_1 and n_2 are the numbers of randomly sampled and over-sampled observations in the regression at each age and n_r is the number of observations in the unweighted OLS regression. Controls for reason for inclusion in the sub-sample are also included but not reported here.

14. See notes to Table 12

15. If mobility in the control group is higher than for the fetally undernourished groups then parameter estimates based on the latter groups might be biased downwards but the pattern of results described below changes very little if only control group observations are used. Inferences are also unchanged if the rank score dependent variable is replaced by the continuous test score variables (shown in Figures 1a-1d) using Tobit regression to correct for the evident lower censoring which might also have caused downward bias.

Table 12 shows that, conditioning for parental education and family structure, raw differences between children classified by their father's occupation do not emerge until 42 months. At 22 months, family size is important and girls do much better than boys but the largest association is with mother's possession of a degree. Children of mothers with degrees are more than 12 percentage points higher up the distribution of scores than those without. This is, perhaps, the result of the additional time spent with children by women with degrees observed by Hill and Stafford (1980) [16] although the quality of time spent or genetic inheritance or also plausible interpretations of this finding. Interestingly, for boys taken separately, this figure is 21 percentage points (standard error: 7.1, significant at 1%), whereas for girls the advantage at 22 months of a mother with a degree is only 3.1 (standard error: 8.4)![17]

At 42 months, the association with mother's education is still much the strongest but associations with other variables have also become stronger, in particular the SES variables and the father's education. There is, therefore, clear evidence of social class differences in pre-school educational development. The mother's education is particularly important but even controlling for education and family size, children in the lowest SES groups are already falling behind children in other SES groups in terms of the development of educational ability.

There are three significant gender differences at 42 months. Mother's age predicts the rank of girls while being insignificant to that of boys. Membership of the top social class by father's occupation is more important to boys than to girls. For boys the coefficient is 14.4 (standard error: 4.6), for girls it is 1.6 (standard error: 5.3)! Finally, each younger sibling loses boys 5.2 percentage points (standard error: 2.5) while the coefficients for girls is positive though insignificant at 10%. The generally larger coefficients for boys can be partly explained by the fact that there are substantially more girls than boys in the top of the distribution. Table 13, shows how these early differences continue into school.

Table 13
Conditional expectation - Test ranks on background variables

	5 years		10 years	
	Est.	t	Est.	t
Rank at 42 months	0.36	12.3		
Rank at 60 months			0.39	40.2
Girl=1	-7.2	4.2	0.6	1.1
Mother educ > min.	1.9	0.9	7.7	12.3
Mother degree	3.7	0.7	6.2	3.7
Mother's age	0.1	0.3	0.3	5.2
Father educ. > min.	-3.0	1.4	5.8	8.8
Father's degree	1.8	0.6	4.6	5.1
Father's age	0.1	0.7	-0.0	0.8
Father's SES=1,2	9.0	2.9	8.1	9.1

16. Hill and Stafford (1980) find that, conditioning on family size, mothers of children under three years old, in the US, with at least some college education spend just over two more hours per week on child care than mothers with less education. In an earlier study (1973) they find that women from high SES groups spend between two and three times as much time in pre-school child care than lower status mothers. In Table 12, however, it is the mother's education rather than SES that explains differences in attainment.

17. The other significant gender difference at 22 months is that mother's age is positively associated with rank for girls but not for boys. An increase in age of one year is associated with an increase in rank of 0.9 (standard error 0.3) for girls and -0.2 (standard error 0.2) for boys.

Father's SES=3M,3NM	2.0	0.9	2.9	4.0
No. of older sibs.	-1.3	1.4	-3.5	12.2
No. of younger sibs	-1.3	0.9	-1.4	4.5
One non-UK parent	1.4	0.4	-4.5	3.9
Constant	33.2	6.1	23.2	14.0
Obs	919		8041	
R^2	0.22		0.35	

Notes: Regression at 5 years re-weighted as described in Notes to Table 12

Between 42 months and five years there is only a small degree of catch-up for children from less-educated families although their decline is halted. Boys also catch-up with girls but children from higher SES groups accelerate away between these ages, particularly those from families with professional fathers. Then between five and ten years, the education of parents, occupational category and family size all play a large role in further segregating children into ability groups. These results also hold across genders. Thus, school entry does appear to temporarily slow the effects of advantages accruing to children from more highly educated families but occupational status becomes more important, perhaps because of peer groups or other aspects of school quality. In any case, this slowing of parental education effects appears to be temporary.

Tables 10 and 11 consider attainment in terms of broad aspects of social class but a number of finer measures are also available in the BCS, proxies for social exclusion, nutrition, attitudes and maternal working patterns. Tables 14-17 report the associations of these variables with attainment at 22 months, conditioning on the variables in Table 12. Because not all information was requested in the sub-sample surveys, some of these variables are only available when the children were age five or ten (see Table 12). The measurement error implicit in the assumption that, for example, families without telephones in 1975 were also without telephones in 1972 or 1973 will bias regression coefficients towards zero, strengthening actual significance levels.

Table 14

Conditional expectation - Introducing additional background variables at 22 months by OLS (conditioning on variables in Table 12)

Social Exclusion					
Telephone	3.5 (2.2)	4.0 (2.4)	2.8 (1.5)	3.4 (2.1)	
Persons per room	-5.9 (2.2)	-5.9 (1.7)	-4.9 (1.6)	-6.2 (2.2)	
Father unemployed	-4.2 (1.2)	-4.5 (1.2)	-3.7 (1.0)	-4.1 (1.2)	
Nutrition					
Birth weight, gm		0.0 (0.3)			
Height at 22 months, cm		2.73 (1.7)			
Attitudes					
Mother's interest in ed., 1980			-1.1 (1.3)		
Father's interest in ed., 1980			1.2 (1.7)		
Mother's work and well-being					
Mother works full-time				-0.1 (0.0)	2.3 (0.5)
Mother works part-time				0.2 (0.1)	1.2 (0.5)
Mother's Malaise Score, 1975					-0.3 (1.5)
Obs	1554	1455	1224	1546	1603
R^2	0.06	0.07	0.07	0.06	0.05

Notes: t-statistics in brackets, reweighting as described in notes to Table 12

57% of the children in the full sample lived in households with a telephone in 1975. Table 14 shows that children in families with a telephone were ranked lower than other children by 22 months. Over-crowding was also associated with lower attainment as was nutrition as assessed by height at 22 months. Parents' interest in the education of their children was assessed at age ten. There is no clear association of subsequent educational attitudes with early attainment. Neither is there any association with mothers' labour market activity. In conclusion, therefore, at 22 months the strong associations are with mother's education, family size and social exclusion, including over-crowding.

However, this general picture excludes two gender differences for which the cross-gender differences in coefficients are significant at 5%. Firstly, the social exclusion variable, telephone ownership, is only significantly associated with rank at 22 months for boys. Secondly, the mother's Malaise Score is strongly negative for boys but not for girls; -0.9 (standard error: 0.3), and 0.2 (standard error: 0.3), respectively.

Table 15

Conditional expectation - Introducing additional background variables at 42 months by OLS (conditioning on variables in Table 12)

Social Exclusion					
Telephone	6.5 (2.8)	5.8 (2.5)	4.0 (1.6)	6.2 (2.6)	
Persons per room	-12.3 (2.6)	-13.9 (3.0)	-8.2 (1.5)	-12.6 (2.7)	
Father unemployed	-0.3 (0.0)	-0.7 (0.1)	-4.3 (0.5)	-0.7 (0.1)	
Nutrition					
Birth weight, gm		2.9 (1.2)			
Height at 42 months, cm		0.6 (2.6)			
Attitudes					
Mother's interest in ed., 1980			1.9 (1.5)		
Father's interest in ed., 1980			1.8 (1.7)		
Mother's work and well-being					
Mother works full-time				-11.0 (1.8)	-9.3 (1.6)
Mother works part-time				-2.9 (1.2)	-2.7 (1.1)
Mother's Malaise Score, 1975					-0.7 (2.4)
Obs	787	765	635	782	824
R^2	0.15	0.15	0.13	0.15	0.14

Notes: As Table 14

Table 15 shows that by 42 months there were still stronger associations with social exclusion, in particular persons per room. There appears to be an interaction with family size. Introducing the persons per room variable (holding observations constant) reduced the negative association with older siblings from 3.3 (standard error: 1.1) to 1.9 (standard error: 1.2), suggesting that family size is associated with reduced attainment not just because each individual child receives less parental time but also because of housing conditions.

Nutrition and attitudes were also more strongly associated with attainment at 42 months than at 22 months.[18] A Malaise Score of 20 points, indicating likely psychiatric problems for the mother, was associated with a 14 percentage point reduction in the child's rank. Also stronger at 42 months was the association with mother's labour market activity, particularly for full-time work which was associated with an eleven percentage point decline in attainment rank. It is, of course, entirely possible that this is a selection effect, not due to any causal effect of maternal time and it is worth pointing out that the sub-sample probability of mothers working full-time conditional on possession of a degree was zero when the children were 42 months or five years old had degrees but 0.24 (standard error: 6.6) by the time the children were age ten.[19] As well as the problem of selectivity, it is also the case that there was a strong gender difference found in relation to the association with mother's labour force status. The coefficient for boys was 1.8 (standard error: 6.9) but that for girls was -39.7 (standard error: 11.2)!

Table 16

Conditional expectation - Introducing additional background variables at 5 years by OLS (conditioning on variables in Table 13 including rank at 42 months

Social Exclusion					
Telephone	5.0 (2.7)	4.3 (2.3)	4.5 (2.2)	4.8 (2.6)	
Persons per room	-8.2 (2.0)	-6.4 (1.5)	-8.5 (1.9)	-8.2 (2.1)	
Father unemployed	-12.6 (2.1)	-12.2 (2.0)	-14.2 (2.4)	-12.9 (2.2)	
Nutrition					
Birth weight, gm		3.6 (1.9)			
Height at 5 years, cm		0.5 (3.2)			
Attitudes					
Mother's interest in ed., 1980			6.1 (6.2)		
Father's interest in ed., 1980			-1.5 (1.8)		
Mother's work and well-being					
Mother works full-time				-7.6 (2.2)	-7.2 (2.0)
Mother works part-time				-1.5 (0.8)	-0.8 (0.4)
Mother's Malaise Score, 1975					-0.5 (1.8)
Obs	913	893	733	913	915
R^2	0.24	0.25	0.27	0.24	0.22

Notes: As Table 14

Fathers' unemployment was clearly important between 42 months and five years. Gregg and Machin (1997) found that NCDS children had significantly worse school attendance records at age 16 if their father had been unemployed at age seven.

18. Gender differences were apparent for the results concerning the effects of attitudes. In particular, the interest of the father was significant at 5% for girls and that of the mother, significant at 5% for boys.
19. One mother with a degree was working full-time in 1972, when the sub-sample children were 22 months.

This finding shows that at least part of this association lies in early effects on educational performance.

Nutrition was also important over this period, in terms both of birthweight and age five height. The mother's attitudes to education were significant by age five.[20] Children of mothers in full-time work were still doing less well over this period and the measures of social exclusion were also still important.

Table 17
Conditional expectation - Introducing additional background variables at 10 years by OLS (conditioning on variables in Table 13 including rank at 5 years)

Social Exclusion					
Telephone	3.6 (6.2)	3.4 (5.8)	2.8 (4.9)	3.6 (6.0)	
Persons per room	-2.2 (2.1)	-2.2 (2.2)	-0.8 (0.8)	-1.6 (1.5)	
Father unemployed	-2.0 (1.8)	-1.6 (1.5)	0.4 (0.4)	-1.9 (1.7)	
Nutrition					
Birth weight, gm		2.3 (4.5)			
Height at 5 years, cm *		0.2 (4.3)			
Attitudes					
Mother's interest in ed., 1980			3.2 (11.3)		
Father's interest in ed., 1980			1.8 (7.5)		
Mother's work and well-being					
Mother works full-time				1.6 (2.1)	1.5 (1.9)
Mother works part-time				0.7 (1.2)	0.8 (1.3)
Mother's Malaise Score, 1975					-0.5 (6.5)
Obs	7902	7590	7854	7600	7656
R^2	0.35	0.36	0.37	0.35	0.35

Notes: As Table 14
* Height at age 5 is used to proxy for school age nutrition because of concerns over mis-coding of the age ten height variable.

Social exclusion and nutrition were associated with worsening attainment position between five and ten years. However, although the strong negative association with unemployment at five years is carried over through the lagged dependent variable, there is no large extra decline over the period for children whose fathers were unemployed in 1980. This is, perhaps, because unemployment was a much wider phenomenon in 1980 than 1975 and a larger group of children are indicated by the unemployment dummy variable, many of whose fathers had only recently become unemployed.

Interestingly, low birthweight was associated with an ever-decreasing position in these data, the implications being worse at ten years than at five. This holds even when the very low birthweight group is dropped. Parental attitudes to education, now

20. At this age it is the mother's attitudes that dominate for both girls and boys.

measured contemporaneously, were also clearly important by age ten. Children of working mothers performed marginally better over this period than others.

The picture that emerges from these regressions is that pre-school attainment is clearly associated with family background in terms of housing, social exclusion, nutrition, the mental health of the mother, parental education and, at 42 months, time poverty. All of these factors influence the position of children in the distribution of tested ability before they have entered school, some even at 22 months.

8. The Association of Income With Early Attainment

So far nothing has been said about income yet income is clearly central to household production, presumably being an important cause of many of the differences between children in terms of housing, nutrition, health and time constraints. Unfortunately household income was only requested in the age ten sweep of the BCS. However, information about possession of consumer durables was requested at age five and at age ten, together with tenure and other housing variables, basic statistics for which are shown in Appendix Table A2. Using this information, observed at both ages, it is possible to construct a prediction for income at age five. This can be thought of as a general consumption index. Under permanent income conditions, one would expect income at ten to represent a reasonable proxy for income at any other age of the child. The additional gain of predicting income at five is that no permanent income assumption need be made and that advantage can be taken of the additional household information. The results of the forecast equation are reported in Table 18.

Table 18

Coefficients for forecast equation from regression of household income in 1980 on consumer durables, housing, father's age and mother's labour force status

	Coefficient in forecast equation
Fridge, 1980	-6.4 (1.9)
Washer, 1980	8.5 (3.7)
Drier, 1980	2.3 (1.7)
Car, 1980	29.1 (21.8)
Telephone, 1980	18.2 (12.7)
Owner-occupier, 1980	5.9 (1.8)
Mortgaged property, 1980	27.4 (9.3)
Council rented, 1980	-10.9 (3.6)
Privately rented, 1980	-6.7 (1.7)
Own kitchen, 1980	3.0 (0.2)
Own kitchen > 6 sq. ft. , 1980	11.2 (4.5)
Own bathroom, 1980	14.8 (2.2)
Constant	50.7 (3.6)
Obs	12278
R^2	0.22

Notes: t-statistics in brackets. Coefficients are used to predict income in 1975.

If the labour force participation decision of mothers is similar for pre-school and age five children, and fathers' incomes are assumed to be constant, then household income is stable between these years. The age five income forecast could, therefore, also be included, with some measurement error, in the conditional expectations at 22 and 42 months. It has already been shown that the probabilities of mothers with degrees working full-time were similar at 22 months, 42 months and five years and that the big increase in participation came subsequently. Table 19 reports the probabilities of mothers working at different ages of the BCS children. It can be seen that, overall, the expansion of working came after the children were five years old.

Table 19

Mothers' labour force probabilities

	Full-time	Part-time	Any hours	Observations
22 months	0.03 (0.003)	0.13 (0.007)	0.16 (0.008)	2413
42 months	0.04 (0.004)	0.23 (0.009)	0.27 (0.009)	2275
5 years	0.07 (0.002)	0.34 (0.004)	0.40 (0.004)	13062
10 years	0.20 (0.004)	0.43 (0.004)	0.64 (0.004)	13001

Notes: Standard errors in brackets.

Some class differences in the pattern of working mothers were observed in Table 11, above, which suggested that working class mothers where more likely to be working full-time when the children were age five and below and that once children had started school, top and particularly middle SES mothers were much more likely to be working part-time. Clearly, therefore, the income forecast variable will suffer from measurement error that is correlated with other right-hand side variables. It must be remembered, however, that the aim here is to observe whether children's pre-school educational performance was associated with social class factors and to see which groups of children were under-performing. To say, for example, that poorer 42 month year old children were ranked significantly lower that those with higher parental income, is merely suggestive of a social problem. The simple question asked is whether or not children's position in the distribution of test scores was indeed correlated with the income of their parents (consumption in the household) once other social class factors have been controlled for. Table 20 provides a descriptive answer to that question using the income forecast described. The conditioning variables are all contemporaneous unless otherwise specified.

Table 20

Conditional expectation - Test ranks regressed on background variables including household income (forecast, prior at age 10)

	22 months	42 months	5 years	10 years
Rank at 42 months			0.34 (11.5)	
Rank at 60 months				0.38 (37.8)
Household income, age 10				0.03 (4.8)
Household income forecast, age 5	0.02 (0.6)	0.11 (2.8)	0.13 (4.0)	
Girl=1	5.9 (4.1)	8.3 (4.1)	-6.8 (4.0)	0.3 (0.5)
Mother educ > min.	-0.6 (0.4)	1.2 (0.5)	1.2 (0.6)	7.5 (11.4)
Mother degree	12.5 (2.3)	15.1 (2.4)	3.4 (0.6)	5.1 (2.9)
Mother's age	0.3 (1.4)	0.1 (0.4)	0.0 (0.1)	0.3 (5.2)
Father educ. > min.	0.8 (0.5)	8.0 (3.2)	-4.1 (1.9)	5.5 (8.0)

Father's degree	4.5 (1.8)	-1.4 (0.4)	0.5 (0.2)	4.1 (4.2)
Father's SES=1,2	1.9 (0.8)	7.5 (2.1)	6.2 (1.9)	6.8 (7.0)
Father's SES=3M,3NM	-1.3 (0.7)	7.0 (2.5)	0.1 (0.0)	2.3 (3.1)
No. of older sibs.	-2.7 (4.0)	-3.3 (3.1)	-0.5 (0.5)	-3.4 (11.3)
No. of younger sibs		-0.6 (0.3)	-0.4 (0.3)	-1.2 (3.8)
One non-UK parent	-4.7 (1.4)	-4.9 (1.1)	2.5 (0.6)	-4.6 (3.7)
Constant	-15.7 (0.8)	-114.8 (3.4)	28.5 (5.0)	21.3 (11.9)
Obs	1570	805	885	7409
R^2	0.06	0.15	0.23	0.35

Notes: t-statistics in brackets, reweighting as described in notes to Table 12

The first point to note from Table 20 is that observed household income is positive and significant at 1% for the movement along the ability distribution between the ages of five and ten. A hundred pound increase in household income is associated with a movement of three percentage points. The association is strongly significant but weak in magnitude. However, coefficients are larger for the income forecast at 42 months and five years. Income does not dominate the effects of the social class variables already observed to be important but does appear to provide an additional explanation of variance.

9. Conclusions

The primary question asked by this paper was the extent to which investment in schools is sufficient to reduce inequality in Great Britain given that educational performance is to some extent influenced by factors beyond the control of schools and, possibly, determined prior to school entry. Although no causal models have been developed, clear differences have been shown in the educational performance of children from different social groups before they enter school. These combine with later non-schooling effects to influence ultimate schooling outcomes and so, as other research has shown, earnings. This suggests that a policy of reducing earnings inequality solely by reducing educational inequality will be insufficient unless policies are found to support the learning of children before they enter school.

The primary preschool institution is for most children, of course, the family, but it is differences between families in terms of such factors as, for example, parenting skills, transmission of ability and school choice that appear to be the primary determinants of educational success or failure. There is also evidence (Feinstein *et al* 1998) that pre-school institutions such as nursery schools, might have negative effects on educational development, perhaps because of excessive class sizes. It is clearly important, therefore, that more thought be given to the questions of how parenting can be supported and of what additional resources need to be expended on improving the quality of pre-school provision so that interactions with adults are maintained and the early effects of material and intellectual inequality are addressed.

Appendix Table A1
Basic statistics for background information

	Obs	Mean	Std.Dev.	Min	Max
Mother educ>min	12459	.3186052	.4659535	0	1
Father educ>min	12888	.3207635	.4667882	0	1
Mother's age	12911	26.02479	5.833316	13	65
No. of older sibs, 1970	17108	1.167115	1.390815	0	17
No. of younger sibs, 1973	2272	0.3935	0.5575113	0	3
No. of younger sibs, 1975	13062	.5194457	.644576	0	5
No. of younger sibs, 1980	11258	1.50151	1.068269	0	12
Weight at birth, 1970, gm *	17073	3.269071	.5810932	.2	6.463
Weight , 1972, kilos	2329	11.92816	1.555589	6.4	20.41
Weight , 1973, kilos	2175	15.04494	1.99224	8.3	27.96
Height , 1975, cm	12821	108.7515	5.235412	84	130
Height , 1980, cm *	7165	138.7409	30.41599	1.2	588
Multiple birth	2436	.0931856	.290752	0	1
Postmature birth	2436	.3041872	.4601568	0	1
Small for dates	2436	.2298851	.4208451	0	1
Mother's interest in ed., 1980	12670	2.039937	1.121472	0	3
Father's interest in ed., 1980	12816	1.357366	1.337104	0	3
Mother full-time, 1972	2413	.0335682	.1801522	0	1
Mother part-time, 1972	2413	.1313717	.3378765	0	1
Mother full-time, 1973	2275	.0430769	.2030749	0	1
Mother part-time, 1973	2275	.2250549	.4177103	0	1
Mother full-time, 1975	13062	.0653039	.2470708	0	1
Mother part-time, 1975	13062	.3360129	.4723614	0	1
Mother full-time, 1980	13001	.2040612	.4030294	0	1
Mother part-time, 1980	13001	.4340435	.4956497	0	1
Mother's Malaise score (0-23), 1975	12902	4.37851	3.675716	0	23
Lone mother, 1975	18180	.0353685	.1847146	0	1
Lone mother, 1980	18180	.0540704	.2261628	0	1
Persons per room, 1975	12873	.8965311	.3302333	.0709999	6
Father unemployed, 1972	2326	.0769561	.2665792	0	1
Father unemployed, 1973	2168	.0258303	.1586653	0	1
Father unemployed, 1975	13135	.0299201	.1703733	0	1
Father unemployed, 1980	13542	.1274553	.3334946	0	1

Appendix Table A2
Basic statistics for income forecast variables

	Obs	Mean	Std.Dev.	Min	Max
Household income , 1980	12459	128.6483	64.49184	18	300
Forecast income, 1975	12526	69.84968	31.68478	-14.2481	114.4801
Fridge, 1975	15490	.783215	.4120682	0	1
Washer, 1975	15490	.7587476	.4278569	0	1
Drier, 1975	15490	.6864429	.4639536	0	1
Car, 1975	15490	.5939316	.4911135	0	1
Telephone, 1975	15490	.4854099	.4998032	0	1
Owner-occupier, 1975	13094	.1293722	.3356243	0	1
Mortgaged property, 1975	13094	.4346265	.4957268	0	1
Council rented, 1975	13094	.3229724	.4676301	0	1
Privately rented, 1975	13094	.0622422	.2416042	0	1
Own kitchen, 1975	12922	.9915648	.0914588	0	1
Own kitchen > 6 sq. ft. , 1975	15209	.6984023	.4589667	0	1
Own bathroom, 1975	12929	.9643437	.1854388	0	1
Fridge, 1980	15520	.8592784	.3477454	0	1
Washer, 1980	15520	.8244201	.3804746	0	1
Drier, 1980	15520	.70625	.4554935	0	1
Car, 1980	15520	.6471649	.4778673	0	1
Telephone, 1980	15520	.7027706	.4570531	0	1
Owner-occupier, 1980	13609	.1124256	.315901	0	1
Mortgaged property, 1980	13609	.5004776	.5000181	0	1
Council rented, 1980	13609	.3214784	.4670611	0	1
Privately rented, 1980	13609	.0335072	.1799636	0	1
Own kitchen, 1980	13608	.9982363	.0419605	0	1
Own kitchen > 6 sq. ft. , 1980	13647	.9547886	.2077751	0	1
Own bathroom, 1980	13643	.9921572	.0882151	0	1
Father’s age, 1980	13095	26.04047	10.6835	0	72
Father’s age squared, 1980	13095	792.2347	480.8376	0	5184

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Telephone, 1980	15520	.7027706	.4570531	0	1
Owner-occupier, 1980	13609	.1124256	.315901	0	1
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privately rented, 1980	13609	.0335072	.1799636	0	1
Own kitchen, 1980	13608	.9982363	.0419605	0	1
Own kitchen > 6 sq. ft. , 1980	13647	.9547886	.2077751	0	1
Own bathroom, 1980	13643	.9921572	.0882151	0	1
Father's age, 1980	13095	26.04047	10.6835	0	72
Father's age squared, 1980	13095	792.2347	480.8376	0	5184