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Ethnic Differences in Educational Attainments and Progress Revisited

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The primary school population in England is becoming ethnically more diverse and differences in educational attainments between ethnic groups continue to be of interest. This paper applies multilevel modelling to an administrative database – the National Pupil Database – to assess the extent of these differences and to compare them with more limited data from the 1980s. It shows that the current national picture hides considerable heterogeneity between schools and that the models for both attainment and progress are complex. The analyses highlight the relative educational success of Chinese pupils and a cause for concern about the attainments of black Caribbean boys. Methodological issues about the categorisation of ethnic groups are discussed. .

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1. Introduction

More than one in five pupils in maintained primary schools in England are from minority ethnic groups: 20.6% in 2006 compared with 18.3% in 2004 (DfES, 2006) and 11.2% in 1997 (DES, 1999). A decade before that, in a paper on the educational progress of pupils from different ethnic groups read at the RSS Charter Centenary conference (Plewis, 1988), I pointed out that data on the educational attainments and progress of minority ethnic group pupils were patchy so that it was not possible to paint a detailed picture at the national level. The data that did exist suggested that pupils from ethnic minorities were doing less well than the white majority and that this was especially true for male pupils from black Caribbean backgrounds. Other messages from that paper included the necessity to consider ethnic group and sex differences together, the importance of longitudinal data, and the potential value of a multilevel approach, all of which would provide a more detailed description of ethnic group differences.

I return to the same topic in a much-changed environment. Schools now have to deliver a national curriculum and to conduct national tests at prescribed ages. The ethnic make up of society has changed with, for example, an increasing proportion of young people having a 'mixed' ethnic classification. Moreover, some ethnic groups are long-established in England whereas others have settled much more recently. In addition, family structure has changed with a much higher proportion of children from all ethnic groups experiencing at least some of their school years living with just one parent (Dex and Joshi, 2005).

With the advent of new longitudinal studies (for example, the Millennium Cohort Study) and the availability for secondary analysis of administrative databases, we are in a much better position to document these societal changes than we were 20 years ago. Of particular relevance to this paper is the development by what is now the Department for Children, Schools and Families (DCSF) of a National Pupil Database (NPD) that, along with the Pupil Level Annual Schools Census (PLASC), is generating longitudinal records of pupils' attainments including a detailed classification of ethnic groups. The paucity of information about the attainment and progress of pupils from different ethnic groups can now be a thing of the past. The fact that much more relevant data are available does not, of course, necessarily mean that we are better informed. Many of the concerns raised in my 1988 paper are just as germane today: why is it useful to study ethnic group differences, to what extent do the categories used to delineate ethnic groups enlighten or obscure, and what statistical models should we use to describe and possibly to explain differences (and similarities)?

I return to these questions at the end of the paper but stress at this stage that the paper is descriptive and the descriptions are limited by the available data. I set out to show the extent of ethnic group differences and how these differences vary according to personal, family, school and Local Education Authority (LEA) characteristics. Despite the limitations of the data, we shall see that the combination of a large multilevel dataset with appropriate statistical techniques leads to descriptions that go well beyond a comparison of mean scores. Nevertheless, explanations of why things are as they are and how they might be different can, at best, only be tentative and speculative.

The focus of this paper is on pupils' attainment and progress through the English state primary school system from age seven to just before the great majority start secondary school at age 11. All pupils take tests in English and mathematics at ages seven and 11 - known as Key Stage tests (KS1 and KS2) – and their attainments in these core subjects

are also assessed by their teachers at these two occasions. This period of schooling has received somewhat less attention from researchers than the period from ages 11 to 16 at secondary school, partly no doubt because examination outcomes at age 16 have such a strong bearing on later life chances. Yet how well a child is doing at school before they start secondary school is a very good predictor of how well they will do later and so the more we know about group differences in attainment at age 11, the better we will understand later inequalities. Ideally, we would study the whole period of primary school - from the start of compulsory schooling around the age of five - but collection of national data on children's abilities on entry to school (known as the Foundation Stage profile) has only recently started and longitudinal records linking these scores to KS2 tests have yet to be generated.

Three recent studies have all used the NPD to examine ethnic group differences in attainment and progress from KS1 to KS2. Wilson et al. (2005) looked at attainments for the cohort reaching KS2 in 2002 although most of their paper is concerned with relative progress through secondary school. Their results cannot easily be compared with those presented here as they do not look at interactions between ethnic group and sex, they only present results for an aggregate score rather than for the core subjects separately, and they do not consider how ethnic group differences vary across schools. Rather similar comments can be made about the paper from DfES (2006) except that it does present results for different subjects albeit only in terms of percentages achieving the 'expected' National Curriculum levels. Finally, Melhuish et al. (2006), as part of a study of the effectiveness of primary schools, did use a multilevel modelling approach and present KS2 scores broken down by both ethnic group and sex and for each of English, mathematics and science. We look at their findings in more detail below, noting that science is omitted as an outcome variable from this paper partly because there was no science test at KS1, and partly to cut down on the volume of results presented in the paper.

The paper aims to harness the strengths of the multilevel approach to answer two broad questions. First, to what extent do ethnic groups differ in their attainments in English and mathematics at the end of primary school? Second, are there ethnic group differences in progress between KS1 and KS2. In other words, does change in attainment over this four year period vary across ethnic groups and can this variation be accounted for (in a statistical sense) by other variables measured at the pupil, school and LEA levels?

The paper is organised as follows. The next section describes the structure of the National Pupil Database and the variables used in the analyses. Section 3 considers the ethnic group classification available from the NPD, its strengths particularly when compared with earlier categorisations but also its drawbacks, and presents descriptive data. Sections 4 and 5 focus on models and findings for attainment and progress respectively, and the final section considers more general methodological and interpretational issues.

2. The National Pupil Database

2.1 Sample and variables

The NPD and PLASC in England are linked datasets, which have been constructed annually since 2002 and provide a census of pupils at state schools in England. We focus on the cohort that reached the end of KS1 in 2002 and the end of KS2 in 2006. This cohort, mostly born in 1995, consists of nearly 600 thousand pupils. Omitted from analyses were:

a) Pupils in special and independent schools, pupil referral units etc. where the school experiences are very different (n = 22,448).
b) Pupils in two very small LEAs: City of London and the Scilly Isles (n = 71).

This left up to 572,888 pupils in 148 LEAs and in about 14,750 schools, the exact numbers of pupils and schools depending on the relatively small amount of missing data at the pupil level in any particular model.

The two outcome variables used throughout are the scores awarded in KS2 tests of English and mathematics. The original scales varied from 0 to 100 but both were standardised to mean zero and SD equal to one. A range of measures of attainment at KS1 was used in analyses of progress: test scores in reading (a combination of reading and comprehension), writing and mathematics (all with a range of 0 to 6, the scale points corresponding to National Curriculum levels), and teacher assessments in English, mathematics and science (ranging from level 1 or below up to level 4). All were standardised.

When appropriate, I control for socio-economic circumstances with a scale generated from claims for free school meals (FSM) as measured in PLASC each year. This ordered scale takes the value zero (never claimed free school meals), four (claimed once) up to seven (claimed in each of the four years in question). These particular scale values were adopted because the largest differences in attainment occur between not claiming at all and claiming once. A more complex alternative to using these scale values would be just to use the sum (0 – 4) and enter this summed variable into the models with both linear and quadratic terms. The use of a composite of annual FSM claims gives a somewhat more sensitive scale than just using a binary variable for a single year although it cannot eliminate the considerable heterogeneity in economic circumstances experienced by pupils in families who never claim (Hobbs and Vignoles, 2007).

Pupil sex and ethnic group (in 12 categories – see Section 3), an estimate of the number of changes of address, and various measures computed at the school level (discussed below) were also used in the analyses of progress. For more detailed information about the NPD and PLASC go to:

http://www.bris.ac.uk/depts/CMPO/PLUG/userguide/guide.htm.

2.2 Multilevel structure

The NPD is hierarchically structured. Pupils (level one) are located within schools (level two) within Local Education Authorities (LEA, level three). This structure can, in principle, be extended to account for multiple outcomes and repeated measures of these outcomes. One part of the underlying hierarchy – classes or teachers within schools – is not observed and so variation between teachers is subsumed into variation between pupils within schools. It is possible either to substitute geographical areas such as Census output areas for schools or, again in principle, to analyse the cross classification of schools and output areas (or neighbourhoods).

In this paper, I model the basic three level hierarchy (pupils within schools within LEAs). Although potentially insightful, it was computationally infeasible to analyse both outcomes as a bivariate set. The school and LEA attended by pupils in year six when they take KS2 tests are used to define levels two and three. A more sophisticated but computationally demanding model would allow for pupil mobility between primary schools by using a ‘multiple membership’ multilevel model as used for the same period of schooling by

Goldstein et al. (2007) with NPD data from just two LEAs. I do, however, allow for residential mobility in the model by a proxy measure: the number of changes of postal address (from zero to three) approximated by recorded changes of Census output area from year three to year six. It is likely that this measure will be correlated with school mobility. Goldstein et al. (2007) also model the cross-classification of school attended at the time the KS1 tests are taken (often referred to as 'infant school') with that attended at KS2 (the 'junior school') but this option is not feasible with national data. Consideration was given to modelling the cross-classification of KS2 school and KS2 output area but again this is not feasible with national data; for example, the first LEA on the dataset contains pupil data from 38 schools and 245 Census output areas and so many of the cells in the cross-classification are either empty or very small. We return to these issues in the final section in terms of possible implications for the conclusions about ethnic group differences.

As well as data at the pupil level, I also use variables measured at the school and LEA levels. The type of primary school attended in terms of its governance is known, and contextual measures such as the mean FSM index for the school and LEA, and the size of the cohort for each school are constructed.

3. Ethnic Groups

Classifying pupils into ethnic groups is not unproblematic. For most of this paper a 12-category classification is used (percentages based on the 98.3% of pupils in year six with a reported ethnic group in PLASC 2006 or, if missing or unknown then, by a category from an earlier year):

(i) White British (81%)
(ii) White other (2.9%)
(iii) Mixed (3.2%)
(iv) Indian (2.3%)
(v) Pakistani (3.0%)
(vi) Bangladeshi (1.3%)
(vii) Asian other (0.82%)
(viii) Black Caribbean (1.5%)
(ix) Black African (2.4%)
(x) Black other (0.45%)
(xi) Chinese (0.36%)
(xii) Other (1.0%)

These groups do, of course, refer to ethnic affiliation and not to country of origin and they are categories reported by the school, usually based on parental report. This classification is certainly an improvement over that used in Plewis (1988) which, of necessity, reported results for an undifferentiated South Asian group. It is also more informative than a commonly used grouping with six categories that merges the Pakistani and Bangladeshi groups, merges all the black groups and places the relatively small Chinese group into 'other'.

The largest minority group is the 'mixed' group: most of this group have one white parent (either male or female) and the largest sub-group includes children with one white and one black Caribbean parent. It is a fast-growing and heterogeneous group (see Bradford, 2006 for more details). The Pakistani group is the next largest; many members of this group, and especially those living in the north of England, have their origins in the Mirpur region of

Pakistani-administered Kashmir. Most of the Bangladeshi group come originally from the Sylhet region in north east Bangladesh. The Indian group is much more heterogeneous and includes many whose families came to England from East Africa in the 1970s although some African Asians are classified as 'Asian other', a group that contains also many Sri Lankan Tamils (DfES, 2006, Fig. 7). This heterogeneity also characterises the black African group with substantial numbers both from West Africa (Nigeria, Ghana and Sierra Leone) and from a very different background in Somalia. The groups also differ in terms of their time of arrival in the UK – the 1950s for many of the black Caribbeans so that, at the beginning of the twenty first century, some of these pupils will have grandparents who were born in this country - whereas many black African pupils will have been born outside the UK, some arriving as refugees from, for example, the Democratic Republic of the Congo and Zimbabwe. We return to the implications of this latter point when we consider models for attainment and progress. Over 40% of minority ethnic pupils belong either to the mixed group (iii) or to one of the four 'other' groups (ii, vii, x, xii). Group (xii) includes 'travellers of Irish origin' and 'Gypsy/Roma'. These latter two groups are small and are not, therefore, differentiated here but their low attainments have been noted as a cause for concern (Equalities Review, 2007).

Another problematic aspect of the ethnic group classification is that it is not a fixed measure for all pupils throughout the period of interest. Thus, 27% of the pupils coded Black other in 2006 were coded differently in 2003 (but were not missing then). Similarly, recorded codes of 20% of Asian other, 17% of Other, 14% of White other, 11% of Mixed, 6.1% of black Caribbeans and 5.1% of black Africans changed between these two time points (but less than 5% of the four Asian groups and only 0.4% of white British). The coding framework was changed in 2003 and some of these fluctuations could be attributed to this change, some might have arisen when a pupil changed school, some just from errors of transcription etc. I use the codes recorded in 2006 but we need to be mindful of their instabilities, especially of the black and mixed groups. Such instabilities, in the context of the 1991 and 2001 Censuses, are discussed in detail by Simpson and Akinwale (2007). They suggest using an eight category classification to get round some of these problems but further aggregation does magnify the problems of heterogeneity discussed above.

Related to the classification of ethnic groups is whether pupils speak English as their main language at home. Over 80% of pupils with Indian and Chinese backgrounds and over 90% of those in the Pakistani and Bangladeshi groups are coded as having English as an additional language (EAL) whereas less than 10% of Black Caribbeans and Mixed are. In other words, ethnic group and EAL are essentially confounded and it makes little sense to try to separate their effects. EAL is not, therefore, used as an explanatory variable in any of the models in the following two sections.

4. **Attainment at Key Stage 2**

4.1 Overall differences by ethnic group and sex

Table 1 gives the mean attainments for English and mathematics for each of the 24 combinations of ethnic group and sex, with white boys as the reference group. These are estimates of 'raw' differences that ignore the possibility that group differences within schools and LEAs are different from group differences between these higher-level units. Raw differences present a national picture, essentially averaged over schools and LEAs, that can inform national policy about ethnic inequalities but which, as we shall see, omit important heterogeneities at the school and LEA levels. The main points to emerge from Table 1 are:

(i) Chinese pupils are doing well in both subjects (relative to white British pupils).
(ii) Pupils from the three black groups are doing relatively poorly and this is particularly true in mathematics.
(iii) Among the three main South Asian groups, Indian pupils are doing relatively well, Pakistani pupils relatively poorly with Bangladeshi pupils in between.
(iv) The mixed group perform more or less the same as white British pupils.
(v) Girls out-perform boys in English and are somewhat behind in mathematics.

The results in Table 1 are very similar to those presented by Melhuish et al. (2006) for the three cohorts that reached KS2 in 2002 to 2004. There is no consistent evidence that the relative positions of the ethnic sex groups have changed over this four year period although there is a suggestion that the attainments of the three South Asian groups in English are improving relative to white British pupils.

Table 1: KS2 mean attainments (SD units) by ethnic group and sex, 2006

Ethnic group	n	English		Mathematics	
		Boys	Girls	Boys	Girls
White British	438632	0 (fixed)	0.34	0 (fixed)	-0.13
White other	14932	-0.01	0.27	-0.03	-0.16
Mixed	17372	0.05	0.40	-0.05	-0.15
Indian	12494	0.11	0.44	0.14	0.02
Pakistani	15942	-0.35	-0.02	-0.37	-0.49
Bangladeshi	6851	-0.19	0.08	-0.20	-0.39
Asian other	4352	0.02	0.27	0.08	-0.04
Black Caribbean	8307	-0.32	0.11	-0.53	-0.51
Black African	12404	-0.25	0.09	-0.44	-0.46
Black other	2367	-0.25	0.18	-0.41	-0.44
Chinese	1929	0.33	0.64	0.64	0.48
Other	5104	-0.20	0.11	-0.13	-0.25

Note
Standard errors are omitted for clarity of presentation. They are all very small (< 0.03).

The heterogeneity of the black African group, in terms of their country of origin, was alluded to in the previous section. They are also, as a group, more likely to have immigrated into England between KS1 and KS2: over a quarter of black African pupils with measured attainment at KS2 were not in the KS1 sample whereas, for the rest of the main groups (excluding the 'other' groups), the proportions were generally less than one tenth. The mean attainments of these two sub-divisions of the black African group in English at KS2 are substantially different: -0.094 for pupils attending an English school at both KS1 and KS2 compared with -0.63 for pupils not attending an English school at KS1.

4.2 The multilevel approach

We now consider whether the national picture presented in Table 1 changes once we explicitly introduce the structure of the data into a multilevel model. In particular, we might expect differences between the ethnic groups and the sexes to vary from school to school, partly as a result of selection of different kinds of pupils into different schools and partly as a result of school policies. These effects of selection and policy might result in school differences in ethnic group effects being systematically associated with the ethnic composition of the school. Certainly there is considerable variation between schools in the

proportions of different ethnic groups at the end of KS2 (year six). Table 2 shows the 97.5% cut-off point (covering about 370 schools) for schools' ethnic group distributions. We see that, for example, there are substantial numbers of schools where at least 27% of the pupils in year six are of Pakistani origin. In addition, we find that 2.5% of primary schools have fewer than 7% of white British pupils in year six.

Table 2: School ethnic group distributions: 97.5% cut-off

Ethnic group	97.5% cut-off
White other	0.18
Mixed	0.15
Indian	0.16
Pakistani	0.27
Bangladeshi	0.09
Asian other	0.07
Black Caribbean	0.15
Black African	0.22
Black other	0.04
Chinese	0.04
Other	0.09

In the light of the above considerations, our model for attainment is:

$$y_{ijk} = b_{0jk} + b_{1j}x_{1ijk} + \sum_{p=2}^{P} b_{pj}x_{pijk} + \sum_{p=2}^{P} c_p x_{1ijk}x_{pijk} + e_{ijk} \qquad (1a)$$

$$b_{0jk} = b_{00k} + \sum_{q=1}^{Q} b_q \bar{x}_{qjk} + \sum_{q=Q+1}^{Q+3} b_q z_{qjk} + u_{0jk} \qquad (1b)$$

$$b_{1j} = b_{10} + u_{1jk} \qquad (1c)$$

$$b_{pj} = b_{p0} + d_p \bar{x}_{pjk} + u_{pjk} \qquad (1d)$$

$$b_{00k} = b_{000} + v_k \qquad (1e)$$

where y_{ijk} is a test score at KS2 for pupil *i* (i = 1..n_{jk}) in school *j* (j = 1.. J_k) in LEA *k* (k = 1..K), x_1 is a dummy for sex (taking the value 1 for girls), x_p are dummies for ethnic group, $\bar{x}_q$ are school means (i.e. proportions) for some ethnic group dummies x_p, and z_q are dummies for school type. As indicated earlier, ethnic group sex interactions are required in equation 1(a). The parameter vectors **b**, **c** and **d** are fixed effects.

In line with other research (Yang et al., 2002), the between pupil variation within schools is allowed to vary by sex so that:

$$\mathrm{var}(e_{ijk}) = \sigma^2_{ef} x_{1ijk} + \sigma^2_{em}(1 - x_{1ijk})$$

where σ^2_{ef} and σ^2_{em} are the female and male components of the between pupil variation. The sex effect is also allowed to vary between schools (equation 1(c)). The between school variation in the intercept varies systematically with the proportion of ethnic groups in the school (equation 1(b)). In addition, the between school variation in the ethnic group effects is specified to be related to the school proportion of the corresponding ethnic group

(equation 1(d)). Other specifications are, however, possible so that, for example, the between school variation for ethnic group p could be related to the proportion in ethnic group q ($p \neq q$) as well as, or instead of, in ethnic group p. It is, however, difficult to find any theoretical justification for this additional degree of complexity.

The usual assumptions are made about the random effects **e** and **u**: mean zero, Normally distributed, uncorrelated across the three levels but correlated within levels. The *MLwiN* package (Rasbash et al., 2004) was used for estimation by Iterative Generalised Least Squares (IGLS). The four 'other' groups (ii, vii, x, xii) were combined into one group for the school mean and a combination of black Caribbean and black African was used in the random part of the model at level two.

Table 3 gives the estimates of the fixed effects and their standard errors from model (1) for the two attainment tests. Table 4 gives the corresponding estimates of the random effects. The main points to note from Tables 3 and 4 are:

(i) There is variation between schools in attainments and some of this is systematically related to the proportion of ethnic minorities in schools (Wald statistics for Main(4), Table 3): χ^2_7 = 512 (Eng.), 481 (Maths.)). In particular, mean attainments of all pupils are much lower in schools with high proportions of black African and Bangladeshi pupils and somewhat higher in schools with high proportions of Indian pupils. In other words, the within and between school associations between attainment and ethnic group differ substantially.

(ii) There is between school variation for most of the ethnic group effects (Wald statistics for Interaction (24): χ^2_6 = 80 (Eng.), 88 (Maths.)). Black African and Bangladeshi pupils tend to do relatively better than white pupils in schools with high proportions of their ethnic group whereas the opposite is true for 'mixed' pupils.

(iii) There is a little more variation within schools for boys than for girls, notably in English (Deviance statistics for Table 4: χ^2_1 = 283 (Eng.), 68 (Maths.)), and some variation between schools in the sex effect (Deviance statistics: χ^2_2 = 148 (Eng.), 64 (Maths.)).

(iv) About a third of pupils attend schools that are not directly funded and run by LEAs (these are often faith schools) and these pupils have higher attainments on average than pupils in community schools (where white British pupils are slightly under-represented). The Wald statistics for Main (3) are: χ^2_3 = 878 (Eng.), 634 (Maths.).

Table 3: Fixed effects estimates from model (1)

Fixed effects		English		Mathematics	
		Estimate	s.e.	Estimate	s.e.
Main (1)	Sex (girls (G))	0.34	*	-0.13	*
Main (2)	White, other (WO)	-0.05	0.01	-0.03	0.01
	Mixed (M)	0.09	0.02	0.01	0.02
	Indian (I)	0.19	0.02	0.21	0.02
	Pakistani (P)	-0.09	0.02	-0.17	0.02
	Bangladeshi (B)	-0.01	0.02	-0.08	0.02
	Asian, other (AO)	0.06	0.02	0.13	0.02
	Black Caribbean (BC)	-0.17	0.02	-0.39	0.02
	Black African (BA)	-0.17	0.02	-0.38	0.02
	Black, other (BO)	-0.14	0.03	-0.30	0.03
	Chinese (C)	0.30	0.03	0.61	0.03
	Other (O)	-0.11	0.02	-0.04	0.02
Interaction (12)	WO*G	-0.05	0.02	-0.01	0.02
	M*G	0.02	0.01	0.03	0.02
	I*G	-0.01	0.02	0.01	0.02
	P*G	-0.01	0.02	*	0.02
	B*G	-0.08	0.02	-0.07	0.02
	AO*G	-0.08	0.03	0.01	0.03
	BC*G	0.09	0.02	0.14	0.02
	BA*G	-0.02	0.02	0.09	0.02
	BO*G	0.06	0.04	0.10	0.04
	C*G	-0.02	0.04	-0.02	0.04
	O*G	-0.02	0.03	0.01	0.03
Main (3)	Voluntary aided	0.23	0.01	0.18	0.01
	Voluntary controlled	0.15	0.01	0.13	0.01
	Foundation	0.15	0.02	0.14	0.02
Main (4)	M_school propn.	0.07	0.09	0.04	0.08
	I_school propn.	0.25	0.06	0.22	0.06
	P_school propn.	-0.41	0.04	-0.39	0.04
	B_school propn.	-0.57	0.08	-0.50	0.08
	BC_school propn.	-0.41	0.09	-0.40	0.09
	BA_school propn.	-1.19	0.08	-1.09	0.07
	O_school propn.	*	0.05	-0.03	0.05
Interaction (24)	M*M_school propn.	-0.37	0.13	-0.37	0.14
	I*I_school propn.	-0.11	0.06	-0.10	0.06
	P*P_school propn.	-0.06	0.05	0.04	0.05
	B*B_school propn.	0.30	0.07	0.31	0.07
	BC*BC_school propn.	-0.21	0.10	-0.09	0.10
	BA*BA_school propn.	0.49	0.08	0.58	0.08
	Sample size	540686		544178	

Notes

1. * - < |0.005|
2. 'O_school propn' includes all 'other' groups.
3. Reference groups: boys (Main (1)); White British (Main (2)); community schools (Main (3)).

Table 4: Estimates of variances of random effects from model (1)

Random effects	English		Mathematics	
	Estimate	s.e.	Estimate	s.e.
LEA, Intercept	0.02	*	0.01	*
School				
Intercept	0.13	*	0.11	*
Sex	0.01	*	0.01	*
Mixed	0.02	0.01	0.02	0.01
Indian	0.05	0.01	0.06	0.01
Pakistani	0.06	0.01	0.07	0.01
Bangladeshi	0.08	0.01	0.07	0.01
Black	0.07	0.01	0.06	0.01
Other	0.06	0.01	0.04	0.01
Pupil				
Boys	0.84	*	0.87	*
Girls	0.78	*	0.85	*

Notes
1. * - < 0.005
2. 'Black' combines black Caribbean and black African for ease of estimation.
3. All covariances at school level estimated but omitted from the table for clarity.

4.3 Predictions from the model

The ethnic group and sex effects in Table 3 are more easily interpreted if we consider how the predicted values of *y* vary with the characteristics of schools. One way of thinking about this is in terms of how the attainments of the intake of a secondary school from a group of primary schools might vary by ethnic group. Setting all random effects to zero (i.e. their means) and omitting the overall intercept for simplicity then predicted *y* for a boy in ethnic group *p* in a community school is:

$$\hat{y}_{ijk}^{(p)(B)} = \hat{b}_{p0} + \sum_{q=1}^{Q} \hat{b}_q \bar{x}_{qjk} + \hat{d}_p \bar{x}_{pjk} \qquad 2(a)$$

and for a girl it is:

$$\hat{y}_{ijk}^{(p)(G)} = \hat{b}_{10} + \hat{c}_p + \hat{y}_{ijk}^{(p)(B)} \quad 2(b)$$

Table 5 presents predicted values for some ethnic sex combinations (omitting the Indian, Chinese and 'other' groups) for five notional types of secondary schools:

1. Those with a primarily white British intake so that the fixed effects for school proportions and their interactions with ethnic group in Table 3 have little effect on predicted values for the ethnic groups which are essentially based on the within school effects.

2. Schools in a multi-ethnic LEA (50% white British, 10% of each of Pakistani, Bangladeshi, black Caribbean, black African and mixed) but where all primary schools reflect this mix in the same way. All the group means are lowered by about 0.25 SD units (because the estimated coefficients for the school means $\bar{x}_q$ are mostly negative

in Table 3) but the relative differences between the ethnic sex groups are not substantially changed because the interaction effects contribute little to the predictions.
3. Schools drawing pupils from primary schools where all white British pupils are in all white schools and Pakistani and Bangladeshi pupils are only in schools with 50% of each group.
4. As 3 but the 'non-white' schools instead contain 50% black Caribbean and 50% black African.
5. As 3 but the 'non-white' schools consist of 20% of each of mixed, Pakistani, Bangladeshi, black Caribbean and black African.

We see from Table 5 that the predicted differences between ethnic groups vary according to the ethnic composition of the schools. Bangladeshi and, especially, Pakistani pupils would have much lower predicted scores on average than white British pupils if they were to attend primary schools where Pakistani and Bangladeshi pupils make up all the school and white British pupils go to all white schools (column 3). Similarly, black Caribbean pupils, boys particularly, would be over a SD unit behind white British pupils if they attend all black schools (column 4) although the penalty for black African pupils is less severe. Column 5 tells a similar story and brings out the putative lower attainments of the mixed group in ethnic schools without white British pupils.

The types of schools and LEAs used to illustrate these points do not, of course, exist in exactly this way. The important point to emerge from the multilevel model is that differences between ethnic groups in attainments at KS2 are not homogeneous, rather they depend to a considerable extent on the kinds of schools attended and so the national picture presented in Table 1 is incomplete. It is equally important to remember that these findings are just a description of how attainments vary across groups and between schools. It is certainly not the case that these results tell us anything about why minority ethnic and white British pupils diverge in their attainments any more than they tell us why Indian and Chinese pupils are doing relatively well at KS2, not least because schools with high proportions of minority ethnic pupils will tend to be schools with higher proportions of pupils from disadvantaged homes and serving poorer neighbourhoods.

Table 5: Predicted means at KS2 by ethnic group and sex for pupils in different types of schools

Group	TYPE 1		TYPE 2		TYPE 3		TYPE 4		TYPE 5	
	Eng	Maths	Eng	Maths	Eng	Maths	Eng	Maths	Eng	Maths
WB, B	0	0	-0.25	-0.23	0	0	0	0	0	0
WB, G	0.34	-0.13	0.09	-0.36	0.34	-0.13	0.34	-0.13	0.34	-0.13
M, B	0.09	0.01	-0.20	-0.26					-0.48	-0.53
M, G	0.45	0.09	0.16	-0.18					-0.12	-0.45
P, B	-0.09	-0.17	-0.35	-0.41	-0.61	-0.60			-0.60	-0.63
P, G	0.24	-0.30	-0.02	-0.54	-0.28	-0.73			-0.27	-0.76
B, B	-0.01	-0.08	-0.23	-0.28	-0.35	-0.37			-0.45	-0.49
B, G	0.25	-0.28	0.03	-0.48	-0.09	-0.57			-0.19	-0.69
BC, B	-0.17	-0.39	-0.44	-0.64			-1.1	-1.2	-0.71	-0.88
BC, G	0.26	-0.38	-0.01	-0.63			-0.65	-1.2	-0.28	-0.87
BA, B	-0.17	-0.38	-0.37	-0.56			-0.74	-0.85	-0.57	-0.73
BA, G	0.15	-0.42	-0.05	-0.60			-0.42	-0.89	-0.25	-0.77

4.4 Comparisons with earlier research

Plewis (1988, 1991) present results for attainment at KS1 and KS2, based on two relatively small studies of primary schools in London (Tizard et al., 1988; Mortimore et al., 1988). The Tizard et al. sample came from 33 schools that had at least two pupils entering the school from nursery in each of the four black Caribbean and white British by sex groups. We can approximate this sample from the NPD at KS2, giving us 388 schools in

49 LEAs across England with at least two pupils in each of the four groups. As well as the geographical difference, the Tizard et al. study counted as black Caribbean those 'mixed' pupils with one black Caribbean parent. The Mortimore et al. study selected a random sample of 50 junior schools across inner London, regardless of their ethnic make-up. Tables 6 and 7 compare the KS1 and KS2 attainments from Plewis (1988, 1991) with those from the current analyses. They show that the relative position of the four groups is little changed except that the black Caribbean girls were doing better than the white British girls in reading and writing in the Tizard et al. sample at KS1, and the gap between white and black girls was narrower in the London studies than in the NPD at KS2. The relatively poor performance of black Caribbean boys is strikingly consistent in all the studies.

Table 6: Mean KS1 attainments by ethnic group and sex, 1985 and 2002

Group	NPD, 2002				London, 1985			
	n	Read	Write	Maths	n	Read	Write	Maths
WB, boys	3650	0	0	0	93	0	0	0
WB, girls	3678	0.20	0.31	-0.08	90	0.1	0.2	-0.3
BC, boys	1538	-0.21	-0.20	-0.44	54	-0.1	-0.3	-0.4
BC, girls	1598	0.09	0.17	-0.37	57	0.5	0.5	-0.4

Notes

1. The NPD sample is restricted to 388 schools as described above.
2. The London study is Tizard et al. (1988).The results are only available to 1 d.p.
3. Tests: KS1 tests in NPD; Young's reading and maths tests in London.

Table 7: Mean KS2 attainments by ethnic group and sex, 1984 to 2006

Group	NPD, 2006			London (1), 1989			London (2), 1984		
	n	English	Maths	n	English	Maths	n	English	Maths
WB, boys	3489	0	0	65	0	0	364	0	0
WB, girls	3602	0.29	-0.15	54	0.15	-0.01	341	0.33	0.08
BC, boys	1546	-0.32	-0.52	38	-0.12	-0.41	97	-0.49	-0.61
BC, girls	1681	0.10	-0.48	41	0.40	-0.19	80	0.21	-0.05

Notes

1. The NPD sample is restricted to 388 schools as described above.
2. The London (1) study is Tizard et al. (1988); London (2) is Mortimore et al. (1988).
3. Tests: KS2 tests in NPD; Suffolk reading test and Young's maths test in London (1); London Reading Test and NFER Basic Maths Test C in London (2).

5. Progress from Key Stage 1 to Key Stage 2

The results on attainment in the previous section describe how the different ethnic groups were performing at a particular point in their school careers. We can learn some more about how these differences arose by considering relative progress between KS1 and KS2. It is, however, important to remember that inferences about progress are inferences about a proportion of pupils who are more settled in England than the population of all pupils in English schools at the time they take KS2 tests.

5.1 Basic progress model

Progress in English and mathematics is first modelled by including as explanatory variables in equation 1(a) measures of attainment from KS1. We find that all KS1 tests and teacher assessments make a contribution to the prediction of each of the two KS2 measures, that the separate coefficients of (i) reading, (ii) writing and (iii) the teacher assessment of English vary across schools for English at KS2, and that both the test score and the teacher assessment of mathematics vary across schools for mathematics at KS2. In addition, the relations between some of the KS1 and KS2 tests vary by ethnic group and by sex.

Table 8 gives the estimates of the fixed effects for the progress models (discussion of the random effects is deferred until later in this section). The estimates for the school ethnic group proportions (Wald statistics for Main (10) in Table 8: χ^2_7 = 58 (Eng.), 60 (Maths.)) and their interactions with ethnic group (Wald statistics for Interaction (210): χ^2_6 = 47 (Eng.), 9.2 (Maths.)) are substantially smaller in the progress models than in the models for attainment and so differences in progress between ethnic groups are driven mostly by the within school coefficients in these models. The other main conclusions from Table 8 are:

1. Ethnic group boys and girls make more progress than their white British counterparts except for the black Caribbean group (Wald statistics for Main (2): χ^2_{11} = 1135 (Eng.), 1582 (Maths.)). The Wald statistics for the ethnic group sex interactions (Interaction (12) are: χ^2_{11} = 58 (Eng.), 116 (Maths.).
2. The relations between KS1 and KS2 tests are less marked for all ethnic groups (Wald statistics for Interactions (23/25): χ^2_{11} = 711 (Eng.), 450 (Maths.)).

This final point has implications for predicted KS2 means from the model and these are shown in Table 9. Here we consider three groups of pupils: those who attain at the mean for all six measures of attainment in Table 8 (KS1 = 0), lower-attaining pupils (KS1 = -1 throughout) and higher-attaining pupils (KS1 = +1 throughout). We also assume that the school proportions for the minority ethnic groups are all small (<10%). The main points to emerge from this table are:

1. For all initial test scores, Chinese pupils of both sexes make more progress than any other group.
2. Amongst the lower-attaining pupils in English at KS1, white British boys make less progress than any other group.
3. Amongst the higher-attaining boys at KS1, the group differences in progress are small apart from both black groups in mathematics where progress is lower.
4. For all initial test scores, girls from all ethnic groups make more progress than white British boys in English.
5. Girls from each of the three main South Asian groups make relatively more progress than girls from other groups in mathematics.

5.2 Extended progress model

Controls for free school meals (FSM) and residential mobility are included in the second model for progress. Families from most minority ethnic groups are poorer on average than white British families and so some of the group differences estimated from the first model might be reduced after controlling for FSM. Table 10 gives the proportions of families never claiming FSM between KS1 and KS2 and also the mean score for the FSM scale by ethnic group at the pupil, school and LEA levels. Approximately 78% of the variability in the FSM

scale is between pupils with 13% between schools and 9% between LEAs. We see that Indian and Chinese families in fact claim FSM less than the white British whereas the other minority groups claim more, the Bangladeshi and black African groups notably so. We also see that Bangladeshis tend to be in schools and LEAs with much higher average FSM levels whereas Pakistanis attend schools with high average FSM scores but these schools tend not to be located in such high FSM LEAs. Despite their low rates of claiming, Indian and Chinese pupils do attend schools in LEAs where, for both levels, FSM scores are higher than for white British pupils.

There are, however, two difficulties with using FSM as a control in models for progress. The first is that there could be a stigma attached to the act of claiming in that parents could be reluctant for their child to be seen by their peers and teachers as poor, and this stigma might be distributed unevenly across ethnic groups. The second is the point made in my 1988 paper: that minority ethnic group pupils might be poor (and hence claimants) because they are discriminated against in the labour market and so to control for any measure of socio-economic circumstances is in fact to over-control by removing some of the difference that results from being in a minority ethnic group.

Turning to the indicator of residential mobility, we see (final two columns of Table 10) that minority ethnic families – and particularly black African families - make more moves than white British families. Many families move because they have no choice – evictions, family breakdown etc. – and these changes are likely to have a deleterious effect on a pupil's progress at school. On the other hand, it is likely that some families change address solely to move their child to a 'better' school especially if the child is not making the expected progress, or to position themselves to get their child into a better secondary school. Controlling for residential mobility if these latter circumstances hold differentially across ethnic groups could be misleading as mobility will then be endogeneous and estimates of ethnic differences conditional on number of moves would become more difficult to interpret.

Some authors (e.g. Melhuish et al., 2006) include in models for progress a categorical explanatory variable representing levels of Special Educational Needs (SEN). I do not do so here partly because some SEN categories can reasonably be supposed to be an outcome of education and also because the process of assigning pupils to SEN categories can vary markedly from school to school and across LEAs (Lindsay et al., 2006).

Table 8: Fixed effects from first model for progress

Fixed effects		English		Mathematics	
		Estimate	**s.e.**	**Estimate**	**s.e.**
Main (1)	Sex (girls (G))	0.18	*	-0.17	*
Main (2)	White, other (WO)	0.13	0.01	0.11	0.01
	Mixed (M)	0.06	0.01	*	0.01
	Indian (I)	0.13	0.01	0.18	0.01
	Pakistani (P)	0.12	0.01	0.13	0.01
	Bangladeshi (B)	0.20	0.02	0.18	0.02
	Asian, other (AO)	0.19	0.02	0.27	0.02
	Black Caribbean (BC)	-0.05	0.01	-0.18	0.01
	Black African (BA)	0.15	0.01	-0.01	0.01
	Black, other (BO)	*	0.02	-0.10	0.02
	Chinese (C)	0.27	0.02	0.42	0.02
	Other (O)	0.15	0.01	0.18	0.01
Interaction (12)	WO*G	*	0.01	0.01	0.01
	M*G	0.02	0.01	0.02	0.01
	I*G	0.02	0.01	0.01	0.01
	P*G	0.01	0.01	-0.03	0.01
	B*G	0.01	0.02	-0.03	0.02
	AO*G	0.02	0.02	0.05	0.02
	BC*G	0.08	0.01	0.09	0.01
	BA*G	0.04	0.01	0.09	0.01
	BO*G	0.03	0.03	0.03	0.03
	C*G	-0.01	0.03	0.003	0.029
	O*G	0.04	0.02	0.025	0.020
Main (3)	Read, KS1	0.40	*	0.12	*
Main (4)	Write, KS1	0.24	*	0.10	*
Main (5)	Maths, KS1	0.14	*	0.51	*
Main (6)	English TA, KS1	0.05	*	0.01	*
Main (7)	Maths TA, KS1	0.02	*	0.10	*
Main (8)	Science TA, KS1	0.05	*	0.06	*
Interactions (13/15)	Sex*KS1 test	-0.02	*	0.03	*
Interactions (23/25)	WO*KS1 test	-0.06	0.01	-0.05	0.01
	M*KS1 test	-0.04	0.01	-0.02	0.01
	I*KS1 test	-0.06	0.01	-0.04	0.01
	P*KS1 test	-0.07	0.01	-0.04	0.01
	B*KS1 test	-0.09	0.01	-0.07	0.01
	AO*KS1 test	-0.10	0.01	-0.08	0.01
	BC*KS1 test	-0.06	0.01	-0.05	0.01
	BA*KS1 test	-0.11	0.01	-0.10	0.01
	BO*KS1 test	-0.08	0.01	-0.05	0.01
	C*KS1 test	-0.06	0.02	-0.10	0.02
	O*KS1 test	-0.09	0.01	-0.07	0.01
Main (9)	Voluntary aided	0.09	0.01	0.05	0.01
	Voluntary controlled	0.06	0.01	0.04	0.01
	Foundation	0.04	0.02	0.04	0.01
Main (10)	M_school propn.	0.12	0.06	0.05	0.06
	I_school propn.	0.15	0.05	0.09	0.04
	P_school propn.	-0.13	0.03	-0.12	0.03

	B_school propn.	-0.02	0.06	-0.04	0.05
	BC_school propn.	-0.08	0.07	-0.07	0.07
	BA_school propn.	-0.24	0.06	-0.29	0.05
	O_school propn.	0.13	0.04	0.04	0.04
Interaction (210)	M*M_school propn.	-0.12	0.08	-0.11	0.09
	I*I_school propn.	-0.08	0.04	-0.01	0.04
	P*P_school propn.	-0.13	0.03	-0.07	0.03
	B*B_school propn.	-0.01	0.05	0.05	0.05
	BC*BC_school propn.	-0.15	0.07	-0.05	0.07
	BA*BA_school propn.	-0.19	0.05	-0.04	0.06
	Sample size	512409		514195	

Notes
1. * - < |0.005|
2. Reference categories as in Table 3.

Table 9: Predicted KS2 means by ethnic group and sex, first progress model

Group	English						Mathematics					
	Boys			Girls			Boys			Girls		
	KS1 =-1	KS1 =0	KS1 =+1	KS1 =-1	KS1 =0	KS1 =+1	KS1 =-1	KS1 =0	KS1 =+1	KS1 =-1	KS1 =0	KS1 =+1
WB	-0.90	0	0.90	-0.74	0.18	1.10	-0.89	0	0.89	-1.09	-0.17	0.75
M	-0.80	0.06	0.92	-0.62	0.26	1.14	-0.87	0	0.87	-1.05	-0.15	0.75
I	-0.71	0.13	0.97	-0.53	0.33	1.19	-0.68	0.18	1.04	-0.86	0.02	0.90
P	-0.71	0.12	0.95	-0.54	0.31	1.16	-0.83	0.13	0.99	-0.95	-0.07	0.81
B	-0.61	0.20	1.01	-0.44	0.39	1.22	-0.64	0.18	1.00	-0.87	-0.02	0.83
BC	-0.89	-0.05	0.79	-0.65	0.21	1.07	-1.03	-0.18	0.67	-1.13	-0.26	0.61
BA	-0.64	0.15	0.94	-0.44	0.37	1.18	-0.90	-0.10	0.70	-0.95	-0.09	0.77
C	-0.56	0.27	1.10	-0.41	0.44	1.29	-0.38	0.42	1.22	-0.58	0.25	1.08

Note
Intercept term omitted from the predictions.

Table 10: Descriptive data: FSM and residential mobility by ethnic group

Ethnic group	n	% never claiming	Mean scale score			Number of moves	
			Pupil	School	LEA	% ≥ 1	Mean
White British	447994	80	1.21	1.23	1.29	27	0.33
White other	13262	67	2.05	1.75	1.73	45	0.57
Mixed	17059	64	2.19	1.77	1.71	34	0.43
Indian	11808	83	0.97	1.73	1.78	31	0.38
Pakistani	15595	57	2.61	2.61	1.94	33	0.41
Bangladeshi	6716	42	3.56	3.45	2.75	31	0.38
Other Asian	3356	68	1.88	1.90	1.75	55	0.72
Black Caribbean	8272	59	2.44	2.62	2.36	34	0.43
Black African	9813	45	3.45	2.83	2.35	55	0.72
Black other	2165	52	2.92	2.50	2.22	42	0.54
Chinese	1728	85	0.90	1.53	1.63	37	0.45
Other	4162	47	3.34	2.54	2.17	54	0.71
All	541930	76	1.41	1.43	1.42	29	0.37

Note
These data refer to the cohort of pupils in English schools at both KS1 and KS2

The extended models for progress include:

(i) the FSM measure, varying randomly across schools (Deviance statistics: χ^2_{12} = 128 (Eng.), χ^2_{11} = 66 (Maths.)) and also at the pupil level to accommodate within school heteroscedasticity (Deviance statistics: χ^2_2 = 776 (Eng.), 1457 (Maths.));

(ii) interactions between FSM and ethnic group (Wald statistics for Interaction (12): χ^2_{11} = 85 (Eng.), 28 (Maths.)) so this interaction was omitted from the model for mathematics;

(iii) school mean FSM, varying randomly at LEA level (Deviance statistics: χ^2_2 = 6.3 (Eng.), 20 (Maths.));

(iv) LEA mean FSM (Wald statistics for Main (3): χ^2_1 = 17 (Eng.), 16 (Maths.));

(v) interactions between pupil and school FSM scores (Wald statistics for Interaction (12): χ^2_1 = 11 (Eng.), 38 (Maths.)), between school and LEA FSM means (Wald statistics for Interaction (27): χ^2_1 = 17 (Eng.), 8.2 (Maths.)), and between school FSM and KS1 scores (Wald statistics for Interaction (26): χ^2_1 = 78 (Eng.), 227 (Maths.));

(vi) the residential mobility measure, varying randomly across schools (Deviance statistics: χ^2_{12} = 299 (Eng.), χ^2_{11} =219 (Maths.));

(vii) interactions between residential mobility and (a) ethnic group (Wald statistics for Interaction (47): χ^2_{11} = 45 (Eng.), 62 (Maths.)), (b) school FSM (Wald statistics for Interaction (24): χ^2_1 = 14 (Eng.), 41 (Maths.));

(viii) size of the school cohort and its interaction with school FSM (Wald statistics for Main (3) and Interaction (25): χ^2_2 = 112 (Eng.), 79 (Maths.)).

The introduction of these explanatory variables provides new insights into progress over the period of interest but does not have any substantial effects on the ethnic group estimates and their interactions with sex in Table 9. The estimates of the interactions between KS1 tests and ethnic group are somewhat lower in the extended model and the estimates of the school proportions of minority ethnic groups and their interaction with ethnic group become unimportant. Table 11 gives the estimates of the fixed effects only for the variables introduced into the extended model.

Table 11: Fixed effects, second progress model

Fixed effects		English		Mathematics	
		Estimate	s.e.	Estimate	s.e.
Main (1)	FSM (Pupil)	-0.02	*	-0.02	*
Main (2)	FSM (School)	-0.08	0.01	-0.05	0.01
Main (3)	FSM (LEA)	0.04	0.01	0.03	0.01
Main (4)	Res. mobility (RM)	-0.01	*	-0.03	*
Main (5)	School size/10 (SS)	-0.01	*	-0.003	0.001
Interaction (12)	FSM,P*S	0.001	0.0003	0.0024	0.0003
Interaction (23)	FSM,S*LEA	0.01	*	0.010	0.004
Interaction (24)	FSM(S)*RM	0.005	0.001	0.0082	0.001
Interaction (25)	FSM(S)*SS	-0.003	0.001	-0.003	0.001
Interaction (26)	KS1 test*FSM(S)	-0.01	*	-0.01	*
Interaction (17)	WO*FSM(P)	-0.0039	0.002	-	-
	M* FSM(P)	0.0027	0.002	-	-
	I* FSM(P)	0.0099	0.003	-	-
	P* FSM(P)	0.0097	0.002	-	-
	B* FSM(P)	0.012	0.003	-	-
	AO* FSM(P)	0.014	0.004	-	-
	BC* FSM(P)	0.0039	0.0023	-	-
	BA* FSM(P)	0.0052	0.0021	-	-
	BO* FSM(P)	0.0037	0.0043	-	-
	C* FSM(P)	0.0081	0.0068	-	-
	O* FSM(P)	0.0055	0.0032	-	-
Interaction (47)	WO*RM	0.03	0.01	0.03	0.01
	M*RM	0.01	0.01	*	0.01
	I*RM	0.01	0.01	0.02	0.01
	P*RM	0.02	0.01	0.03	0.01
	B*RM	*	0.01	0.01	0.02
	AO*RM	0.06	0.02	0.09	0.02
	BC*RM	0.03	0.01	0.01	0.01
	BA*RM	0.04	0.01	0.02	0.01
	BO*RM	*	0.02	0.05	0.02
	C*RM	0.03	0.03	0.04	0.03
	O*RM	0.02	0.02	0.06	0.02
	Sample size	507672		509446	

Notes

1. * - < |0.005|
2. Interactions with FSM are given to 4 d.p.

£. Model included other terms not shown here.

We see from Table 11 that where families claim FSM for each of the four years (i.e. score = 7) then their children make about 0.15 SD units less progress than children for whom no claims are made. However, for English, this difference is smaller for minority ethnic groups. The estimates for the measures of FSM at the three levels in Table 11 show that the deleterious effects of being a poor child in a school with other poor pupils are mitigated if that school is in an LEA with a high proportion of poor pupils. Thus, a pupil claiming FSM each year and attending a school with a mean FSM score of four is predicted to make 0.23 SD units more progress in English and 0.18 SD units more progress in mathematics if the school is in a poor LEA (FSM = 3) than the same kind of pupil in the same kind of school in

a prosperous LEA (FSM = 0.5). Also, although between LEA variation in progress is small, it is greater for schools with higher FSM scores. It is possible that schools in poorer LEAs are better financed and so the mitigating effects of poverty arise from these extra resources. This is, however, a complicated question to address – see Steele et al. (2006) for an attempt to do so for secondary schools. Residential mobility has a detrimental effect on the progress of white British pupils but less so for minority groups where, at least for some of the 'other' groups, it is associated with more progress.

Turning to the random effects from the extended model, we find that there is a little more variability within schools for boys' progress in English but not in mathematics and, for both subjects, level-one variability increases as the FSM score increases. We can use the estimated covariance matrix at level two to estimate between school variances for different combinations of the random effects. These between school variances are easier to interpret than the individual random effects and are shown (for selected combinations) in Table 12.

Table 12: Estimated between school variances from second progress model

Ethnic group	Sex	KS1 test	KS1 TA	FSM	Res. Mobility	Level 2 variance	
						English	Maths
WB	B	0	0	0	0	0.08	0.07
WB	B	1	0	0	0	0.07	0.06
WB	B	2	0	0	0	0.10	0.07
WB	B	0	1	0	0	0.07	0.06
WB	B	0	2	0	0	0.07	0.05
WB	B	1	1	0	0	0.07	0.04
WB	B	2	2	0	0	0.08	0.03
WB	B	-1	0	0	0	0.11	0.10
WB	B	-2	0	0	0	0.16	0.16
WB	B	0	-1	0	0	0.08	0.09
WB	B	0	-2	0	0	0.09	0.12
WB	B	-1	-1	0	0	0.11	0.12
WB	B	-2	-2	0	0	0.17	0.19
WB	G	0	0	0	0	0.08	0.07
WB	B	0	0	4	0	0.07	0.06
WB	B	0	0	0	1	0.07	0.07
M	B	0	0	0	0	0.08	0.07
I	B	0	0	0	0	0.06	0.08
P/B	B	0	0	0	0	0.08	0.08
BC/BA	B	0	0	0	0	0.08	0.09
O	B	0	0	0	0	0.08	0.07
BC/BA	B	-1	-1	0	0	0.11	0.14
BC/BA	B	-2	-2	0	0	0.17	0.21
BC/BA	B	-2	-2	4	0	0.17	0.21
BC/BA	B	-2	-2	0	1	0.16	0.20
BC/BA	G	-2	-2	0	0	0.16	0.21

The estimated between school variance for the first row of Table 11 is just $\hat{\sigma}^2_{u0}$ whereas for the final row it is:

$$\hat{\sigma}^2_{u0} - 4\hat{\sigma}_{u01} + 4\hat{\sigma}^2_{u1} - 4\hat{\sigma}_{u02} + 8\hat{\sigma}_{u12} + 4\hat{\sigma}^2_{u2} + 2\hat{\sigma}_{u03} - 4\hat{\sigma}_{u13} - 4\hat{\sigma}_{u23} + \hat{\sigma}^2_{u3}$$

where subscripts 0, 1, 2 and 3 refer to intercept, KS1 test score, KS1 teacher assessment and sex respectively. This variance function illustrates just how the between school variance is influenced by the covariances between random effects as well as by their variances and hence why, for example, FSM score does not affect the overall variance between schools despite having a non-zero between school variance.

The main points to emerge from Table 12 are:

(i) between school variance in progress tends to be higher for lower-attaining pupils in both subjects at KS1, and also lower for higher-attaining pupils at KS1 in mathematics although not in English;
(ii) between school variance is somewhat higher for black Caribbean/black African pupils (a combined category) for mathematics although not for English;
(iii) sex, FSM and residential mobility all have negligible effects on between school variances.

6. Discussion

We find that, with one exception that we return to shortly, minority ethnic pupils are, on average, either ahead of white British pupils at KS2 (Indian and Chinese) or they make more progress between KS1 and KS2. In particular, low-attaining minority ethnic pupils at KS1 make considerably more progress than white British pupils and one possible explanation for this is that the disadvantages of not having English as a first language dissipate with time. It is, nevertheless, important to recognise just how large the gaps between the majority and the lower attaining groups – Pakistanis, Bangladeshis, black Caribbeans and black Africans – can be at KS2 when pupils in these groups attend schools with high proportions of their groups. These gaps are likely to be difficult to bridge during secondary school.

This generally optimistic picture of minority ethnic group performance is tempered, however, by one area of concern: the school attainments of black Caribbean pupils and especially black Caribbean boys. We see that black Caribbean boys are well behind their white British counterparts at KS2; they make less progress than all other groups between KS1 and KS2, and this is particularly so for pupils who were doing well at KS1; and the gap between them and white British pupils does not appear to have narrowed over a generation. Moreover, black Caribbean pupils are doing much less well in mathematics at KS2 than they are in English and this finding points to the importance of analysing subjects separately rather than constructing an overall measure of attainment. The situation does not seem to improve in secondary school or in later life. The odds of a black Caribbean boy getting 5 A* to C GCSE grades (including English and mathematics) are only half those of a white British boy; this rises to 0.64 for a black Caribbean girl relative to a white British girl (DCSF, 2007). The corresponding figures for the next poorest achieving group - the Pakistani group - are 0.68 and 0.72. Dustmann and Theodoropoulos (2006), using LFS data, show that the odds of a second generation black Caribbean man having a qualification equal to the equivalent of a first degree are 0.61 times those of a white British man whereas this rises to 0.83 for a woman relative to a white British woman. The corresponding figures for the Pakistanis are 2.1 and 1.1. The second generation groups in their analyses all have a mean age of about 30. These conclusions are reinforced by

analyses of NPD data by Kingdon and Cassen (2007) and by analysis of data from the Longitudinal Study of Young People in England by Strand (2006).

The NPD is not a suitable dataset for understanding why these differences exist and why they appear to be so persistent. It is worth noting that the proportion of the black Caribbean group claiming FSM, although much higher than for white British families, is not as high as the Bangladeshi, black African and Pakistani groups and so poverty does not seem to provide a full explanation of these differences. Strand (2006) came to a similar conclusion for the period from KS2 to KS3 at age 14. One possible explanation comes from the data on between school variance. This is greater for low attaining pupils at KS1 and also for the combined black group of black Africans and black Caribbeans. This suggests that primary schools can have both stronger positive and negative effects for low attainers and, conditional on low attainment, for the black group. It might therefore be possible to learn more about factors that either depress or enhance the attainments of these groups from more detailed study within schools. In addition, the fact that there is more variation in pupils' progress within schools at higher levels of poverty in the family (as measured by FSM) suggests that within school practices (for example, setting pupils by perceived ability levels) might have a part to play in furthering our understanding of inequalities. It is, however, worth noting that the gap between black Caribbean and white British children is found as young as age three and that it is more marked for boys. Analyses of data from the Millennium Cohort Study, reported by George et al. (2007), show that on tests of vocabulary and school readiness, black Caribbean boys are over 0.4 SD units behind their white British contemporaries whereas the gap for girls is between 0.29 (school readiness) and 0.35 SD units (vocabulary).

This paper, in common with most other research, compares the attainments and progress of minority ethnic groups with those of the majority white British group. If, however, we were to make the high attaining Chinese group the reference group then we would see that all other groups are doing relatively poorly. This suggests that a better understanding of the factors that lead to the relative educational success of the Chinese pupils might help to raise attainment levels of all other groups.

Turning to more methodological issues, we find that the richness and size of the NPD create opportunities for detailed and insightful analyses of educational attainment and progress. One difficulty that analysts face, however, is how to reconcile the competing demands of improved model fit (as judged by likelihood ratio (deviance) and Wald tests for example) that comes with adding increasingly complex interactions and random effects to the model on the one hand, and the parsimony principle on the other. The models presented here err on the side of being inclusive in that in only a few instances that had no bearing on the substantive conclusions about ethnic group differences have terms been excluded from a model when, on conventional criteria of statistical significance, they should have been included. One justification for this more inclusive approach is that estimates of interactions and random effects that, on their own, are small can combine to have an important bearing on the overall findings.

The models for progress generate another set of questions about which explanatory variables should be included. I have chosen to omit English as an additional language (EAL) and special educational needs (SEN) that, for example, Melhuish et al. (2006) use. Consequently, it is not possible directly to compare their results with these, a difficulty rather exacerbated by some unlikely parameter estimates in their progress models such as a strongly positive effect on progress in English and mathematics (but not in science) of having the *lowest* teacher assessment of science at KS1. Other candidate variables for

inclusion in the models are age, and variables measured at the Census output level such as the Index of Multiple Deprivation. It is certainly the case, as Goldstein et al. (2007) demonstrate, that younger pupils make more progress from KS1 to KS2 (but that they are still behind their older peers at KS2). There was, however, no evidence from initial analyses that age interacted with ethnic group so conclusions about ethnic group differences do not depend on the inclusion of age in the model. The area-level statistics were not available for these analyses but they are, at best, only another proxy for economic position and if used as a pupil-level variable, ignore the fact that variation between families within small areas can be considerable.

Statistical model-building inevitably involves a degree of judgment that is informed by subject-matter considerations and the models presented in this paper are no different. For example, if it were computationally feasible to incorporate cross-classifications and multiple school membership into models for national as opposed to the local data used by Goldstein et al. (2007), then a different pattern of results might emerge although the evidence presented by them suggests that the fixed effects at least are unlikely to change much. It does, however, seem clear that modelling school and LEA differences as random effects that is inherent in the multilevel approach does offer many advantages over the fixed effects approach used by other analysts of NPD (for example, Wilson et al., 2005; Kingdon and Cassen, 2007). Although modelling LEAs and schools as fixed effects can offer advantages when there are concerns about the endogeneity of institutions and areas, it is difficult to apply with such a large data set (over 14 thousand schools, for example) and it does not allow the analyst the opportunity to unravel and describe the complex variation at different levels that is such a feature of these data and which provides a richer understanding of ethnic group differences in a situation in which causality (and hence endogeneity) is not the main concern.

We should also recognise that not only is the minority ethnic population diverse in a way that is not always captured by necessarily rather coarse-grained official classifications, it is also changing so that the more traditional Caribbean, African and South Asian categories no longer reflect the great majority of minority young people as they used to. The increasing proportions of ‘mixed’ pupils and increasing numbers of pupils from ‘new’ groups such as those from eastern Europe and the Middle East suggest that flexibility is needed in the way ethnic categories are constructed and reconstructed over time in order to highlight situations where particular groups are not doing well.

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