

# Factors associated with achievement: key stage 2

Research report

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Any remaining errors or omissions are the responsibility of the research team.

# **Executive Summary**

This report assesses whether free school meal (FSM) eligibility can be improved upon as a proxy for socio-economic status (SES) for primary school pupils. Specifically, it considers how well FSM eligibility predicts pupil achievement relative to other alternative proxy measures of family background or neighbourhood. This report follows work undertaken asking the same empirical questions for secondary age pupils (Sutherland et al., 2015; herein 'KS4 report'), and the intention is that the reports should be considered together, but can also be read as stand-alone pieces of work.

# **FSM** eligibility

To be eligible for FSM, families (or children) must be claiming one of several benefits and notify the school of this. It is well known that there are limitations to using FSM as a proxy for socio-economic disadvantage (see e.g. Hobbs and Vignoles, 2009). One issue is that FSM-eligibility can fluctuate over time and is affected by economic cycles, with the number of families being FSM-eligible increasing during times of economic hardship. Equally in the English context parents have to register their children as eligible for FSM and there may be stigma associated with doing so (Iniesta-Martinez and Evans, 2012). Parents are also less likely to sign up if their child is not going to eat the meal. Hence recorded eligibility may vary by factors that affect whether or not the child is likely to eat a school meal, such as age, phase of schooling and ethnicity (McMahon and Marsh, 1999; see also the KS4 report). It is therefore important to consider how well FSM eligibility predicts pupil achievement across the different phases of the school system and whether other proxy measures of family background are more predictive. That said, the relationships described in this report are not causal, and given other factors that drive attainment that may be missing from the models, should not be interpreted as such.

# Research questions addressed in this report

- 1. Can FSM histories be improved on as a proxy for social deprivation?
- 2. What alternative (practical) proxy measures of SES can be used that better capture variation in achievement?
- 3. Do alternative proxy measures better enable us to identify pupils at risk of low achievement?
- 4. Does the pattern of results observed for different proxies at KS4 hold for KS2?

#### Methods and data

This study combined data from the Millennium Cohort Study (MCS), a prospective longitudinal study of 19,000 UK children born in 2000/1, with publicly-available data from the Census and linked administrative data from central government. The focus of the analysis was on predicting pupils' achievement at key stage 2 (KS2, age 11) in 2011/12. Specifically the dependent variable is the average of the English and mathematics fine grade KS2 level scores. The sample was restricted to pupils attending state-funded mainstream schools in England, since data on KS2 results was only available for these pupils (max n = 6,917, estimation sample=5,456).

The proxy variables considered were:

- highest household education;
- highest household occupation;
- household income;
- household characteristics such as housing tenure;
- neighbourhood measures including measures of neighbourhood poverty (IDACI) and neighbourhood occupations, derived from census data.

# **Previous key stage 4 findings**

The findings from the secondary school key stage 4 (KS4) analyses contained in Sutherland et al. (2015) frame the present study. Those results relate to KS4 attainment in 2006, as opposed the current study relating to KS2 attainment in 2012. The overall conclusion from the KS4 work was that, at least in terms of explaining KS4 achievement (age 16, GCSE or equivalent), FSM eligibility remained the 'best practical proxy' of SES. 'Best' in that FSM eligibility captured variation as well as alternative measures; 'practical' in that the potential costs of switching to another approach far outweigh the gains of doing so. Thus a key motivator – and therefore central question for this research – was to assess whether similar patterns of results were observed for the same proxies and attainment at KS2.

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<sup>&</sup>lt;sup>1</sup> The KS4 study used data from the first phase of the Longitudinal Study of Young People in England. <sup>2</sup> Fine grade scores use the level thresholds and the actual marks awarded in the test paper to create a measure with finer distinctions. This assigns pupils to a subdivision of the national curriculum level e.g. a pupil halfway between the level 4 and level 5 thresholds may be deemed to have a fine grade of 4.5.

<sup>&</sup>lt;sup>3</sup> Special schools were also excluded.

# **Key findings from KS2 research**

The overall pattern of results for KS2 was remarkably similar to that found for KS4, in relation to both the relative performance of proxy measures and FSM eligibility itself.

The magnitude of the variation that was explained in the KS2 achievement models was much less than in the secondary school models. This can be caused by differences in the outcomes being assessed, as well as differences in the sample and other variables used in the model. However, the pattern of results was very similar for primary and secondary school achievement, i.e. the predictive power of FSM eligibility relative to other proxy variables showed similar patterns.

Models that included FSM eligibility explained about 14% of the variation in pupil achievement at KS2. If a measure of 'years FSM' or 'ever FSM eligible in the previous six years' was included, this performed slightly better than a measure relating to 'current FSM'. (Which was also the case with KS4.)

Parental education, parental occupations and household income were individually slightly 'better' predictors of achievement, but this gain was marginal versus the potential costs of moving to a new system, between one and four percentage point increase above using FSM alone. (Which was also the case with KS4.)

Neighbourhood level measures of SES performed 'worse' than FSM, typically a few percentage points lower in terms of variance explained. This differed from the KS4 results and suggests that the correlation between neighbourhood measures and KS2 outcomes is weaker than for KS4 outcomes.

Combining all the 'practical' proxy variables (FSM eligibility and neighbourhood based measures) into one model did not produce an appreciable advantage in terms of predicting achievement, as compared to using FSM measures on their own. (Similar to KS4 results.) Models that include prior attainment perform 'best' overall in terms of explaining variation, as was also the case at KS4. However, predicting outcomes based on early testing, particularly with very young children, is inherently error-prone, particularly if those children are from poorer backgrounds (see Crawford et al., 2014). Further, for a wide range of reasons, pupils may make more or less progress than expected given early testing.

The statistical models presented in this report (and the sister report on KS4) can be used for systems analysis, and/or to better understand the relationship between socio-economic disadvantage and pupil achievement. But they are probabilistic and can predict likely achievement for groups of students who have particular characteristics *on average*. They cannot be reliably used to predict an individual child's future achievement since there is likely to be much variation around the average and a considerable amount of error for children who are not near the

average. It is also worth remembering that explaining 10-15% of variation in pupil attainment using general measures of socio-economic status and household characteristics is what might be expected given the many intervening (and unmeasured) factors related to this outcome.

#### **Conclusions**

The conclusions from this report closely follow those from the previous KS4 report. Namely, that FSM eligibility is the best 'practical' proxy of socio-economic status for predicting pupil achievement, as it does better than the alternative proxy indicators that might be feasible to use, such as neighbourhood measures of deprivation. There are family background indicators that would outperform FSM as predictors of low achievement, such as parental education or occupation. However, the gain in predictive power is relatively small and the difficulty of collecting better proxy information, and indeed the high cost of collecting such data, makes FSM a practical choice. At the same time, one must keep in mind that all the measures of poverty considered here only capture or proxy the effects that living in deprivation can have on individuals' attainment. Further, there are many other factors associated with attainment that are not included here.

It is also noteworthy that the predictive power of neighbourhood data is weaker at primary level. This may be because peer effects are weaker at primary and hence neighbourhood matters less than home background. Or it may be because the level or school sorting is greater at secondary level than at primary. Sorting could begin before primary school and continue through a pupil's school career, based largely on factors known to be associated with school performance such as income. The end result would be highly 'sorted' neighbourhoods at KS4 where neighbourhood characteristics correlate more strongly with KS4 outcomes. It was not possible to definitively explain why this may be the case but it does suggest that alternatives to FSM eligibility based on postcode and neighbourhood census data may be even less desirable at primary school level.

It was also notable that even when included alongside a range of other measures of socio-economic status, FSM remained statistically related to KS2 outcomes. This suggests that FSM eligibility was still able to capture something 'unique' about the lived experience of deprivation during the primary years that even the rich measures of socio-economic status, collectively, miss.

#### 1. Introduction

#### 1.1 Introduction

This report assesses whether free school meal eligibility (FSM) can be improved upon as a proxy for socio-economic status (SES) for primary school pupils. This report follows work undertaken asking the same questions for secondary age pupils (Sutherland et al., 2015), and the intention is that the reports should be considered together, but can also be read as stand-alone pieces of work. That said, this particular report was intended as a replication of the secondary (KS4) research (henceforth 'the KS4 report'), so much of the rationale, background literature and discussion of methodology is included in the KS4 report. This is cross-referenced where relevant.

#### 1.1.1 A note on replication

Replication means testing the same approach or analysis in a new context or with new data – here the different context/data are primary school pupils measured at a different time from the KS4 pupils in the secondary school report. The KS4 report relates to pupils sitting GCSEs in 2005/6, whereas this report is on KS2 outcomes from 2011/12. The shift to younger pupils means that it is not possible to use exactly the same measures as were used for the KS4 report and of course by definition some of those measures will differ due to the different age group – most notably the attainment measure itself. The value of keeping as closely as possible to the approach used in the KS4 report is that it allows one to understand whether the pattern of results and the relative magnitude of results are similar (or not) when looking at KS2.

# 1.2 What is free school meal eligibility and what are its limitations?

As noted in the KS4 report, there is a wealth of literature examining the association between pupils' socio-economic background and progression/attainment within a given educational system. Practical questions about how best to measure pupils' socio-economic status abound and there are a number of different possibilities. In England the current measure used is FSM eligibility.

To be eligible for FSM, families (or children) must be claiming one of several benefits and notify the school of this.<sup>4</sup> It is well known that there are limitations to using FSM

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<sup>&</sup>lt;sup>4</sup> For a list see <a href="https://www.gov.uk/apply-free-school-meals.">https://www.gov.uk/apply-free-school-meals.</a>

as a proxy for economic disadvantage (see e.g. Hobbs and Vignoles, 2009). One issue is that being FSM-eligible can fluctuate over time and is affected by economic cycles and in particular by recessions, with the number of families being FSM-eligible increasing during times of economic hardship.. Equally in the English context students, or rather their parents, have to register their children as eligible for FSM. They are less likely to do this if their child is not going to eat the meal. Hence recorded eligibility may vary by factors that affect whether or not the child is likely to eat a school meal (e.g. age and ethnicity) (McMahon and Marsh, 1999). Since this may vary according to the child's age, it is important to consider how well FSM eligibility predicts pupil achievement across the different phases of the school system.

Another issue is that the pool of pupils/families that are eligible for FSM during primary school may be qualitatively different from those eligible during secondary school. One example of this might be single mothers with a high level of education who are not working during the first few years of their child's schooling. This might mean that parental education or household income could be more important than FSM in explaining pupil achievement in primary school, empirical questions that are assessed below.<sup>5</sup>

# 1.3 The relationship between FSM and pupil attainment at KS2

Whichever measure is used, there is a persistent attainment gap between those eligible and claiming versus those ineligible / not claiming FSM, as Figure 1 (below) sets out. Simplistic analyses such as these do not account for other differences between FSM and non-FSM pupils that lessen or reduce differences in outcomes; nevertheless, they make clear that since measures began, and despite some successful policy initiatives aimed at reducing this gap, pupils from deprived backgrounds have poorer attainment than their peers.

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<sup>&</sup>lt;sup>5</sup> One should also keep in mind that the thresholds for benefits may shift over time. There is a six year gap between study data in which time eligibility criteria could alter substantially.

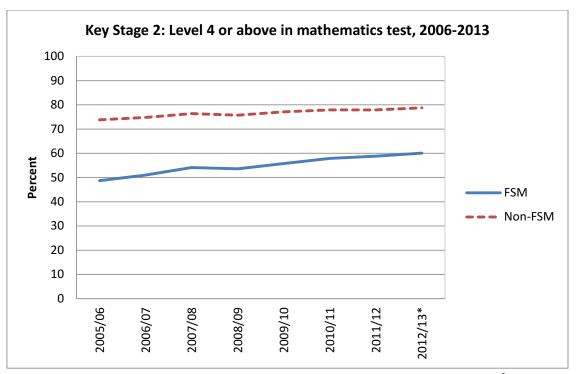


Figure 1 Attainment at key stage 2 and FSM eligibility 2005/06 – 2012/13<sup>6</sup>

# 1.4 Summary of KS4 results

The findings from the KS4 analyses contained in Sutherland et al. (2015) frame the present study. Broadly, that study found that there were relationships between proxies and attainment, with some of these measures – notably parent/carer education and occupation – performing 'better' that FSM in the sense that they explained a greater proportion of the variation in pupil achievement. One measure that produced surprising results was household income – this was not as strongly related to FSM eligibility as previous research suggested, a finding put down to the quality of the income measure used. The overall conclusion from this previous work was that, at least in terms of explaining KS4 achievement, FSM eligibility remained the 'best' practical proxy of SES. There are different ways of using FSM, such as the current 'ever6' FSM (i.e. eligible for FSM in any of the previous six years), the number of years a pupil was eligible for FSM, or whether a pupil was eligible for FSM in the most recent school year; the conclusion relates to the use of the 'ever6' FSM measure versus others. Thus a key motivator – and therefore central question for this research – was to assess whether similar patterns of results were observed for the same proxies and attainment at KS2. So that readers do not have to switch

<sup>&</sup>lt;sup>6</sup> Figures for 2012/13 provisional. Sources for both figures given in references section. The definition of Key Stage 2 attainment levels can be found here: <a href="http://www.education.gov.uk/schools/performance/primary">http://www.education.gov.uk/schools/performance/primary</a> 14/index.html

<sup>&</sup>lt;sup>7</sup> The performance of proxies was assessed via pupil-level variance explained (see Sutherland et al., 2015: 31-32; Snijders and Bosker, 1994).

between the two reports, the main findings from this primary school report are contrasted with those from the earlier secondary report.

# 1.5 Measures to supplement FSM

To match the KS4 report, the following measures were used, grouped by the spatial unit they relate to (household, neighbourhood). Discussions of the research evidence relating to the measures can be found in section 1.1.4 of the KS4 report. A discussion of where these measures comes from is in Section 3 below.

#### Household

- Highest parental occupational class.
- Highest parental education level.
- Household employment status.
- Annual parental income.
- Other household characteristics, such as housing tenure and mothers' age.

#### Neighbourhood

- Income Deprivation Affecting Children Index (IDACI).
- Occupational groups, e.g. the proportion of the working population in 'Higher managerial, administrative and professional occupations' based on the fiveclass occupational (NS-SEC) grouping, as a proxy for the overall economic wellbeing of the local area.

# 2. Research questions and purpose of the project

The research questions framing the project were:

- 1. Can FSM histories be improved on as a proxy for social deprivation?
  - If so, what measures can be used and what improvement do they make? Within that: who are the FSM eligible children and what are their characteristics?
- 2. What alternative (practical) proxy measures of SES can be used that better capture variation in achievement?

For example, are models using neighbourhood and geographic indicators better at predicting variation in achievement than models that rely on FSM? Are models that use a combination of both FSM and alternative proxies better at predicting achievement?

- 3. Do alternative proxy measures better enable us to identify pupils at risk of low achievement?
- 4. Does the pattern of results observed for different proxies at KS4 hold for KS2?

# 2.1 This study is not about causation, school effectiveness or individual pupils

Combining large-scale survey and routine administrative data has advantages — most notably the capacity to go beyond what each source offers on its own. But however rigorous the analytical approach used it is important to state that this research does not — and was never intended to — allow an estimation of causal effects. At most it would be possible to say whether or not a given proxy is predictive of KS2 attainment, but this does not mean that the relationship is causal and there are likely many intervening and largely unmeasured factors between, for example, household income and pupil attainment. Similarly, even when using rich survey data it is not possible to account for all the factors influencing pupil achievement.

Using statistical models also carries an inherent uncertainty about the associations found – technically expressed through standard errors and confidence intervals. But more importantly statistical models relate to associations 'on average' and cannot be used to infer outcomes for specific individuals. Finally, this research can help inform policy decisions by giving insight into the possible implications of using different measures to identify pupils at risk of not achieving but it cannot decide what the policy objectives should be. The main contribution made by this report (and the KS4 report) is to help policy-makers assess whether – and how – the current system

might be improved specifically in relation to the measurement of socio-economic disadvantage and the use of proxy variables to predict pupil achievement.

# 2.2 Overview of analysis approach

As described in the next section, the analysis made use of Millennium Cohort Study data, combined with publicly-available data from the Census and linked administrative data. The research team were assisted by colleagues from the Centre for Longitudinal Studies and are grateful for their assistance in this respect.

Proxies were chosen during the initial project on KS4 (see Sutherland et al., 2015) so these were also used for the KS2 analyses. These proxies and full sets of controls were analysed using multilevel linear models, accounting for the clustering of pupils in schools. The analysis followed the pattern illustrated by Figure 2 below. Specifically, all models control for a range of factors that influence pupil achievement (individual factors, region, and school). As will be discussed in section 4.5, prior attainment was not part of the set of basic controls included in every model. This approach allowed for the estimation of 'absolute' gaps in attainment between the different socio-economic group (as driven by the various proxies) instead of the *progress* made by pupils during KS2. In the first model the FSM eligibility measure was added as the indicator of pupil socio-economic background and the predictive power of the model was assessed. The FSM eligibility measure was then removed and replaced with each alternative proxy variable separately and sequentially, testing in each case the predictive power of the proxy in the model. By doing this it is possible to compare the predictive power of the different proxy variables.

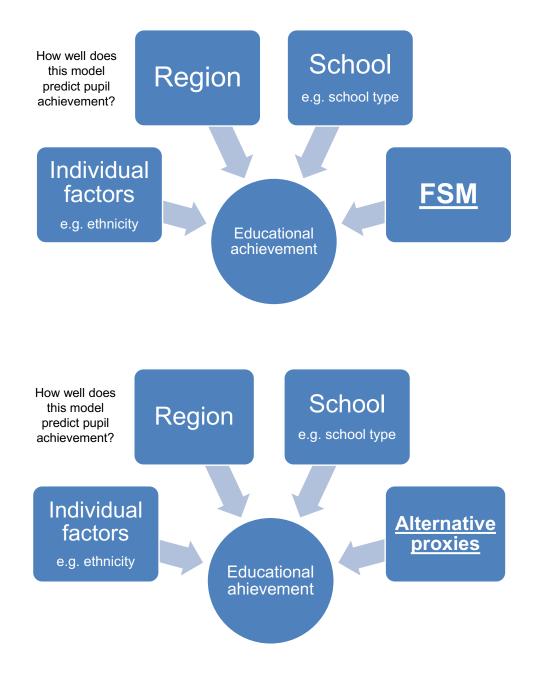


Figure 2 Summary of modelling approach

# 3. Data sources used in the study

The main data set used in this report is the Millennium Cohort Study (MCS). The MCS was constructed from a sample of all live births in the UK, which for England and Wales took place over a 12 month period from 1 September 2000 and 31 August 2001 (Hansen et al., 2014). The sample was restricted to English pupils, since KS2 results were only available for these pupils (n=7,476). The MCS sample disproportionately over sampled children from poor backgrounds to ensure sufficient representation of such pupils. In particular pupils from the poorest 25% of wards based on the Child Poverty Index (CPI) and from areas with high (>30%) concentrations of Black and Asian families were over sampled.<sup>8</sup>

#### Additional data merged for analysis

The following five datasets were merged to create the analysis file:

- 1. MCS wave 1-3 (all but income from waves 1 and 2 to account for some late entries into the study; income from waves 1-3);
- 2. school variables, from Census and National Pupil Database (NPD) extracts:
- 3. all pupil level achievement data, from NPD and school/individual pupil census referring to the school year 2011-2012;
- 4. a FSM eligibility file, containing FSM variables from NPD for the period 2007-2012;
- 5. neighbourhood characteristics file (downloaded from the Census 2001 website and cleaned).<sup>9</sup>

<sup>&</sup>lt;sup>8</sup> Analytical weights supplied with the MCS were not used, but the variables used to construct these weights were included in all models. MCS guidance informs us that these measures are highly correlated with missingness in the study. Future research could usefully investigate various techniques to address the missing data, including multiple imputation. These approaches generally rely on the assumption that data are missing at random (MAR), which may or may not hold, but which is also invoked here on the basis of including many control measures correlated with missingness.
<sup>9</sup> In 2001, MCS young people were at most one year old, so these data relate to their neighbourhoods at that point in time.

# 4. Sample and measures

#### 4.1 Sample

The original sample for the MCS was 19,000 UK children, of which approximately 11,700 were in England. Consent for the matching of KS2 achievement data to English MCS participants occurred in Wave 4 of the survey. Therefore, respondents in the earlier waves of the MCS who subsequently dropped out of the survey, as well as those who did not consent to matching, did not have KS2 data. The initial sample (Wave 4) of England-only pupils with KS2 attainment results was 7,476, of which 7,085 had data at Wave 1 of the MCS (95%), 6,927 had data at Wave 2 (93%), and 7,167 had data at Wave 3 (96%).

The analytical approach, focusing on comparisons of the predictive power of a set of different proxies for socio-economic background, required that the analyses be carried out on the same sample of pupils. Therefore, all observations with missing data on least one of the variables to be used across all models were removed from the analysis (listwise deletion). The final estimation sample consisted of 5,456 pupils in 2,392 schools. The reduction in size compared to the original sample of pupils with KS2 attainment records is similar to the observed reduction in sample that occurred for the KS4 analysis in the accompanying secondary-school focused report. The analytical approach used here allows for the direct comparison between different statistical models, and therefore proxies, this issue will require additional work, outside the remit of this report

#### 4.2 Control measures

The analytical approach outlined above relies on the direct comparison of the predictive power of models including successive proxies for socio-economic deprivation. In addition to using a constant estimation sample, as discussed previously, all models use a consistent set of controls. Similarly to KS4, the set of controls is made up of several groups of variables (see Appendices I & II). Firstly, individual demographic variables are included to control for basic background factors:

- Quarter of birth, to account for the starting point of the school year and the age cut-offs in place at the time of the survey; the reference category is represented by children born between September and November.
- Gender, to account for known early developmental differences between boys and girls (reference category was boys).

- Ethnicity, as reported in the MCS questionnaire at Wave 1 (or Wave 2 for those families that joined the study later on); the reference category consists of White-British pupils, the largest group in the sample.
- English as an additional language, also derived from the MCS questionnaire: families where English is spoken at home alongside another language are not classed as EAL. (The reference category was pupils whose first language was English.)

Unlike the KS4 analysis, data security issues prevented access to items relating to the disability status of the children in the sample, and therefore, this variable was not included in analyses. The sampling approach relies on removing special schools from the sample. Therefore children in special schools, who have the more severe disabilities and learning needs and who would require enhanced levels of resource provision, are not included in the analyses presented below (n=47).

The next group of control variable refers to region and urban/rural environment, as a means of controlling for both regional differences in attainment and for the influence of living in an urban environment. The following variables were included:

- Region (formerly Government operational regions) with Yorkshire and the Humber as the baseline (matching the approach in the KS4 report).
- Urban/rural environment: urban identifies all pupils who, at the time of Wave 1 (and Wave 2 for families joining the survey later) reside in a denselypopulated area. (Reference category was rural.)

Additionally, the models all use the same group of school-level controls to account for differences between the institutions that pupils in the sample attend. The aim is to allow for the characteristics of schools and peer groups that might influence pupil achievement, in order that the independent correlation between the socio-economic background of children and pupil achievement could be identified. Therefore, the models include both objective features (such as school size) and official measures:

- School size, measured by the number of pupils enrolled at the end of KS2.
- Proportion of students eligible for free school meals, as a measure of the over-all level of deprivation in the school, and potentially an indication of peer effects on children's KS2 outcomes.
- Proportion of pupils classed as having Special Educational Needs (SEN), with statements.
- Proportion of pupils classed as SEN, without statements.

- Proportion of students classed as EAL (English as additional language) this
  differs from the KS4 approach, where the proportion of White students in
  school was used: while the EAL measure will capture a slightly different set of
  families (in particular in relation to within-EU migrant families), its aim is to
  represent a broad measure of the diversity within each school attended by
  members of the sample.
- School type (community, foundation, etc.).

#### 4.3 Outcome measure

The approach taken here was to use an average of the national curriculum level from English and Maths assessments taken at KS2. Fine grade level scores were used as these are directly interpretable: a one unit change in this measure relates to a national curriculum level. The 'shorthand' of KS2 level is used throughout. For the estimation sample used below, this ranged from 2.5 to 6.5, with a mean of 4.9 and a standard deviation of 0.7.

# 4.4 Choosing and describing potential proxies

#### 4.4.1 Proxy measure selection process

As part of the development work for this project modelling iterations were undertaken to assess several proxy measures. The steps in this process are described in section 4.4.1 of the KS4 report (Sutherland et al., 2015).

# 4.4.2 FSM eligibility

Three variants of free school meal eligibility were used in the analyses presented below:

- FSM eligibility in the school year KS2 exams were taken (in this case 2012).
- FSM eligibility ever in the six years preceding KS2 exams.

<sup>10</sup> Fine grade scores use the level thresholds and the actual marks awarded in the test paper to create a measure with finer distinctions. This assigns pupils to a subdivision of the national curriculum level e.g. a pupil halfway between the level 4 and level 5 thresholds may be deemed to have a fine grade of 4.5. In 2011/12 a combined English level was determined by awarding notional test marks for a pupil's teacher assessment level in writing. Maths and English fine grades were averaged to produce the outcome measure used. The definition of Key Stage 2 attainment levels can be found here: http://www.education.gov.uk/schools/performance/primary 14/index.html.

Guidance on level calculations here:

http://www.education.gov.uk/schools/performance/2012/primary 12/KS1-2 Value Added Guide 2012.pdf

 Years of FSM eligibility preceding KS2 exams (2007-2012 inclusive), creating dummy variables identifying whether pupils were FSM eligible for none (the comparator), one, two, three, four, five or six years.

#### 4.4.3 Household employment

Employment was captured by whether one or both parents was in work. Unlike the KS4 report where it was possible to ascertain the parents' work status (full-time vs, part-time), the variables available within MCS did not. Therefore, a derived variable from MCS was used, which classified families into categories depending on whether each of the parents (or the single parent, in single-parent households) was "in work" as opposed to "unemployed". The reference category therefore is a family where neither parent is in work.

Similarly to the KS4 report, a measure recording whether pupils lived in single-parent households was also used in order to capture the independent relationship of employment over and above family structure.

#### 4.4.4 Household occupational class

Household occupational class was defined using the ONS NS-SEC classification, broadly covering 'managerial', 'non-managerial', and skilled/unskilled labour roles. <sup>11</sup> Dummy variables for each category were created and entered into models, with "Higher managerial" being omitted as the reference category.

#### 4.4.5 Household qualifications

To capture differences between households in terms of education level, the highest educational qualification achieved for either parent was used. These were then operationalised as n-1 dummy variables corresponding to different categories of educational attainment, with households with "Degree or above" as the reference or comparison category (and thus omitted).

#### 4.4.6 Household income

The secondary school research for KS4 outcomes found that there was not as strong a link between household income and pupil achievement as previous research would suggest. This was attributed to a reliance on self-reported household income in the first year of the study. Household income is typically mis-estimated by survey respondents and suffers from substantial non-response bias (see e.g. Hobbs and

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<sup>&</sup>lt;sup>11</sup> http://www.ons.gov.uk/ons/guide-method/classifications/current-standard-classifications/soc2010/soc2010-volume-3-ns-sec--rebased-on-soc2010--user-manual/index.html

Vignoles, 2009). To address these issues, which also arise in the MCS data, income data from waves 1-3 of the MCS, corresponding to when children in the study were pre-school (aged 0-4) were averaged to give a better indication of household income. No further modifications were performed on the variable, other than a rescaling to a unit of £1,000. A further step taken was to assess the relationship of household income whilst the child was in primary school (rather than pre-school), operationalised by averaging income from waves 4 and 5. The results from this analysis are reported in section 6.6 below.

#### 4.4.7 Household characteristics

The last of the household-related potential SES proxies consisted of a combination of factors present in the MCS questionnaire that reflected aspects of the household not previously captured above. The variables included in this set were:

- mother's age;
- whether the mother was of working age;<sup>12</sup>
- a series of dummy variables identifying the type of housing tenure: owned; privately-rented; rented from a local authority; or other housing arrangement;
- household size.

#### 4.4.8 Neighbourhood characteristics: occupations

The socio-economic proxies listed above all relate to the children and their families. It was believed, however, that neighbourhood-level characteristics may be a pragmatic way of measuring socio-economic deprivation, given the availability of Census data. The measure used here used data from the 2001 Census and was derived as the proportion of working-age people in the neighbourhood who, at the time of the Census, were in higher-managerial, lower-managerial/professional occupations (thereafter, top-level occupations). This mirrored the KS4 approach.

# 4.4.9 Income Deprivation Affecting Children Index (IDACI)

Similarly to the KS4 report, the first proxy referring to the neighbourhood was the 2004 Income Deprivation Affecting Children Index (IDACI), derived using data collected in the 2001 Census. This index relies on data collected at each Census and scores then ranks neighbourhoods based on the proportion of children affected by income deprivation via the fact that they live in low-income households. This

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<sup>&</sup>lt;sup>12</sup> Since the MCS includes carers under the mother/father denomination, this variable captures those who are at the extremes of the age distribution, as well as a majority of step families.

study uses the score (proportion) for each LSOA. To match the KS4 approach and ensure ease of interpretation, the index was rescaled by a multiple of 100 (originally 0 to 1).

#### 4.4.10 Summary of differences between KS2 and KS4 measures

For a large majority of cases, the creation of both control and proxy variables matched the KS4 strategy perfectly. However, a combination of data availability issues, and the different educational stage in the KS2 analysis led to four points of difference between the KS2 and the KS4 set of variables:

- Controls: the use of the *proportion of EAL students within schools* as opposed to the *proportion of self-reported White students* within schools; and the lack of an individual-level measure of disability (both these differences were compromises arising from the availability and accessibility of data).
- Proxies: the use of a general "in-work" category for the employment proxy (this emerged from the different manner of coding original and derived variables in MCS and LSYPE1); the different approach to handling the household income variable (which was driven by the variables available in MCS, and considered of higher quality than the approach in the KS4 analysis).

#### 4.5 Prior attainment

In the KS4 project, pupils' key stage 2 attainment was used as a way of testing whether candidate proxy variables were still associated with KS4 attainment once past variation in attainment had been accounted for. To parallel the approach taken – wherein prior attainment is measured independently and rigorously – the cognitive skills measures from the second sweep of MCS data were used (when pupils were around three years old). Following MCS guidelines that the cognitive measures should not be aggregated (Connelly, 2013), a single scale from the British Ability Scales – the raw vocabulary score - was used as a prior attainment measure. This score ranged from 0-80, with a mean of 55.

One point to keep in mind is the effect on interpretation that including prior attainment has on results. Without prior attainment, model results reflect the relationship between a given variable and the *final level* of pupil achievement. With prior attainment, model results tell us about a given variable and the *change* in pupil achievement between reception and KS2.

# 5. Analysis approach and results

# 5.1 What characterises FSM eligible children in the MCS?

The first aim of the KS2 analysis was to describe and compare FSM-eligible and non-FSM eligible pupils in MCS. Appendix III lists the proportion of cases (or the mean statistic, depending on the appropriate measure for the type of variable used) for the basic controls and the candidate proxies, for both FSM and non-FSM pupils.<sup>13</sup>

In the MCS estimation sample, 19.5% of pupils were eligible for FSM in at least one year during the six years prior to the end of KS2. Compared to pupils who were not eligible for FSM:

- Eligible pupils were more likely to come from households with lower qualifications. The parents of FSM-eligible children were 27.8 percentage points less likely to have a degree and 12 percentage points more likely to have only a Level-1 qualification.
- Similarly, FSM-children were 34 percentage points more likely to be in a household where both parents were unemployed.
- In terms of occupations, children eligible for FSM were 17 percentage points less likely to have parents with a higher managerial occupation, and 22 percentage points less likely to have parents with a lower managerial/professional occupation.
- Additionally, children who were eligible for FSM were more likely to be part of single-parent households. Of those children eligible for FSM, 22% were in single-parent households, while of those not eligible, only 5% were.

Household parental income was also significantly different between households of FSM and non-FSM children. The average annual income (over Waves 1-3 of MCS) for FSM-eligible households was £12,600, while for non-FSM-eligible households it was approximately £23,800. The ethnic make-up of the FSM/non-FSM was also different. Approximately 75% of the FSM-eligible pupils were White-British, while 85% of non-FSM-eligible pupils were of the same ethnic group. Overall, there were more children of the Indian, Pakistani, Bangladeshi, Black African and mixed White and Black Caribbean in the FSM-eligible group than in the non-FSM-eligible group.

With regard to the schools attended, FSM-eligible pupils were more likely to attend schools with a higher proportion of pupils classed as SEN (with or without

<sup>&</sup>lt;sup>13</sup> For the purpose of this table, FSM is defined as 'ever6fsm'.

statements), schools with a higher proportion of EAL pupils, as well as schools with a higher proportion of FSM-eligible pupils (see Appendix III).

#### 5.1.1 How do these results compare to secondary school?

The results show very similar patterns to the KS4 results. The proportion of FSM-eligible pupils is lower in the MCS sample, despite the over-sampling of low socio-economic background as part of the MCS design, a difference of seven percentage points to the LSYPE KS4 sample. A plausible explanation may relate to the lower proportion of single-parent households at KS2 (8.5% of the entire sample at KS2, vs. approximately 25% of the KS4 sample). Otherwise, the KS2 observed patterns are very similar to the KS4 results. <sup>14</sup>

# 5.2 Analysis approach: Multilevel models

Analyses were run using multilevel models, with pupils clustered in schools. This approach means that it is possible to examine sources of variation in outcomes between and within schools. In Table 1 below, results from several models are presented, with each column representing the results from a different proxy model. Each proxy is substituted in and out of the model as the working assumption is that only one proxy might be available to the Department, but a model containing all proxies together is included in section 6.1 below. All analyses presented were conducted using the xtmixed command in Stata 12 (StataCorp, 2014).

# 5.3 Results from SES proxy models

It is worth reiterating here that aside from the relative pattern of results it is not possible to directly compare results between the KS4 and KS2 reports. That is, one cannot say anything meaningful about the magnitude of the differences in 'variance explained' for a model of KS4 test scores compared to variance explained in a model of KS2 test scores. This is because the data, sample and outcomes are different. But, it is possible, for example, to discuss the *relative performance* of a particular proxy in the KS2 model compared to the relative performance of the same proxy in

 $Y_{ij} = \alpha_0 + b_1 x_{1ij} + b_2 z_{2j} + \mu_{0j} + \varepsilon_{ij}$ 

Where Yij is a continuous outcome measure for individual i in school j.  $\alpha_0$  is the overall intercept (average),  $b_{ij}x_{1ij}$  is an individual level measure for person i in school j and  $z_{2j}$  is a school level variable.  $\varepsilon_{ij}$  and  $\mu_{0j}$  are, respectively, the pupil and school level error terms (residuals) (see e.g. Snijders and Bosker, 2012).

<sup>&</sup>lt;sup>14</sup> As is common with may surveys, the MCS estimation sample also contains a smaller proportion of 'ever6fsm' pupils (19.5%) than comparable national data for pupil premium at KS2 (29.3%), again suggesting that the MCS under-represents this group of pupils. (Remembering that pupil premium is largely 'ever6' pupils and a small number of Looked After Children (Department for Education, 2012).) <sup>15</sup> A general formalisation of the models used here – random intercepts multilevel models – is:

the KS4 model. For instance, one can talk about the variance explained when parental occupation is used as a proxy in the KS2 model, compared to the variance explained when other proxy measures are used. One can then compare this pattern of results to the pattern for the same proxy variables in the KS4 model, and comment whether parental occupation performs better/worse than FSM in both models. The approach taken below is to first discuss the results for KS2 then discuss how this compares to the results from the KS4 model.

The first result in Table 1 relates to the so-called 'empty model' (Model 1). This is 'empty' because it contains only the outcome (KS2 attainment) and no covariates, and informs us of the unconditional variance in KS2 attainment (i.e. how much variation occurs within schools versus between schools). Model 2 contains the basic control variables (described above in section 4.2). This provides a comparison against which the impact that adding any measures of socio-economic disadvantage has on the model fit can be evaluated. Model 3 adds in the first of these measures, 'ever been eligible for FSM in the previous six years' [ever6fsm]. A summary of the models is given in Box 1 below and Table 1 follows directly. The relative performance of models was assessed using the same approach as for KS4, using the Snijders and Bosker (1994) computation of R-squared, which relies on the proportional reduction in mean square prediction error (Snijders and Bosker, 1994, p.342) (henceforth 'variance explained').

#### **Box 1: Summary of proxy models**

| Model 1:    | Null model  | (no controls)           |
|-------------|-------------|-------------------------|
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Model 2: Basic controls

**Model 3**: Basic controls and FSM eligibility ever in the six years prior to KS2 exams (ever6FSM)

**Model 4**: Basic controls and years of FSM eligibility in the six years prior to KS2 exams

**Model 5**: Basic controls and FSM eligibility in the year of the KS2 exams (most recent FSM status)

**Model 6**: Basic controls and IDACI

**Model 7**: Basic controls and the proportion in young person's neighbourhood with top occupations

**Model 8**: Basic controls and household employment status

**Model 9**: Basic controls and highest household education

**Model 10**: Basic controls and parental occupations **Model 11**: Basic controls and household income

**Model 12**: Basic controls and other household characteristics

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<sup>&</sup>lt;sup>16</sup> But one cannot assign changes in variance explained to just the SES measures on their own. In each case, it is the cumulative impact of all the variables in a model that result in the variance explained.

Table 1: Mulitlevel linear model results for baseline and proxy measures

|  | Model 1 | Model 2  | Model 3 | Model 4          | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 | Model 11 | Model 12 |
|--|---------|----------|---------|------------------|---------|---------|---------|---------|---------|----------|----------|----------|
| Model                                    |         | Controls |         | <b>FSMrecent</b> |         |         |         |         |         | HH_occup |          | HH_other |
| Residual between-school variation (ICC)  | 13.3%   | 2.2%     | 1.9%    | 1.8%             | 1.8%    | 1.9%    | 1.3%    | 2.2%    | 1.5%    | 1.1%     | 4.5%     | 2.0%     |
| Individual-level explained variance      | N/A     | 12%      | 14.85%  | 13.67%           | 15.01%  | 12.86%  | 13.60%  | 12.35%  | 17.69%  | 18.92%   | 16.06%   | 16.464%  |
| Ever 6 FSM eligible                      |         |          | -0.315* |                  |         |         |         |         |         |          |          |          |
| Most recent FSM eligible                 |         |          |         | -0.296           |         |         |         |         |         |          |          |          |
| 1 year of FSM eligibility                |         |          |         |                  | -0.247* |         |         |         |         |          |          |          |
| 2 years of FSM eligibility               |         |          |         |                  | -0.275* |         |         |         |         |          |          |          |
| 3 years of FSM eligibility               |         |          |         |                  | -0.289* |         |         |         |         |          |          |          |
| 4 years of FSM eligibility               |         |          |         |                  | -0.408* |         |         |         |         |          |          |          |
| 5 years of FSM eligibility               |         |          |         |                  | -0.412* |         |         |         |         |          |          |          |
| 6 years of FSM eligibility               |         |          |         |                  | -0.337* |         |         |         |         |          |          |          |
| IDACI score                              |         |          |         |                  |         | -0.005  |         |         |         |          |          |          |
| Proportion higher occupations            |         |          |         |                  |         |         | 0.015*  |         |         |          |          |          |
| At least one parent full-time employment |         |          |         |                  |         |         |         | 0.224*  |         |          |          |          |
| Single-parent households                 |         |          |         |                  |         |         |         | -0.071* |         |          |          |          |
| HE, below degree-level                   |         |          |         |                  |         |         |         |         | -0.187* |          |          |          |
| A-level or equivalent                    |         |          |         |                  |         |         |         |         | -0.257* |          |          |          |
| GCSE-level or equivalent                 |         |          |         |                  |         |         |         |         | -0.366* |          |          |          |
| Other qualification                      |         |          |         |                  |         |         |         |         | -0.592* |          |          |          |
| Level1 qualification                     |         |          |         |                  |         |         |         |         | -0.275* |          |          |          |
| Lower-managerial occupation              |         |          |         |                  |         |         |         |         |         | -0.214*  |          |          |
| Intermediate occupation                  |         |          |         |                  |         |         |         |         |         | -0.334*  |          |          |
| Small employers/self-employed            |         |          |         |                  |         |         |         |         |         | -0.366*  |          |          |
| Lower supervisory occupation             |         |          |         |                  |         |         |         |         |         | -0.506*  |          |          |
| Semi-routine occupation                  |         |          |         |                  |         |         |         |         |         | -0.513*  |          |          |
| Routine occupation                       |         |          |         |                  |         |         |         |         |         | -0.572*  |          |          |
| Unemployed                               |         |          |         |                  |         |         |         |         |         | -0.565*  |          |          |
| Annual household income                  |         |          |         |                  |         |         |         |         |         |          | 0.010*   |          |
| House tenure: private rent               |         |          |         |                  |         |         |         |         |         |          |          | -0.173*  |
| House tenure: LA rent                    |         |          |         |                  |         |         |         |         |         |          |          | -0.296*  |
| House tenure: other                      |         |          |         |                  |         |         |         |         |         |          |          | 0.032*   |
| Household size (persons)                 |         |          |         |                  |         |         |         |         |         |          |          | -0.061*  |
| Age of mother                            |         |          |         |                  |         |         |         |         |         |          |          | 0.014*   |
| Mother of working age                    |         |          |         |                  |         |         |         |         |         |          |          | -0.213*  |

Notes: \*p≤.05. Results for basic controls omitted from this table. Reference categories for proxy variables: Models 1 & 2: none; Models 3 & 4 & 5: never eligible for FSM; Model 6: none (IDACI=continuous variable); Model 7: none (proportion higher occupations = continuous variable); Model 8: No parent employed full-time, household with both parents; Models 9: degree-level qualification; Model 10: higher-managerial occupation; Model 11: none (income – continuous variable); Model 12: house tenure: owner-occupier; mother not of working age, all other variables continuous.

Model 1, the 'empty model', shows us that before adjustment for school or pupil covariates, the between-school variation in KS2 attainment is 13.3%. This means that there is more variation within schools than between them (i.e. 86.7% of the variation is within schools; meaning *between* pupils *within* schools). Model 2 includes the basic control measured discussed above – the inclusion of these variables reduces the ICC to around 2.2%, meaning that there are only very small residual differences between schools once these measures are included. All subsequent models contain these basic controls, which is the reason that pupil-level variance explained is the measure used to assess differences between models.

In the Model 3, the 'ever 6 FSM' measure was introduced, and this model accounted for 14.9% of the variance explained in KS2 outcomes. The result for this measure was b=-0.315 (se 0.02; p<0.01; 95% CI -0.36, -0.27), meaning that there was a difference of roughly one-third of a KS2 level between pupils who were FSM eligible in any of the six years of primary school, and those who were not FSM eligible at any point in the same period. At KS2, pupils are expected to make 2-levels worth of progress over four years, therefore a difference of a third of level between FSM and non-FSM pupils represents a relatively large effect size. (This is in keeping with KS4 results, where the 'ever-eligible for FSM measure was associated with a difference of one letter grade on 7 of the 8 GCSE exams making up the capped score.)

In Models 4 and 5 two different ways of capturing FSM were introduced. In Model 4 'current year FSM eligible' was used – meaning that the pupil had to have been assessed as being FSM eligible in any of the three terms of the school year that KS2 tests were taken. This model explained 13.7% of the individual-level variance. Pupils that were eligible for FSM in the year they took key stage 2 exams attained, on average, nearly one-third of a level lower (0.29) in terms of the fine graded level score than those pupils who were not eligible for FSM in that year.

In Model 5 years of FSM eligibility, ranging between one and six years was used, with 'never eligible for FSM' being the comparator or reference category. The coefficients for these dummy variables indicate the impact of different years of FSM eligibility versus never being eligible. Being eligible for FSM for one year in primary school compared to never eligible children was associated with roughly a quarter of a level difference between the two groups (b=0.25; se 0.04; p<0.01; 95% CI -0.34, -0.16). Two years of FSM eligibility were related to a 0.27 level difference, and three years to 0.29. Four years of eligibility were associated with a 0.41 level difference in fine-graded level score, five years to 0.41 and six years to a one-third (b=0.34; se 0.04; p<0.01; CI -0.42, -0.25) difference in fine graded level scores versus pupils who were never eligible for FSM. The smaller reduction in scores associated with six years of FSM eligibility mirrors results from the LSYPE analysis. In that analysis, five

years of FSM eligibility was associated with a smaller decrease in scores than four years of FSM eligibility. <sup>17</sup> It might be that those pupils who were 'always' eligible for FSM includes a sub-set of families where parents are disabled or otherwise restricted from working. Similarly, this group could also contain extremely poor families that are not close the FSM / non-FSM threshold but who receive additional support in other forms that suppresses the effect of sustained economic disadvantage. Both possibilities could be investigated further using MCS data.

Overall, the three FSM eligibility models explain very similar amounts of variance, mirroring the results obtained from the KS4 work. The model using the discrete 'years of FSM eligibility' variables performs marginally better than the variable measuring FSM eligibility ever in the six years prior to KS2 exams, with the 'eligible in current year' variable performing relatively worse.

Model 6 included IDACI as a neighbourhood-level proxy for social deprivation. The model (including the same basic control measures as above) explained 12.9% of pupil-level variance. With a higher IDACI score indicating a more deprived neighbourhood, the difference between children living in a neighbourhood at the 25<sup>th</sup> percentile of deprivation, and those in neighbourhoods at the 75<sup>th</sup> percentile of deprivation was approximately a quarter of a fine-graded level; the most extreme difference possible, between children residing in the most deprived (where IDACI is close to 1) and those in least deprived (where IDACI is close to 0) neighbourhoods is therefore half a fine-graded level. Another neighbourhood-level proxy was used in Model 7: the proportion in the neighbourhood of people with managerial and professional ('top-level') occupations. This model explained 13.6% of the variance at the pupil level. An increase of 10 percentage points in the proportion with top-level occupations in the neighbourhood was associated with an increase of 0.15 fine-graded level points, or roughly one-sixth of a level.

Subsequent models explore proxies for social deprivation that refer to the household. Model 8 includes the household employment status at Wave 1 (and also Wave 2 for those participants who joined later), this model explained 13.3% of pupil-level variation. Compared to a household where no parent was in in full-time employment, pupils from a household where at least one parent was in full-time employment achieved one-fifth of a level higher (0.22) on average, a result that holds even after single parenthood has been accounted for.<sup>18</sup>

<sup>&</sup>lt;sup>17</sup> Note that there were only five years of FSM data available for the LSYPE KS4 analysis.

<sup>&</sup>lt;sup>18</sup> The KS2 attainment of a child in a single-parent household is 0.07 fine-grade level points lower than one in a two-parent household, over and above employment status. This represents a small effect size, of less than one tenth of a level.

Model 9 used the highest qualifications of adults in the household. The proportion of pupil-level variance explained was higher than in any other preceding models, at 17.7%. Compared to the reference category (families where at least one of the parents hold a higher education degree or the vocational equivalent), pupils in households with other levels of qualifications achieved lower levels at KS2. For families with sub-degree level higher education, the difference was 0.18 fine-grade level points, or roughly one-fifth of a level. A-level qualifications (or the vocational equivalent) were associated with a difference in pupils' KS2 fine-grade level points of around one-quarter of a level (0.26). Pupils from households where the highest qualifications were GCSE-level (grades A to C or equivalents) achieved KS2 scores 0.37 lower than households with at least one degree-educated parent. Pupils from households where the highest educational qualification was equivalent to a Level-1 typically achieved 0.59 fewer fine-graded levels, nearly two-thirds of a level. Mirroring results from the secondary-school report, pupils in households with other types of qualifications also performed worse on average than pupils from families with at least one degree-educated parent (0.27 point difference).

In Model 10, the highest occupations of the household were used as the proxy for SES. This model explained more individual-level variance than the parental qualifications model (18.9%). The coding of this variable mirrors that of the KS4 report, <sup>19</sup> and the reference category was households where the highest occupation was 'higher managerial'. Compared to reference households, pupils from households with a lower managerial occupation attained 0.21 level points fewer, equivalent to one-fifth of a level. Pupils from households with parents in 'intermediate occupations' or 'small employers/self-employed' attained around one-third of a level lower than pupils from reference households (0.33 and 0.37 level points lower respectively). Also, compared to the reference category, pupils in households where parents were in lower-supervisory, semi-routine and routine occupations achieved 0.50, 0.51 and 0.57 less fine-graded levels respectively (roughly half of a level at the end of primary school). The last category, where no-one in the household was employed, was associated with a difference of 0.56 level points, also slightly over half a KS2 level, compared to pupils from a household with a parent in a higher-managerial occupation.

Model 11 assessed household income as a measure of socio-economic deprivation. The model explained 16.1% of pupil-level variance. The coefficient indicates that an increase of £1,000 in the average annual household income is associated with a difference of 0.01 fine-graded levels. That would suggest, for instance, that the

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<sup>&</sup>lt;sup>19</sup> A model where the household occupations were calculated from either the current or the most recently-held position (a different approach to the current-job only one reported above and also used in the KS4 report) yields a worse model fit, at only 14.5% of variance explained.

difference in pupils' KS2 fine-graded levels between a household earning £25,000 annually and one earning £15,000 annually is roughly one tenth of a level.

Finally, Model 12 looked at other household characteristics, such as household size, housing tenure and the age of the mother. This model explained 16.5% of pupil-level variation. In terms of house tenure, compared to the owner-occupier reference category, <sup>20</sup> pupils from households that rented accommodation privately achieved 0.17 fine-graded levels less, while pupils in council housing achieved 0.3 levels less. Household size was very weakly related to KS2 attainment, with each additional household member negatively associated with pupils' fine-grained level score (b - 0.06; se 0.008). Similarly, each additional year in terms of mother's age was associated with an increase of 0.01 fine-graded levels, or 1% of a level, a very small effect size, but consistent with KS4 results.

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<sup>&</sup>lt;sup>20</sup> Owning the house with or without a mortgage.

#### 6. Robustness checks

This section sets out the results from several robustness checks. As with the KS4 analyses, these are included in order to assess whether the results presented are sensitive to different approaches to analysing the data. The first step was to run analyses with all of the potential proxies included in a single model. As set out in the KS4 report, this is unlikely to occur in practice, but it is still informative to know whether the relationship a specific proxy has with KS2 attainment still holds when other proxies are included, as well as the variance explained in KS2 attainment by the respective models. Again as before, several other checks were included relating to gender, and urban/rural differences.

# 6.1 What results are observed when all proxies are in a single model?

Combining all the proxy measures (Table 2, Model 13, full results in Appendix IV), the model performs better in terms of variance explained (22.9%), the highest so far of any model. This is to be expected given the cumulative effect of all proxies together. <sup>21</sup> What is interesting, as with the KS4 report, is that ever6FSM remained a statistically significant predictor of KS2 attainment, albeit with an effect size roughly half that when this measured was used on its own (*b* 0.15 vs *b* 0.315). This suggests that FSM eligibility was still able to capture something 'unique' about the lived experience of deprivation during the primary years that even the rich measures of socio-economic status, collectively, miss.

There are other interesting findings – namely that IDACI and household employment became non-significant when all proxies are added in the model together. Conversely, household qualifications, occupations and income all remained significant; so did 'household characteristics' but only in relation to whether pupils lived in council housing (versus owner-occupier).

As a final step, only 'practical proxies' were included (FSM eligibility [ever6FSM], the proportion of top-level occupations neighbourhood, and IDACI – Table 2, Model 15). This model explained 16.2% of variance in individual-level KS2 attainment, only marginally better than models with individual proxies or years of FSM in. The FSM measure remained significant: eligibility was associated with a difference of roughly a third of a level at KS2. Additionally, in this model, IDACI became non-significant,

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<sup>&</sup>lt;sup>21</sup> Adding all the measures of socio-economic status simultaneously raises the concern about strong overlaps in the data (multicollinearity). This is a concern because at very high levels of correlation (e.g. above r=.8), coefficients and standard errors can be affected (i.e. standard errors become inflated). However, the highest correlation between proxy measures was for housing tenure (own) and household work status (either parent in work) (r = .48).

while the proportion of top-level occupations in the neighbourhood retained its significance.

#### 6.2 Prior attainment

When used without any proxy measures or FSM, a model including prior attainment at KS2 was the best in terms of predicting KS4 attainment, explaining roughly 44% of variation. At KS2, a model with prior attainment, measured via early-years vocabulary score on a test administered within the MCS, was still a good predictor of attainment at KS2, explaining 27.6% of variation, more than the KS2 model including all proxy indicators together.<sup>22</sup>

# 6.3 All proxy indicators and prior attainment

In the KS4 results, combining both prior attainment and all proxy measures accounted for around 55% of variation in GCSE scores, the highest of any model in that study (Table 2, Model 14, full results in Appendix V). This was also observed in the present study when combining prior attainment and proxy measures – again Model 14 explained more variation than any other (33%). As was the case in the KS4 report however, ever6FSM remained statistically significant, amounting to a difference of around one-sixth of a level (*b* 0.14) between FSM and non-FSM pupils. The ever6FSM measure also remained significant when using only 'practical proxies' (b 0.23).

<sup>&</sup>lt;sup>22</sup> Note that this model still contains the other basic control variables used in all other models.

Table 2: Multilevel linear model results for all proxy and prior attainment

| Outcome: KS2 fine-graded levels<br>Proxy indicator<br>(regression coefficient) | All proxies, no | All proxies, prior | Model 15 | Model 16 –<br>Practical<br>proxies, prior<br>achiev. |
|--|-----------------|--------------------|----------|--|
| Ever 6- FSM-eligible   | -0.148*         | -0.136*            | -0.298*  | -0.231*  |
| IDACI score  | 0.0002          | 0.0001             | -0.001   | -0.001   |
| Proportion higher occupations  | 0.002*          | 0.001              | 0.008*   | 0.005*   |
| At least one parent full-time employed   | 0.056           | 0.014              |          |  |
| Single-parent household  | -0.006*         | -0.013             |          |  |
| HE, below degree-level   | -0.084*         | -0.077*            |          |  |
| A-level or equivalent  | -0.114*         | -0.081*            |          |  |
| GCSE-level or equivalent   | -0.173*         | -0.132*            |          |  |
| Level 1 qualification  | -0.326*         | -0.268*            |          |  |
| Other qualification  | -0.060          | -0.001             |          |  |
| Lower-managerial   | -0.145*         | -0.123*            |          |  |
| Intermediate occupation  | -0.184*         | -0.125*            |          |  |
| Small employers  | -0.173*         | -0.148*            |          |  |
| Lower supervisory  | -0.314*         | -0.243*            |          |  |
| Semi-routine   | -0.281*         | -0.223*            |          |  |
| Routine  | -0.304*         | -0.219*            |          |  |
| Unemployed   | -0.197*         | -0.149*            |          |  |
| Household annual income  | 0.003*          | 0.002*             |          |  |
| Age of mother  | 0.004*          | 0.002              |          |  |
| Mother of working age  | 0.059           | 0.097              |          |  |
| House tenure: private rent   | -0.027*         | -0.014             |          |  |
| Housing tenure: LA rent  | -0.118*         | -0.102             |          |  |
| Housing tenure: other  | 0.097*          | -0.070             |          |  |
| Household size (persons)   | -0.043*         | -0.012             |          |  |
| Prior achievement (vocabulary score)   |                 | 0.024*             |          | 0.026*   |
| Individual sample size   | 5,456           | 5,456              | 5,456    | 5,456  |
| School sample size   |                 |                    |          |  |
| Residual between school variation (ICC)  | 1.3%            | 2.4%               | 1.1%     | 2.3%   |
| Individual-level explained variance  |                 |                    |          |  |

Note: \*p≤0.05. Basic control variable results are omitted from this table. Reference categories for categorical variables are listed in Table 1.

# 6.4 Do results differ by gender?

Table 3 illustrates that the overall pattern of results in terms of variance explained was very similar for male and female pupils. There were differences between the results for KS4 and KS2 however. Most notably, measures of SES appear more strongly related to girls' performance than boys' – evidenced by the greater variance explained in all girl-only models of KS2 attainment. The KS4 results (Table 3 in the KS4 report) suggested that boy's GCSE attainment could be better predicted by the estimated models; however, the differences between the models for the genders at both KS2 and KS4 were not major. Additionally, the patterns regarding the relative differences in variance explained by each individual proxy model replicate the results from the model using the full estimation sample, at both KS2 and KS4.

# 6.5 Do results differ by urban-rural locations?

A further point of interest is the potential of the proxy models to explain different proportions of variance in KS2 outcomes in rural and urban environments (Table 4). The sample sizes for the two environments are unbalanced (with only 13.6% of the sample classed as rural) and therefore differences should be cautiously interpreted. The results suggested that the models explained more variance in rural settings, indicating a stronger relationship between socio-economic background and KS2 attainment in rural areas. It is beyond the scope of this study to explain this and more work is required to understand whether these differences reflect real differences in attainment or are the result other factors. There are many potential explanations. For example much has been written about the success of some key urban education systems, particularly London. In these systems the link between socio-economic background and pupil achievement is less strong. Equally it may be that the influence of the 'home learning environment' is more important in rural areas, in essence here the social and material difficulties faced by the rural poor may be more predictive of pupil achievement. In rural areas lower unemployment rates may also mean that FSM eligibility, which is largely linked to parent(s) being out of work, is a stronger signal of deprivation.

# 6.6 Do results differ using household income *during* primary school rather than *prior* to it?

An additional question emerged during the analysis of the household income proxy, namely whether income as measured during schooling years (i.e. Waves 4 and 5 in MCS) would be a better predictor of KS2 attainment than income measured prior to entry into the school system (i.e. Wave 1 to 3 in MCS). To address this, a different household income variable was created as the average annual income reported in Waves 4 and 5. This proxy was tested in the same manner as all other proxies: in a model containing the same set of controls as the models previously reported. Due to survey attrition, the estimation sample was slightly reduced to 5,298 observations. To allow for a direct comparison between the explanatory power of the two versions of the income variables, the original income measure from Waves 1-3 was reestimated using the new sample of 5,298 observations. Therefore, the results presented in this section should not be directly compared to the results presented for the any of the other proxy variables previously.

Table 3: Multilevel linear model results for split-sample male/female robustness check

|                                 | Gi                   | irls                      | Boys                 |                           |  |
|---------------------------------|----------------------|---------------------------|----------------------|---------------------------|--|
| Outcome: KS2 fine-graded levels |                      | ,744                      | N=2,712              |                           |  |
|                                 | Residual intra-class | Individual R <sup>2</sup> | Residual intra-class | Individual R <sup>2</sup> |  |
|                                 | correlation          |                           | correlation          | Coefficient               |  |
| Model 3                         | 3.65%                | 15.94%                    | 2.39 %               | 14.88%                    |  |
| Ever-6 FSM-eligible             |                      | -0.28*                    |                      | -0.35*                    |  |
| Model 4                         | 3.22%                | 14.72%                    | 2.58%                | 13.62%                    |  |
| Most recently FSM-eligible      |                      | -0.26*                    |                      | -0.34                     |  |
| Model 5                         | 3.44%                | 16.02%                    | 2.25%                | 15.21%                    |  |
| 1 year of FSM eligibility       |                      | -0.23*                    |                      | -0.27*                    |  |
| 2 years of FSM eligibility      |                      | -0.27*                    |                      | -0.30*                    |  |
| 3 years of FSM eligibility      |                      | -0.25*                    |                      | -0.35*                    |  |
| 4 years of FSM eligibility      |                      | -0.30*                    |                      | -0.52*                    |  |
| 5 years of FSM eligibility      |                      | -0.32*                    |                      | -0.52*                    |  |
| 6 years of FSM eligibility      |                      | -0.35*                    |                      | -0.33                     |  |
| Model 6                         | 3.67%                | 13.68%                    | 3.10%                | 13.11%                    |  |
| IDACI score                     |                      | -0.003*                   |                      | -0.007*                   |  |
| Model 7                         | 3.07%                | 14.72%                    | 1.74                 | 13.47%                    |  |
| NH proportion top occupations   |                      | 0.01*                     |                      | 0.01*                     |  |
| Model 8                         | 3.9%                 | 14.95%                    | 3.15%                | 12.62%                    |  |
| At least one parent full-time   |                      | 0.26*                     |                      | 0.19*                     |  |
| Single-parent household         |                      | -0.05*                    |                      | -0.09                     |  |
| Model 9                         | 3.26%                | 19.13%                    | 2.80%                | 17.56%                    |  |
| HE, below degree-level          |                      | -0.12*                    |                      | -0.25*                    |  |
| A-level or equivalent           |                      | -0.24*                    |                      | -0.27*                    |  |
| GCSE-level or equivalent        |                      | -0.34*                    |                      | -0.39*                    |  |
| Other qualification             |                      | -0.08                     |                      | -0.43*                    |  |
| Level1 qualification            |                      | -0.56*                    |                      | -0.63*                    |  |
| Model 10                        | 2.68%                | 20.41%                    | 1.93%                | 18.91%                    |  |
| Lower-managerial                |                      | -0.23*                    |                      | -0.20*                    |  |
| Intermediate occupation         |                      | -0.37*                    |                      | -0.30*                    |  |
| Small employers                 |                      | -0.35*                    |                      | -0.38*                    |  |
| Lower supervisory               |                      | -0.41*                    |                      | -0.60*                    |  |
| Semi-routine                    |                      | -0.49*                    |                      | -0.53*                    |  |
| Routine                         |                      | -0.57*                    |                      | -0.60*                    |  |
| Unemployed                      |                      | -0.59*                    |                      | -0.54*                    |  |
| Model 11                        | 2.34%                | 17.39%                    | 2.33%                | 15.78%                    |  |
| Income                          |                      | 0.01*                     |                      | 0.01                      |  |
| Model 12                        | 3.89%                | 18.23%                    | 3.12%                | 16.08%                    |  |
| Age of mother                   |                      | 0.01*                     |                      | 0.01*                     |  |
| Mother of working age           |                      | -0.25                     |                      | Omitted                   |  |
| House tenure: private rent      |                      | -0.21*                    |                      | -0.14*                    |  |
| Housing tenure: LA rent         |                      | -0.25*                    |                      | -0.34*                    |  |
| Housing tenure: other           |                      | -0.1*                     |                      | -0.04                     |  |
| Household size (persons)        |                      | -0.06*                    |                      | 07                        |  |

Note: \*p≤.05. Basic control variable results are omitted from this table. Reference categories for categorical variables are discussed in Section 4.

Table 4: Multilevel linear model results for split-sample urban/rural robustness check

| Outcome: KS2 fine-graded levels         |                      | ban                       | Rural                |                           |
|---|----------------------|---------------------------|----------------------|---------------------------|
| outcome. Not time graded levels         | N=4                  | ,715                      | N=                   | 741                       |
|   | Residual intra-class | Individual R <sup>2</sup> | Residual intra-class | Individual R <sup>2</sup> |
|   | correlation          | Coefficient               | correlation          | Coefficient               |
| Model 3                                 | 2.31%                | 14.42%                    | 0 %                  | 20.82%                    |
| Ever-6 FSM-eligible                     |                      | -0.30*                    |                      | -0.48*                    |
| Model 4                                 | 2.22%                | 13.41%                    | 0%                   | 17.91%                    |
| Most recently FSM-eligible              |                      | -0.29*                    |                      | -0.40*                    |
| Model 5                                 | 2.23%                | 14.59%                    | 0%                   | 22.37%                    |
| 1 year of FSM eligibility               |                      | -0.25*                    |                      | -0.22*                    |
| 2 years of FSM eligibility              |                      | -0.22*                    |                      | -0.70*                    |
| 3 years of FSM eligibility              |                      | -0.26*                    |                      | -0.64*                    |
| 4 years of FSM eligibility              |                      | -0.37*                    |                      | -0.71*                    |
| 5 years of FSM eligibility              |                      | -0.42*                    |                      | -0.25*                    |
| 6 years of FSM eligibility              |                      | -0.33*                    |                      | -0.37*                    |
| Model 6                                 | 2.22%                | 12.63%                    | 0%                   | 16.65%                    |
| IDACI score                             |                      | -0.005*                   |                      | -0.006*                   |
| Model 7                                 | 1.60%                | 13.55%                    | 0%                   | 16.57%                    |
| NH proportion top occupations           |                      | 0.01*                     |                      | 0.006                     |
| Model 8                                 | 2.59%                | 13.20%                    | 0%                   | 16.71%                    |
| At least one parent full-time           |                      | 0.22*                     |                      | 0.24                      |
| Single-parent household                 |                      | -0.1*                     |                      | 0.18                      |
| Model 9                                 | 1.77%                | 17.40%                    | 0%                   | 22.18%                    |
| HE, below degree-level                  |                      | -0.18*                    |                      | -0.22*                    |
| A-level or equivalent                   |                      | -0.25*                    |                      | -0.28*                    |
| GCSE-level or equivalent                |                      | -0.36*                    |                      | -0.40*                    |
| Other qualification                     |                      | -0.27*                    |                      | -0.62                     |
| Level1 qualification                    |                      | -0.60*                    |                      | -0.50*                    |
| Model 10                                | 1.45%                | 18.61%                    | 0%                   | 23.11%                    |
| Lower-managerial                        |                      | -0.22*                    |                      | -0.22*                    |
| Intermediate occupation                 |                      | -0.34*                    |                      | -0.30*                    |
| Small employers                         |                      | -0.37*                    |                      | -0.35*                    |
| Lower supervisory                       |                      | -0.52*                    |                      | -0.48*                    |
| Semi-routine                            |                      | -0.52*                    |                      | -0.44*                    |
| Routine                                 |                      | -0.56*                    |                      | -0.65*                    |
| Unemployed                              |                      | -0.57*                    |                      | -0.51*                    |
| Model 11                                | 1.41%                | 16.07%                    | 0%                   | 18.96%                    |
| Income                                  |                      | 0.01*                     |                      | 0.008*                    |
| Model 12                                | 2.63%                | 16.16%                    | 0%                   | 21.06%                    |
| Age of mother                           |                      | 0.01*                     |                      | 0.02*                     |
| Mother of working age                   |                      | -0.2                      |                      | Omitted                   |
| House tenure: private rent              |                      | -0.19*                    |                      | -0.09                     |
| Housing tenure: LA rent                 |                      | -0.30*                    |                      | -0.30*                    |
| Housing tenure: other                   |                      | -0.01                     |                      | 0.15                      |
| Household size (persons)                |                      | -0.06*                    |                      | -0.08*                    |
| Note: *n< 05 Rasic control variable res | 1. 1. 1.             |                           |                      |                           |

Note: \*p≤.05. Basic control variable results are omitted from this table. Reference categories for categorical variables are discussed in Section 4.

The model using Wave 4 & 5 household income (and all controls) explained 14.9% of variance in KS2 attainment. An increase of £1,000 in this annual income was associated with an increase of 0.006 fine grade level points. The model using Wave 1-3 household income (and all controls) estimated on the new sample explained 15.8% of variance in KS2 attainment. An increase of £1,000 in the early income was associated with an increase of 0.01 fine-graded levels. This effect size was of a similar magnitude, though not identical in size, for the two models, in that a difference of £10,000 pounds in any of the annual income measures was associated with less than 10% of a fine-graded level at KS2. Therefore, given the lower predictive power of the later (Wave 4-5) income measure, as interesting as this finding was, the original approach of measuring household income early, and before the start of schooling was deemed to be the better of the two options.

## 6.7 Are SES-attainment relationships consistent across the KS2 pupil attainment distribution?

To assess the relationship between the proxy measures and KS2 attainment at different points in the attainment distribution, single-level quantile regressions were used (described further in Sutherland et al., 2015). As the quantile models were not carried out in a multilevel framework as above, cluster-robust standard errors were used to account for clustering of pupils within schools. Table 5 below indicates the regression coefficients for all the proxy measures, estimated on the same original sample of 5,456 pupils.

Some of the proxy measures perform differently for low-achieving pupils (the 25<sup>th</sup> quintile) compared to model referring to high-achieving pupils (75<sup>th</sup> quintile), but the differences across quantiles are generally less striking than for the KS4 results.

'Ever6' eligibility for FSM was associated with a difference of 0.3 fine-graded levels for the low-achieving pupils, and with 0.35 fine-graded levels for the high achievers. At KS4, the pattern was reversed, with FSM eligibility being related to a larger gap in the case of the low attaining children. While the years of FSM proxy mirrored the ever-6 FSM proxy results, in that eligibility for FSM (for any number of years) was associated with a larger difference in KS2 fine-graded levels, this was not consistent for all years of eligibility, and the overall pattern observed in the original multilevel models (whereby six years of eligibility is associated with a smaller difference than five years) remained the same. The employment proxy also performed differently between the two ends of the attainment distribution (Table 5). Having both parents in employment was associated with a positive difference of 0.18 fine-graded levels for the low achievers, and with 0.26 fine-graded levels for the high achievers. This suggests that the relationship between socio-economic deprivation as measured by FSM eligibility varies across the schooling cycles. The estimation procedure does not

allow for a definitive conclusion on whether the difference in effect size is statistically significant. However, the impact of deprivation on high achieving pupils has been noted elsewhere (see Crawford et al., 2014).

The relationships between all other proxies and KS2 attainment were very similar across low-achieving and high-achieving pupils, with very minor inconsistencies in the qualification and occupation proxies, which nonetheless followed the same pattern of difference between categories at both ends of the distribution.

Table 5: Quantile regression results for robustness check

|                               | 25% Quantile | 75% Quantile   |
|-------------------------------|--------------|----------------|
|                               | N=5456       | N=5456         |
| Proxy indicator               | Regressio    | on coefficient |
| Model 3                       |              |                |
| Ever 6 FSM-eligible           | -0.29*       | -0.35*         |
| Model 4                       |              |                |
| Most recently FM-eligible     | -0.24*       | -0.34*         |
| Model 5                       |              |                |
| 1 year of FSM eligibility     |              | -0.30*         |
| 2 years of FSM eligibility    |              | -0.34*         |
| 3 years of FSM eligibility    |              | -0.32*         |
| 4 years of FSM eligibility    |              | -0.42*         |
| 5 years of FSM eligibility    |              | -0.41*         |
| 6 years of FSM eligibility    | -0.31*       | -0.35*         |
| Model 6                       |              |                |
| IDACI score                   | -0.005*      | -0.005*        |
| Model 7                       |              |                |
| At least one parent full-time |              | 0.26*          |
| Single-parent household       | -0.12*       | -0.03          |
| Model 8                       |              |                |
| HE, below degree-level        | -0.18*       | -0.17*         |
| A-level or equivalent         |              | -0.27*         |
| GCSE-level or equivalent      |              | -0.38*         |
| Level1 qualification          |              | -0.56*         |
| Other qualification           | -0.30*       | -0.23*         |
| Model 9                       |              |                |
| Proportion occupations        | 0.01*        | 0.01*          |
| Model 10                      |              |                |
| Lower-managerial              | -0.21*       | -0.18*         |
| Intermediate occupation       | -0.36*       | -0.29*         |
| Small employers               | -0.34*       | -0.36*         |
| Lower supervisory             | -0.52*       | -0.43*         |
| Semi-routine                  |              | -0.46*         |
| Routine                       |              | -0.51*         |
| Unemployed                    | -0.56*       | -0.50*         |
| Model 11                      |              |                |
| Income                        | 0.01*        | 0.01*          |
| Model 12                      |              |                |
| Age of mother                 |              | 0.01*          |
| Mother of working age         | -0.41*       | 0.007          |
| House tenure: private rent    | -0.15*       | -0.19*         |
| Housing tenure: LA rent       |              | -0.27*         |
| Housing tenure: other         | -0.003       | -0.07          |
| Household size (persons)      | -0.05*       | -0.05*         |

Note: \* indicates p<0.05. Basic control variable results are omitted from this table. Reference categories for categorical variables are discussed in Section 4

## 7. Other points of interest

To complete the replication, the additional points of interest raised in the KS4 report were also reviewed. This section reports on the three most pressing issues (also included in the KS4 report), and Appendices IV and V contain the full set of results. All the results are based on the set of models where all proxies (and the set of controls) have been included in analyses.

#### 7.1 Date of birth

Residual differences between the quarters of birth of children were found in the model including all proxies, both when prior attainment was included, and when it was not. The differences are larger than the ones reported in the KS4 analysis, but seem plausible given the young age of children, where each additional three months of age may be strongly related to attainment because of developmental trajectories. This finding is also consistent with the existing literature as discussed in the KS4 report. Additionally, and again in contrast to KS4 results, the outcomes of the models with and without prior attainment do not result in a reversal of the relationship of quarter of birth to KS2 attainment, suggesting that both the absolute levels of attainment and the progress made are related to quarter of birth in the same manner. This would suggest that during KS2, older pupils start at higher levels of attainment and continue to make more progress than their younger peers; while during KS4, younger pupils are the ones progressing further, and therefore reaching similar levels of attainment to older children by the end of KS4.

## 7.2 Ethnicity

The reference ethnicity category was White-British, the most populous group in the sample. In relation to this category, there were only two instances of residual ethnic differences at KS2 in the model not controlling for prior attainment: children of Chinese and Other Asian background performed significantly better than White-British children. However, the estimation samples for these latter ethnic groups are small and the results have no implication of causality. When adding prior attainment to the model, therefore switching the interpretation to the progress made by children during KS2, several additional ethnic groups emerged as making significantly more progress, and therefore catching up to White British pupils: the groups above, and also White Other, Indian, Pakistani, Bangladeshi, and Black African. It must be noted that, as with the KS4 analysis, the sample sizes for some of the ethnic groups are very small and may therefore bias the results.

## 7.3 Regions

All models contained a set of dummy indicators referring to the region in which children resided at Wave 1 of the MCS, with Yorkshire and the Humber as the reference category. Compared to this region, only the East Midlands was significantly different in terms of KS2 outcomes in the model without prior attainment controls. Children in the East Midlands performed, on average 12% of a fine-graded level better than children in Yorkshire and the Humber. When exploring the model with prior attainment controls, none of the regions emerged as making significant progress compared to the reference category. This suggests that regional differences at KS2 – such as the so-called 'London effect' – can be fully accounted for by compositional effects; in particular socio-economic status and pre-school prior ability (see also Greaves et al., 2014).

### 8. Discussion and conclusion

## 8.1 Summary of results

The aim of this project was to assess whether the results found for the relationship between key measures of socio-economic status and secondary (KS4) attainment in the earlier report also hold for primary school attainment (KS2). The central focus was on assessing whether, in comparison to measures of FSM, other proxy measures of SES could better predict achievement at the end of primary school. As before, a range of proxy measures from different domains were considered.

#### The main findings were that:

- The overall pattern of results for KS2 was similar to that found for KS4 in relation to both the relative performance of proxy measures and FSM eligibility itself.
- Models that included FSM eligibility explained about 14% of the variation in pupil achievement at KS2. The measures of 'years of FSM' or 'eligible at any time in the previous six years' performed slightly better than a measure of whether the pupil was FSM eligible in the year they sat KS2 exams.
- Parent education, parental occupations and household income were slightly 'better' predictors of achievement, but this gain was marginal at around a one percentage point increase above using FSM alone. (Which was also the case for KS4).
- Neighbourhood level measures of SES performed 'worse' than FSM, typically
  a few percentage points lower in terms of variance explained. This differed
  from the KS4 results and suggests that the correlation between
  neighbourhood measures at KS2 outcomes is weaker than for KS4 outcomes:
  there may be many reasons for this and this is discussed further below.
- As expected given the KS4 results, adding in prior achievement resulted in greater explanatory power to all KS2 models (roughly doubling the explanatory power), but the pattern of results remains largely the same.

To summarise (see Box 2), the results presented here suggest that during the primary school phase, FSM eligibility can be improved upon marginally as a proxy for social deprivation, but only through relying on measures that may be impractical to collect, such as household income or parental education level. If such measures are not available, then FSM eligibility remains a better proxy for socio-economic

disadvantage than a range of other measures at the neighbourhood and household level. This is a very similar conclusion to that found for the secondary phase.

#### **Box 2. Summary of findings**

## Q1. Can FSM histories be improved on as a proxy for social deprivation at KS2?

A1. Yes, but only by using proxies for which it may be difficult to collect data, such as parental education or income. Collecting data on household income might be feasible if a child's administrative school record could be linked to their parents' HMRC tax data.

## Q2. What alternative (practical) proxy measures of SES can be used that better capture variation in achievement at KS2?

A2. Without access to high quality measures of income, FSM remains the best proxy measure at KS2. Even with household income included in the model, FSM independently predicts KS2 attainment, suggesting that eligibility for FSM captures distinct aspects of socio-economic disadvantage over and above the risks from low income.

## Q3. Do alternative proxy measures better enable us to identify pupils at risk of low achievement at KS2?

A3. There are measures that do perform better in terms of predicting achievement at KS2, though as has been said such measures may be difficult to collect data on. Further, it is important to note that the majority of the difference between pupils in terms of their achievement remains unexplained (in excess of 60%). This means, in short, that attempts to identify pupils at risk of 'low achievement', however defined, via such models would be inherently errorprone and likely result in many false-positives and false-negatives. That is, many pupils would be incorrectly classified as 'at risk' or 'not at risk' when the opposite was true.

## Q4. Does the pattern of results observed for different proxies at KS4 hold for KS2?

A4. Broadly very similar patterns of results were found for the different proxies at KS2 as compared to KS4. However, all proxies explained less variation in KS2 test scores than they did for KS4 test scores.

#### 8.2 Discussion

This study has some limitations that should be considered alongside the conclusions drawn. First, as this is primarily a replication study, the same set of control measures was included to match the model specification for the KS4 analyses. It is an open question as to whether other variables are important in predicting primary school achievement and hence should also be included in the model. As an illustration of this point, in the MCS data 11% of the variation in KS2 outcomes was explained by basic demographic controls. By contrast using LSYPE data, the model with basic demographic controls explained 18% of the variation in the KS4 scores. This may of course reflect the different attainment measures and samples as much as differences in covariates included - however it is an important caveat.

Developing this point further, one might expect that FSM eligibility, and parental employment status more generally, would be a stronger predictor at KS4 than at KS2. During the primary school phase many mothers will not have returned to work yet, hence being out of work might be a more ambiguous signal of whether the child is in a disadvantaged household. Indeed the analysis found that FSM eligibility predicted less variation in KS2 test scores. However, it is not possible to conclude from this that FSM eligibility is a worse predictor of achievement in primary school as compared to secondary school. Another explanation is that parents at KS4 would presumably be older and more financially stable, meaning that FSM eligibility — particularly if sustained over several years — might represent a more extreme subgroup than in the KS2 sample.

As has been said, it is not possible to compare the results from the KS2 and KS4 models directly because the greater predictive power of FSM eligibility in secondary school may simply reflect differences in the particular sample used and more importantly the quite different outcome. Similarly, there is a six year gap between the two samples, during which many macro-economic changes have occurred that could have affected which pupils were classified as FSM eligible. There is a more general point that reliably measuring achievement in younger children is difficult, and becomes more difficult the younger children are. One should also bear in mind that pupils may make more or less progress that expected given early testing .So whilst the greater predictive power of socio-economic proxies in secondary school is consistent with other evidence that the achievement of disadvantaged students starts to fall away in early secondary school (see Crawford et al. 2014 for discussion of this), the analysis does not provide definitive evidence on this.

One interesting difference between the KS2 and the KS4 analysis is the predictive power (relative to FSM eligibility) of the neighbourhood proxies. The neighbourhood proxies were relatively more predictive at KS4. This may not be surprising if one thinks that a neighbourhood community has more of a direct impact on teenagers,

who spend far more time with their peers and out of the home than younger children. The neighbourhood proxies also predict achievement because they reflect socioeconomic sorting into neighbourhoods and differential access to schools of different quality. Prior research has certainly shown that access to schooling is a major driver of housing mobility, particularly amongst middle class parents. Neighbourhood measures therefore partly reflect the level of socio-economic segregation in schools, brought about by more advantaged families locating near to "good" schools. However, the models allow for the school characteristics and, in some specifications, the actual school attended. So this is essentially comparing the achievement of children from different neighbourhoods who attend the same school. Primary school catchment areas are smaller and more homogenous, so an individual's neighbourhood (operationalised here as LSOA), may not be highly predictive of their achievement once an allowance is made for which school they attend. Secondary school catchment areas are larger and hence a child's home neighbourhood may be predictive of achievement because relative to others in the same school they are more disadvantaged. Such proxies may therefore be of greater use as an additional indicator in secondary schools, but not as a replacement for FSM.

Even though prior attainment does drastically improve the predictive power of the models used at both KS2 and KS4, it is also important to note that a child's achievement at Key Stage 2 (or indeed Key Stage 1) is not completely predictive of their achievement at KS4 (and KS2 respectively). This has important policy implications. Children's trajectories are not determined by the age of 7 or 11 and early achievement is predictive but not deterministically so. The conclusion is therefore that prior attainment is a good predictor for children who are at risk of low achievement in the future, but one must be mindful that it cannot be used in a deterministic way and that measuring achievement reliably in young children is difficult as noted above.

More generally the statistical models presented in this report (and the sister report on KS4) can be used for systems analysis, to better understand the relationship between socio-economic disadvantage and pupil achievement. They are probabilistic and can predict likely achievement for groups of students who have particular characteristics on average. They cannot however, be reliably used to predict an individual child's future achievement since there is likely to be much variation around the average and a considerable amount of error for children who are not near the average.

#### 8.3 Areas for further research

There are a number of important areas in which further research might be undertaken.

The relationship between FSM eligibility and pupil achievement should be compared to the relationship between other neighbourhood based proxies and pupil achievement, using the National Pupil Database. In the data used in this report (the Millennium Cohort Study) the sample sizes are insufficient to look in detail at subgroups, for example particularly groups of minority ethnic students. Hence in this report the predictive power of FSM eligibility is an average across all students (though it was possible to look separately for boys and girls, and urban and rural living children). It is important to consider how much variation in pupil achievement FSM eligibility or alternative neighbourhood proxies predict for different sub-groups of children, including different minority ethnic groups and those living in different regions (in London and elsewhere for example). Additionally one would want to consider whether FSM eligibility and alternative neighbourhood proxies can predict under achievement as distinct from low achievement. To do this one could consider high and low achieving students separately (as measured at Key Stage 1) and then determine the predictive power of the proxy variables for these two different types of student.

In the longer term, it will be important to continue to monitor the children in the Millennium Cohort Study and to analyse their achievement when they reach key stage 4. By that time one will be able to determine *for the same cohort of children*, whether FSM eligibility and other socio-economic proxies work similarly throughout the different phases of schooling in terms of predicting low achievement.

## **Appendix I: Variable construction and coding**

| Variable   | Derived from           | Coding   |
|--|------------------------|--|
| Free school meal eligibility for 0 years   |                        | For each variable:   |
| Free school meal eligibility for 1 years   | _                      | 1 if pupil eligible for the respective number of           |
| Free school meal eligibility for 2 years   | _                      | years/ever/in particular year                              |
| Free school meal eligibility for 3 years   | _                      | 0 if pupil not eligible                                    |
| Free school meal eligibility for 4 years   | NPD extract variable   |  |
| Free school meal eligibility for 5 years   | identifying FSM        |  |
| Free school meal eligibility for 6 years   | eligibility            |  |
| Free school meal eligibility ever in the 6 years                                   |                        |  |
| prior to KS2 finish  |                        |  |
| Free school meal eligibility for the year prior to                                 | _                      |  |
| KS2 finish   |                        |  |
| IDACI_score  | ONS IDACI variable     | Continuous variable, rescaled (original score *100) to     |
|  | from 2004 Census       | enable regression coefficient interpretation               |
|  | 110111 2004 CC113u3    | Missing values as resulting from LSOA merge retained       |
| Proportion of persons in neighbourhood with  |                        | Continuous variable  |
| top-level occupations  | 2001 Census            | Missing values resulting from LSOA merge retained          |
| Household employment status  | ADCWRK00               | 1 if at least one of the parents in employment             |
|  |                        | 0 if both parents unemployed                               |
|  | APDWRK00               | Missing is both parents (where present) exhibit missing    |
|  | AMDWRK00<br>BPDWRK00   | data   |
|  | BMDWRK00               |  |
| Single-parent household  | Biribrinico            | 1 if respondent has no partner                             |
| Single parent nousenous  | ADHTYS00               | 0 if otherwise   |
|  | BDHTYS00               | Missing values retained                                    |
| Highest qualification in household: Degree-level                                   |                        | For each variable:   |
| or above (incl. vocational equivalent)   |                        |  |
| Highest qualification in household: HE, below                                      |                        | 1 if the highest qualification in the household (of either |
| degree (incl. vocational equivalent)   | ΙΔΙΜΑ( ( ) Ι Ι ( ) ( ) | the mother or the father, where present) falls under       |
| Highest qualification in household: A-level (incl.                                 | AMVCOLIOO              | each respective category  O if otherwise                   |
| vocational equivalent)   | APACQU00               | Missing if both parents (where present) exhibit missing    |
| Highest qualification in household: GCSE-level                                     | APVCQU00               | data   |
| (grades A-C) (incl. vocational equivalent)   | BMACQU00               |  |
| Highest qualification in household: Level 1 (incl.                                 | BMVCQU00<br>BPACQU00   |  |
| vocational equivalent)   | BPVCQU00               |  |
| Highest qualification in household: Other  | Di Vegeto              |  |
| qualification (incl. vocational equivalent)  |                        |  |
| Highest qualification in household: No qualification (incl. vocational equivalent) |                        |  |
| Highest occupation in household: Higher  |                        | For each variable:   |
| Managerial   |                        | roi eacii variable.  |
| Highest occupation in household: Lower   |                        | 1 if the highest occupation in the household (of either    |
| Managerial   |                        | the mother or the father, where present) falls under       |
| Highest occupation in household: Intermediate                                      |                        | each respective category                                   |
| Highest occupation in household: Small   | AMD07S00               | 0 if otherwise   |
| employer/self-employed   | BMD07S00               | Missing if both parents (where present) exhibit missing    |
| Highest occupation in household: Lower   | APD07S00               | data   |
| supervisory  | BPD07S00               |  |
| Highest occupation in household: Semi-routine                                      |                        |  |
| Highest occupation in household: Routine   |                        |  |
| Highest occupation in household: Unemployed  |                        |  |
| (therefore no job category)  |                        |  |
|  |                        |  |

| Household income, annual, as average of income | AMNETA00        | Continuous variable, expressed in £thousands per year.  |
|--|-----------------|---|
| over Waves 1 through to 3                      | AMNETP00        | Computed as average of combined income of main          |
|  | BMNETA00        | respondent and partner (where available) over the first |
|  | BMNETP00        | three waves of the survey.                              |
|  | CMNETA00        | Missing if income is missing across all three years of  |
|  | CMNETP00        | survey  |
|  | APNETA00        |   |
|  | APNETP00        |   |
|  | BPNETA00        |   |
|  | BPNETP00        |   |
|  | CPNETA00        |   |
|  | CPNETP00        |   |
| House tenure: own (with or without mortgage)   |                 | For each variable:                                      |
| House tenure: rent (privately)                 | ADROOW00        | 1 if house tenure falls under each respective category; |
| House tenure: rent (from Local Authority)      | BDROOW00        | 0 if otherwise  |
| House tenure: other                            |                 | Missing values retained                                 |
| Household size                                 | ADTOTP00        | Continuous variable                                     |
|  | BDTOTP00        | Expressed in number of persons                          |
|  | БОТОТРОО        | Missing values retained                                 |
| Age of mother                                  | AMDAGB00        | Continuous variable                                     |
|  | BMDAGB00        | Expressed in years                                      |
|  | AMPSEX          | Missing values retained                                 |
|  | BMPSEX          |   |
| Mother of working age                          | AMDAGI00        | 1 if Mother is of working age (16-64 years of age)      |
|  | APDAGI00        | 0 if otherwise  |
|  | BMDAGI00        | Missing values retained                                 |
|  | BPDAGI00 AMPSEX |   |
|  | BMPSEX          |   |

## **Appendix II: Descriptive statistics for control measures**

| Panel A: Individual control variables    | Mean  | Median | Std.<br>Dev. | Min. | Max.     | Valid cases |
|--|-------|--------|--------------|------|----------|-------------|
| Quarter of birth: September-November     | 0.25  |        | 0.43         | 0    | 1        | 6917        |
| Quarter of birth: December-February      | 0.24  |        | 0.43         | 0    | 1        | 6917        |
| Quarter of birth: March-May              | 0.25  |        | 0.43         | 0    | 1        | 6917        |
| Quarter of birth: June-August            | 0.24  |        | 0.43         | 0    | 1        | 6917        |
| Gender: female                           | 0.50  |        | 0.50         | 0    | 1        | 6917        |
| Ethnicity: White                         | 0.777 |        | 0.41         | 0    | 1        | 6828        |
| Ethnicity: White Irish                   | 0.002 |        | 0.04         | 0    | 1        | 6828        |
| Ethnicity: White Other                   | 0.010 |        | 0.10         | 0    | 1        | 6828        |
| Ethnicity: White and Black Caribbean     | 0.013 |        | 0.11         | 0    | 1        | 6828        |
| Ethnicity: White and Black African       | 0.003 |        | 0.05         | 0    | 1        | 6828        |
| Ethnicity: White and Asian               | 0.012 |        | 0.11         | 0    | 1        | 6828        |
| Ethnicity: Any other mixed               | 0.005 |        | 0.07         | 0    | 1        | 6828        |
| Ethnicity: Asian Indian                  | 0.035 |        | 0.18         | 0    | 1        | 6828        |
| Ethnicity: Asian Pakistani               | 0.062 |        | 0.24         | 0    | 1        | 6828        |
| Ethnicity: Asian Bangladeshi             | 0.021 |        | 0.14         | 0    | 1        | 6828        |
| Ethnicity: Asian Other                   | 0.009 |        | 0.09         | 0    | 1        | 6828        |
| Ethnicity: Black Caribbean               | 0.014 |        | 0.11         | 0    | 1        | 6828        |
| Ethnicity: Black African                 | 0.022 |        | 0.14         | 0    | 1        | 6828        |
| Ethnicity: Black Other                   | 0.002 |        | 0.04         | 0    | 1        | 6828        |
| Ethnicity: Chinese                       | 0.001 |        | 0.03         | 0    | 1        | 6828        |
| Ethnicity: Any Other                     | 0.006 |        | 0.08         | 0    | 1        | 6828        |
| English as additional language           | 0.042 |        | 0.20         | 0    | 1        | 6917        |
| Panel B: Geographical measures           | 0.0.1 |        | 0.20         |      |          | 0011        |
| North East                               | 0.05  |        | 0.21         | 0    | 1        | 6917        |
| North West                               | 0.12  |        | 0.32         | 0    | 1        | 6917        |
| Yorkshire and the Humber                 | 0.11  |        | 0.32         | 0    | 1        | 6917        |
| East Midlands                            | 0.08  |        | 0.27         | 0    | 1        | 6917        |
| West Midlands                            | 0.11  |        | 0.31         | 0    | 1        | 6917        |
| East of England                          | 0.11  |        | 0.31         | 0    | 1        | 6917        |
| London                                   | 0.15  |        | 0.36         | 0    | 1        | 6917        |
| South East                               | 0.15  |        | 0.35         | 0    | 1        | 6917        |
| South West                               | 0.08  |        | 0.27         | 0    | 1        | 6917        |
| Environment: urban                       | 0.87  |        | 0.32         | 0    | 1        | 6899        |
| Panel C: School characteristics          | 0.0.  |        | 0.02         |      |          | 0000        |
| School type: Voluntary Aided             | 0.028 |        | 0.16         | 0    | 1        | 6917        |
| School type: Voluntary Controlled        | 0.649 |        | 0.47         | 0    | 1        | 6917        |
| School type: Foundation                  | 0.000 |        | 0.01         | 0    | 1        | 6917        |
| School type: Other Independent           | 0.004 |        | 0.20         | 0    | 1        | 6917        |
| School type: City Technical College      | 0.178 |        | 0.38         | 0    | 1        | 6917        |
| School type: Sponsor-led Academy         | 0.096 |        | 0.29         | 0    | 1        | 6917        |
| School size (pupils)                     | 346   | 333    | 163          | 22   | 2393     | 6898        |
| Proportion pupils eligible for FSM       | 0.29  | 0.25   | 0.20         | 0    | 0.97     | 6897        |
| Proportion SEN pupils with statements    | 0.019 | 0.01   | 0.02         | 0    | 0.32     | 6897        |
| Proportion SEN pupils without statements | 0.211 | 0.2    | 0.11         | 0    | 0.8      | 6917        |
| School CVA score (KS1-KS2)               | 99.93 | 100    | 1.12         | 96.6 | 103.6    | 6886        |
| Proportion of pupils in EAL households   | 0.18  | 0.05   | 0.27         | 0    | 100.0    | 6897        |
| Panel D: Attainment measure              | 3.10  | 5.00   | V.E1         |      | <u> </u> | 3307        |
| Fine-graded KS2 levels score             | 4.802 | 4.86   | 0.71         | 2.5  | 6.5      | 6896        |

## Appendix III: Table on descriptive characteristics for FSM/non-FSM

|  | Eligibility for FSM, e |               | Sig.* |
|--|------------------------|---------------|-------|
| Sample: 5456 pupils in 2392 schools;<br>19.5% of estimation sample was eligible for FSM,<br>ever in the 6 years preceding KS2 exams. | NO                     | YES           |       |
| QOB decfeb   | 24.5%                  | 24.7%         |       |
| QOB_marmay   | 25.7%                  | 25.8%         |       |
| QOB_junaug   | 24.5%                  | 24.5%         |       |
| QOB_sepnov   | 25.3%                  | 25.0%         |       |
| Gender=Female  | 49.2%                  | 49.7%         |       |
| Ethnicity=White British  | 85.2%                  | 74 70/        | *     |
| Ethnicity=White Irish  | 0.3%                   | 74.7%<br>0.2% |       |
| Ethnicity=White Other  | 1.1%                   | 0.2%          |       |
| Ethnicity=White and Black Caribbean  | 0.9%                   | 2.9%          | *     |
| Ethnicity=White and Black Cambrean  Ethnicity=White and Black African  | 0.9 / 0.2              | 0.5%          |       |
| Ethnicity=White and Black African<br>Ethnicity=White and Asian   | 1.0%                   | 1.4%          |       |
| Ethnicity=White and Asian Ethnicity=Any other mixed  | 0.5%                   | 0.7%          |       |
| Ethnicity=Any other mixed<br>Ethnicity=Indian  | 3.7%                   | 1.8%          | *     |
| Ethnicity=Indian<br>Ethnicity=Pakistani  | 3.1%                   | 7.3%          | *     |
| Ethnicity=Bangladeshi  | 0.8%                   | 3.2%          | *     |
| Ethnicity=Asian Other  | 0.6%                   | 0.6%          |       |
| Ethnicity=Black Caribbean  | 1.0%                   | 2.2%          |       |
| Ethnicity=Black African  | 1.2%                   | 2.5%          | *     |
| Ethnicity=Black Other  | 0.1%                   | 0.3%          |       |
| Ethnicity=Chinese  | 0.1%                   | 0.1%          |       |
| Ethnicity=Any Other  | 0.4%                   | 0.6%          |       |
| Household EAL  | 2.0%                   | 3.9%          |       |
|  | 10.00/                 | 40.00/        |       |
| Region: Yorkshire and the Humber   | 10.8%                  | 12.9%         | *     |
| Region: North West<br>Region: North East   | 11.6%<br>4.6%          | 14%<br>6.2%   | *     |
| Region: North East<br>Region: East Midlands  | 9.0%                   | 7.2%          |       |
| Region: West Midlands  | 10.0%                  | 13.3%         | *     |
| Region: East of England  | 12.5%                  | 11.8%         |       |
| Region: London   | 14.6%                  | 14.6%         |       |
| Region: South East   | 17.6%                  | 12.6%         | *     |
| Region: South West   | 9.5%                   | 7.3%          | *     |
| Urban  | 85.0%                  | 92.1%         | *     |
| School proportion SEN with statements  | 1.9%                   | 2.2%          | *     |
| School proportion SEN with statements  | 19%                    | 24.8%         | *     |
| School proportion 5EN without statements School proportion of pupils from EAL households   | 13.1%                  | 20.5%         | *     |
| School proportion of pupils from EAL nouseholds School size  | 337                    | 341           |       |
| School KS1KS2 CVA score  | 99.9                   | 99.9          |       |
| School proportion of pupils eligible for FSM   | 22.8%                  | 39.9%         |       |
| IDACI score  | 17.65                  | 14.6          | *     |
|  |                        |               | *     |
| neighbourhood_prop_topoccupations  | 25%                    | 19.2%         | *     |
| household_employment   | 96.1%                  | 63.8%         | *     |
| household_singleparent   | 5.0%                   | 22.4%         | *     |
| Qualification: HE degree or above  | 39.6%                  | 11.8%         | *     |
| Qualification: HE below degree, or vocational equivalent   | 11.%                   | 7.2%          | *     |

|   | -                  |                    |   |
|---|--------------------|--------------------|---|
| Qualification: A-Level or vocational equivalent                 | 18.6%              | 18.9%              |   |
| Qualification: GCSE A-C, or vocational equivalent               | 27.6%              | 42.3%              | * |
| Qualification: Level 1, or vocational equivalent                | 3.5%               | 15.2%              | * |
| Qualification: Other qualification                              | 1.5%               | 4.5%               | * |
| Qualification: No qualification                                 | none in estimation | none in estimation |   |
| Qualification. No qualification                                 | sample             | sample             |   |
|   |                    |                    |   |
| Occupation: Higher Managerial                                   | 20.9%              | 3.2%               | * |
| Occupation: Lower Managerial/Professional                       | 32.0%              | 10.7%              | * |
| Occupation: Intermediate occupation                             | 11.9%              | 6.1%               | * |
| Occupation: Small employer/self-employed                        | 6.6%               | 4.6%               | * |
| Occupation: Lower supervisory                                   | 9.5%               | 9.8%               |   |
| Occupation: Semi-routine occupation                             | 7.7%               | 12.9%              | * |
| Occupation: Routine occupation                                  | 4.9%               | 11.9%              | * |
| Occupation: Unemployed/never had a job                          | 6.5%               | 40.9%              | * |
|   |                    |                    |   |
| Household yearly net income                                     | £23,881            | £12,640            | * |
|   |                    |                    |   |
| House tenure: Privately rented                                  | 78.6%              | 27.8%              | * |
| House tenure: Rent from local authority                         | 9.5%               | 29.5%              | * |
| House tenure: Other   | 7.7%               | 34.7%              | * |
| Household size  |                    |                    |   |
| Age of mother   | 29.9 years         | 26 years           | * |
| Mother of working age   | 99.9%              | 100%               |   |
|   |                    |                    |   |
| Prior achievement (vocabulary score)                            | 56.3%              | 51.2%              | * |
| , ,   |                    |                    |   |
| KS2 fine-graded level   | 4.94               | 4.54               | * |
|   | -                  | -                  |   |
| * Indicates statistically-significant difference (at p<0.05 lev | vel)               | L                  |   |
| (at p 0.00 to   | - /                |                    |   |

# Appendix IV: Multilevel linear model for key stage 2 attainment with all SES proxy measures, without a measure of prior attainment

| Outcome measure: Key stage 2 fine graded level score                  | Coef.         | Std. Err | Z             | p> z | 95%   | 6CI          |
|---|---------------|----------|---------------|------|-------|--------------|
| QOB decfeb  | -0.07         | 0.02     | -2.93         | 0.00 | -0.11 | -0.02        |
| QOB marmay  | -0.10         | 0.02     | -4.47         | 0.00 | -0.15 | -0.06        |
| QOB_junaug  | -0.22         | 0.02     | -9.68         | 0.00 | -0.27 | -0.18        |
|   |               |          |               |      |       |              |
| Gender=Female   | 0.06          | 0.02     | 3.57          | 0.00 | 0.03  | 0.09         |
| Ethniaity-White Iriah   | 0.20          | 0.17     | 1 17          | 0.24 | -0.53 | 0.12         |
| Ethnicity=White Irish Ethnicity=White Other                           | -0.20<br>0.17 | 0.17     | -1.17<br>2.10 | 0.24 | 0.01  | 0.13         |
| Ethnicity=White and Black Caribbean                                   | -0.13         | 0.08     | -1.75         | 0.04 | -0.27 | 0.02         |
| Ethnicity=White and Black Ganbbean  Ethnicity=White and Black African | 0.06          | 0.07     | 0.35          | 0.73 | -0.28 | 0.02         |
| Ethnicity=White and Black Arrican  Ethnicity=White and Asian          | 0.00          | 0.18     | 1.90          | 0.06 | -0.20 | 0.40         |
| Ethnicity=Any other mixed   | 0.13          | 0.00     | 1.59          | 0.00 | -0.01 | 0.41         |
| Ethnicity=Indian  | 0.10          | 0.12     | 1.74          | 0.08 | -0.04 | 0.20         |
| Ethnicity=Indian Ethnicity=Pakistani                                  | 0.09          | 0.03     | 0.33          | 0.74 | -0.01 | 0.20         |
| Ethnicity=Pakistani<br>Ethnicity=Bangladeshi                          | 0.02          | 0.00     | 2.11          | 0.74 | 0.01  | 0.14         |
| Ethnicity=Bangladesiii Ethnicity=Asian Other                          | 0.18          | 0.09     | 4.00          | 0.04 | 0.01  | 0.35         |
| Ethnicity=Asian Other Ethnicity=Black Caribbean                       | -0.09         | 0.11     | -1.18         | 0.00 | -0.25 | 0.05         |
| Ethnicity=Black Cambbean  Ethnicity=Black African                     | 0.03          | 0.08     | 0.39          | 0.24 | -0.23 | 0.00         |
| Ethnicity=Black Other   | 0.03          | 0.08     | 0.55          | 0.70 | -0.12 | 0.18         |
| Ethnicity=Chinese   | 0.13          | 0.25     | 2.84          | 0.01 | 0.22  | 1.19         |
| Ethnicity=Any Other   | -0.09         | 0.23     | -0.72         | 0.01 | -0.35 | 0.16         |
| Ettillicity-Arry Other  | -0.09         | 0.13     | -0.72         | 0.47 | -0.33 | 0.10         |
| Household_EAL   | -0.03         | 0.06     | -0.53         | 0.59 | -0.15 | 0.09         |
|   | 0.00          | 2.24     | 4 =0          | 2.22 | 0.04  | 0.40         |
| Region: North West  | 0.06          | 0.04     | 1.76          | 0.08 | -0.01 | 0.13         |
| Region: North East  | 0.08          | 0.05     | 1.81          | 0.07 | -0.01 | 0.18         |
| Region: East Midlands   | 0.12          | 0.04     | 2.96          | 0.00 | 0.04  | 0.19         |
| Region: West Midlands   | 0.02          | 0.04     | 0.44          | 0.66 | -0.06 | 0.09         |
| Region: East of England   | 0.00          | 0.04     | 0.02          | 0.98 | -0.07 | 0.07         |
| Region: London  | 0.06          | 0.04     | 1.54          | 0.12 | -0.02 | 0.14         |
| Region: South East  | 0.01          | 0.03     | 0.31          | 0.76 | -0.06 | 0.08         |
| Region: South West  | 0.02          | 0.04     | 0.58          | 0.56 | -0.05 | 0.10         |
| Urban   | 0.05          | 0.03     | 1.92          | 0.06 | 0.00  | 0.11         |
| Cahaal tugas Valuntawy aidad  | 0.10          | 0.26     | 0.20          | 0.70 | 0.60  | 0.41         |
| School type: Voluntary-aided  | -0.10         | 0.26     | -0.38         | 0.70 | -0.62 | 0.41         |
| School type: Voluntary controlled                                     | -0.14         | 0.26     | -0.53         | 0.60 | -0.64 | 0.37<br>0.47 |
| School type: Foundation   | -0.04         | 0.26     | -0.15         | 0.88 | -0.55 |              |
| School type: Independent approved for SEN children                    | -0.14         | 0.26     | -0.55         | 0.58 | -0.66 | 0.37         |
| School type: Other Independent  | -0.13         | 0.26     | -0.50         | 0.62 | -0.64 | 0.38         |
| School proportion SEN with statements                                 | -1.02         | 0.30     | -3.35         | 0.00 | -1.62 | -0.43        |
| School proportion SEN without statements                              | -0.39         | 0.09     | -4.39         | 0.00 | -0.57 | -0.22        |
| School proportion of pupils from EAL households                       | -0.04         | 0.06     | -0.65         | 0.52 | -0.16 | 0.08         |
| School size   | 0.00          | 0.00     | 0.01          | 1.00 | 0.00  | 0.00         |
| School KS1KS2 CVA score   | 0.12          | 0.01     | 14.74         | 0.00 | 0.11  | 0.14         |
| School proportion of pupils eligible for FSM                          | 0.14          | 0.07     | 2.05          | 0.04 | 0.01  | 0.28         |
|   |               |          |               |      |       |              |
| FSM_ever_6  | -0.15         | 0.03     | -5.86         | 0.00 | -0.20 | -0.10        |
| IDACI score   | 0.00          | 0.00     | 0.24          | 0.81 | 0.00  | 0.00         |
| _   |               |          |               |      |       |              |
| neighbourhood_prop_topoccupations                                     | 0.00          | 0.00     | 2.03          | 0.04 | 0.00  | 0.00         |

| household_employment                                     | 0.06                  | 0.06     | 0.96    | 0.34                 | -0.06 | 0.17  |
|--|-----------------------|----------|---------|----------------------|-------|-------|
| household_singleparent                                   | -0.01                 | 0.04     | -0.16   | 0.87                 | -0.08 | 0.07  |
|  |                       |          |         |                      |       |       |
| Qualification: HE below degree, or vocational equivalent | -0.08                 | 0.03     | -2.83   | 0.01                 | -0.14 | -0.03 |
| Qualification: A-Level or vocational equivalent          | -0.11                 | 0.03     | -4.46   | 0.00                 | -0.17 | -0.06 |
| Qualification: GCSE A-C, or vocational equivalent        | -0.17                 | 0.02     | -7.04   | 0.00                 | -0.22 | -0.13 |
| Qualification: Level 1, or vocational equivalent         | -0.33                 | 0.04     | -7.79   | 0.00                 | -0.41 | -0.24 |
| Qualification: Other qualification                       | -0.06                 | 0.06     | -0.98   | 0.33                 | -0.18 | 0.06  |
| Qualification: No qualification                          | omitted               |          |         |                      |       |       |
| 0 6 1  | 0.45                  | 0.00     |         | 0.00                 | 0.00  | 0.00  |
| Occupation: Lower Managerial                             | -0.15                 | 0.03     | -5.55   | 0.00                 | -0.20 | -0.09 |
| Occupation: Intermediate occupation                      | -0.18                 | 0.04     | -5.27   | 0.00                 | -0.25 | -0.12 |
| Occupation: Small employer/self-employed                 | -0.17                 | 0.04     | -4.06   | 0.00                 | -0.26 | -0.09 |
| Occupation: Lower supervisory                            | -0.31                 | 0.04     | -8.50   | 0.00                 | -0.39 | -0.24 |
| Occupation: Semi-routine occupation                      | -0.28                 | 0.04     | -7.08   | 0.00                 | -0.36 | -0.20 |
| Occupation: Routine occupation                           | -0.30                 | 0.04     | -6.92   | 0.00                 | -0.39 | -0.22 |
| Occupation: Unemployed/never had a job                   | -0.20                 | 0.06     | -3.56   | 0.00                 | -0.31 | -0.09 |
|  | 0.04                  | 0.00     | 4.00    | 0.00                 | 0.04  | 2.22  |
| Household yearly net income                              | 0.01                  | 0.00     | 4.20    | 0.00                 | 0.01  | 0.02  |
| House tenure: Privately rented                           | -0.03                 | 0.03     | -0.99   | 0.32                 | -0.08 | 0.03  |
| House tenure: Rent from local authority                  | -0.12                 | 0.03     | -3.85   | 0.00                 | -0.18 | -0.06 |
| House tenure: Other                                      | 0.10                  | 0.04     | 2.21    | 0.03                 | 0.01  | 0.18  |
| Household size   | -0.04                 | 0.01     | -5.37   | 0.00                 | -0.06 | -0.03 |
| Age of mother  | 0.00                  | 0.00     | 2.34    | 0.02                 | 0.00  | 0.01  |
| Mother of working age                                    | 0.06                  | 0.43     | 0.14    | 0.89                 | -0.78 | 0.90  |
| Would of working age                                     | 0.00                  | 0.40     | 0.14    | 0.00                 | 0.70  | 0.00  |
| Intercept  | -7.09                 | 0.97     | -7.33   | 0.00                 | -8.99 | -5.20 |
|  |                       |          |         |                      |       |       |
|  |                       |          |         |                      |       |       |
| Random-effects Parameters                                | Est.                  | Std.Err  |         |                      | 95%   |       |
| Var(cons)  | 0.004                 | 0.003    |         |                      | 0.001 | 0.022 |
| Var(residual)  | 0.358                 | 0.007    |         |                      | 0.343 | 0.373 |
| LR test vs. linear regression                            | Chi <sup>2</sup> (01) | 1.79     | Prob >= | chi <sup>2</sup> = 0 | .09   |       |
|  |                       |          |         |                      |       |       |
| Residual intra-class correlation                         | ICC                   | Std. Err |         |                      | 95%   | 6 CI  |
|  | 0.012                 | 0.010    |         |                      | 0.002 | 0.058 |
|  |                       |          |         |                      |       |       |
| Explained variance                                       |                       |          |         |                      |       |       |
| Level 1  | 22.88%                |          |         |                      |       |       |
| Level 2  | 25.93%                |          |         |                      |       |       |

# Appendix V: Multilevel linear model for key stage 2 attainment with all SES proxy measures, and British Ability Scales (vocabulary test)

| Outcome measure: Key stage 2 fine graded level score | Coef. | Std. Err | Z      | p> z |       | 95%CI |
|--|-------|----------|--------|------|-------|-------|
| QOB_decfeb   | -0.05 | 0.02     | -2.15  | 0.03 | -0.09 | 0.00  |
| QOB_marmay   | -0.10 | 0.02     | -4.55  | 0.00 | -0.14 | -0.06 |
| QOB_junaug   | -0.24 | 0.02     | -11.22 | 0.00 | -0.29 | -0.20 |
|  |       |          |        |      |       |       |
| Gender=Female  | 0.04  | 0.02     | 2.74   | 0.01 | 0.01  | 0.07  |
| Ethnicity=White Irish                                | -0.09 | 0.16     | -0.58  | 0.56 | -0.40 | 0.22  |
| Ethnicity=White Other                                | 0.27  | 0.07     | 3.65   | 0.00 | 0.13  | 0.42  |
| Ethnicity=White and Black Caribbean                  | -0.13 | 0.07     | -1.89  | 0.06 | -0.26 | 0.00  |
| Ethnicity=White and Black African                    | 0.11  | 0.16     | 0.67   | 0.50 | -0.21 | 0.43  |
| Ethnicity=White and Asian                            | 0.13  | 0.07     | 1.72   | 0.09 | -0.02 | 0.28  |
| Ethnicity=Any other mixed                            | 0.16  | 0.11     | 1.52   | 0.13 | -0.05 | 0.37  |
| Ethnicity=Indian                                     | 0.17  | 0.05     | 3.40   | 0.00 | 0.07  | 0.27  |
| Ethnicity=Pakistani                                  | 0.20  | 0.06     | 3.61   | 0.00 | 0.09  | 0.31  |
| Ethnicity=Bangladeshi                                | 0.32  | 0.08     | 4.00   | 0.00 | 0.16  | 0.48  |
| Ethnicity=Asian Other                                | 0.63  | 0.10     | 6.24   | 0.00 | 0.43  | 0.83  |
| Ethnicity=Black Caribbean                            | 0.01  | 0.07     | 0.16   | 0.87 | -0.13 | 0.16  |
| Ethnicity=Black African                              | 0.21  | 0.07     | 2.99   | 0.00 | 0.07  | 0.35  |
| Ethnicity=Black Other                                | 0.20  | 0.22     | 0.94   | 0.35 | -0.22 | 0.63  |
| Ethnicity=Chinese                                    | 0.79  | 0.23     | 3.44   | 0.00 | 0.34  | 1.25  |
| Ethnicity=Any Other                                  | 0.07  | 0.12     | 0.56   | 0.58 | -0.17 | 0.30  |
| Household_EAL  | 0.07  | 0.06     | 1.24   | 0.21 | -0.04 | 0.18  |
| Region: North West                                   | 0.05  | 0.03     | 1.33   | 0.19 | -0.02 | 0.11  |
| Region: North East                                   | 0.09  | 0.04     | 2.07   | 0.04 | 0.00  | 0.18  |
| Region: East Midlands                                | 0.09  | 0.04     | 2.40   | 0.02 | 0.02  | 0.16  |
| Region: West Midlands                                | 0.01  | 0.04     | 0.31   | 0.76 | -0.06 | 0.08  |
| Region: East of England                              | -0.01 | 0.04     | -0.31  | 0.76 | -0.08 | 0.06  |
| Region: London                                       | 0.05  | 0.04     | 1.31   | 0.19 | -0.02 | 0.12  |
| Region: South East                                   | 0.01  | 0.03     | 0.38   | 0.71 | -0.05 | 0.08  |
| Region: South West                                   | 0.00  | 0.04     | 0.10   | 0.92 | -0.07 | 0.08  |
| Urban  | 0.06  | 0.03     | 2.23   | 0.03 | 0.01  | 0.11  |
| School type: Voluntary-aided                         | -0.07 | 0.25     | -0.30  | 0.76 | -0.56 | 0.41  |
| School type: Voluntary controlled                    | -0.10 | 0.24     | -0.43  | 0.67 | -0.58 | 0.37  |
| School type: Foundation                              | -0.02 | 0.24     | -0.06  | 0.95 | -0.50 | 0.46  |
| School type: Independent approved for SEN children   | -0.12 | 0.24     | -0.49  | 0.62 | -0.60 | 0.36  |
| School type: Other Independent                       | -0.11 | 0.24     | -0.45  | 0.65 | -0.59 | 0.37  |
| School proportion SEN with statements                | -1.08 | 0.29     | -3.74  | 0.00 | -1.64 | -0.51 |
| School proportion SEN without statements             | -0.30 | 0.08     | -3.62  | 0.00 | -0.47 | -0.14 |
| School proportion of pupils from EAL households      | 0.04  | 0.06     | 0.64   | 0.53 | -0.08 | 0.15  |
| School size  | 0.00  | 0.00     | 0.31   | 0.76 | 0.00  | 0.00  |
| School KS1KS2 CVA score                              | 0.11  | 0.01     | 14.49  | 0.00 | 0.10  | 0.13  |
| School proportion of pupils eligible for FSM         | 0.15  | 0.07     | 2.32   | 0.02 | 0.02  | 0.28  |
| FSM_ever_6   | -0.14 | 0.02     | -5.79  | 0.00 | -0.18 | -0.09 |
| IDACI_score  | 0.00  | 0.00     | 0.05   | 0.96 | 0.00  | 0.00  |

|  |                       |          | 1         |             |       |       |
|--|-----------------------|----------|-----------|-------------|-------|-------|
| neighbourhood_prop_topoccupations                        | 0.00                  | 0.00     | 0.87      | 0.38        | 0.00  | 0.00  |
| household employment                                     | 0.01                  | 0.05     | 0.27      | 0.78        | -0.09 | 0.12  |
| household_singleparent                                   | -0.01                 | 0.03     | -0.38     | 0.71        | -0.08 | 0.06  |
| nouscrioid_singicparent                                  | -0.01                 | 0.04     | -0.00     | 0.7 1       | -0.00 | 0.00  |
| Qualification: HE below degree, or vocational equivalent | -0.08                 | 0.03     | -2.79     | 0.01        | -0.13 | -0.02 |
| Qualification: A-Level or vocational equivalent          | -0.08                 | 0.02     | -3.41     | 0.00        | -0.13 | -0.03 |
| Qualification: GCSE A-C, or vocational equivalent        | -0.13                 | 0.02     | -5.76     | 0.00        | -0.18 | -0.09 |
| Qualification: Level 1, or vocational equivalent         | -0.27                 | 0.04     | -6.89     | 0.00        | -0.34 | -0.19 |
| Qualification: Other qualification                       | 0.00                  | 0.06     | 0.02      | 0.99        | -0.11 | 0.11  |
| Qualification: No qualification                          | omitted               |          |           |             |       |       |
|  | 0.40                  | 2.22     |           |             | 0.45  | 0.00  |
| Occupation: Lower Managerial                             | -0.12                 | 0.02     | -5.07     | 0.00        | -0.17 | -0.08 |
| Occupation: Intermediate occupation                      | -0.13                 | 0.03     | -3.86     | 0.00        | -0.19 | -0.06 |
| Occupation: Small employer/self-employed                 | -0.15                 | 0.04     | -3.75     | 0.00        | -0.23 | -0.07 |
| Occupation: Lower supervisory                            | -0.24                 | 0.03     | -7.05     | 0.00        | -0.31 | -0.18 |
| Occupation: Semi-routine occupation                      | -0.22                 | 0.04     | -6.03     | 0.00        | -0.30 | -0.15 |
| Occupation: Routine occupation                           | -0.22                 | 0.04     | -5.34     | 0.00        | -0.30 | -0.14 |
| Occupation: Unemployed/never had a job                   | -0.15                 | 0.05     | -2.91     | 0.00        | -0.25 | -0.05 |
| Household yearly net income                              | 0.01                  | 0.00     | 3.26      | 0.00        | 0.00  | 0.02  |
| riouseriola yearly flet ilicome                          | 0.01                  | 0.00     | 3.20      | 0.00        | 0.00  | 0.02  |
| House tenure: Privately rented                           | -0.01                 | 0.03     | -0.56     | 0.58        | -0.07 | 0.04  |
| House tenure: Rent from local authority                  | -0.10                 | 0.03     | -3.59     | 0.00        | -0.16 | -0.05 |
| House tenure: Other                                      | 0.07                  | 0.04     | 1.72      | 0.09        | -0.01 | 0.15  |
| Household size   | -0.01                 | 0.01     | -1.67     | 0.10        | -0.03 | 0.00  |
| Age of mother  | 0.00                  | 0.00     | 1.36      | 0.17        | 0.00  | 0.01  |
| Mother of working age                                    | 0.10                  | 0.40     | 0.24      | 0.81        | -0.68 | 0.88  |
|  |                       |          |           |             |       |       |
| Prior attainment (vocab)                                 | 0.02                  | 0.00     | 29.18     | 0.00        | 0.02  | 0.03  |
| Intercept  | -7.77                 | 0.91     | -8.50     | 0.00        | -9.56 | -5.98 |
| intercept  | -1.11                 | 0.91     | -0.50     | 0.00        | -9.50 | -5.96 |
|  |                       |          |           |             |       |       |
| Random-effects Parameters                                | Est.                  | Std.Err  |           |             | 95%   | , CI  |
| Var(cons)  | 0.007                 | 0.003    |           |             | 0.003 | 0.018 |
| Var(residual)  | 0.306                 | 0.005    |           |             | 0.293 | 0.319 |
| var(residual)  | Chi <sup>2</sup> (01) | 6.25     | Prob >= 0 | hi2 = 0 0   |       | 0.010 |
| LR test vs. linear regression                            | OIII (01)             | 0.20     | 11007-0   | JIIIZ - 0.0 | 00    |       |
|  |                       |          |           |             |       |       |
| Residual intra-class correlation                         | ICC                   | Std.Err. |           |             | 95%   | . CI  |
| ivesinna ilitia-ciass colletation                        | 0.024                 | 0.010    |           |             | 0.009 | 0.058 |
|  | 0.024                 | 0.010    |           |             | 0.008 | 0.000 |
| Explained variance                                       |                       |          |           |             |       |       |
| Level 1  | 33.22%                |          |           |             |       |       |
| Level 1  | 35.61%                |          |           |             |       |       |
| Level 2  | JJ.U I /0             |          |           |             |       |       |

### References

Department for Education (2012) National Curriculum Assessments at Key Stage 2 in England, 2011/2012 (revised). London: Department for Education. (National tables: SFR33/2012, Table 9, cells c49 (numerator) and c51 (denominator)).

Connelly, R. (2013) Interpreting Test Scores. Millennium Cohort Study Data Note 2013/1. London: Centre for Longitudinal Studies.

Crawford, C., Macmillan, L. and Vignoles, A. (2014) Progress made by high-attaining children from disadvantaged backgrounds: research report. London: Social Mobility and Child Poverty Commission.

Greaves, E., Macmillan, L. and Sibieta, L. (2014) Lessons from London schools for attainment gaps and social mobility. London: Social Mobility and Child Poverty Commission.

Hansen, K., Johnson, J., Calderwood, L., Mostafa, T., Platt, L., Rosenberg, R., Smith, K. and the Millennium Cohort Team (2014) Millennium Cohort Study: A Guide to the Datasets. London: Centre for Longitudinal Studies.

Hobbs, G and Vignoles, A. (2009). 'Is children's free school meal 'eligibility' a good proxy for family income?', British Educational Research Journal, vol. 36, no. 4, pp.1469-3518.

Iniesta-Martinez, S. and Evans, H. (2012) Pupils not claiming free school meals. London: Department for Education.

McMahon, W. and Marsh, T. (1999) Filling the gap: free school meals, nutrition and poverty. London: Child Poverty Action Group.

Snijders, T.A.B., Bosker, R.J. (1994). Modelled variance in two-level models. Sociological Methods & Research, 22(3): 342-363.

StataCorp (2014). Stata 13.1. Texas, USA: StataCorp.

Sutherland, A., Ilie, S. and Vignoles, A. (2015) Factors associated with achievement: Research report. London: Department for Education.

#### **References for Figure 1**

Key stage 2, 2011-2012 & 2012-2013:

https://www.gov.uk/government/statistics/national-curriculum-assessments-at-key-stage-2-2012-to-2013 [Accessed 6<sup>th</sup> August 2015]

Key stage 2, 2010-2011: <a href="https://www.gov.uk/government/statistics/national-curriculum-assessments-at-key-stage-2-in-england-academic-year-2011-to-2012">https://www.gov.uk/government/statistics/national-curriculum-assessments-at-key-stage-2-in-england-academic-year-2011-to-2012</a> [Accessed 25th November 2014]



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