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STATISTICAL BULLETIN

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SCHOOL STANDARDS AND SPENDING: STATISTICAL ANALYSIS

A FURTHER APPRECIATION

Introduction and Summary

1. Statistical Bulletin 16/83 (School Standards and Spending: Statistical analysis) considered the associations between measures of the socio-economic background of pupils in LEA maintained schools and their average levels of attainment in public examinations. It described how the analysis indicated that between two-thirds and three-quarters of the variation between authorities in their pupils' examination achievements was statistically associated with variations in the values of the background measures. The Bulletin also described that once allowance had been made for socio-economic background, variations in examination attainment were related only to a very small degree with variations in the level of secondary school expenditure. This Bulletin presents the results of further work undertaken to refine and review the statistical investigation.

2. The additional analysis broadly confirms the findings of the earlier study. More timely data on the background measures — which are now available from the 1981 Census — combined with the inclusion, for the first time in these analyses, of school-based factors that might be considered to have influence on pupil examination success increased the proportion of the variation in LEA pupil examination achievements accounted for by the set of explanatory variables to between three-quarters and eighty-six per cent. The previous Bulletin explained that the statistical associations between social background and examination results do not imply the existence of causal relationships between them. It also described a number of difficulties regarding the interpretation of the statistical results; these difficulties remain equally relevant to the new analyses.

Factors considered in the analysis

3. The earlier analyses reported in Statistical Bulletin 16/83 considered the statistical association between examination attainment and measures of social background. Other factors that might be expected to affect school-based examination success — such as the level of parental support and the quality of teaching and organisation in the school — were recognised as relevant. Data are available for some factors on a consistent basis, and have been incorporated in the new analyses described below. Most refer to structural aspects of schooling and are aggregated to local authority level. However data on many other factors that could be influential are not available, for example parental support, the quality and breadth of the school curriculum and teacher orgainisation and commitment.

4. The new analyses like the previous ones have been conducted at local authority level; this is because appropriate data are not generally available below this level of aggregation. Clearly the interpretations of the analyses can only provide insights into comparisons between LEAs. This work has not explored the variations in examination results either within or between individual schools, or

factors which may bear upon such variations. Analyses at the school or the pupil level would enable the statistical significance of both school and local authority effects to be judged. Nevertheless, the magnitude and consistency of the statistical associations revealed by the analyses at LEA level do underline the likely importance of socio-economic factors or their surrogates for any alternative experimental design.

Measure of pupil performance

5. Success in public examinations is by no means the sole criterion of performance by which schools, parents or pupils themselves set store. It is at best one measure of the outcome of school activity. Also the examination results at age 16 or 18 are not direct measures of the value of academic education received; to estimate this it would be necessary to adjust attainments on leaving school by pupil ability and attainment at the time they entered the school. Consistent data on attainment of pupils on entry to secondary schools are not available.

6. Six measures of pupil examination success were tested in the analyses. Between them they represent a wide range of examination performance achieved by the majority of school leavers in GCE/CSE examinations. The analyses are based on achievements gained by school pupils (including where appropriate those students who studied at tertiary college instead of at school) but does not include the examinations passed by students at other further education establishments. This may understate performance within authorities who encourage study in further education establishments for the 16–19 age group.

7. The six measures are defined as the percentage of maintained school leavers in each LEA achieving:

1 at least 1 A level pass
2 at least 5 higher grade[1] passes at O level/CSE
3 at least 1 higher grade[1] pass at O level/CSE
4 no graded result at O level/CSE
5 2 or less graded results[2] at O level/CSE
6 6 or more graded results[2] at O level/CSE.

8. The six measures are compiled from the results of the Department's School Leavers Survey. Limitations of the measures for the purpose of this exercise are:

i. the measures of examination success are not mutually exclusive or exhaustive. Double or triple counting of individual leavers occurs, for example, where leavers with at least one A level pass also obtained higher grade passes at O level/CSE. The addition of the fifth and sixth measures improves the coverage of different levels of attainment;

ii. The proportion of school leavers with 1 or more A levels and, to a lesser extent, the other categories will have been affected in those instances where local authorities operate tertiary colleges as alternatives to school sixth forms. An adjustment to the A level measure (but not to the others) was made for the 11 LEAs with tertiary colleges;

iii. the School Leavers Survey currently collects information on academic attainment at CSE/O level and A level. Technical and vocational examinations data are not included in the examination measures described in paragraph 7 above;

iv. data on examination achievements of young people in FE establishments (other than those achieved at tertiary colleges at A level) have not been included in the analysis. This is partly due to the lack of appropriate data and partly due to the necessary extension to the list of explanatory factors and their data requirements that would result. By restricting the analyses to school pupils the present analysis avoids any confounding of school and post school effects;

v. There may be significant year-to-year changes in the values of the examination results due to changing proportions of school leavers in different age groups. This is because the age of school leavers is in general correlated with their level of examination attainment;

1 O level grades A-C, CSE grade 1.
2 O level grades A-E, CSE grades 1-5

vi. the qualifications data collected by the School Leavers Survey are based on a 10 per cent sample of school leavers and are therefore subject to sampling error. In order to reduce the year-to-year variations in the examination measures due to sampling and other causes, the results of the latest three years have been averaged; these are for academic years 1980-81, 1981–82 and 1982–83.

9. The six examination measures discussed above were investigated in separate analyses. This approach, adopted in part by the lack of any satisfactory method of obtaining an aggregate of the six measures, enabled some comparisons to be made between factors which appeared to have a stronger statistical association at one level of academic attainment than at another. It also provided general impressions about the robustness of the explanatory power of the variables for each of the attainment measures.

Explanatory variables

10. The earlier analyses reported in Statistical Bulletin 16/83 investigated the relationships of certain socio-economic background factor and the expenditure per pupil in secondary schools with respect to examination attainments at school. Data for the six socio-economic background indicators were drawn from the 1981 Census. The set of six indicators were those used in the Grant Related Expenditure calculations. The six indicators are:

i. children born outside the UK, Ireland, USA and the Old Commonwealth or in households whose head was born outside the UK, Ireland, USA and the Old Commonwealth;

ii. children living in households whose head is a semi-skilled or unskilled manual worker, personal service or farm worker described subsequently as the low socio-economic group;

iii. children living in households lacking the exclusive use of one or more of the standard amenities or living in a household at a density of occupation greater than 1.5 persons per room;

iv. children in one parent families;

v. children in families with 4 or more children;

vi. children living in households receiving supplementary benefit.

The present analyses use the six variables defined above except that the second one differs in one respect from that used in the previous analysis, by including children living in households whose head is a personal service worker. This change has been incorporated in the light of comment received following the publication of Statistical Bulletin 16/83.

11. Six other socio-economic variables were used in the analysis. Data for all except the infant mortality variable are provided by the 1981 Census:

a. children living in households whose head is a non-manual worker (though with the exceptions noted below). This variable continues to be referred to as the high socio-economic group variable but unlike the earlier analyses it now relates to the proportion of children in these households rather than the proportion of heads of households in these social groups. It also excludes those groups labelled as the junior non-manual and non-manual supervisory groups and is thus more narrowly defined than in the previous analyses. These changes have also been made as a consequence of comments received following the earlier analyses;

b. the 16–18 population density (16–18 year old persons per hectare);

c. the population density (persons per hectare);

d. the rate of unemployment (16–18 age group) — the percentage not at work of those at work, seeking work or temporarily sick;

e. the rate of unemployment (all age groups);

f. the infant mortality rate (the number of deaths under 1 year per 1000 live births, derived from local authority vital statistics data for 1981).

12. The earlier analyses included a single educational resources variable, namely the secondary school expenditure per pupil for each LEA expressed on a common price base and averaged over the four years 1977–78 to 1980–81. The present analyses have introduced two changes.

First, two expenditure variables are included. These are the secondary school teaching expenditure per pupil and the secondary school non-teaching expenditure per pupil.

Second, both variables are expressed at November 1982 prices and are taken as the average of three years expenditure — 1980–81, 1981–82 and 1982–83. As before, the London weighting element of teaching expenditure has been removed. No comparable adjustment has been made, however, to the non-teaching expenditure measure.

13. Additionally eight variables representing different aspects of aggregate LEA schooling structure are included. These are:

i. teacher turnover, defined as the proportion of teachers in each LEA who had joined their school in the previous year. The proportions are averaged over three years — 1979–80, 1980–81 and 1981–82;

ii. age weighted pupil/teacher ratio (PTR) for 11-16 age group in 1983;

iii. PTR for 16–18 age group in 1983;

iv. age weighted PTR for 11–18 age group in 1983;

v. percentage change in the numbers of 11-15 year old pupils on LEA roll between 1977–78 and 1982-83 inclusive;

vi. average school fifth-form year size;

vii. the percentage of maintained school leavers in 1980–81, 1981–82 and 1982–83 who attended grammar schools at age 12;

viii. the percentage of pupil-years attended in grammar schools for all maintained school pupils leaving during 1980–81, 1981–82 and 1982–83.

14. These measures were selected as indicators of certain financial and non-financial aspects of a local authority's secondary school system. They have been designed to record differences between authorities in the movements from school to school of the teaching force, the relationships between pupil and teacher numbers and the rate of change in the numbers of secondary school pupils. The two variables on grammar school pupils are indicative of one aspect of school organisation. The first of them has been chosen to reflect the assumption that pupils who begin their secondary education at grammar schools continue to receive this form of education even when the school has changed during the pupil's secondary years. The second measure has been designed according to the hypothesis that equal weighting can be given to the periods of attendance at grammar and non-grammar schools alike.

Methodology and analysis

15. The statistical association between examination results for each LEA and the social background and other measures were investigated by stepwise multiple regression, the same method employed in the earlier analyses described in the Statistical Bulletin 16/83. This technique yields a numeric measure of the extent to which the variation in LEA examination results are associated with chosen combinations of the explanatory variables. A major benefit arising from the use of the stepwise multiple regression is that the method systematises the procedures involved in the selection from the different possible sets of the explanatory variables. It allows not only an efficient selection of a linear combination of the variables which accounts for most of the variation of the examination measures but also enables comparisons with other, possibly related, groups of variables.

16. Each analysis provides a multiple correlation coefficient (R) indicating the degree of statistical association between the examination measure included and the background variables. The square of the correlation coefficient, R^2, measures the amount of variation in the examinations data that can be accounted for by variations in the set of explanatory variables used; this statistic is referred to in the text and tables. The value of R^2 can vary from 0 to 1 where a value of 1 indicates perfect association and a value of O an absence of association.

17. The statistical method must be interpreted with care. The existence of a non zero value of R^2 does not imply that there is a causal relationship between the explanatory variables and the examination outcomes. Statistical significance does not imply educational significance (and vice versa) and this has a bearing both on the interpretation of the findings and on their implications. The present analyses have set the statistical significance level for individual variables at 10 per cent; this means that the addition of a new variable to the set of those already included in a regression is permitted only if the increment in R^2 that it provides would be expected to have occurred by chance at most ten times in a hundred.

18. The set of variables selected by the stepwise regressions cannot with certainly be said to generate statistical relationships which are 'best' solutions. Means exist to explore the form of relationship to provide the evidence on whether the relationships selected should be accepted. The main tests applied are described below:

a. many of the variables express attributes as a percentage of the population under consideration. The form of the equations calculated by the stepwise multiple regressions are linear and it may be that at the extremes of the percentage scale non-linearities may occur. Examination of the residuals (observed values minus fitted values) reveals whether there is any systematic under or over prediction by the equations. Within the constraints of this analysis no such evidence was found which might lead to a rejection of the equations selected;

b. errors in the measurement of variables and the omission of relevant factors may lead to equations that are not optimal. The use of different attainment measures and the testing of their relationships with separate combinations of the background and resource variables assisted in providing evidence on which to base interpretations;

c. analyses were undertaken on sub-sets or clusters of authorities which appeared to be homogeneous in certain patterns of their social characteristics. The results of these and the other sensitivity analyses are discussed later. All of the results, and particularly those for the cluster sub-sets, are based on the relationships observed amongst a relatively small number of data points, one for each of the 96 English LEAs. Higher degrees of association need to be demonstrated by these regressions than would be required if a larger data set were available. Several of the explanatory social background variables are highly correlated with one another and this also limits the additional contribution that combinations of these variables can make compared with the contribution of each variable taken separately.

Results

19. Table A shows the correlations between the examination measures and the social background and educational and resourses variables taken individually. The socio-economic groups variables are very strongly associated with pupils' examination attainments. Indeed these variables account for most of the variation explained throughout the analyses. Taken individually, there has been an increase in the present analyses in the association between the socio-economic variables and the attainment measures compared with the correlations recorded in the earlier analyses described in Statistical Bulletin 16/83. Most of this increase may be due to the use of the 1981 Census results, which correspond in time much more closely with the attainment measures than did the 1971 data used in the earlier analyses. The educational and resources variables, including the overall expenditure measures, have generally much lower levels of correlation with the academic attainment variables. This finding is consistent with the earlier analyses.

20. Tables B-G record the outcomes of the stepwise regressions when all explanatory variables were included in the procedure. The tables indicate which variables were found to be statistically significant in the regressions, the order in which they were introduced by the stepwise procedure and the incremental amount of variation each added; the form of the final regression equation is also specified.

21. The equations confirm the conclusion in the previous bulletin that any comparison of the examination achievements between authorities would be seriously misleading if the socio-economic backgrounds of pupils were not taken into account. The high socio-economic group variable has the greatest individual correlation of any variable with respect to the 1 or more and 5 or more higher grade O level/CSE pass categories and also the 1 + A level category; this is reflected in the results of the regressions for these categories in tables B-D respectively. It has a lower correlation with the other categories (tables E-G), where the correlations for the high socio-economic group variable are below some of the measures of social disadvantage.

22. Examination of the tables reveals that the socio-economic variables account for nearly all of the variation explained by all variables that were judged to be statistically significant. For the attainment categories defined by the achievement of higher grade O level/CSE passes or A level passes the high socio-economic groups variable was by far the most important. For the lower achievement categories — the two any grades results and the no grades results — the variables expressing aspects of social disadvantage, poor housing and one parent families, assumed the greatest importance.

23. None of the other variables played much part in the overall associations calculated by the regressions. Teaching and non-teaching expenditure entered most of the equations but added only a small, though statistically significant contribution. A slightly greater contribution was made by the teaching expenditure variable in the equation for the 1+ A level category, which may partly reflect the higher expenditure per pupil in sixth forms and tertiary colleges. Teaching expenditure also featured in the equations of the five or more and the one or more higher grades examination attainment categories, where in each case higher attainment was positively associated with teaching expenditure. Also higher attainment was linked with lower non-teaching expenditure for these two categories. Higher non-teaching expenditure was associated with the proportion of pupils achieving no graded results but since non-teaching expenditures are markedly higher in the metropolitan (especially inner London) authorities, this variable may be acting as a proxy for other social background factors. The PTR variables only enter one equation (for no graded results), and then with little impact. As low PTRs are closely related to high teaching expenditure the selection of both variables is unlikely, and the selection of one implies the significance of the other.

24. Two variables relating to grammar school attendance were included in the regressions. The first variable corresponded to the percentage of maintained school leavers who attended grammar schools at age 12, as explained in paragraph 13(vii) above. This variable was found to be of statistical significance and to contribute to a small degree to the overall association discovered in the 5+ and 1+ higher grade O level/CSE categories. The second variable measuring the proportion of pupil-years of maintained pupils in each LEA who attended grammar schools added a small but statistically significant contribution to the overall association in the no graded results category. In all three cases the incidence of grammar school attendance was positively associated with examination attainment but the impact of the associations accounted for only 1 or 2 per cent of the overall R^2.

25. Both of the unemployment variables tested were found to be directly associated with social disadvantage and inversely associated with examination attainment. The unemployment variable relating to all ages in the population entered the equations for all but the highest and lowest of the attainment categories and was positively associated in each case with examination achievement. This might suggest that poor employment prospects may have encouraged pupils to stay-on at school to attempt to obtain better examination results. However this conclusion is not supported by the behaviour of the other unemployment variable relating specifically to the 16-18 age group, which entered only once, in the equation fo the 1+ higher grades category where it was inversely associated with attainment. Table A shows the extent to which the percentage of children of New Commonwealth origin was inversely correlated with examination performance. This variable entered only one of the equations where it would seem that, once other background factors had been taken into account, higher proportions of children of New Commonwealth origin were positively associated with levels of attainment though the effect was small. The teacher turnover measure was also tested and was found to be marginally associated with poor attainment. It featured in three equations wher the size of the effect was statistically significant but small; greater levels of turnover were associated with lower levels of attainment.

26. The results from the earlier analyses given in Statistical Bulletin 16/83 and from the present exercise can be broadly compared. Apart from the 1+ A level category, where the degree of variation explained was approximately the same, the new results show that the complete set of explanatory factors accounted for an additional 10 per cent of the variation in academic attainment. This increase appears to be mainly due to the increased association between examination achievement and the socio-economic groups variables. Some of the additional variables in the present analyses add a much smaller but statistically significant amount to the explained variation.

27. Table I shows the actual percentage of leavers in each LEA achieving each examination attainment category and the corresponding percentages predicted by the equations given in tables B–G. It permits comparison between the results achieved and those that might be expected taking into account the variables shown to be of statistical significance in the predicted national analyses. The difference between the actual and predicted values may be due in part to local factors which have not been taken account of in these analyses.

Sensitivity analysis

28. The statistical relationships put forward by the analyses may, for example, be sensitive to the geographical coverage of the data employed. Factors which are not of statistical significance for all English LEAs taken together may be of greater importance for some of them. The stepwise regression technique allows a variety of different analysis using alternative groupings of explanatory factors. This approach may be of particular benefit where these variables are cross-correlated — a feature observed in this exercise — where variables may be measuring substantially similar or complementary social or other aspects. An inspection of the residuals that is the difference between the actual and predicted values may provide an indication of the strength of the relationships between the explanatory variables and the examination attainment categories.

29. Different combinations of explanatory variables were tested for the purposes described below:

a. the high and low socio-economic groups (SEG) variables are negatively correlated, and they may serve complementary functions in the regressions. The set of all explanatory variables excluding the high SEG variable was regressed on the attainment data. For the no graded results category, the same overall amount of variation was explained but the low SEG variable did not enter the equation, possibly because the other measures of social disadvantage acted assubstitutes for this variable. For the other categories of attainment, the low SEG variablereplaced high SEG as the overall most powerful explanatory variable but with a lower degree of overall correlation. The variable measuring grammar school attendance at age 12 entered the equation for the 1+ and 5+ higher grades criteria accounting in both instances for approximately 4 per cent of the overall R^2, twice the amount when the SEG variable was included in the regressions. This may suggest that the absence of the high SEG variable could have been partly substituted in the equation by the grammar school variable.

b. the educational and financial resource variables relate to maintained secondary schools within LEAs, while the social background variables corresponds to all young people resident in an authority regardless of the type of school attended. Two analyses were conducted to test the effects, if any, of these coverage differences; the first adjusted the school achievement data to cover all schools located in each authority area and regressions were run against the full set of explanatory variables together with a variable which measures the proportion of all school leavers from independent schools. Data for the numbers of independent school leavers and their attainment results are available only by the local authority of location of the school, not the local authority of residence of the pupils. The second analysis used all the explanatory variables including the independent school variable but regressed these against the maintained school attainment data. In respect of the first analysis, the regression for the no graded, 2 or less graded and 6 or more graded results showed almost no change in the overall R^2 and the order of introduction of the variables into the equations was hardly altered. The analyses for the higher grades and 1+ A level categories had increases in R^2 of between 3 and 6 percentage points. This very largely reflected increased amounts of explanation offered by the high SEG variable and, in the case of the 1+ A level category, the introduction of the independent schools variable. No differences in the overall R^2 were noted for any of the attainment categories for the second analysis although the independent school leavers variable did enter the equations for no graded results and 1 or more higher grades;

c. the regressions were also run against all variables other than the expenditure variables. Their omission did not affect the overall amount of variation explained, though the overall PTR variable entered the equation for the 1+ A category, possibly as a substitute for the teaching expenditure variable which had been present in the original regression;

d. paragraphs 10 and 11 outlined the differences between the definitions used for the low and high SEG variables in the present analyses compared with those presented in Statistical Bulletin 16/83. A further analysis was conducted using the former definitions for the two socio-economic groups variables but using the latest data from the 1981 Census. It was found that these versions of the variables were slightly less associated with academic attainment than were

the variables constructed according to the revised definitions. This feature was more marked in the equations for the lower levels of attainment.

Cluster analyses

30. Statistical Bulletin 16/83 described a sensitivity analysis in which stepwise regressions were performed on sub-sets of the English LEAs. The two sub-sets of 80 and 16 were obtained by cluster analysis using the LEA values of the educational needs (AEN) variables. The method was repeated in the present exercise using the AEN values for authorities obtained from the 1981 Census. (There were also slight differences in the present analyses for the definitions of the AEN variables compared with those originally described in Statistical Bulletin 8/82).

31. The revised clustering process yielded 3 groups of LEAs numbering 52, 28 and 16 respectively. The authorities which had been previously partitioned into the smaller sub-set were similarly classified, categorised by above average educational needs. The two larger groups were of authorities with below average (52) and average (28) levels.

32. The regression analyses were conducted separately on the three clusters. The socio-economic background variables accounted for similar degrees of variation within the clusters as in the main analyses for all authorities. The smaller sizes of the clusters may be expected to reduce the stability of the regression equations, and the analyses did indicate some differences compared with the overall analyses. For the cluster of authorities with above average needs, higher degrees of association were recorded with the low SEG variable particularly in the equation for the no graded results and the one or more grades categories; similarly the high SEG variable scored more highly with the higher grade O level/CSE passes and A level achievement groups. With the exception of the one parent family variable (particularly for the lower achievement categories) and the grammar school attendance and infant mortality variables — the latter possibly acting as a surrogate for the socio-economic variables — no other explanatory variables entered the regressions for the above average cluster.

33. The regressions for the other two groupings of LEAs (below average and average educational needs) were broadly similar to those obtained for the national data. In respect of the cluster of authorities with average AEN values (28 LEAs) non-teaching expenditure entered the equations more prominently in the lowest three attainment categories, and the expenditure variable was inversely correlated with attainment. For the cluster with lower than average educational needs (52 LEAs) markedly lower levels of the overall R^2 were observed in the equations for all of the attainment categories other than the 1 + A level. The variables for 16-18 unemployment and teacher turnover took much more significant places in the regressions for the no graded results and 2 or less graded results categories, where higher levels of these variables were positively associated with lack of examination success.

34. An alternative method of "clustering" LEAs was also tested. This partitioned authorities into three equal groups according to the high SEG variable. The variation in attainment within each group was much less than for all 96 authorities, as may be expected because the attainment measures were strongly correlated with high SEG, the variable used to partition authorities into the three groups. The proportions of the variations in the attainment measures in the lowest high SEG group that were accounted for by the equations were similar to those for all authorities taken together. The variables also entered the equations in similar ways, though infant mortality was a slightly stronger factor and the expenditure variables were not significant. In the other two groups the proportion of variation accounted for was rather lower than for the main analyses for all authorities.

Conclusions

35. All of the latest analyses have indicated that the social background, and to a much lesser extent the school-based and financial factors, provide a statistically significant explanation of the variation between local authorities in the levels of examination success of school leavers. The use of more up-to-date data for most of the variables in the present analyses as well as the use of measures for certain factors not previously taken into consideration may have been responsible for the increases in the degree of variation accounted for by the explanatory variables.

36. The results show that for the lower levels of examination achievement the social disadvantage factors were the most important influence in the amount of variation explained whilst for higher levels of attainment the high SEG variable came to the forefront. The lowest levels of explanatory power of the equations were associated with the 1 + A levels and 6 or more any grades categories.

37. Several of the school based variables, including the expenditure variables, were found to have statistically significant associations with the attainment measures but of small degree. Included in this set were the variables representing teaching and non teaching expenditure, teacher turnover and pupil grammar school attendance.

38. The supplementary analyses undertaken to test the robustness of the regression relationships seem to indicate that although the exact significance of particular explanatory variables may need to be interpreted with care, the overall pattern of relationships is reasonably stable. The cluster analyses and the three high SEG groupings all suggest that the forms of relationships established for all authorities taken together seem to apply also to the various sub-sets of authorities identified.

Table A Correlation (R^2) between academic attainment and background variables taken individually

$R^2 \times 100$

	1 + A levels	5 + higher grade O level/CSE passes[1]	1 + higher grade O level/CSE passes[1]	6 + graded results[2]	2 or less graded results[2]	No graded results[2]
Socio-economic variables						
High socio-economic groups	70(+)	76(+)	72(+)	28(+)	46(—)	52(—)
High SEG (same definition as used in SB16/83)	70(+)	72(+)	70(+)	21(+)	40(—)	46(—)
Low socio-economic groups	56(—)	63(—)	64(—)	29(—)	48(+)	52(+)
Low SEG (same definition as used in SB16/83)	56(—)	60(—)	63(—)	25(—)	43(+)	46(+)
Poor housing	21(—)	38(—)	41(—)	43(—)	55(+)	59(+)
Unemployment	39(—)	41(—)	43(—)	16(—)	33(+)	39(+)
16-18 unemployment	48(—)	51(—)	55(—)	19(—)	37(+)	44(+)
Large families	25(—)	35(—)	43(—)	41(—)	52(+)	49(+)
Supplementary benefit	38(—)	45(—)	48(—)	29(—)	46(+)	51(+)
One parent families	11(—)	28(—)	28(—)	44(—)	49(+)	50(+)
Non-white children	0	3(—)	2(—)	19(—)	14(+)	15(+)
Sum of additional educational needs	22(—)	41(—)	41(—)	49(—)	59(+)	63(+)
16-18 population density	2(—)	9(—)	8(—)	32(—)	28(+)	32(+)
Population density	1(—)	7(—)	6(—)	30(—)	26(+)	29(+)
Infant mortality	17(—)	17(—)	25(—)	9(—)	16(+)	16(+)
Resources variables						
Overall expenditure	2(+)	1(—)	1(—)	20(—)	14(+)	15(+)
Teaching expenditure	0	4(—)	3(—)	21(—)	17(+)	19(+)
Non-teaching expenditure	4(+)	0	0	17(—)	10(+)	10(+)
School-based variables						
Teacher turnover	9(+)	2(+)	4(+)	2(—)	0	0
11-16 PTR	6(+)	20(+)	15(+)	20(+)	24(—)	26(—)
16-18 PTR	8(+)	13(+)	13(+)	2(+)	7(—)	10(—)
11-18 PTR	3(+)	15(+)	12(+)	19(+)	22(—)	26(—)
Change in roll	0	2(+)	2(+)	15(+)	12(—)	14(—)
Average school-year year size	2(—)	3(—)	3(—)	1(+)	0	0
Pupil-years in grammar schools	6(+)	14(+)	13(+)	1(+)	4(—)	8(—)
Pupils in grammar schools at 12	6(+)	15(+)	14(+)	0	3(—)	7(—)

1 O level grades A-C, CSE grade 1.
2 O level grades A-E, CSE grades 1-5.
3 The sign given in brackets indicates whether the association between the academic attainment category and the background variable was direct (+) or inverse (—). With 96 data points (1 for each LEA), a correlation coefficient of 0.2 (ie $R^2 = 4\%$) is significantly different from O, statistically, at the 5 per cent level.

Table B Stepwise regression for 1 or more A level passes against all background variables

Variables included (in order)	R^2 (%)
High socio-economic groups	70
Teaching expenditure	73
One parent families	74

All other variables were found not to be statistically significant at the 10% level.

Regression equation used to calculate fitted values

fitted value = —9.26 + 0.41 High socio-economic groups
+ 0.02 Teaching expenditure
—0.20 One parent families

Note: the relative size of coefficients is *not* indicative of the relative importance of variables.

Table C Stepwise regression for 5 or more higher grades at O level/CSE against all background variables

Variables included (in order)	R^2 (%)
High socio-economic groups	76
One parent families	78
Unemployment	81
Pupils in grammar schools at 12	83
Teaching expenditure	84
Non-teaching expenditure	85
Population density	85
Teacher turnover	86
Poor housing	86

All other variables were found not to be statistically significant at the 10% level.

Regression equation used to calculate fitted values

fitted value = 0.48 + 0.56 High socio-economic groups
—0.48 One parent families
+ 0.26 Unemployment
+ 0.14 Pupils in grammar schools at 12
+ 0.03 Teaching expenditure
—0.02 Non-teaching expenditure
+ 0.06 Population density
—0.18 Teacher turnover
—0.21 Poor housing

Note: the relative size of coefficients is *not* indicative of the relative importance of variables.

Table D Stepwise regression for 1 or more higher grades at O level/CSE against all background variables

Variables included (in order)	R^2 (%)
High socio-economic groups	72
One parent families	75
Infant mortality	78
Pupils in grammar schools at 12	79
Unemployment	80
Teaching expenditure	82
16-18 Unemployment	83
Poor housing	84
Non-white families	86
Non-teaching expenditure	86

All other variables were found not to be statistically significant at the 10% level.

Regression equation used to calculate fitted values

fitted value = 34.72 + 0.44 High socio-economic groups
—0.66 One parent families
—0.34 Infant mortality
+ 0.16 Pupils in grammar schools at 12
+ 0.90 Unemployment
+ 0.03 Teaching expenditure
—0.49 16-18 unemployment
—1.00 Poor housing
+ 0.20 Non-white families
—0.01 Non-teaching expenditure

Note: the relative size of coefficients is *not* indicative of the relative importance of variables.

Table E Stepwise regression for 6 or more graded results at O level/CSE against all background variables

Variables included (in order)	R^2 (%)
One parent families	44
Poor housing	54
High socio-economic groups	56
Unemployment	58
Supplementary benefit	60
Average school year size	61

All other variables were found not to be statistically significant at the 10% level.

Regression equation used to calculate fitted values

fitted value = 57.06 —0.83 One parent families
—0.87 Poor housing
+ 0.37 High socio-economic groups
+ 1.58 Unemployment
—0.74 Supplementary benefit
+ 0.02 Average school year size

Note: the relative size of coefficients is *not* indicative of the relative importance of variables.

Table F Stepwise regression for 2 or less graded results at O level/CSE against all background variables

Variables included (in order)	R^2 (%)
Poor housing	55
One parent families	64
High socio-economic groups	71
Teacher turnover	72
Non-white families	73
Unemployment	74
Supplementary benefit	76

All other variables were found not to be statistically significant at the 10% level.

Regression equation used to calculate fitted values

fitted value = 12.23
+ 1.22 Poor housing
+ 0.59 One parent families
—0.23 High socio-economic groups
+ 0.30 Teacher turnover
—0.18 Non-white families
—0.95 Unemployment
+ 0.48 Supplementary benefit

Note: the relative size of coefficients is *not* indicative of the relative importance of variables.

Table G Stepwise regression for no graded results at O level/CSE against all background variables

Variables included (in order)	R^2 (%)
Poor housing	59
High socio-economic groups	69
One parent families	76
Teacher turnover	77
Infant mortality	78
Non-white families	79
Grammar schools	80
Non-teaching expenditure	81
11-16 PTR	81

All other variables were found not to be statistically significant at the 10% level.

Regression equation used to calculate fitted values

fitted value = —8.76
+ 0.74 Poor housing
—0.16 High socio-economic groups
+ 0.39 One parent families
+ 0.25 Teacher turnover
+ 0.20 Infant mortality
—0.10 Non-white families
—0.08 Pupil years in grammar schools
+ 0.01 Non-teaching expenditure
+ 0.48 11-16 PTR

Note: the relative size of coefficients is *not* indicative of the relative importance of variables.

Table H LEAs whose residual values of academic attainment (based on the appropriate regression equation) fall outside 1.96 standard deviations of the mean residual

	Standardised Actual Expected [1]					
LEA	No graded results	2 or less graded results	6 or more graded results	1 or more higher grades [2]	5 or more higher grades [2]	1 or more A levels
Solihull	—2.21	—2.15				
Barnsley	+ 2.08					
North Tyneside		—2.05	+ 2.46			
Knowsley		+ 2.13	—2.18			
Barking		+ 2.33	—3.18			
Redbridge			—2.27			
Norfolk			—2.12		—2.24	
Bromley				—2.27	—2.07	
Berkshire				—2.18		
West Sussex				+ 2.00		
Northumberland				+ 2.03		
Cleveland					+ 2.26	
Harrow					+ 3.23	
Barnet						+ 2.39
Sutton						+ 2.44
Wigan						+ 3.33
Richmond						+ 3.84

1 Note, for the no graded results category, and for 2 or less graded results a negative residual implies that the LEA performance was better than that which was expected on the basis of the regression equations; a positive residual indicates the contrary. A negative residual for the 4 other attainment categories, however, indicates that performance was worse than that which was predicted by the regression equation and vice versa.

2 O level grades A-C, CSE Grade 1.

3 Theoretically about five LEAs should lie outside the 1.96 standard deviations boundary in each column. They should be roughly equally divided between positive and negative deviations. All except the 1 or more A levels category are acceptable from this viewpoint. In that category there may be some bias, possibly partially stemming from the adjustment made to Wigan's and Richmond's figures for passes at tertiary colleges.

Table 1 Regression analysis results for individual local education authorities [1]

Actual and fitted values [2] — as given by the regression equations — for each academic category

Local Education Authority	Percentage of maintained school leavers achieving											
	No graded results [3]		2 or less graded results [3]		6 or more graded results [3]		1 or more higher graded passes [4] at O level/CSE		5 or more higher graded passes [4] at O level/CSE		1 or more passes at A level	
	Actual	Fitted	Actual	Fitted	Actual	Fitted	Actual	Fitted	Actual	Fitted	Actual	Fitted
Barking	18.6	15.5	29.6	23.5	41.8	57.5	37.7	41.9	13.4	14.6	9.6	9.1
Barnet	8.8	6.0	15.4	10.3	65.5	68.3	64.4	64.0	35.8	33.3	27.9	22.7
Bexley	7.6	8.0	11.1	15.7	70.4	65.3	53.1	54.6	25.3	25.2	15.3	15.7
Brent	15.0	17.3	23.5	24.0	54.3	51.4	49.5	48.5	17.8	17.4	13.4	15.0
Bromley	9.0	7.3	15.0	12.9	64.3	70.4	55.7	60.9	28.8	32.8	19.3	23.2
Croydon	10.3	10.9	15.8	17.2	62.9	61.0	53.5	53.2	25.3	24.3	16.1	17.7
Ealing	13.9	14.7	22.1	20.9	56.1	56.4	49.1	49.8	19.3	19.8	13.1	14.9
Enfield	11.1	8.9	18.0	15.8	62.3	63.8	55.9	56.4	22.9	24.3	16.3	15.9
Haringey	20.0	17.2	26.6	25.2	51.3	47.5	44.9	48.0	14.8	17.2	11.4	14.1
Harrow	6.3	7.3	9.8	11.3	67.2	69.9	67.4	63.0	37.2	31.0	25.9	23.2
Havering	7.0	10.3	14.7	16.0	62.1	66.4	57.3	53.7	25.2	24.0	17.0	16.7
Hillingdon	10.9	10.9	14.9	16.1	64.6	64.5	53.9	52.7	21.4	23.8	15.2	16.7
Hounslow	12.9	12.9	19.4	20.8	60.4	59.1	56.0	51.9	22.2	19.7	17.1	14.2
Kingston-upon-Thames	9.4	6.4	15.3	13.0	63.6	69.1	60.7	63.0	31.3	32.3	21.6	21.3
Merton	12.7	10.5	16.3	16.6	65.1	63.4	52.8	52.4	24.5	24.0	15.8	15.9
Newham	25.1	22.0	33.3	32.0	45.3	45.7	36.9	36.5	11.3	11.4	7.4	8.3
Redbridge	9.3	9.1	19.3	14.4	55.7	66.9	57.6	57.6	25.7	27.3	18.1	18.1
Richmond-upon-Thames	11.8	11.3	18.4	15.8	66.8	68.4	58.2	58.7	27.6	28.8	32.4 [5]	24.0
Sutton	6.6	7.8	12.7	14.6	70.6	66.3	60.2	57.7	33.5	30.3	24.1	18.8
Waltham Forest	15.3	16.4	25.9	24.7	51.4	51.6	42.9	45.9	16.2	18.3	11.2	13.8
ILEA	21.0	22.7	29.3	32.5	46.6	42.0	41.8	39.8	14.4	14.2	10.5	13.4
Birmingham	14.4	16.6	21.7	25.9	59.3	52.2	45.8	44.5	18.8	17.9	11.7	9.9
Coventry	11.6	14.4	16.3	18.4	66.0	64.1	49.1	47.8	21.7	18.5	12.6	10.6
Dudley	11.8	9.5	15.2	16.0	71.8	67.1	54.2	52.8	24.7	24.1	13.4 [5]	13.8
Sandwell	17.7	17.7	24.2	24.9	54.6	56.7	38.2	40.9	13.1	15.7	7.6	8.7
Solihull	4.5	8.4	8.5	14.2	77.1	68.1	56.4	54.6	26.3	27.9	16.3	17.7
Walsall	14.4	13.0	20.5	20.5	62.2	62.4	47.8	49.0	19.7	21.2	12.8	12.5
Wolverhampton	14.9	17.7	23.1	26.3	61.4	55.3	44.3	43.7	16.6	17.5	9.6	10.1
Knowsley	21.1	18.8	31.4	25.7	44.9	55.6	37.9	42.0	12.5	14.8	7.6	8.1
Liverpool	19.4	18.5	30.7	26.5	48.1	53.7	43.3	41.9	18.3	16.8	12.0	8.7
St Helens	13.5	13.1	20.4	17.5	62.8	65.8	49.7	46.4	22.6	20.8	14.1	12.9
Sefton	10.7	8.2	17.7	13.1	61.3	70.5	55.9	55.7	28.0	26.9	17.8	15.8
Wirral	8.4	9.8	15.6	16.1	66.8	66.5	55.8	54.1	25.8	26.1	16.4	14.6
Bolton	11.7	13.0	20.3	22.7	58.5	62.1	51.3	50.9	23.2	23.9	13.7	13.9
Bury	11.4	13.0	18.9	19.4	64.0	65.5	52.8	53.2	26.4	23.7	14.2	16.2
Manchester	21.1	20.2	32.8	32.1	42.2	46.3	41.0	39.8	15.8	13.5	9.9	9.3
Oldham	17.9	16.1	26.1	23.7	52.7	57.6	43.9	42.0	12.8	15.7	7.1	10.0
Rochdale	17.4	16.0	24.4	24.0	54.6	58.0	43.7	45.7	18.0	19.3	12.9	13.2
Salford	14.4	14.4	24.3	22.7	51.3	57.2	46.3	44.0	17.0	18.1	11.5	10.6
Stockport	9.3	7.7	16.6	13.1	64.9	70.6	57.6	56.1	26.9	29.6	17.4	19.0
Tameside	13.2	13.0	22.6	22.6	55.6	58.5	47.6	48.4	19.2	19.5	8.7	[redacted]
Trafford	8.2	8.0	14.8	15.3	64.1	64.2	57.8	56.1	26.3	27.4	14.6	[redacted]
Wigan	11.0	10.3	18.2	16.6	64.5	67.0	53.6	50.8	22.9	21.8	20.6 [5]	13.4
Barnsley	16.0	12.4	22.0	18.3	58.8	63.8	41.7	43.4	15.8	15.6	9.1	9.2
Doncaster	11.0	13.2	18.4	19.6	63.8	64.6	47.2	45.3	17.6	17.2	11.6	10.7
Rotherham	10.3	12.6	16.5	18.8	69.4	63.1	46.6	43.7	18.2	17.6	10.0	9.9
Sheffield	9.7	12.3	15.8	19.0	68.9	63.2	48.2	47.8	20.4	20.1	13.2	13.0
Bradford	17.6	15.7	27.7	25.7	51.3	55.8	41.8	43.4	18.6	16.7	13.0	10.5
Calderdale	11.7	12.1	20.2	22.1	60.9	58.0	52.6	50.5	23.2	21.8	15.4	[redacted]
Kirklees	11.2	13.1	18.9	20.8	64.1	60.7	51.0	46.7	23.9	20.2	15.1	[redacted]
Leeds	11.4	11.1	20.5	19.4	63.0	60.9	48.1	48.9	22.6	20.8	15.0	12.4
Wakefield	14.6	11.8	22.2	18.1	62.1	63.8	43.5	43.8	16.8	18.7	9.0 [5]	10.4
Gateshead	14.6	13.9	19.4	18.2	64.3	65.2	41.9	46.1	17.5	19.0	10.2	11.0
Newcastle-upon-Tyne	13.2	11.5	18.0	19.9	66.4	62.0	47.5	49.9	20.4	22.2	14.1	14.2
North Tyneside	8.2	9.2	11.6	17.0	77.4	65.3	55.1	53.2	23.1	22.7	13.1	13.7
South Tyneside	10.4	13.1	13.5	18.4	74.1	65.3	48.0	50.1	18.6	19.0	9.6	10.7
Sunderland	10.0	12.4	14.4	18.7	71.5	64.1	51.1	49.0	18.8	19.3	9.3	10.1
Avon	8.0	8.9	14.2	14.4	67.1	67.7	52.2	53.5	22.9	24.8	13.9	16.4
Bedfordshire	6.8	9.4	16.1	16.0	63.8	65.9	50.9	52.2	21.2	22.3	12.5	15.7
Berkshire	6.0	7.5	11.2	13.9	72.0	68.5	53.3	58.3	25.4	28.4	16.8	19.4
Buckinghamshire	5.0	5.9	9.4	12.7	72.5	70.3	63.8	63.3	33.2	32.3	21.0	21.4
Cambridgeshire	7.9	8.6	15.2	14.5	66.1	67.2	54.8	53.8	25.8	24.1	14.3	16.4
Cheshire	10.0	9.0	17.3	13.7	66.3	70.0	56.1	55.7	25.1	26.8	18.0 [5]	16.9
Cleveland	12.1	13.8	17.1	18.4	69.4	64.6	50.3	47.6	22.7	18.4	13.4	10.5
Cornwall	10.3	10.5	15.3	15.6	65.8	69.4	55.7	53.5	25.3	23.1	14.0	14.2
Cumbria	10.0	11.5	14.8	17.0	68.9	66.3	51.9	50.4	23.9	21.0	14.5	13.8
Derbyshire	9.0	10.7	14.4	17.1	69.6	64.3	50.0	48.9	21.5	20.8	14.2 [5]	13.3
Devon	8.5	9.3	16.0	16.0	63.3	65.2	55.9	52.9	22.3	23.3	16.0 [5]	14.2
Dorset	7.0	8.1	10.3	14.3	72.5	68.5	55.3	55.2	26.8	25.5	16.3	16.0
Durham	13.1	11.8	18.8	16.9	65.3	66.5	47.5	49.6	19.1	19.6	11.5	11.3
East Sussex	9.2	10.6	15.1	16.8	65.5	66.6	55.0	54.1	27.6	25.2	17.1	17.2
Essex	9.8	8.2	18.1	14.1	60.9	69.0	53.5	55.7	23.7	25.7	14.3	17.0
Gloucestershire	8.0	7.4	14.8	14.0	67.1	67.0	54.4	55.4	27.4	27.0	16.7	16.6
Hampshire	7.3	9.1	12.8	14.5	70.5	67.1	54.1	52.4	24.9	24.0	16.0 [5]	16.0
Hereford & Worcester	11.5	8.7	15.5	15.1	71.8	68.1	52.5	53.8	23.5	25.5	13.7	16.3
Hertfordshire	6.8	6.4	13.1	11.5	68.5	70.6	60.9	60.1	30.6	31.0	19.9	21.7
Humberside	13.8	12.6	20.6	19.1	62.3	64.1	46.5	46.7	20.6	19.6	12.6	12.3
Isle of Wight	9.8	10.4	15.0	15.0	71.1	71.9	49.5	50.7	20.1	21.8	14.3	13.9
Kent	8.5	8.8	13.8	15.5	69.3	66.0	51.1	53.5	25.6	25.3	16.8	16.0
Lancashire	12.4	11.5	21.3	19.0	58.2	62.2	51.2	50.2	21.9	22.0	16.5 [5]	14.0
Leicestershire	11.4	11.1	18.4	17.6	65.0	63.0	49.2	50.7	22.7	21.4	16.4	14.4
Lincolnshire	6.7	7.9	11.5	14.2	71.0	65.8	52.2	55.1	23.5	25.1	13.3	15.0
Norfolk	11.0	10.2	21.0	17.1	55.7	66.1	50.3	53.6	19.3	23.6	10.9	14.8
North Yorkshire	7.9	7.5	13.9	11.9	71.3	69.4	56.3	55.0	28.5	26.7	17.9	17.3
Northamptonshire	9.1	10.7	13.6	16.3	70.4	66.2	47.3	51.6	18.8	21.3	11.9	14.0
Northumberland	7.4	8.5	10.9	13.7	78.1	70.9	57.1	52.4	25.6	23.2	15.6	14.5
Nottinghamshire	11.7	12.3	17.7	20.3	66.9	60.7	43.8	47.4	19.0	19.2	12.0	12.8
Oxfordshire	7.9	8.3	12.2	12.9	73.8	70.3	55.4	56.1	26.6	25.0	17.5	17.7
Shropshire	11.8	8.5	17.1	15.4	67.9	66.8	51.7	55.9	23.5	25.2	13.8 [5]	15.5
Somerset	10.6	9.6	17.5	14.9	65.0	67.5	50.7	52.1	20.5	22.2	16.5 [5]	14.7
Staffordshire	13.9	11.0	18.1	17.0	67.1	67.1	49.6	50.3	20.6	22.1	12.2	14.3
Suffolk	10.0	8.8	19.7	15.6	57.5	67.2	48.9	51.3	21.0	21.8	12.0	13.9
Surrey	5.8	5.8	10.4	9.6	74.4	74.2	60.6	61.9	33.0	34.4	22.0	24.4
Warwickshire	8.1	7.9	11.2	13.3	75.0	68.5	55.9	56.5	25.1	26.0	15.2	16.2
West Sussex	5.9	7.0	9.4	12.5	76.0	71.8	62.0	57.4	31.2	28.3	19.5	19.3
Wiltshire	7.5	8.7	13.2	14.1	68.4	66.7	54.9	52.6	24.1	22.1	13.0	14.2
England (excluding Isles of Scilly)	11.1	11.1	17.7	17.7	64.1	64.1	51.2	51.2	22.7	22.7	14.6	14.6

1 The percentage of maintained school leavers in each category was derived from the school leaver sample surveys averaged over the years 1980-81, 1981-82, 1982-83.

2 The fitted values correspond to the percentage of school leavers in each academic category which individual LEAs might expect to obtain on the basis of the relationships as calculated by the regression analyses reported in tables B to G between academic attainment and the background variables.

3 Graded results = O level grade A-E or CSE grade 1-5.

4 Higher grade pass = O level grade A-C or CSE grade 1.

5 These figures included estimates for the percentage of those who left school with no A levels but would have passed at least one A level at Tertiary College. As a result they are somewhat less reliable than other figures.