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# The Educational Achievement Penalty from School Exclusion

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## Abstract

Exclusion is a disciplinary practice used by headteachers which removes misbehaving pupils from the classroom or from the school, either temporarily or permanently. Its growing use has led to increased concern about potential negative effects on excluded pupils, including on their educational achievement. This paper estimates the effect of being excluded on subject test scores and teacher assessment outcomes using detailed administrative data on an entire cohort of pupils in the English state school system. To mitigate selection bias, we use a novel empirical approach for this literature which compares excluded pupils with pupils who experienced exclusion after outcomes were measured but not before. We find that excluded pupils perform worse in subsequent tests and teacher assessments, with 0.03-0.07 standard deviation lower standardised test scores and 2.5-3.6 percentage point higher probability of not reaching the expected level in teacher assessments. We assess the extent to which these estimated associations might reflect a negative causal impact of exclusion.

**JEL Codes**: I24, I28

**Keywords**: school exclusion, educational achievement, administrative data

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# 1 Introduction

Exclusion is a practice used by headteachers in schools around the world involving the removal of a pupil from the classroom or school for disciplinary reasons.[1] It is a response to misbehaviour and can be temporary (fixed-term), with the pupil returning to the class or school after a period of time, or permanent, with the pupil unable to return. The ostensible aims of this practice are to deter misbehaviour and prevent disruption to peer learning. However, there are concerns that it could affect excluded pupils in other ways, with evidence of associations with various negative outcomes, but little evidence to show that it reduces or eliminates problematic behaviours (Skiba & Knesting, 2001; Theriot et al., 2010). In this paper we focus on out-of-school exclusion, both fixed-term and permanent, rather than in-school removals of pupils from classrooms.

A key concern is whether exclusion harms the educational achievement of excluded pupils. On the one hand, if it deters future misbehaviour, exclusion could improve achievement since risky and anti-social behaviours are negatively associated with educational performance (Goodman & Gregg, 2010; Gregg & Washbrook, 2011; Gutman & Vorhaus, 2012; Wright et al., 2018). On the other hand, exclusion separates pupils from teachers, peers and the school environment, leading not only to lost instructional time but potentially to wider disengagement (Graham et al., 2019; Pyne, 2019). Whether the net effect is positive or negative is an empirical question.

Understanding whether exclusion harms the educational achievement of the excluded pupil is important for informing its use. In England, at the time of writing, exclusions are at record levels (Department for Education, 2025a). Exclusion is also applied unequally, with certain pupil types – e.g. those eligible for Free School meals (FSM) and those with identified Special Educational Needs (SEN) – experiencing especially high rates (Department for Education, 2025a), leading to calls for better understanding of its impact (Timpson, 2019). When taking the decision to exclude, headteachers must weigh the expected benefits against the expected costs, judging whether disrupting the instruction of a misbehaving pupil is justified to protect the instruction of other pupils. Research evidence of the impact of exclusion on the educational achievement of the excluded, as well as on their peers, is therefore crucial if headteachers and policy makers are to make informed decisions regarding its use.

[1] The name given to this practice varies by context. In the UK, temporary exclusions are also called fixed-term exclusions or suspensions, and they refer to the practice of removing the pupil from school. In the US, the more widely used term is suspension, which most commonly refers to out-of-school suspension. Permanent exclusions are also called expulsions. Here we use the term 'exclusion' as a catchall to denote all out-of-school exclusions/suspensions/expulsions, whether permanent or temporary.

This paper investigates one side of this trade-off: specifically, whether excluding a pupil from school harms their educational achievement. Evidence of such an effect would have several implications. First, educational achievement is strongly linked to many future outcomes, including progress within education (Jerrim, 2023), interaction with the criminal justice system (Bacher-Hicks et al., 2024; Machin et al., 2011), and labour market earnings (Britton et al., 2022). Second, exclusion could exacerbate educational inequalities among pupils. Pupils at higher risk of exclusion typically have other forms of disadvantage which contribute to lower achievement, such as SENs (Department for Education, 2025a), with exclusion potentially adding another layer of disadvantage for such pupils. The uneven application of exclusionary discipline may also widen ethnic/racial achievement gaps, as has been shown in the United States (US) context (Morris & Perry, 2016). Given this, research that helps to identify whether being excluded impacts on educational achievement, and if so in which direction and by how much, is crucial.

Quantifying the empirical relationship between exclusion and educational achievement is challenging, however, because excluded pupils are likely to differ systematically from never-excluded pupils in terms of characteristics and behaviours, potentially leading to differences in average outcomes. There is an extensive correlational literature, mostly from the US, which applies regression analysis to pupil-level data to determine whether excluded pupils have lower levels of educational achievement than observationally equivalent pupils who are not excluded. Noltemeyer et al. (2015) presents a meta-analytic review of this literature, finding a statistically significant inverse relationship between being excluded (both in-school and, particularly, out-of-school) and achievement, along with a significant positive relationship with high school dropout. The evidence available for the UK is limited to this type of study, e.g. Education Policy Institute (2024).[2] However, Cobb-Clark et al. (2015) uses Australian data to demonstrate the fragility of such estimated associations to bias from selection on unobservables, concluding that their estimated associations were more likely to reflect selection bias than a causal effect of exclusion.

A handful of more recent studies – again predominantly from the US – have attempted to address this empirical challenge in two different ways. One approach has been to exploit longitudinal data to estimate individual fixed effects models, thereby addressing that part of selection bias due to time-invariant unobservables (Chu & Ready, 2018; Hwang, 2018; Lacoe & Steinberg, 2019). Although such models do not provide causal estimates – time-varying unobservables likely

[2] There are two partial exceptions to this, where studies using English data adopt quasi-experimental methods to estimate plausibly causal impacts of exclusion on school-level indicators of performance (Machin & Sandi, 2020) and on future criminal justice outcomes (Dorsett et al., 2023).

remain – the resulting associations are plausibly closer to causal than cross-sectional correlational studies. They typically report negative associations between exclusion and achievement, of varying magnitudes, which tend to be smaller than cross-section estimates. Note, however, that because this approach exploits within-individual variation in exclusion over time, it is best suited to estimating short-run exclusion effects (e.g. effects in the same quarter, semester or year). Further, individual fixed effect estimates of short-run exclusion effects can be biased if outcomes in exclusion-free periods are impacted by past exclusions. This approach also disregards students who are persistently excluded, for whom we might expect the largest cumulative impacts (Hwang, 2018; Lacoe & Steinberg, 2019).

Another approach uses quasi-experimental methods, exploiting plausibly exogenous variation in exclusion propensities due to local-level changes or variation in exclusion policy (Bacher-Hicks et al., 2024; Craig & Martin, 2025; Lacoe & Steinberg, 2019; Pope & Zuo, 2023). Of these studies, however, only Lacoe & Steinberg (2019) provides an estimate of the impact of exclusion specifically on the excluded, with others estimating net impacts of variation in exclusion propensities at the school level, i.e. effects averaged over both the excluded and their peers. Lacoe & Steinberg (2019) leverages a district-level change in Philadelphia in which out-of-school exclusions were prohibited for two non-violent behavioural infractions (disruption and profanity). Their instrumental variable (IV) estimates suggest a small but statistically insignificant negative exclusion impact on average, but a larger and statistically significant negative impact of exclusion related to disruptive behaviour for older but not younger pupils.[3]

Although the quasi-experimental approach is ultimately the more promising, opportunities to exploit suitable natural experiments are limited, and the generalisability of existing findings from specific US contexts remains unclear. This leaves an important complementary role for correlational studies that seek to mitigate selection bias as far as possible, such as the individual fixed effects studies cited above, while stopping short of identifying casual effects. This study makes several novel contributions to this strand of the literature. First, we adopt an innovative approach – in this literature – to mitigating concerns about selection bias. Specifically, we compare outcomes of excluded pupils with outcomes of pupils who are excluded *later on* (after outcomes are measured but not before). This approach, which has been used to estimate the labour market impacts of disability onset and health shocks (Fadlon & Nielsen, 2021; Jones &

[3] Lacoe and Steinberg (2019) adopt both an individual fixed effects and quasi-experimental approach in their study, comparing estimates from the two approaches. Although there are some differences in the resulting estimates, neither approach returns consistently larger or consistently more statistically significant estimates than the other.

McVicar, 2020), helps to mitigate selection bias because later-excluded pupils are likely more similar to currently excluded pupils, in terms of unobservables, than pupils who never experience exclusion. To counter concerns about remaining sources of selection bias, we then perform bounds analysis to assess the extent to which the resulting estimates could be explained by remaining unobserved confounders, under standard proportionality assumptions (Altonji et al., 2005; Oster, 2019). As a further point of comparison, we also present individual fixed effects estimates along the lines of Lacoe & Steinberg (2019).

Second, the administrative data used in this study offers several notable advantages. We use the Longitudinal Education Outcomes (LEO) database, which tracks the entire population of English state school pupils throughout their school careers, with detailed individual-level information on exclusions, multiple measures of achievement, (anonymised) school attended, and a wide range of demographic and socioeconomic attributes which permit extensive control for correlated determinants of educational achievement, including prior achievement. Further, whereas existing studies typically specify a binary exclusion indicator without capturing variation in the number or types of exclusions experienced, here we can distinguish between exclusion experiences in this way. Finally, because we use English data, we contribute both to the specific evidence base required for headteachers and other stakeholders in the English school context, and to the wider international literature, by providing estimates that complement recent district- and city-specific US studies.

Our estimates show that being excluded from school is strongly negatively associated with educational achievement, with excluded pupils having lower mean test scores and performing worse in teacher assessment. Our preferred estimates, which compare excluded with later-excluded pupils, suggest that being excluded is associated with test scores that are lower by 0.03-0.07 of a standard deviation, and with a 2.5-3.6 percentage points higher probability of not reaching the expected level in teacher assessment (depending on subject). These estimates are substantially smaller than equivalent estimates based on comparisons with never-excluded pupils. We also find evidence suggestive of dose response, with estimated exclusion effects increasing with the number of exclusions.

Although we do not interpret these estimates as causal, the degree of adjustment for measured differences between pupils, the use of later-excluded pupils as our comparison group, the suggestion of dose response, and robustness to alternative approaches, suggest our estimates are plausibly closer to causal than those reviewed by Noltemeyer et al. (2015). Bias-adjusted estimates, following the approach of Oster (2019), are attenuated in magnitude but remain

economically and statistically significant, and potentially represent a lower bound for the causal effect of exclusion. Taken together then, we present evidence that is strongly suggestive of a non-trivial adverse causal effect of exclusion on the educational achievement of the excluded in the English school context, consistent with the evidence in the US context presented by Lacoe & Steinberg (2019).

# 2 Institutional Context: Exclusions in England

Two types of formal out-of-school exclusion are used within the English school system: (i) temporary exclusion (sometimes called suspension or fixed-term- or fixed-period exclusion), and (ii) permanent exclusion (sometimes called expulsion). Pupils may be excluded in response to various types of behavioural infraction, e.g. bullying and physical or verbal abuses towards pupils and staff. The process for excluding a pupil is formal and governed by specific procedures. Only a headteacher can exclude a pupil and they are legally required to notify parents or guardians when they do so (Department for Education, 2024b).

A temporary exclusion involves the removal of a pupil from school for one or more fixed periods of time, i.e. a period with a defined start and end date, with headteachers having some discretion over the duration. During this time the school is obligated to continue providing education to the excluded pupil, either sending work home or placing the pupil in alternative provision (external education arranged by local authorities or schools themselves). For suspensions lasting five school days or less, schools should continue to set and mark work; for those lasting longer, suitable alternative provision must be arranged from day six.

A permanent exclusion occurs when a pupil is removed from school and no longer allowed to attend. Unless they are re-instated on appeal, the pupil is struck from the school register, and the local authority is required to find suitable full-time education from day six. Permanent exclusion should only occur in response to a serious breach or persistent breaches of the school's behaviour policy and where allowing the pupil to remain in school would seriously harm the education or welfare of the pupil or others such as staff or pupils. It is usually the final step in the process of dealing with behavioural infractions, following the unsuccessful use of other strategies (including temporary exclusion).

Schools are obligated to keep records of exclusion events, including details about their type and duration, records which are observed in our data. Informal or ‘unofficial’ exclusions – that is, sending pupils home without following the formal school exclusion process – are unlawful.

However, schools can use other disciplinary tools without having to resort to a formal exclusion. For example, pupils can be sanctioned with detention or verbal warnings and may be temporarily removed from class to another part of the school under supervision. Such practices are not recorded in our data.

# 3 Data

## 3.1 LEO Data

This study uses data from LEO, a database from the Department for Education (DfE) that tracks all pupils enrolled in the English state school system – approximately 93 percent of all school pupils (Jay et al., 2018) – throughout their school careers and beyond (Department for Education et al., 2023). LEO links a number of administrative datasets, including education data from the National Pupil Database (NPD) (Department for Education, 2024a), which we draw on here. The NPD contains pupils' exclusion and absence records, a range of attribute data characterising their demographic and socioeconomic circumstances, and test and teacher assessment results, in core subjects, at various stages. Note that we are not the first to use NPD data to study exclusion in the English context, e.g. Education Policy Institute (2024a). Dorsett et al. (2023) and Machin and Sandi (2020) also use NPD data to investigate exclusion effects on other outcomes, while McLean and McVicar (2025) investigate exclusion and exam performance at the end of compulsory schooling using an alternative (sibling fixed effects) approach to mitigating unmeasured selection bias.

Our analysis concentrates on tests and teacher assessments undertaken by pupils at age 14, when they reach the end of a curricular stage called key stage (KS) 3. In England, the national curriculum comprises subjects and standards used by primary and secondary schools to ensure consistent learning across the school system. It is organised into blocks of years called key stages, beginning with Early years at ages 3-5, followed by KS1 at ages 5-7, and progressing to KS4 at ages 15-16. Performance is assessed at the end of each KS, with pupils expected to reach a minimum level (the national curriculum level). From KS1 until KS3, the national curriculum content of each subject is divided into levels (1-8). For example, by the end of KS2 (KS3), most pupils are expected to have reached level 4 (5) or higher in all subjects. Key stage 3 sits in between two key branching points in compulsory education: the end of primary school (KS2, age 11) and the end of secondary school (KS4, age 16).

We focus on a single cohort of pupils who entered KS3 at the start of the 2005/06 academic year, at ages 11-12. KS3 lasts for three academic years, and this cohort was assessed in 2007/08. At this time, there were two forms of end-of-KS3 assessment: national testing and teacher assessments in English, mathematics and science. We select this cohort because it was the last to sit these tests, since testing was discontinued from this year onwards, after which teacher assessment became the sole means of formal assessment. It is also the only tested cohort with complete exclusion records throughout KS3, as comprehensive exclusion data only became available in 2005/06.

The vast majority of pupils in our cohort sat national tests in English, mathematics and science.[4] Teachers also award each pupil a national curriculum level in each of these subjects, reflecting their written, practical and oral work as well as classroom work, homework and the results of school (not national) examinations or tests. In our overall analysis sample, the modal teacher award was level 5 in English and science and level 6 in mathematics. We analyse both test scores and teacher assessments because the teacher assessment level is the only available measure of achievement for the small number of pupils with missing test scores, and because test scores are unlikely to be missing at random. Test scripts were marked externally, i.e. not by a pupil's own teacher.

## 3.2 Analysis Sample

Our baseline analysis sample consists of pupils with at least one KS3 test or teacher assessment in 2007/08 and who were in the same year group throughout KS3 (year 7 in 2005/06, 8 in 2006/07, and 9 in 2007/08). This sample excludes pupils who were not in the school system covered by the NPD throughout KS3, e.g. new immigrants. Pupils are also required to have non-missing prior achievement data (KS2 test score). We refer to this as the 'full sample'.

In order to compare with later-excluded pupils, our preferred analysis is restricted to a subsample of pupils from this cohort who were excluded in either or both KS3 or KS4, where KS4 covers academic years 2008/09 and 2009/10. To construct this subsample, we retain pupils observed in at least one of these KS4 years – pupils not observed (i.e. missing) in both years likely left the state school system after KS3 – who were excluded at least once during KS3 or KS4. Restricting to pupils observed in both KS4 years, by contrast, could lead to the omission of pupils who become detached from the school system as they approach compulsory school leaving age (16), with

[4] In our cohort, 6.3, 3.3, and 3.5 percent of pupils did not have a test score for English, Maths, and Science, respectively.

excluded pupils likely to be over-represented among such pupils. We refer to this as the 'subsample'.

These restrictions yield pupil counts of 535,783 (full sample) and 88,666 (subsample). These overall samples include pupils with missing values on some KS3 outcomes and prior achievement (KS2) variables (in both cases they must have a non-missing value for at least one outcome measure), to ensure that all available information was utilised. Pupils are removed, however, if they have missing attribute or absence data. Since regression analysis is performed separately by subject, estimation sample size varies slightly by outcome-subject pair.

## 3.3 Outcome variables

Educational achievement at the end of KS3 is measured in two ways: (i) test scores, and (ii) binary indicators of achievement in teacher assessment. For each subject, the test score is the sum of all sub-scores, e.g. in English the reading paper score plus the writing paper score. In the regression analysis we standardise test score to have mean zero and standard deviation one. Because teacher assessments are only given in levels, a binary measure is constructed to indicate whether a pupil is performing below the expected national curriculum level (1 if level 4 or below, and 0 otherwise). Note that these outcome variables are measured at a single point in time for each pupil, and the LEO does not contain achievement data outside of the end of each KS.

## 3.4 Exclusion variables

We initially classify pupils as excluded if they experienced either temporary or permanent exclusion at any stage during the three academic years of KS3, distinguishing pupils with any exposure to exclusion from those with no exposure during this period. Adopting this simple binary treatment measure allows us to benchmark our estimates to existing comparable estimates. However, because it does not distinguish exclusions by type (temporary or permanent) or number (some pupils receive multiple exclusions), we also analyse a richer 6-category measure which captures differences in levels of exposure to exclusion. For this measure, we classify pupils by numbers of temporary exclusions (1, 2, 3, 4, 5+) but no permanent exclusion, and by having at least one permanent exclusion (regardless of number of temporary exclusions).

## 3.5 Covariates

We identify a set of covariates which account for measured differences between excluded and never-excluded (or later-excluded) pupils in other determinants of achievement. Published data

show that excluded pupils are more likely to have other characteristics, such as identified SENs (e.g. a severe learning difficulty), associated with lower achievement (Department for Education, 2025a). In addition to a SEN indicator, we include demographic characteristics such as gender, year and month of birth, and ethnic group. Although the NPD contains no household income information, we include two proxy measures of socioeconomic status. The first indicates whether a pupil is eligible for Free School Meals (FSM), with eligibility determined by whether a parent or child receives certain means-tested social security benefits. The second is an area-level measure (Income Deprivation Affecting Children Index (IDACI)), entered as a categorical quintile variable, which measures the proportion of all children aged 0 to 15 living in income deprived families at a pupil's home postcode. These covariates are measured in the final year of KS3, and we assess sensitivity to this choice in Section 5.7.

We supplement these covariates with information on school absences (for reasons other than exclusion) during KS3. Absence from school can be authorised (e.g. when a pupil has a medical appointment) or unauthorised (when the pupil fails to attend school without permission) and, as for exclusion, involves the loss of class instructional time. Repeatedly excluded pupils tend to be repeatedly absent (Children's Commissioner, 2022), while absence rates are negatively associated with achievement (Department for Education, 2025b). Schools keep records of authorised and unauthorised absences, including information on whether the absence was due to exclusion with no alternative provision in place. When constructing the KS3 absence variable (measured in sessions), we therefore subtract the number of exclusion-related absences[5] from the total number of absences. Because exclusion might itself lead to school disengagement, we cannot rule out that exclusion might *cause* future absence, raising concerns that absence might represent a bad control in this context (Angrist & Pischke, 2009). We therefore conduct two forms of sensitivity analysis, discussed in Section 5.7.

A further empirical concern is whether excluded pupils have lower average achievement than never-excluded pupils because of differences in underlying academic ability. We therefore control for the test score from KS2, before KS3 exclusion can take place. Finally, we account for variation common to pupils from the same school via school fixed effects.

[5] Note that, because exclusion-related absences data were not available in 2005/06, this adjustment could only be performed for two out of the three KS3 years (2006/07 and 2007/08).

# 4 Approach to Estimation

We estimate the effect of being excluded on educational achievement by estimating linear regressions of the following form:

$$y_{is} = \alpha + \beta EXC_{is} + \boldsymbol{\theta X_{is}} + \gamma Prior\_TS_{is} + \varphi_s + \epsilon_{is} \quad (1)$$

where $y_{is}$ denotes outcome $y$ for pupil $i$ in school $s$. The parameter $\beta$ associated with $EXC_{is}$ measures the effect on educational achievement of being excluded versus not being excluded. The variables in $\boldsymbol{X_{is}}$ include pupil-level demographic and socioeconomic characteristics, categorical number of (non-exclusion) sessions absent during KS3, and area-level deprivation (IDACI quintile). Prior achievement (subject-specific KS2 test score) is represented by $Prior\_TS_{is}$, while the school fixed effects term ($\varphi_s$) captures all factors common to pupils attending the same school. Finally, $\epsilon_{is}$ is an error term representing unmeasured determinants of achievement.

Excluded pupils are likely to differ from never-excluded pupils because exclusion is not randomly assigned. Even when including measured covariates, equation (1) will deliver a biased estimate of $\beta$ if there are unobserved (and thus uncontrolled) differences that influence achievement. This motivates the approach of re-estimating equation (1) on the subsample of pupils who are excluded during either KS3 or KS4 (or both). This sample restriction removes pupils if they never experienced exclusion during these key stages, thereby redefining the comparison group to pupils excluded in KS4 only. Thus, in the subsample, we compare the outcomes of pupils experiencing exclusion with the outcomes of pupils experiencing *later* exclusion. Because this approach plausibly mitigates selection bias from unobservables, these are our preferred estimates. In support of this argument, we show in Section 5.1 that these groups have fewer measured differences than the excluded and never excluded. Despite this, some unobserved differences remain likely (e.g. time-varying aspects of behavioural differences), so we do not interpret our subsample estimates as causal. Note, however, that this identification issue – the potential for bias from salient differences in remaining unobservables, whether within or between individuals – is shared by existing US studies adopting individual fixed effects approaches to estimating exclusion effects (Chu & Ready, 2018; Hwang, 2018; Lacoe & Steinberg, 2019).

To gauge the potential impact of remaining unmeasured factors we apply the bounding method of Oster (2019), similar to Cobb-Clark et al. (2015), which we adapt to incorporate school fixed effects following Bryan et al. (2022). This allows us to assess whether our preferred exclusion coefficient estimates could be explained by selection on unobservables, under stated assumptions about its impact relative to selection on observables. First, we calculate bias-

corrected exclusion coefficients, assuming proportional and same-signed selection from observed and unobserved factors. We then estimate the degree of selection on unobservables ($\delta$) required to generate an exclusion coefficient of 0, with $\delta = 1$ (i.e. equal selection) considered a reasonable threshold in the literature.

We estimate equation (1) separately by subject, outcome, and analysis sample. Four models are estimated in each case, adding covariates sequentially, with the Oster-style analysis applied to the subsample model only. Since observations within schools are unlikely to be independent, we use standard errors robust to within-school clustering. Further, because the teacher assessment outcome is binary, we also re-estimate equation (1) as a logit model, as discussed in Section 5.7.

As a further point of comparison, we re-estimate an alternative version of (1) including individual fixed effects along the lines of Hwang (2018), Chu & Ready (2018) and Lacoe & Steinberg (2019). In this model, we treat KS2 and KS3 as two consecutive time periods, with outcomes, exclusion and covariates measured at the end of each KS (adding time subscripts to (1), a key stage dummy, and dropping the prior achievement term). Note that this approach is not possible with our existing cohort because KS2 exclusion records are unavailable for this or earlier cohorts. Instead, we use the next available cohort, i.e. those with KS3 assessments in 2008/09, for whom KS2 exclusion data (in 2005/06) is available. However, because they were discontinued after 2007/08, KS3 test scores are not available, and we can only analyse the teacher assessment outcome. We first check that our standard approach (estimating (1)) provides similar estimates for both cohorts, before presenting pooled and individual fixed effects estimates. The individual fixed effects approach has disadvantages not shared by our preferred approach comparing KS3 excluded pupils to later-excluded pupils, including the potential for persistent exclusion effects to bias estimates and the omission of those excluded in both KS2 and KS3 from the identifying sample. On the other hand, it removes selection bias due to unobserved differences between pupils and, because it relies solely on within-pupil variation in exclusion, is free from potential bias due to indirect effects of exclusion on the within-school peers of the excluded. So, although neither approach identifies the causal effect of exclusion, by mitigating potential biases in different ways, inclusion of these individual fixed effects estimates helps to give a further sense of the robustness of our preferred estimates to remaining identification issues.

# 5 Results

## 5.1 Descriptives

Table 1 presents descriptive statistics for the overall analysis sample and various subgroups. In terms of the full sample, column 1 of Table 1 shows that 89 percent of pupils experienced no form of exclusion during KS3, with the remaining 11 percent having experienced at least one exclusion of any type. Approximately 5.5 percent experienced only a single temporary exclusion with 1.7 percent experiencing five or more. A very small fraction, 0.3 percent, experienced one or more permanent exclusions.

In terms of outcomes, just over 22 percent of the overall analysis sample failed to achieve the expected level of 5 or above in English and science teacher assessment, with a lower percentage (19.5 percent) for mathematics. Table 1 column 1 also shows that just under 83 percent of pupils are classified as White, with Asian/Chinese comprising the largest minority ethnic group (7 percent). Almost one-in-ten pupils (9.7 percent) has one or more identified SENs, and 14.5 percent are classified as FSM-eligible. Non-exclusion-related absence rates vary substantially, with the most frequent category (25.7 percent) having 20-39 sessions absent during KS3 and the least frequent category (7.8 percent) having 80-99.

Columns 2-4 show how these variables differ by experience of exclusion. Pupils excluded in KS3 (column 4) perform worse than pupils not excluded in KS3 (column 2) across all achievement measures. For example, in English, excluded pupils have a lower mean (raw) test score (32.6 compared with 47.6) and a higher probability of failing to reach level 5 or above in teacher assessment (51.2 percent compared with 19.1 percent). Boys and ethnic minority pupils (with the exception of Asian/Chinese) are over-represented among excluded pupils, who also have higher rates of SENs and FSM eligibility and are more likely to live in income-deprived areas. They are also absent from school (for reasons other than exclusion) more frequently and have lower prior test scores.

Finally, column 3 reports these summaries for pupils excluded in KS4 only. In general, this group bears a stronger resemblance to pupils experiencing exclusion in KS3, with comparable (though slightly higher) levels of achievement in KS2 and KS3 and a closer demographic and socioeconomic profile. These narrower differences in observables are suggestive of the value of selecting this subgroup as a point of comparison for KS3 excluded pupils in terms of similarity in unobservables.

## 5.2 Exclusion Effects within the Full Sample

Table 2 reports estimated exclusion coefficients for each outcome by model and subject in the full sample analysis. These coefficients compare pupils who are excluded in KS3 with pupils who are not excluded in KS3. Estimated coefficients for all variables are reported in Appendix Tables A1-A6.

Reflecting the descriptive results, Table 2 shows that excluded pupils have statistically significantly lower average achievement in all subjects. Focusing on model 1 for English, excluded pupils have a 0.82 lower standardised test score, and a 30.9pp higher probability of failing to achieve level 5 or above in teacher assessment. Recall that the overall proportion failing to achieve level 5 in English is only 0.20. These effects are reduced in magnitude by approximately 46 percent after adjusting for observed pupil characteristics, absence and area-level income deprivation (model 2) and by a further 30-39 percent after adjusting additionally for prior achievement (model 3). The exclusion coefficients are essentially unchanged by the inclusion of school fixed effects in model 4, which yields estimates of -0.261 (test score) and 11.7pp (teacher assessment), approximately 68-69 percent smaller than their unadjusted counterparts.

Similar results are evident for Mathematics and science, with relatively large unadjusted effects and smaller adjusted effects. For test scores, the model 1 and model 4 coefficients differ by almost 70 percent in mathematics and 60 percent in science. Overall, exclusion is associated with statistically significantly lower achievement across all models, but, notably, exclusion effects on test scores are markedly larger for English.

To get a sense of the magnitude of these effects, they can be compared to the effects of other variables (see Appendix Tables A1-A3). In model 4, exclusion has a larger estimated adverse effect on test scores than being male, being FSM-eligible, having a SEN (except for science), and living in any area more deprived than the 20 percent least deprived areas. The estimated exclusion effect is also larger than the effect of non-exclusion school absence of any length, except in the case of very high absence for mathematics.

## 5.3 Exclusion Effects within the Subsample

The full sample regression results reveal that up to two-thirds of the exclusion achievement gap is associated with observed differences between excluded and never-excluded pupils. Although the remainder could reflect the effects of exclusion itself, we cannot rule out the possibility that it reflects, at least in part, unobserved differences. This motivates re-estimating equation (1) on the subsample of more comparable pupils. Now, the estimated exclusion coefficients, reported in Table 3, compare pupils excluded in KS3 (including those also excluded in KS4) with pupils who are excluded in KS4 only.

The subsample estimates are much smaller than the full sample estimates. In English, compared to those excluded in KS4 only, pupils excluded during KS3 have a 0.211 lower standardised test mark and a 10.9pp higher probability of not achieving the expected level in teacher assessment. Once again, these effects attenuate, this time by approximately 52-57 percent, once pupil characteristics, absence and area-level income deprivation are included. Including prior achievement and school fixed effects reduces them further, although they remain economically and statistically significant, with estimates of -0.073 for standardised test score and 3.4 pp for teacher assessment.

The results for mathematics and science are qualitatively similar. In model 4 for mathematics, these estimated coefficients are -0.029 for standardised test score and 0.025 for teacher assessment. For science, they are -0.042 and 3.6 pp.

Relative to other determinants of test scores (Appendix Tables A4-A6), model 4 shows that the achievement gap for the excluded is roughly equivalent to around half of that for boys relative to girls in English, around half that of having one or more SEN in both English and mathematics, and either larger than (English, mathematics) or equivalent to (science) the achievement gap for FSM-eligible pupils relative to ineligible pupils. So, although these estimated exclusion effects are considerably smaller than the equivalent full sample estimates – by 72-80 percent for standardised test score and 66-71 percent for teacher assessments – they remain large. Further, the contrast between the full sample and subsample estimates suggests that much of the variation in achievement between excluded and never-excluded pupils can be attributed to unobserved differences not captured by the covariates included in the full sample models. By instead comparing excluded pupils with later excluded pupils, we remove this confounding variation. These are therefore our preferred estimates. However, some salient unobserved differences between these groups may remain. In the following subsection we explore whether such differences might explain the model 4 estimates presented in Table 3.

## 5.4 Sensitivity to Selection on Unobservables (Oster Bounds)

Table 4 presents the results from the bounds analysis applied to the model 4 subsample estimates. Columns 3 and 7 report bias-adjusted exclusion coefficients calculated under the assumption that selection on unobservables is equally as important as selection on observables, and that selection impacts in the same direction for both. If these assumptions hold, and in the absence of other biases, the estimates can be interpreted as lower bounds on the absolute magnitude of the impacts of exclusion on the excluded, i.e. lower bounds of causal effects. Similarly, the estimates shown in Columns 2 and 6 (copied from Table 3) may be interpretable as upper bounds. Finally, columns 4 and 8 show the degree of selection on remaining unobservable factors required to generate an exclusion coefficient of zero.

The bias-adjusted exclusion coefficients (columns 3 and 7) are approximately 42-56 percent smaller than the fully adjusted (preferred) estimates (columns 2 and 6), and all are statistically significant at the 99 or 99.9 percent level. Therefore, although our preferred model likely over-estimates the effect of exclusion, neither the upper nor lower bound estimates coincide with zero (under the stated assumptions). Similarly, the degree of selection on unobserved factors required to generate a zero coefficient is always greater than 1 and in most cases above 2 (except for English and mathematics teacher assessment). The smallest point estimate (English teacher assessment) implies that selection on unobservables would need to be at least 1.7 times greater than selection on observables for exclusion to have zero effect. Given the sample restriction to current- and later-excluded pupils as well as the extensive set of included covariates, this seems implausible.

Although Table 4 suggests it would not be unreasonable to conclude that being excluded has a non-trivial detrimental impact on educational achievement, one reason for caution is the potential for other biases. In particular, if there are non-trivial magnitude indirect effects of exclusion on the later-excluded *peers* of those excluded in KS3, e.g. on classmates, then our estimates of the exclusion effect, including the Oster-style lower bounds estimates, may themselves be biased and in an uncertain direction. Such indirect effects are possible, and indeed partly motivate the use of exclusion in practice, if exclusion of a classmate meaningfully reduces the incidence of classroom disruption, acts as a deterrent to own misbehaviour, or alters own behaviour in some other way (Craig & Martin, 2025; Perry & Morris, 2014). If such indirect effects exist and are positive, i.e. they increase achievement for the peers of excluded pupils, then this would impart an additional negative bias to our estimates for test scores (and positive bias for teacher assessment estimates). Because such biases would exaggerate the magnitude of the

estimated exclusion effect in each case, we could no longer interpret the bias-adjusted estimates as lower bounds on the absolute magnitude of this effect. Alternatively, if any such indirect effects are negative, i.e. they decrease achievement for the peers of excluded pupils, then the lower bound interpretation may still hold. If anything, existing evidence suggests the indirect effects of exclusion are more likely to be negative than positive, i.e. harmful to peer learning, although small in magnitude (Perry and Morris 2014; Lacoe and Steinberg 2019; Craig and Martin, 2025). We discuss this potential source of bias further in the following subsection. Section 5.7 also discusses a sensitivity analysis designed to assess its salience, exploiting differences in cohort size and therefore the likelihood that later-excluded peers are in the same class as KS3 excluded pupils.

## 5.5 Individual Fixed Effects Estimates

Table 5 presents three sets of estimates from an individual fixed effects variant of equation (1), as described in Section 4, estimated for the cohort taking KS3 assessment in 2008/09. The table presents unadjusted and fully adjusted associations for the binary teacher assessment outcome only (equivalent to model 1 and model 4, respectively, but including individual fixed effects in each case, adding a key stage indicator, and omitting prior test score in model 4), plus fully adjusted estimates conditioned additionally on school fixed effects. It suggests adverse exclusion effects that are both economically and statistically significant (at the 99.9 percent level), with fully adjusted individual- and school fixed effects estimates of 0.075, 0.062 and 0.105 for English, mathematics and science, respectively.

Equivalent linear pooled estimates are presented in Appendix Table A7. These estimates are everywhere larger in magnitude than the individual fixed effects estimates presented in Table 5. Cross-sectional estimates adopting our preferred approach (comparing excluded and later-excluded pupils) are presented in Appendix Table A8 for this later cohort. Compared to our preferred estimates in Table 3, the estimates in Table A8 are reassuringly similar (0.034 vs. 0.031 for English, 0.025 vs. 0.027 for mathematics, and 0.036 vs. 0.030 for science).

In comparison to our preferred estimates (Table 3), although these individual fixed effects estimates take the same sign in each case, they are 2-3 times larger in magnitude. Table A8 establishes that this is not driven by differences between the LEO cohorts. Equally, it cannot be driven by bias due to persistent effects of KS2 exclusion that impact on KS3 outcomes, because such effects would bias the individual fixed effects estimates towards zero. Further, because there are far fewer KS2 exclusions compared to KS3 exclusions, this is unlikely to be driven by disproportionate exclusion impacts in KS2 compared to those in KS3. Finally, if bias due to

indirect exclusion effects on later-excluded peers acts to exaggerate our preferred exclusion effect estimates, and because there is no such potential bias in the individual fixed effects estimates, this would not explain the larger relative magnitude of the fixed effects estimates either.

Instead, we offer three potential interpretations of this difference. First, we cannot rule out that our preferred approach better mitigates selection on unobservables than our individual fixed effects approach. Hwang (2018), Chu & Ready (2018) and Lacoe & Steinberg (2019) acknowledge that the individual fixed effects approach potentially over-estimates exclusion effects because of remaining uncontrolled factors. Having said that, our individual fixed effects estimates are either smaller than (English, mathematics) or similar in magnitude (science) to our own fully-adjusted *full-sample* estimates (see Table 2). Second, although Hwang (2018) argues that removing the consistently excluded from the identifying sample might lead to individual fixed effects models underestimating exclusion effects because they are likely to experience larger exclusion penalties, were exclusion to have decreasing marginal effects then the opposite might be the case. In other words, if the effect of being excluded in KS3 is smaller for pupils previously excluded in KS2 than for those not previously excluded in KS2, then individual fixed effects estimates might exaggerate the exclusion effect on average. Third, if there are non-trivial *negative* indirect effects of exclusion at the school year level, i.e. if having an excluded peer detrimentally impacts a pupil's own achievement, then this would bias our preferred estimates towards zero but would not affect the individual fixed effects estimates. Sensitivity analysis discussed in Section 5.7 suggests this latter conjecture is unlikely to hold, however.

## 5.6 Effects of Number and Type of Exclusion

In the following analysis, we distinguish excluded pupils according to the type and number of exclusions they experience, checking for dose-response relationships. Figure 1 displays the estimated model 4 coefficients on a categorical exclusion variable (reported in tabular form in Appendix Table A9). Note that pupils experiencing at least one permanent exclusion are classified as '1+ PE' regardless of how many temporary exclusions they received.

The figure reveals a gradient in which greater exposure to exclusion is associated with larger reductions in achievement. Looking firstly at temporary exclusion, the full sample estimates indicate that pupils excluded only once have a 0.20 lower standardised English test score than observationally equivalent never-excluded pupils, while pupils excluded 5 times or more have a 0.43 lower standardised score. The subsample estimates also exhibit a negative gradient but with

smaller magnitudes. Here, however, statistically significant negative effects only emerge after the first temporary exclusion. These patterns also generally hold for teacher assessment.

The results for permanent exclusion suggest that it is no more damaging for achievement than approximately 4 or more temporary exclusions. Permanent exclusion may indeed be less disruptive for excluded pupils, on average, than repeated temporary exclusions, although most of those permanently excluded (roughly 93 percent) have already experienced multiple temporary exclusions. However, there are two reasons to be cautious about this conclusion. First, there is greater statistical uncertainty as indicated by relatively wide 95 percent confidence intervals. Second, a disproportionate share of permanently excluded pupils with the worst behavioural records and achievement levels may have been omitted from the analysis because of sample restrictions or missing values. Had they been included, the coefficients may have been larger, *ceteris paribus*.

To explore this possibility, we compared permanently excluded pupils who were included in our analysis sample with those who were removed. This revealed that those who were removed had lower prior test scores and were more likely to have missing outcomes (see Appendix Table A10). Although this suggests that the effects of permanent exclusion could be under-estimated, given that the number of permanently excluded pupils is small, this is unlikely to materially impact our main results. Further, it does not affect the lower-bound interpretation of the bias-adjusted exclusion estimates.

## 5.7 Additional Sensitivity Analysis

In this section, we highlight additional sensitivity analyses which check whether our main exclusion estimates are robust to alternative absence variables and model specifications, and whether they could potentially be biased by indirect effects of exclusion (peer impacts). The results, reported in the Appendix, show the main conclusions are robust.

We first check whether the results are sensitive to the use of different covariates. Due to concern that school absence might be a bad control, we first gauge the impact of replacing this variable with an alternative that included only authorised absences (i.e. subtracting unauthorised absences potentially affected by exclusion). We then assessed the impact of omitting absence altogether. As shown in Appendix Figure A1, the preferred subsample estimates are statistically identical in both cases. We also check whether measuring selected covariates (ethnic group, SEN, FSM eligibility, and IDACI quintile) in the first (rather than final) year of KS3 affects the results. Appendix Figure A2 shows the estimates are no different.

For the teacher assessment outcome, we check whether, in models 2 and 3, a logit specification gives different results than the linear specification (eschewing model 4 due to the large number of school fixed effects). In the full sample analysis, this check revealed some slight divergence from the main results, with typically smaller logit estimates in all subjects, as shown in Appendix Figure A3. For example, in English, the linear model 3 coefficient is 0.118 while the logit average marginal effect is 0.078. No differences by specification were observed in the subsample analysis, however. Either way, the main conclusions are unchanged: exclusion is associated with a higher chance of achieving below the expected level in teacher assessment, regardless of model specification.

Finally, to explore whether the estimated effects of exclusion are sensitive to potential indirect effects of exclusion on the peers of the excluded(s) within the school, we re-estimate model 4 including an interaction term between exclusion and school cohort size. Indirect exclusion effects, if they exist, are likely to be stronger for peers in the same school class than for those in other school classes, because they are likely to be more impacted by disruptive behaviour and will likely have more regular contact with the excluded pupil(s). In smaller schools, a larger proportion of non-excluded (or later excluded) pupils will be in the same class as the excluded pupil(s). If bias due to indirect exclusion effects is salient, we might therefore expect bigger (smaller) estimated exclusion effects on the excluded in smaller (larger) schools, other things being equal, and depending on the sign of any indirect exclusion effect.

Table A11 reports the main estimates and reveals no evidence of differential effects by cohort size in the subsample, with estimated interaction terms individually and jointly statistically insignificant. Results are more mixed for the full sample, but overall no pattern emerges to suggest that exclusion effects are consistently larger (or smaller) in smaller cohorts where indirect effects, if they are salient, might be expected to have a larger impact and lead to larger bias.

# 6 Discussion and Conclusion

This study contributes to the international school exclusion literature by applying a novel empirical strategy and drawing on high-quality administrative data which covers most of the English school system, providing novel estimates of the effects of being excluded in a previously understudied educational setting. It also provides policymakers and headteachers with context-specific evidence to inform exclusion policy and individual exclusion decisions. Our approach

complements those of other studies conducted in and outside the English context, which employ different analytical methods yielding varying results.

The results show that excluded pupils achieve lower mean test scores and are less likely to reach the expected level in teacher assessment than pupils who are not excluded. The first set of empirical estimates, which compare excluded and never-excluded pupils, shows large negative effects that are generally consistent with other comparable estimates. Lacoe & Steinberg's (2019) linear estimates adjusted for student characteristics and school fixed effects imply that out-of-school suspension is associated with 0.23 and 0.25 lower Math and English Language Arts (ELA) standardised test scores, respectively. In our most comparable specification, the English estimate is very similar (-0.26), though our mathematics estimate is smaller (-0.15). Analysing multiple out-of-school suspensions among 12-16-year-olds, Hwang (2018) estimates coefficients of -0.26 for ELA and -0.27 for Math tests.

Motivated by concern about selection on unobserved factors, our preferred set of empirical estimates compares excluded pupils with later-excluded pupils, an approach that contrasts with and complements other studies' use of individual fixed effects. This approach yields smaller but still economically and statistically significant exclusion effects which are comparable in magnitude to some, though not all, existing individual fixed effect estimates. Lacoe & Steinberg (2019) find 0.04 lower standardised Math and ELA test scores, slightly larger than our own Math estimate (-0.03) but smaller than our English estimate (-0.07). By contrast, Hwang's (2018) point estimates are larger than our own but statistically insignificant (-0.21 for Math) or significant at only the 95 percent level (-0.18 for ELA). Our own individual fixed effects estimates, presented as a point of comparison, fall between our preferred estimates (comparing excluded with later-excluded) and our full-sample estimates (comparing excluded with never excluded) in magnitude. Our preferred estimates are also smaller in magnitude than the sibling fixed effects estimates of McLean and McVicar (2025).

Because confounding unobserved differences between the excluded and the later excluded likely remain, like other correlational and fixed effects studies, we cannot interpret our estimates as causal. Building on Cobb-Clark et al. (2015), we assess how far our preferred estimates might reasonably be explained by remaining selection on unobservables, following Oster (2019). This analysis suggests that, although they would exaggerate the magnitude of the impacts of exclusion if interpreted causally, a disproportionate (and therefore unlikely) degree of selection on unobservables would be required to fully explain our preferred estimates. One tentative interpretation of the resulting bias-adjusted estimates is that they represent a plausible lower

bound on the magnitude of the exclusion effect. This interpretation would imply a smaller but still economically and statistically significant adverse effect of exclusion, in the range of -0.015 to -0.039 for standardised test scores and 1.1-2.1 pp for teacher assessments.

These modest but non-trivial adverse effects of being excluded are consistent with excluded pupils subsequently falling behind their peers because of lost instructional time and/or wider disengagement resulting from exclusion (Graham et al., 2019; Pyne, 2019). Moreover, even when/if excluded pupils enter alternative provision (e.g. in the case of lengthy suspensions), this may be a fragmented, inferior substitute for their usual learning arrangements (Ofsted, 2011). However, in common with the wider (non-quasi-experimental) exclusion literature, including the individual fixed effects approaches of Hwang (2018), Chu & Ready (2018) and Lacoe & Steinberg (2019), we cannot rule out that our estimates, including the Oster-style bias-adjusted estimates, might be at least partly driven by underlying student behaviour and not by exclusion *per se*. Nevertheless, because we compare currently excluded with later excluded pupils – likely following similar behavioural trajectories, albeit perhaps at different stages – our approach arguably mitigates the extent to which this explains our preferred estimates, relative to other non-quasi-experimental studies.

Although the main implication is that excluding a pupil likely has an adverse negative effect on their educational achievement, further analysis suggests that pupils excluded temporarily on only one occasion do not suffer such effects, while repeatedly excluded pupils suffer adverse effects that increase with each additional exclusion. This suggests that a single temporary exclusion may carry no educational penalty, at least in this context. If repeated exclusions cannot be avoided, then their adverse impacts could be mitigated by improving alternative provision or taking remedial steps for affected pupils.

A limitation of our study is that we cannot account for other disciplinary practices used by teachers. Other 'unofficial' or 'informal' practices may be used strategically to avoid the use of formal exclusion, including the removal of a pupil to another part of the school (Power & Taylor, 2020). Schools may also use so-called managed moves, which involves the transfer of a child to another school under the voluntary agreement of parents, children and schools. These moves are not explicitly recorded, but estimates of their prevalence puts them in the thousands per year (Education Policy Institute, 2024b).

Arguably more important is that this study focuses on only one side of the exclusion trade-off: because the LEO data do not contain classroom identifiers, it does little to inform about the potential (indirect) impact on classmates' achievement, despite this being a crucial

consideration in an informed decision-making process. Existing studies suggest that pupils in schools or grades with high exclusion rates tend to suffer small (or no) adverse education impacts (Perry and Morris 2014; Lacoe and Steinberg 2019; Craig and Martin, 2025), but none have been able to separately identify peer impacts of exclusions within classrooms. So, although the present study offers further evidence of adverse achievement effects of exclusion on excluded pupils, further research is necessary to more fully inform this other aspect of the trade-off.

There are also growing concerns about the impacts of exclusion on other outcomes, including interaction with the criminal justice system (Dorsett et al., 2023; Theriot et al., 2010). The societal costs of these combined impacts, and their unequal distribution, are likely to be considerable. The repeated use of exclusion for a pupil may be an indication that the school/class environment is ill-suited to their needs, but that headteachers have few alternative interventions at their disposal. Identifying such pupils and intervening as early as possible to provide support could mitigate against the adverse costs of future exclusions, in addition to narrowing the existing achievement gaps experienced by pupils facing these kinds of disadvantages.

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# Tables and Figures

**Table 1: Summary Statistics: Full Cohort and Pupil Subgroups**

| | Full Cohort | | Not Excluded KS3 | | Excluded KS4 only | | Excluded KS3 | |
|---|---|---|---|---|---|---|---|---|
| | Mean/ Proportion | N | Mean/ Proportion | N | Mean/ Proportion | N | Mean/ Proportion | N |
| *KS3 Outcomes* | | | | | | | | |
| English Test Score | 46.1 | 501823 | 47.6 | 452159 | 36.5 | 27066 | 32.6 | 49664 |
| Mathematics Test Score | 77.2 | 516697 | 78.4 | 463086 | 68.9 | 28266 | 66.3 | 53611 |
| Science Test Score | 97.1 | 516512 | 98.1 | 462901 | 91.8 | 28298 | 88.5 | 53611 |
| English TA: Level <5 | 0.225 | 491898 | 0.191 | 439393 | 0.398 | 27063 | 0.512 | 52505 |
| Mathematics TA: Level <5 | 0.195 | 492730 | 0.169 | 439925 | 0.326 | 27074 | 0.417 | 52805 |
| Science TA: Level <5 | 0.222 | 494340 | 0.190 | 441493 | 0.381 | 27116 | 0.486 | 52847 |
| *KS3 Exclusion* | | | | | | | | |
| No Exclusion | 0.890 | 535783 | 1.000 | 476597 | 1.000 | 29480 | N/A | 59186 |
| 1 Temporary Exclusion only | 0.055 | 535783 | N/A | 476597 | N/A | 29480 | 0.498 | 59186 |
| 2 Temporary Exclusions only | 0.019 | 535783 | N/A | 476597 | N/A | 29480 | 0.175 | 59186 |
| 3 Temporary Exclusions only | 0.010 | 535783 | N/A | 476597 | N/A | 29480 | 0.094 | 59186 |
| 4 Temporary Exclusions only | 0.006 | 535783 | N/A | 476597 | N/A | 29480 | 0.058 | 59186 |
| 5+ Temporary Exclusions only | 0.017 | 535783 | N/A | 476597 | N/A | 29480 | 0.153 | 59186 |
| 1+ Permanent Exclusions | 0.003 | 535783 | N/A | 476597 | N/A | 29480 | 0.023 | 59186 |
| *Pupil Characteristics* | | | | | | | | |
| Female | 0.490 | 535783 | 0.513 | 476597 | 0.359 | 29480 | 0.298 | 59186 |
| Male | 0.510 | 535783 | 0.487 | 476597 | 0.641 | 29480 | 0.702 | 59186 |
| White | 0.827 | 535783 | 0.832 | 476597 | 0.808 | 29480 | 0.785 | 59186 |
| Asian/Chinese | 0.070 | 535783 | 0.072 | 476597 | 0.064 | 29480 | 0.056 | 59186 |
| Black | 0.037 | 535783 | 0.033 | 476597 | 0.054 | 29480 | 0.073 | 59186 |
| Mixed | 0.031 | 535783 | 0.029 | 476597 | 0.039 | 29480 | 0.048 | 59186 |
| Other | 0.035 | 535783 | 0.035 | 476597 | 0.035 | 29480 | 0.037 | 59186 |
| No SEN | 0.903 | 535783 | 0.924 | 476597 | 0.874 | 29480 | 0.728 | 59186 |
| Has SEN | 0.097 | 535783 | 0.076 | 476597 | 0.126 | 29480 | 0.272 | 59186 |
| Not FSM Eligible | 0.855 | 535783 | 0.872 | 476597 | 0.768 | 29480 | 0.713 | 59186 |
| FSM Eligible | 0.145 | 535783 | 0.128 | 476597 | 0.232 | 29480 | 0.287 | 59186 |
| *KS3 Absences (number of sessions)* | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Less than 20 | 0.196 | 535783 | 0.211 | 476597 | 0.117 | 29480 | 0.074 | 59186 |
| 20-39 | 0.257 | 535783 | 0.269 | 476597 | 0.209 | 29480 | 0.163 | 59186 |
| 40-59 | 0.192 | 535783 | 0.195 | 476597 | 0.193 | 29480 | 0.166 | 59186 |
| 60-79 | 0.124 | 535783 | 0.122 | 476597 | 0.145 | 29480 | 0.140 | 59186 |
| 80-99 | 0.078 | 535783 | 0.074 | 476597 | 0.104 | 29480 | 0.111 | 59186 |
| 100+ | 0.152 | 535783 | 0.128 | 476597 | 0.232 | 29480 | 0.346 | 59186 |
| *Income Deprivation Affecting Children Index (quintile)* | | | | | | | | |
| 1 (most deprived) | 0.230 | 535783 | 0.214 | 476597 | 0.310 | 29480 | 0.358 | 59186 |
| 2 | 0.201 | 535783 | 0.195 | 476597 | 0.235 | 29480 | 0.252 | 59186 |
| 3 | 0.191 | 535783 | 0.193 | 476597 | 0.180 | 29480 | 0.174 | 59186 |
| 4 | 0.190 | 535783 | 0.198 | 476597 | 0.153 | 29480 | 0.124 | 59186 |
| 5 (least deprived) | 0.188 | 535783 | 0.200 | 476597 | 0.122 | 29480 | 0.092 | 59186 |
| *Prior Achievement* | | | | | | | | |
| KS2 English Test Score | 55.8 | 509839 | 56.8 | 455968 | 49.5 | 27635 | 46.7 | 53871 |
| KS2 Mathematics Test Score | 63.9 | 513300 | 65.1 | 458150 | 56.6 | 27998 | 53.9 | 55150 |
| KS2 Science Test Score | 58.6 | 520374 | 59.4 | 463776 | 54.1 | 28562 | 52.2 | 56598 |

*Notes: Table reports means, proportions, and number of pupils (N) with non-missing values. Column 1 includes all pupils KS3 taking assessments in 2007/08. Column 2 includes pupils not excluded during KS3. Column 3 is a subset of pupils in column 2 who were excluded during KS4. Column 4 includes all pupils excluded during KS3. Pupil characteristics and IDACI quintile are measured in 2007/08. Exclusion and absences are measured throughout KS3 (2005/06 – 2007/08). KS2 test scores are measured in 2004/05.*

**Table 2: Estimated Effects of Exclusion on Key Stage 3 Educational Attainment by Model Specification: Full Sample**

| | Standardised Test Score | | | | TA level < 5 | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
| | | | | ***English*** | | | | |
| Excluded in KS3 | -0.822*** | -0.437*** | -0.267*** | -0.261*** | 0.309*** | 0.167*** | 0.118*** | 0.117*** |
| (Ref: Not Excluded KS3) | (0.008) | (0.006) | (0.004) | (0.003) | (0.003) | (0.003) | (0.003) | (0.002) |
| Observations | 488436 | 488436 | 488436 | 488436 | 471066 | 471066 | 471066 | 471066 |
| Adjusted R-squared | 0.061 | 0.233 | 0.634 | 0.692 | 0.055 | 0.176 | 0.367 | 0.398 |
| Outcome mean/proportion | 0.04 | 0.04 | 0.04 | 0.04 | 0.198 | 0.198 | 0.198 | 0.198 |
| | | | | ***Maths*** | | | | |
| Excluded in KS3 | -0.504*** | -0.269*** | -0.150*** | -0.148*** | 0.239*** | 0.122*** | 0.075*** | 0.073*** |
| (Ref: Not Excluded KS3) | (0.007) | (0.006) | (0.005) | (0.004) | (0.003) | (0.003) | (0.002) | (0.002) |
| Observations | 500512 | 500512 | 500512 | 500512 | 474786 | 474786 | 474786 | 474786 |
| Adjusted R-squared | 0.024 | 0.134 | 0.409 | 0.500 | 0.037 | 0.145 | 0.416 | 0.440 |
| Outcome mean/proportion | 0.04 | 0.04 | 0.04 | 0.04 | 0.172 | 0.172 | 0.172 | 0.172 |
| | | | | ***Science*** | | | | |
| Excluded in KS3 | -0.388*** | -0.228*** | -0.156*** | -0.158*** | 0.294*** | 0.161*** | 0.112*** | 0.111*** |
| (Ref: Not Excluded KS3) | (0.007) | (0.007) | (0.006) | (0.005) | (0.003) | (0.003) | (0.003) | (0.002) |
| Observations | 506112 | 506112 | 506112 | 506112 | 482720 | 482720 | 482720 | 482720 |
| Adjusted R-squared | 0.014 | 0.059 | 0.140 | 0.261 | 0.049 | 0.169 | 0.384 | 0.417 |
| Outcome mean/proportion | 0.02 | 0.02 | 0.02 | 0.02 | 0.209 | 0.209 | 0.209 | 0.209 |
| Pupil Attributes | No | Yes | Yes | Yes | No | Yes | Yes | Yes |
| KS2 Test Score | No | No | Yes | Yes | No | No | Yes | Yes |
| School Fixed Effects | No | No | No | Yes | No | No | No | Yes |

*Notes: Table reports exclusion coefficients and standard errors (in parentheses) from linear regressions. Test score outcome is standardised to have mean 0 and standard deviation 1. Teacher assessment outcome is equal to 1 if a pupil is awarded a level below 5, and equal to 0 if 5 or above. Analysis sample includes all KS3 pupils. Each coefficient is from a separate regression and expressed relative to pupils not excluded in KS3. Pupil attributes include gender, year of birth, month of birth, ethnic group, identified SEN, FSM eligibility, KS3 absences, and area Income Deprivation Affecting Children Index quintile. KS2 test score is subject-specific. Standard errors are clustered by school. Statistical significance denoted as follows: $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$.*

**Table 3: Estimated Effects of Exclusion on Achievement by Model Specification: Subsample**

| | Standardised Test Score | | | | TA level < 5 | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
| | | | | ***English*** | | | | |
| Excluded KS3 | -0.211*** | -0.101*** | -0.078*** | -0.073*** | 0.109*** | 0.047*** | 0.035*** | 0.034*** |
| (Ref: Excluded KS4 only) | (0.009) | (0.008) | (0.005) | (0.005) | (0.005) | (0.004) | (0.004) | (0.003) |
| Observations | 73072 | 73072 | 73072 | 73072 | 73568 | 73568 | 73568 | 73568 |
| Adjusted R-squared | 0.013 | 0.159 | 0.557 | 0.631 | 0.011 | 0.123 | 0.362 | 0.407 |
| Outcome mean/proportion | -0.63 | -0.63 | -0.63 | -0.63 | 0.438 | 0.438 | 0.438 | 0.438 |
| | | | | ***Maths*** | | | | |
| Excluded KS3 | -0.103*** | -0.038*** | -0.033*** | -0.029*** | 0.085*** | 0.031*** | 0.026*** | 0.025*** |
| (Ref: Excluded KS4 only) | (0.008) | (0.008) | (0.007) | (0.006) | (0.004) | (0.004) | (0.003) | (0.003) |
| Observations | 77632 | 77632 | 77632 | 77632 | 75226 | 75226 | 75226 | 75226 |
| Adjusted R-squared | 0.003 | 0.083 | 0.317 | 0.417 | 0.007 | 0.113 | 0.443 | 0.474 |
| Outcome mean/proportion | -0.38 | -0.38 | -0.38 | -0.38 | 0.357 | 0.357 | 0.357 | 0.357 |
| | | | | ***Science*** | | | | |
| Excluded KS3 | -0.129*** | -0.055*** | -0.044*** | -0.042*** | 0.103*** | 0.046*** | 0.039*** | 0.036*** |
| (Ref: Excluded KS4 only) | (0.009) | (0.009) | (0.008) | (0.008) | (0.004) | (0.004) | (0.003) | (0.003) |
| Observations | 79294 | 79294 | 79294 | 79294 | 77058 | 77058 | 77058 | 77058 |
| Adjusted R-squared | 0.003 | 0.063 | 0.193 | 0.287 | 0.010 | 0.119 | 0.342 | 0.392 |
| Outcome mean/proportion | -0.28 | -0.28 | -0.28 | -0.28 | 0.437 | 0.437 | 0.437 | 0.437 |
| Pupil Attributes | No | Yes | Yes | Yes | No | Yes | Yes | Yes |
| KS2 Test Score | No | No | Yes | Yes | No | No | Yes | Yes |
| School Fixed Effects | No | No | No | Yes | No | No | No | Yes |

*Notes: Table reports exclusion coefficients and standard errors (in parentheses) from linear regressions. Test score outcome is standardised to have mean 0 and standard deviation 1. Teacher assessment outcome is equal to 1 if a pupil is awarded a level below 5, and equal to 0 if 5 or above. Analysis sample includes all KS3 pupils excluded in either KS3 or KS4 (or both). Each coefficient is from a separate regression and expressed relative to pupils excluded in KS4 only. Pupil attributes include gender, year of birth, month of birth, ethnic group, identified SEN, FSM eligibility, KS3 absences, and area Income Deprivation Affecting Children Index quintile. KS2 test score is subject-specific. Standard errors are clustered by school. Statistical significance denoted as follows: $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$.*

**Table 4: Sensitivity to Selection on Unmeasured Factors: Subsample**

| | Standardised Test Score | | | | TA level < 5 | | |
|---|---|---|---|---|---|---|---|
| | Exclusion Coefficient | Bias-adjusted Exclusion Coefficient (given δ=1) | Degree of Unmeasured Selection (given β=0) | | Exclusion Coefficient | Bias-adjusted Exclusion Coefficient (given δ=1) | Degree of Unmeasured Selection (given β=0) |
| Subject, N | (β) | (β*) | (δ) | Subject, N | (β) | (β*) | (δ) |
| English | -0.073*** | -0.039*** | 2.1*** | English | 0.034*** | 0.015*** | 1.7*** |
| *N=73072* | (0.005) | (0.005) | (0.17) | *N*=73568 | (0.003) | (0.004) | (0.19) |
| Maths | -0.029*** | -0.015** | 2.1*** | Maths | 0.025*** | 0.011*** | 1.8*** |
| *N=77632* | (0.006) | (0.007) | (0.44) | *N*=75226 | (0.003) | (0.003) | (0.20) |
| Science | -0.042*** | -0.023*** | 2.2*** | Science | 0.036*** | 0.021*** | 2.3*** |
| *N=79294* | (0.007) | (0.006) | (0.43) | *N*=77058 | (0.003) | (0.004) | (0.25) |

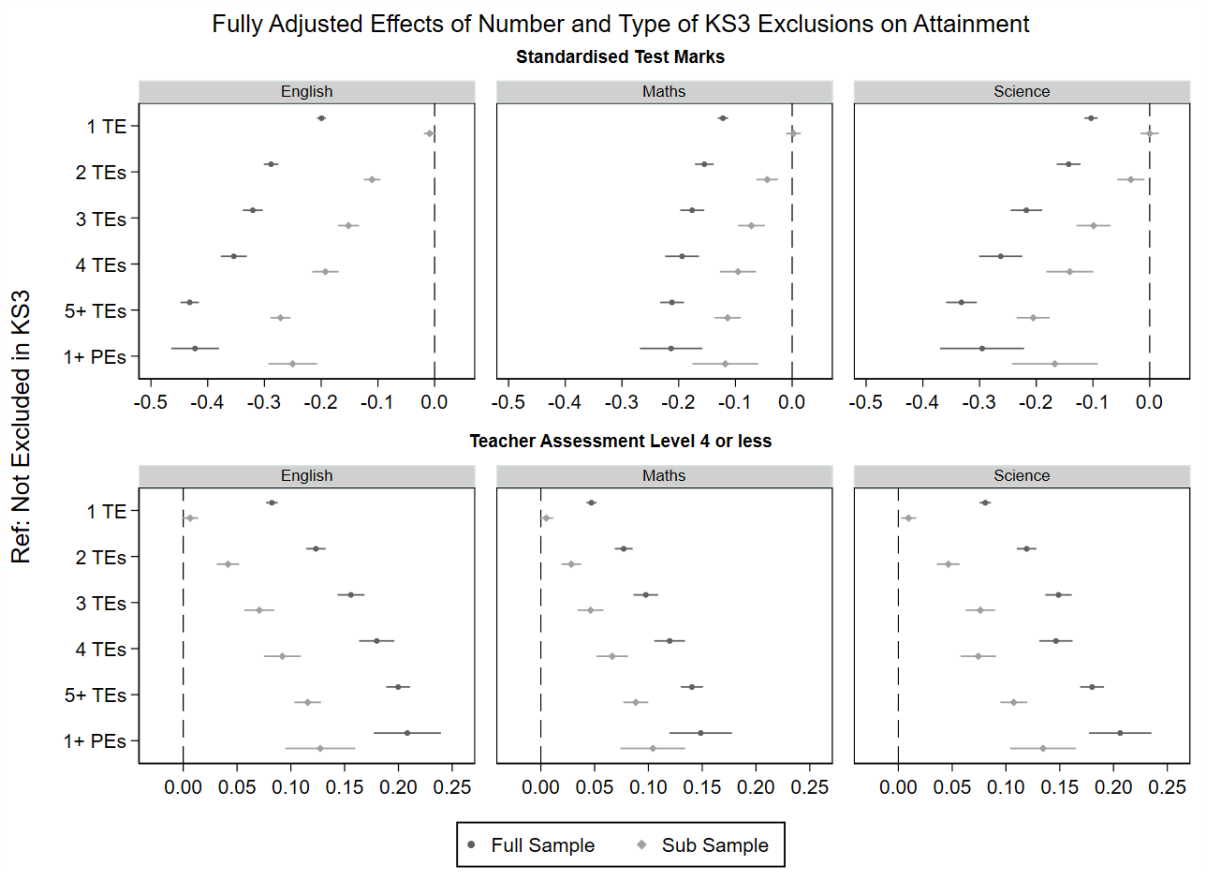
*Notes: Columns 1 and 4 reports the exclusion coefficient (β) from the fully adjusted model 4 specification with standard errors clustered by school in parentheses (also reported in Table 3). Analysis sample restricted to KS3 pupils excluded in either KS3 or KS4 (or both). Columns 2 and 5 report the bias-adjusted exclusion coefficient (β*) assuming proportional selection on observed and unmeasured factors (δ=1). Columns 3 and 6 report the degree of selection (δ) on unmeasured factors required to generate an exclusion coefficient of 0. Estimates assume a maximum R-squared of 1.3 times the within-R-squared from model 4, following Oster (2019). Bootstrapped standard errors with 50 replications are clustered by school. Statistical significance, applied to test of δ greater than or equal to 1, denoted as follows: * p < 0.05, ** p < 0.01, *** p < 0.001.*

**Table 5: Individual Fixed Effects Estimates of the Effect of Exclusion on the Probability of a Teacher Assessment Level below 5 by Model Specification: 2008/09 KS3 Cohort**

| | (1) | (2) | (3) |
|---|---|---|---|
| | | ***English*** | |
| Excluded (Ref: Not Excluded) | 0.091*** | 0.073*** | 0.075*** |
| | (0.003) | (0.003) | (0.003) |
| Observations | 787058 | 787058 | 785954 |
| Number of pupils | 393529 | 393529 | 392977 |
| Adjusted within-R-squared | 0.009 | 0.019 | 0.016 |
| Outcome mean/proportion | 0.214 | 0.214 | 0.214 |
| | | ***Maths*** | |
| Excluded (Ref: Not Excluded) | 0.082*** | 0.064*** | 0.062*** |
| | (0.003) | (0.003) | (0.003) |
| Observations | 783510 | 783510 | 782404 |
| Number of pupils | 391755 | 391755 | 391202 |
| Adjusted within-R-squared | 0.014 | 0.021 | 0.011 |
| Outcome mean/proportion | 0.204 | 0.204 | 0.204 |
| | | ***Science*** | |
| Excluded (Ref: Not Excluded) | 0.145*** | 0.110*** | 0.105*** |
| | (0.003) | (0.003) | (0.003) |
| Observations | 784530 | 784530 | 783452 |
| Number of pupils | 392265 | 392265 | 391726 |
| Adjusted within-R-squared | 0.025 | 0.034 | 0.015 |
| Outcome mean/proportion | 0.177 | 0.177 | 0.177 |
| Key Stage Year Dummy | Yes | Yes | Yes |
| Pupil Attributes | No | Yes | Yes |
| Pupil FE | Yes | Yes | Yes |
| School FE | No | No | Yes |

*Notes: Table reports exclusion coefficients and standard errors (in parentheses) from linear individual fixed effects regressions. Each coefficient is from a separate regression and expressed relative to not-excluded pupils. The analysis sample is a balanced panel of pupils pooled over KS2 (2005/06) and KS3 (2008/09) assessment years. Pupil attributes include ethnic group, identified SEN, FSM eligibility, absences, and area Income Deprivation Affecting Children Index quintile. Standard errors are clustered by pupil. FE denotes fixed effects. Statistical significance denoted as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

**Figure 1: Estimated Effects of the Number and Type of Exclusions on Achievement**




*Notes: Figure displays exclusion coefficients and 95% confidence intervals from the fully adjusted model 4 specification. Each plot is from a separate regression and shows the effects of different levels of exposure to temporary (TE) and permanent (PE) exclusion expressed relative to pupils not excluded in KS3 (full sample) or pupils excluded in KS4 only (sub sample). Models include pupil characteristics, KS3 absences, area IDACI quintile, subject-specific KS2 test score, and school fixed effects.*

# Appendix

**Table A1: Linear Model of Standardised Test Score by Sample and Model Specification: English**

| | Full Sample | | | | Subsample | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
| Not Excluded KS3 | | | | | | | | |
| Excluded KS3 | -0.822*** | -0.437*** | -0.267*** | -0.261*** | -0.211*** | -0.101*** | -0.078*** | -0.073*** |
| | (0.008) | (0.006) | (0.004) | (0.003) | (0.009) | (0.008) | (0.005) | (0.005) |
| Female | | | | | | | | |
| Male | | -0.328*** | -0.141*** | -0.151*** | | -0.251*** | -0.126*** | -0.132*** |
| | | (0.007) | (0.004) | (0.002) | | (0.009) | (0.006) | (0.005) |
| White | | | | | | | | |
| Asian/Chinese | | 0.130*** | 0.174*** | 0.108*** | | 0.214*** | 0.220*** | 0.171*** |
| | | (0.015) | (0.011) | (0.005) | | (0.019) | (0.014) | (0.012) |
| Black | | 0.081*** | 0.149*** | 0.072*** | | 0.224*** | 0.224*** | 0.145*** |
| | | (0.014) | (0.011) | (0.006) | | (0.018) | (0.015) | (0.012) |
| Mixed | | 0.219*** | 0.120*** | 0.067*** | | 0.253*** | 0.148*** | 0.101*** |
| | | (0.010) | (0.007) | (0.005) | | (0.017) | (0.012) | (0.011) |
| Other | | 0.150*** | 0.154*** | 0.098*** | | 0.156*** | 0.160*** | 0.105*** |
| | | (0.019) | (0.014) | (0.006) | | (0.024) | (0.018) | (0.013) |
| No SEN | | | | | | | | |
| Has SEN | | -0.680*** | -0.117*** | -0.126*** | | -0.454*** | -0.130*** | -0.138*** |
| | | (0.008) | (0.005) | (0.004) | | (0.010) | (0.007) | (0.007) |
| Not FSM Eligible | | | | | | | | |
| FSM Eligible | | -0.271*** | -0.083*** | -0.067*** | | -0.182*** | -0.060*** | -0.041*** |
| | | (0.006) | (0.004) | (0.003) | | (0.008) | (0.006) | (0.005) |
| KS3 Absences: Less than 20 | | | | | | | | |
| 20-39 | | -0.140*** | -0.066*** | -0.059*** | | -0.128*** | -0.069*** | -0.056*** |
| | | (0.004) | (0.003) | (0.002) | | (0.014) | (0.009) | (0.009) |
| 40-59 | | -0.245*** | -0.113*** | -0.101*** | | -0.183*** | -0.108*** | -0.089*** |
| | | (0.005) | (0.003) | (0.003) | | (0.014) | (0.009) | (0.009) |
| 60-79 | | -0.335*** | -0.151*** | -0.134*** | | -0.264*** | -0.158*** | -0.126*** |
| | | (0.006) | (0.004) | (0.003) | | (0.014) | (0.010) | (0.009) |
| 80-99 | | -0.412*** | -0.193*** | -0.171*** | | -0.334*** | -0.204*** | -0.166*** |
| | | (0.007) | (0.004) | (0.003) | | (0.015) | (0.011) | (0.010) |
| KS3 Absences: 100+ | | -0.548*** | -0.262*** | -0.238*** | | -0.454*** | -0.278*** | -0.234*** |
| | | (0.006) | (0.004) | (0.003) | | (0.014) | (0.010) | (0.009) |
| IDACI: 1 (most deprived) | | -0.525*** | -0.230*** | -0.137*** | | -0.391*** | -0.201*** | -0.111*** |
| | | (0.011) | (0.008) | (0.004) | | (0.016) | (0.012) | (0.009) |
| 2 | | -0.399*** | -0.168*** | -0.100*** | | -0.326*** | -0.164*** | -0.096*** |
| | | (0.009) | (0.007) | (0.003) | | (0.015) | (0.011) | (0.009) |
| 3 | | -0.256*** | -0.107*** | -0.063*** | | -0.213*** | -0.104*** | -0.053*** |
| | | (0.008) | (0.006) | (0.003) | | (0.015) | (0.011) | (0.009) |
| 4 | | -0.127*** | -0.052*** | -0.035*** | | -0.116*** | -0.064*** | -0.039*** |
| | | (0.007) | (0.005) | (0.003) | | (0.015) | (0.011) | (0.009) |
| IDACI: 5 (least deprived) | | | | | | | | |
| Born in January | | | | | | | | |
| February | | -0.024*** | -0.003 | -0.005 | | -0.017 | 0.001 | -0.003 |
| | | (0.006) | (0.004) | (0.004) | | (0.015) | (0.011) | (0.010) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| March | | -0.048*** | -0.002 | -0.003 | | -0.042** | 0.005 | -0.001 |
| | | (0.006) | (0.004) | (0.004) | | (0.015) | (0.011) | (0.010) |
| April | | -0.078*** | -0.009* | -0.012** | | -0.055*** | 0.005 | -0.007 |
| | | (0.006) | (0.004) | (0.004) | | (0.015) | (0.011) | (0.010) |
| May | | -0.098*** | -0.001 | -0.006 | | -0.090*** | 0.005 | -0.005 |
| | | (0.006) | (0.004) | (0.004) | | (0.015) | (0.011) | (0.010) |
| June | | -0.124*** | -0.004 | -0.006 | | -0.119*** | -0.007 | -0.012 |
| | | (0.006) | (0.004) | (0.004) | | (0.015) | (0.011) | (0.010) |
| July | | -0.145*** | -0.007 | -0.009* | | -0.120*** | 0.004 | -0.006 |
| | | (0.006) | (0.004) | (0.004) | | (0.015) | (0.010) | (0.010) |
| August | | -0.169*** | -0.009* | -0.013** | | -0.145*** | 0.009 | -0.007 |
| | | (0.006) | (0.004) | (0.004) | | (0.015) | (0.011) | (0.010) |
| September | | 0.418*** | 0.079** | 0.090*** | | 0.345*** | 0.124 | 0.177* |
| | | (0.037) | (0.027) | (0.024) | | (0.092) | (0.074) | (0.072) |
| October | | 0.393*** | 0.081** | 0.092*** | | 0.335*** | 0.131 | 0.180* |
| | | (0.037) | (0.027) | (0.024) | | (0.092) | (0.074) | (0.072) |
| November | | 0.372*** | 0.079** | 0.089*** | | 0.329*** | 0.138 | 0.181* |
| | | (0.037) | (0.027) | (0.024) | | (0.092) | (0.074) | (0.072) |
| Born in December | | 0.344*** | 0.075** | 0.088*** | | 0.289** | 0.132 | 0.179* |
| | | (0.037) | (0.027) | (0.024) | | (0.092) | (0.074) | (0.072) |
| Born in 1993 | | | | | | | | |
| Born in 1994 | | 0.317*** | 0.077** | 0.088*** | | 0.252** | 0.119 | 0.174* |
| | | (0.037) | (0.026) | (0.024) | | (0.091) | (0.073) | (0.071) |
| KS2 English Test Score | | | 0.045*** | 0.043*** | | | 0.041*** | 0.039*** |
| | | | (0.000) | (0.000) | | | (0.000) | (0.000) |
| Constant | 0.115*** | 0.510*** | -2.280*** | -2.232*** | -0.496*** | -0.043 | -2.322*** | -2.363*** |
| | (0.008) | (0.038) | (0.029) | (0.025) | (0.010) | (0.094) | (0.076) | (0.073) |
| Observations | 488436 | 488436 | 488436 | 488436 | 73072 | 73072 | 73072 | 73072 |
| Adjusted R-squared | 0.061 | 0.233 | 0.634 | 0.692 | 0.013 | 0.159 | 0.557 | 0.631 |
| Outcome Mean | 0.04 | 0.04 | 0.04 | 0.04 | -0.63 | -0.63 | -0.63 | -0.63 |
| School FE | No | No | No | Yes | No | No | No | Yes |

*Notes: Table reports estimated coefficients and standard errors (in parentheses) from linear regressions. The full sample includes all KS3 pupils, and the subsample is restricted to KS3 pupils excluded in either KS3 or KS4 (or both). FE denotes fixed effects. Outcome Mean reports the mean standardised test score. Statistical significance denoted as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

**Table A2: Linear Model of Standardised Test Score by Sample and Model Specification: Mathematics**

| | Full Sample | | | | Subsample | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
| Not Excluded KS3 | | | | | | | | |
| Excluded KS3 | -0.504*** | -0.269*** | -0.150*** | -0.148*** | -0.103*** | -0.038*** | -0.033*** | -0.029*** |
| | (0.007) | (0.006) | (0.005) | (0.004) | (0.008) | (0.008) | (0.007) | (0.006) |
| Female | | | | | | | | |
| Male | | 0.174*** | 0.075*** | 0.083*** | | 0.251*** | 0.141*** | 0.142*** |
| | | (0.007) | (0.005) | (0.002) | | (0.008) | (0.007) | (0.006) |
| White | | | | | | | | |
| Asian/Chinese | | 0.112*** | 0.129*** | 0.122*** | | 0.018 | 0.048* | 0.076*** |
| | | (0.017) | (0.013) | (0.006) | | (0.020) | (0.018) | (0.015) |
| Black | | -0.117*** | 0.018 | 0.029*** | | -0.068*** | 0.006 | 0.036** |
| | | (0.015) | (0.013) | (0.007) | | (0.018) | (0.017) | (0.014) |
| Mixed | | 0.082*** | 0.038*** | 0.017** | | 0.059*** | 0.020 | 0.024 |
| | | (0.010) | (0.009) | (0.006) | | (0.017) | (0.015) | (0.013) |
| Other | | 0.092*** | 0.079*** | 0.064*** | | 0.048* | 0.052** | 0.045** |
| | | (0.018) | (0.014) | (0.007) | | (0.022) | (0.019) | (0.016) |
| No SEN | | | | | | | | |
| Has SEN | | -0.419*** | 0.035*** | 0.016** | | -0.300*** | -0.030*** | -0.050*** |
| | | (0.007) | (0.006) | (0.005) | | (0.010) | (0.009) | (0.008) |
| Not FSM Eligible | | | | | | | | |
| FSM Eligible | | -0.176*** | -0.050*** | -0.013*** | | -0.103*** | -0.029*** | -0.006 |
| | | (0.006) | (0.005) | (0.003) | | (0.009) | (0.008) | (0.007) |
| KS3 Absences: Less than 20 | | | | | | | | |
| 20-39 | | -0.161*** | -0.085*** | -0.076*** | | -0.100*** | -0.060*** | -0.049*** |
| | | (0.005) | (0.004) | (0.003) | | (0.013) | (0.011) | (0.011) |
| 40-59 | | -0.265*** | -0.132*** | -0.116*** | | -0.142*** | -0.080*** | -0.063*** |
| | | (0.006) | (0.004) | (0.003) | | (0.014) | (0.012) | (0.011) |
| 60-79 | | -0.347*** | -0.164*** | -0.146*** | | -0.211*** | -0.121*** | -0.100*** |
| | | (0.006) | (0.005) | (0.004) | | (0.015) | (0.012) | (0.011) |
| 80-99 | | -0.411*** | -0.191*** | -0.168*** | | -0.257*** | -0.140*** | -0.112*** |
| | | (0.007) | (0.005) | (0.004) | | (0.015) | (0.013) | (0.012) |
| KS3 Absences: 100+ | | -0.492*** | -0.214*** | -0.192*** | | -0.322*** | -0.172*** | -0.142*** |
| | | (0.007) | (0.005) | (0.004) | | (0.014) | (0.012) | (0.011) |
| IDACI: 1 (most deprived) | | -0.494*** | -0.279*** | -0.078*** | | -0.343*** | -0.221*** | -0.058*** |
| | | (0.011) | (0.010) | (0.004) | | (0.016) | (0.014) | (0.012) |
| 2 | | -0.350*** | -0.176*** | -0.056*** | | -0.246*** | -0.134*** | -0.040*** |
| | | (0.010) | (0.008) | (0.004) | | (0.015) | (0.013) | (0.011) |
| 3 | | -0.236*** | -0.120*** | -0.044*** | | -0.175*** | -0.101*** | -0.040*** |
| | | (0.009) | (0.008) | (0.004) | | (0.015) | (0.013) | (0.011) |
| 4 | | -0.113*** | -0.051*** | -0.024*** | | -0.088*** | -0.043*** | -0.030** |
| | | (0.008) | (0.006) | (0.003) | | (0.014) | (0.012) | (0.011) |
| IDACI: 5 (least deprived) | | | | | | | | |
| Born in January | | | | | | | | |
| February | | -0.001 | 0.014* | 0.014** | | 0.015 | 0.022 | 0.023 |
| | | (0.007) | (0.005) | (0.005) | | (0.016) | (0.014) | (0.013) |
| March | | -0.011 | 0.018*** | 0.017*** | | -0.004 | 0.024 | 0.029* |
| | | (0.006) | (0.005) | (0.005) | | (0.015) | (0.013) | (0.013) |
| April | | -0.030*** | 0.017*** | 0.019*** | | -0.015 | 0.029* | 0.028* |
| | | (0.006) | (0.005) | (0.005) | | (0.015) | (0.013) | (0.013) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| May | | -0.029*** | 0.038*** | 0.035*** | | -0.044** | 0.020 | 0.019 |
| | | (0.006) | (0.005) | (0.005) | | (0.015) | (0.013) | (0.013) |
| June | | -0.040*** | 0.047*** | 0.045*** | | -0.035* | 0.042** | 0.030* |
| | | (0.006) | (0.005) | (0.005) | | (0.015) | (0.013) | (0.013) |
| July | | -0.045*** | 0.056*** | 0.056*** | | -0.040* | 0.043** | 0.037** |
| | | (0.006) | (0.005) | (0.005) | | (0.016) | (0.013) | (0.013) |
| August | | -0.051*** | 0.071*** | 0.071*** | | -0.045** | 0.054*** | 0.051*** |
| | | (0.007) | (0.005) | (0.005) | | (0.016) | (0.014) | (0.013) |
| September | | 0.401*** | 0.116*** | 0.125*** | | 0.249* | 0.058 | 0.112 |
| | | (0.042) | (0.034) | (0.030) | | (0.110) | (0.093) | (0.092) |
| October | | 0.392*** | 0.126*** | 0.134*** | | 0.229* | 0.055 | 0.100 |
| | | (0.042) | (0.034) | (0.030) | | (0.110) | (0.093) | (0.092) |
| November | | 0.386*** | 0.137*** | 0.148*** | | 0.226* | 0.061 | 0.111 |
| | | (0.042) | (0.034) | (0.030) | | (0.110) | (0.093) | (0.093) |
| Born in December | | 0.372*** | 0.137*** | 0.147*** | | 0.211 | 0.068 | 0.113 |
| | | (0.042) | (0.034) | (0.030) | | (0.110) | (0.093) | (0.093) |
| Born in 1993 | | | | | | | | |
| Born in 1994 | | 0.352*** | 0.143*** | 0.151*** | | 0.191 | 0.066 | 0.119 |
| | | (0.041) | (0.033) | (0.030) | | (0.109) | (0.092) | (0.092) |
| KS2 Maths Test Score | | | 0.027*** | 0.025*** | | | 0.023*** | 0.022*** |
| | | | (0.000) | (0.000) | | | (0.000) | (0.000) |
| Constant | 0.091*** | 0.158*** | -1.630*** | -1.654*** | -0.310*** | -0.225* | -1.555*** | -1.697*** |
| | (0.008) | (0.042) | (0.036) | (0.031) | (0.009) | (0.111) | (0.094) | (0.094) |
| Observations | 500512 | 500512 | 500512 | 500512 | 77632 | 77632 | 77632 | 77632 |
| Adjusted R-squared | 0.024 | 0.134 | 0.409 | 0.500 | 0.003 | 0.083 | 0.317 | 0.417 |
| Outcome Mean | 0.04 | 0.04 | 0.04 | 0.04 | -0.38 | -0.38 | -0.38 | -0.38 |
| School FE | No | No | No | Yes | No | No | No | Yes |

*Notes: Table reports estimated coefficients and standard errors (in parentheses) from linear regressions. The full sample includes all KS3 pupils, and the subsample is restricted to KS3 pupils excluded in either KS3 or KS4 (or both). FE denotes fixed effects. Outcome Mean reports the mean standardised test score. Statistical significance denoted as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

**Table A3: Linear Model of Standardised Test Score by Sample and Model Specification: Science**

| | Full Sample | | | | Subsample | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
| Not Excluded KS3 | | | | | | | | |
| Excluded KS3 | -0.388*** | -0.228*** | -0.156*** | -0.158*** | -0.129*** | -0.055*** | -0.044*** | -0.042*** |
| | (0.007) | (0.007) | (0.006) | (0.005) | (0.009) | (0.009) | (0.008) | (0.008) |
| Female | | | | | | | | |
| Male | | 0.121*** | 0.083*** | 0.097*** | | 0.213*** | 0.133*** | 0.154*** |
| | | (0.005) | (0.005) | (0.003) | | (0.009) | (0.009) | (0.008) |
| White | | | | | | | | |
| Asian/Chinese | | 0.007 | 0.070*** | 0.064*** | | -0.049* | 0.031 | 0.024 |
| | | (0.016) | (0.015) | (0.007) | | (0.022) | (0.021) | (0.018) |
| Black | | -0.069*** | 0.012 | 0.021* | | -0.037 | 0.025 | 0.025 |
| | | (0.018) | (0.017) | (0.008) | | (0.022) | (0.020) | (0.016) |
| Mixed | | 0.056*** | 0.030** | 0.018* | | 0.085*** | 0.035* | 0.025 |
| | | (0.011) | (0.010) | (0.008) | | (0.019) | (0.018) | (0.017) |
| Other | | 0.015 | 0.035 | 0.050*** | | 0.001 | 0.043 | 0.039 |
| | | (0.021) | (0.020) | (0.008) | | (0.027) | (0.026) | (0.020) |
| No SEN | | | | | | | | |
| Has SEN | | -0.417*** | -0.175*** | -0.172*** | | -0.392*** | -0.185*** | -0.192*** |
| | | (0.009) | (0.008) | (0.007) | | (0.012) | (0.011) | (0.011) |
| Not FSM Eligible | | | | | | | | |
| FSM Eligible | | -0.137*** | -0.060*** | -0.037*** | | -0.126*** | -0.053*** | -0.037*** |
| | | (0.006) | (0.006) | (0.004) | | (0.010) | (0.009) | (0.009) |
| KS3 Absences: Less than 20 | | | | | | | | |
| 20-39 | | -0.068*** | -0.035*** | -0.030*** | | -0.036* | -0.009 | -0.003 |
| | | (0.004) | (0.004) | (0.004) | | (0.014) | (0.013) | (0.013) |
| 40-59 | | -0.125*** | -0.066*** | -0.055*** | | -0.077*** | -0.031* | -0.023 |
| | | (0.005) | (0.005) | (0.004) | | (0.015) | (0.014) | (0.014) |
| 60-79 | | -0.154*** | -0.072*** | -0.061*** | | -0.105*** | -0.045** | -0.037** |
| | | (0.006) | (0.006) | (0.005) | | (0.016) | (0.015) | (0.014) |
| 80-99 | | -0.195*** | -0.096*** | -0.082*** | | -0.149*** | -0.067*** | -0.051*** |
| | | (0.007) | (0.007) | (0.006) | | (0.017) | (0.016) | (0.015) |
| KS3 Absences: 100+ | | -0.267*** | -0.137*** | -0.122*** | | -0.265*** | -0.154*** | -0.131*** |
| | | (0.007) | (0.006) | (0.005) | | (0.015) | (0.014) | (0.013) |
| IDACI: 1 (most deprived) | | -0.256*** | -0.132*** | -0.033*** | | -0.261*** | -0.136*** | -0.044** |
| | | (0.012) | (0.012) | (0.005) | | (0.017) | (0.017) | (0.015) |
| 2 | | -0.175*** | -0.078*** | -0.017*** | | -0.173*** | -0.063*** | -0.015 |
| | | (0.010) | (0.010) | (0.005) | | (0.016) | (0.016) | (0.014) |
| 3 | | -0.106*** | -0.044*** | -0.007 | | -0.098*** | -0.028 | -0.007 |
| | | (0.009) | (0.009) | (0.004) | | (0.017) | (0.016) | (0.014) |
| 4 | | -0.052*** | -0.021** | -0.004 | | -0.038* | -0.000 | 0.005 |
| | | (0.008) | (0.008) | (0.004) | | (0.016) | (0.016) | (0.014) |
| IDACI: 5 (least deprived) | | | | | | | | |
| Born in January | | | | | | | | |
| February | | 0.001 | 0.009 | 0.009 | | 0.010 | 0.018 | 0.016 |
| | | (0.007) | (0.006) | (0.006) | | (0.017) | (0.016) | (0.016) |
| March | | -0.008 | 0.008 | 0.005 | | -0.008 | 0.013 | 0.014 |
| | | (0.007) | (0.006) | (0.006) | | (0.018) | (0.017) | (0.016) |
| April | | -0.013* | 0.009 | 0.008 | | -0.013 | 0.013 | 0.008 |
| | | (0.007) | (0.006) | (0.006) | | (0.018) | (0.017) | (0.017) |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| May | | -0.022** | 0.012 | 0.010 | | -0.009 | 0.040* | 0.029 |
| | | (0.007) | (0.006) | (0.006) | | (0.019) | (0.017) | (0.017) |
| June | | -0.011 | 0.030*** | 0.029*** | | -0.018 | 0.039* | 0.025 |
| | | (0.007) | (0.006) | (0.006) | | (0.018) | (0.017) | (0.017) |
| July | | -0.017** | 0.030*** | 0.029*** | | -0.032 | 0.028 | 0.020 |
| | | (0.007) | (0.006) | (0.006) | | (0.018) | (0.017) | (0.016) |
| August | | -0.022*** | 0.034*** | 0.035*** | | -0.053** | 0.022 | 0.015 |
| | | (0.007) | (0.006) | (0.006) | | (0.019) | (0.017) | (0.017) |
| September | | 0.197*** | 0.054 | 0.075* | | 0.089 | -0.073 | -0.010 |
| | | (0.039) | (0.036) | (0.034) | | (0.114) | (0.104) | (0.106) |
| October | | 0.205*** | 0.070 | 0.092** | | 0.109 | -0.039 | 0.020 |
| | | (0.039) | (0.036) | (0.034) | | (0.114) | (0.104) | (0.106) |
| November | | 0.197*** | 0.069 | 0.091** | | 0.079 | -0.056 | 0.004 |
| | | (0.039) | (0.036) | (0.034) | | (0.114) | (0.104) | (0.106) |
| Born in December | | 0.197*** | 0.077* | 0.092** | | 0.073 | -0.049 | 0.006 |
| | | (0.039) | (0.036) | (0.034) | | (0.114) | (0.104) | (0.106) |
| Born in 1993 | | | | | | | | |
| Born in 1994 | | 0.185*** | 0.075* | 0.096** | | 0.055 | -0.054 | 0.011 |
| | | (0.038) | (0.036) | (0.034) | | (0.113) | (0.103) | (0.105) |
| KS2 Science Test Score | | | 0.024*** | 0.023*** | | | 0.030*** | 0.030*** |
| | | | (0.000) | (0.000) | | | (0.000) | (0.000) |
| Constant | 0.061*** | 0.088* | -1.363*** | -1.393*** | -0.198*** | -0.063 | -1.734*** | -1.862*** |
| | (0.007) | (0.040) | (0.040) | (0.036) | (0.010) | (0.114) | (0.106) | (0.109) |
| Observations | 506112 | 506112 | 506112 | 506112 | 79294 | 79294 | 79294 | 79294 |
| Adjusted R-squared | 0.014 | 0.059 | 0.140 | 0.261 | 0.003 | 0.063 | 0.193 | 0.287 |
| Outcome Mean | 0.02 | 0.02 | 0.02 | 0.02 | -0.28 | -0.28 | -0.28 | -0.28 |
| School FE | No | No | No | Yes | No | No | No | Yes |

*Notes: Table reports estimated coefficients and standard errors (in parentheses) from linear regressions. The full sample includes all KS3 pupils, and the subsample is restricted to KS3 pupils excluded in either KS3 or KS4 (or both). FE denotes fixed effects. Outcome Mean reports the mean standardised test score. Statistical significance denoted as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

**Table A4: Linear Model of the Probability of a Teacher Assessment Level Below 5 by Sample and Model Specification: English**

| | Full Sample | | | | Subsample | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
| Not Excluded KS3 | | | | | | | | |
| Excluded KS3 | 0.309*** | 0.167*** | 0.118*** | 0.117*** | 0.109*** | 0.047*** | 0.035*** | 0.034*** |
| | (0.003) | (0.003) | (0.003) | (0.002) | (0.005) | (0.004) | (0.004) | (0.003) |
| Female | | | | | | | | |
| Male | | 0.087*** | 0.034*** | 0.036*** | | 0.111*** | 0.056*** | 0.058*** |
| | | (0.002) | (0.001) | (0.001) | | (0.004) | (0.004) | (0.004) |
| White | | | | | | | | |
| Asian/Chinese | | -0.029*** | -0.041*** | -0.038*** | | -0.074*** | -0.073*** | -0.063*** |
| | | (0.005) | (0.004) | (0.003) | | (0.010) | (0.008) | (0.008) |
| Black | | -0.032*** | -0.049*** | -0.033*** | | -0.085*** | -0.077*** | -0.060*** |
| | | (0.006) | (0.005) | (0.004) | | (0.010) | (0.008) | (0.008) |
| Mixed | | -0.051*** | -0.022*** | -0.018*** | | -0.081*** | -0.032*** | -0.028*** |
| | | (0.004) | (0.003) | (0.003) | | (0.009) | (0.008) | (0.007) |
| Other | | -0.025*** | -0.025*** | -0.020*** | | -0.036** | -0.037*** | -0.025* |
| | | (0.006) | (0.006) | (0.003) | | (0.012) | (0.010) | (0.010) |
| No SEN | | | | | | | | |
| Has SEN | | 0.325*** | 0.155*** | 0.154*** | | 0.237*** | 0.078*** | 0.084*** |
| | | (0.004) | (0.003) | (0.003) | | (0.006) | (0.005) | (0.004) |
| Not FSM Eligible | | | | | | | | |
| FSM Eligible | | 0.093*** | 0.040*** | 0.037*** | | 0.084*** | 0.030*** | 0.023*** |
| | | (0.002) | (0.002) | (0.002) | | (0.005) | (0.004) | (0.004) |
| KS3 Absences: Less than 20 | | | | | | | | |
| 20-39 | | 0.024*** | 0.003* | 0.005*** | | 0.042*** | 0.017** | 0.019*** |
| | | (0.001) | (0.001) | (0.001) | | (0.007) | (0.006) | (0.006) |
| 40-59 | | 0.047*** | 0.010*** | 0.012*** | | 0.067*** | 0.035*** | 0.034*** |
| | | (0.002) | (0.002) | (0.001) | | (0.007) | (0.006) | (0.006) |
| 60-79 | | 0.074*** | 0.023*** | 0.024*** | | 0.105*** | 0.059*** | 0.058*** |
| | | (0.002) | (0.002) | (0.002) | | (0.007) | (0.006) | (0.006) |
| 80-99 | | 0.100*** | 0.038*** | 0.039*** | | 0.138*** | 0.081*** | 0.079*** |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.007) | (0.007) |
| KS3 Absences: 100+ | | 0.172*** | 0.090*** | 0.088*** | | 0.215*** | 0.134*** | 0.126*** |
| | | (0.003) | (0.002) | (0.002) | | (0.007) | (0.006) | (0.006) |
| IDACI: 1 (most deprived) | | 0.138*** | 0.053*** | 0.033*** | | 0.170*** | 0.083*** | 0.040*** |
| | | (0.003) | (0.003) | (0.002) | | (0.008) | (0.007) | (0.006) |
| 2 | | 0.097*** | 0.031*** | 0.018*** | | 0.133*** | 0.061*** | 0.030*** |
| | | (0.003) | (0.002) | (0.002) | | (0.007) | (0.006) | (0.006) |
| 3 | | 0.056*** | 0.014*** | 0.007*** | | 0.093*** | 0.044*** | 0.024*** |
| | | (0.002) | (0.002) | (0.001) | | (0.007) | (0.006) | (0.006) |
| 4 | | 0.027*** | 0.006*** | 0.004** | | 0.053*** | 0.028*** | 0.019** |
| | | (0.002) | (0.002) | (0.001) | | (0.007) | (0.006) | (0.006) |
| IDACI: 5 (least deprived) | | | | | | | | |
| Born in January | | | | | | | | |
| February | | 0.003 | -0.003 | -0.002 | | -0.005 | -0.012 | -0.008 |
| | | (0.003) | (0.002) | (0.002) | | (0.009) | (0.007) | (0.007) |
| March | | 0.012*** | -0.001 | -0.001 | | 0.015 | -0.006 | -0.007 |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.007) | (0.007) |
| April | | 0.014*** | -0.006* | -0.005* | | 0.024** | -0.001 | 0.002 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | (0.003) | (0.002) | (0.002) | | (0.009) | (0.007) | (0.007) |
| May | | 0.019*** | -0.008*** | -0.008*** | | 0.028** | -0.011 | -0.008 |
| | | (0.003) | (0.002) | (0.002) | | (0.009) | (0.007) | (0.007) |
| June | | 0.029*** | -0.006* | -0.005* | | 0.043*** | -0.007 | -0.004 |
| | | (0.003) | (0.002) | (0.002) | | (0.009) | (0.007) | (0.007) |
| July | | 0.031*** | -0.008*** | -0.008*** | | 0.044*** | -0.009 | -0.005 |
| | | (0.003) | (0.002) | (0.002) | | (0.009) | (0.007) | (0.007) |
| August | | 0.041*** | -0.005* | -0.004 | | 0.058*** | -0.008 | -0.005 |
| | | (0.003) | (0.002) | (0.002) | | (0.009) | (0.007) | (0.007) |
| September | | -0.094*** | -0.002 | -0.010 | | -0.134** | -0.024 | -0.055 |
| | | (0.017) | (0.015) | (0.014) | | (0.050) | (0.041) | (0.043) |
| October | | -0.086*** | -0.002 | -0.010 | | -0.129** | -0.028 | -0.060 |
| | | (0.017) | (0.015) | (0.014) | | (0.050) | (0.041) | (0.042) |
| November | | -0.082*** | -0.003 | -0.011 | | -0.123* | -0.026 | -0.057 |
| | | (0.017) | (0.015) | (0.014) | | (0.050) | (0.041) | (0.043) |
| Born in December | | -0.074*** | -0.002 | -0.010 | | -0.093 | -0.010 | -0.043 |
| | | (0.017) | (0.015) | (0.014) | | (0.050) | (0.041) | (0.043) |
| Born in 1993 | | | | | | | | |
| Born in 1994 | | -0.067*** | -0.003 | -0.012 | | -0.084 | -0.011 | -0.047 |
| | | (0.017) | (0.015) | (0.014) | | (0.049) | (0.041) | (0.042) |
| KS2 English Test Score | | | -0.013*** | -0.013*** | | | -0.017*** | -0.017*** |
| | | | (0.000) | (0.000) | | | (0.000) | (0.000) |
| Constant | 0.166*** | 0.047** | 0.826*** | 0.842*** | 0.367*** | 0.140** | 1.094*** | 1.140*** |
| | (0.002) | (0.017) | (0.016) | (0.015) | (0.004) | (0.050) | (0.042) | (0.043) |
| Observations | 471066 | 471066 | 471066 | 471066 | 73568 | 73568 | 73568 | 73568 |
| Adjusted R-squared | 0.055 | 0.176 | 0.367 | 0.398 | 0.011 | 0.123 | 0.362 | 0.407 |
| Outcome Proportion | 0.198 | 0.198 | 0.198 | 0.198 | 0.438 | 0.438 | 0.438 | 0.438 |
| School FE | No | No | No | Yes | No | No | No | Yes |

*Notes: Table reports estimated coefficients and standard errors (in parentheses) from linear probability models. The full sample includes all KS3 pupils, and the subsample is restricted to KS3 pupils excluded in either KS3 or KS4 (or both). FE denotes fixed effects. Outcome proportion reports the proportion of pupils receiving a teacher assessment level below 5. Statistical significance denoted as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

**Table A5: Linear Model of the Probability of a Teacher Assessment Level Below 5 by Sample and Model Specification: Mathematics**

| | Full Sample | | | | Subsample | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
| Not Excluded KS3 | | | | | | | | |
| Excluded KS3 | 0.239*** | 0.122*** | 0.075*** | 0.073*** | 0.085*** | 0.031*** | 0.026*** | 0.025*** |
| | (0.003) | (0.003) | (0.002) | (0.002) | (0.004) | (0.004) | (0.003) | (0.003) |
| Female | | | | | | | | |
| Male | | -0.022*** | 0.017*** | 0.016*** | | -0.065*** | 0.005 | 0.001 |
| | | (0.001) | (0.001) | (0.001) | | (0.004) | (0.003) | (0.003) |
| White | | | | | | | | |
| Asian/Chinese | | -0.024*** | -0.031*** | -0.033*** | | -0.041*** | -0.061*** | -0.058*** |
| | | (0.004) | (0.003) | (0.002) | | (0.009) | (0.007) | (0.007) |
| Black | | 0.007 | -0.046*** | -0.036*** | | -0.016 | -0.062*** | -0.052*** |
| | | (0.005) | (0.004) | (0.003) | | (0.009) | (0.007) | (0.007) |
| Mixed | | -0.029*** | -0.012*** | -0.012*** | | -0.041*** | -0.018** | -0.017* |
| | | (0.004) | (0.003) | (0.003) | | (0.009) | (0.007) | (0.007) |
| Other | | -0.023*** | -0.018*** | -0.015*** | | -0.024* | -0.029*** | -0.019* |
| | | (0.005) | (0.004) | (0.003) | | (0.011) | (0.009) | (0.009) |
| No SEN | | | | | | | | |
| Has SEN | | 0.310*** | 0.135*** | 0.131*** | | 0.251*** | 0.081*** | 0.082*** |
| | | (0.004) | (0.003) | (0.003) | | (0.005) | (0.004) | (0.004) |
| Not FSM Eligible | | | | | | | | |
| FSM Eligible | | 0.075*** | 0.027*** | 0.023*** | | 0.061*** | 0.015*** | 0.006 |
| | | (0.002) | (0.002) | (0.002) | | (0.005) | (0.004) | (0.004) |
| KS3 Absences: Less than 20 | | | | | | | | |
| 20-39 | | 0.022*** | -0.007*** | -0.006*** | | 0.029*** | 0.004 | 0.003 |
| | | (0.001) | (0.001) | (0.001) | | (0.006) | (0.005) | (0.005) |
| 40-59 | | 0.043*** | -0.008*** | -0.005*** | | 0.052*** | 0.012* | 0.015** |
| | | (0.002) | (0.001) | (0.001) | | (0.006) | (0.005) | (0.005) |
| 60-79 | | 0.070*** | -0.001 | 0.001 | | 0.081*** | 0.023*** | 0.023*** |
| | | (0.002) | (0.002) | (0.001) | | (0.007) | (0.005) | (0.005) |
| 80-99 | | 0.097*** | 0.012*** | 0.014*** | | 0.114*** | 0.040*** | 0.041*** |
| | | (0.002) | (0.002) | (0.002) | | (0.007) | (0.006) | (0.006) |
| KS3 Absences: 100+ | | 0.168*** | 0.059*** | 0.058*** | | 0.194*** | 0.094*** | 0.089*** |
| | | (0.002) | (0.002) | (0.002) | | (0.006) | (0.005) | (0.005) |
| IDACI: 1 (most deprived) | | 0.117*** | 0.034*** | 0.014*** | | 0.137*** | 0.060*** | 0.015** |
| | | (0.003) | (0.002) | (0.002) | | (0.007) | (0.005) | (0.006) |
| 2 | | 0.079*** | 0.011*** | 0.003 | | 0.102*** | 0.032*** | 0.008 |
| | | (0.002) | (0.002) | (0.002) | | (0.006) | (0.005) | (0.005) |
| 3 | | 0.044*** | -0.001 | -0.004** | | 0.066*** | 0.018*** | 0.007 |
| | | (0.002) | (0.002) | (0.001) | | (0.006) | (0.005) | (0.005) |
| 4 | | 0.019*** | -0.005** | -0.004*** | | 0.030*** | 0.001 | -0.001 |
| | | (0.002) | (0.001) | (0.001) | | (0.006) | (0.005) | (0.005) |
| IDACI: 5 (least deprived) | | | | | | | | |
| Born in January | | | | | | | | |
| February | | 0.003 | -0.003 | -0.001 | | -0.006 | -0.011 | -0.007 |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.006) | (0.006) |
| March | | 0.011*** | -0.001 | 0.000 | | 0.014 | -0.004 | -0.003 |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.006) | (0.007) |
| April | | 0.013*** | -0.006** | -0.006** | | 0.020* | -0.007 | -0.007 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | (0.002) | (0.002) | (0.002) | | (0.008) | (0.006) | (0.006) |
| May | | 0.016*** | -0.010*** | -0.009*** | | 0.034*** | -0.004 | -0.002 |
| | | (0.002) | (0.002) | (0.002) | | (0.008) | (0.006) | (0.006) |
| June | | 0.026*** | -0.008*** | -0.007*** | | 0.050*** | 0.003 | 0.007 |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.006) | (0.006) |
| July | | 0.031*** | -0.008*** | -0.008*** | | 0.054*** | 0.002 | 0.005 |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.006) | (0.007) |
| August | | 0.039*** | -0.008*** | -0.008*** | | 0.065*** | 0.001 | 0.004 |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.007) | (0.007) |
| September | | -0.101*** | 0.008 | 0.001 | | -0.136** | -0.004 | -0.016 |
| | | (0.016) | (0.014) | (0.013) | | (0.052) | (0.038) | (0.036) |
| October | | -0.094*** | 0.007 | -0.000 | | -0.134* | -0.011 | -0.026 |
| | | (0.016) | (0.014) | (0.013) | | (0.053) | (0.038) | (0.036) |
| November | | -0.088*** | 0.006 | -0.001 | | -0.124* | -0.009 | -0.024 |
| | | (0.016) | (0.014) | (0.013) | | (0.052) | (0.038) | (0.036) |
| Born in December | | -0.083*** | 0.006 | -0.001 | | -0.120* | -0.013 | -0.027 |
| | | (0.017) | (0.014) | (0.013) | | (0.053) | (0.038) | (0.036) |
| Born in 1993 | | | | | | | | |
| Born in 1994 | | -0.074*** | 0.005 | -0.003 | | -0.100 | -0.006 | -0.024 |
| | | (0.016) | (0.014) | (0.013) | | (0.052) | (0.038) | (0.036) |
| KS2 Maths Test Score | | | -0.010*** | -0.011*** | | | -0.014*** | -0.014*** |
| | | | (0.000) | (0.000) | | | (0.000) | (0.000) |
| Constant | 0.147*** | 0.101*** | 0.792*** | 0.819*** | 0.301*** | 0.234*** | 1.044*** | 1.090*** |
| | (0.002) | (0.017) | (0.015) | (0.014) | (0.004) | (0.053) | (0.039) | (0.037) |
| Observations | 474786 | 474786 | 474786 | 474786 | 75226 | 75226 | 75226 | 75226 |
| Adjusted R-squared | 0.037 | 0.145 | 0.416 | 0.440 | 0.007 | 0.113 | 0.443 | 0.474 |
| Outcome Proportion | 0.172 | 0.172 | 0.172 | 0.172 | 0.357 | 0.357 | 0.357 | 0.357 |
| School FE | No | No | No | Yes | No | No | No | Yes |

*Notes: Table reports estimated coefficients and standard errors (in parentheses) from linear probability models. The full sample includes all KS3 pupils, and the subsample is restricted to KS3 pupils excluded in either KS3 or KS4 (or both). FE denotes fixed effects. Outcome proportion reports the proportion of pupils receiving a teacher assessment level below 5. Statistical significance denoted as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

**Table A6: Linear Model of the Probability of a Teacher Assessment Level Below 5 by Sample and Model Specification: Science**

| | Full Sample | | | | Subsample | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (1) | (2) | (3) | (4) |
| Not Excluded KS3 | | | | | | | | |
| Excluded KS3 | 0.294*** | 0.161*** | 0.112*** | 0.111*** | 0.103*** | 0.046*** | 0.039*** | 0.036*** |
| | (0.003) | (0.003) | (0.003) | (0.002) | (0.004) | (0.004) | (0.003) | (0.003) |
| Female | | | | | | | | |
| Male | | -0.012*** | 0.014*** | 0.011*** | | -0.051*** | -0.002 | -0.008* |
| | | (0.002) | (0.001) | (0.001) | | (0.004) | (0.004) | (0.004) |
| White | | | | | | | | |
| Asian/Chinese | | 0.006 | -0.037*** | -0.043*** | | -0.009 | -0.057*** | -0.056*** |
| | | (0.005) | (0.004) | (0.003) | | (0.010) | (0.008) | (0.008) |
| Black | | 0.017** | -0.037*** | -0.027*** | | -0.014 | -0.049*** | -0.039*** |
| | | (0.006) | (0.005) | (0.004) | | (0.011) | (0.009) | (0.008) |
| Mixed | | -0.036*** | -0.019*** | -0.016*** | | -0.063*** | -0.032*** | -0.031*** |
| | | (0.004) | (0.003) | (0.003) | | (0.009) | (0.008) | (0.007) |
| Other | | -0.021*** | -0.033*** | -0.027*** | | -0.027* | -0.053*** | -0.042*** |
| | | (0.005) | (0.005) | (0.003) | | (0.012) | (0.010) | (0.009) |
| No SEN | | | | | | | | |
| Has SEN | | 0.312*** | 0.148*** | 0.144*** | | 0.232*** | 0.104*** | 0.108*** |
| | | (0.004) | (0.003) | (0.003) | | (0.005) | (0.005) | (0.004) |
| Not FSM Eligible | | | | | | | | |
| FSM Eligible | | 0.096*** | 0.044*** | 0.036*** | | 0.077*** | 0.032*** | 0.020*** |
| | | (0.002) | (0.002) | (0.002) | | (0.005) | (0.004) | (0.004) |
| KS3 Absences: Less than 20 | | | | | | | | |
| 20-39 | | 0.026*** | 0.004** | 0.005*** | | 0.032*** | 0.016** | 0.014* |
| | | (0.001) | (0.001) | (0.001) | | (0.007) | (0.005) | (0.006) |
| 40-59 | | 0.050*** | 0.011*** | 0.012*** | | 0.058*** | 0.032*** | 0.028*** |
| | | (0.002) | (0.001) | (0.001) | | (0.007) | (0.006) | (0.006) |
| 60-79 | | 0.078*** | 0.023*** | 0.024*** | | 0.092*** | 0.056*** | 0.052*** |
| | | (0.002) | (0.002) | (0.002) | | (0.007) | (0.006) | (0.006) |
| 80-99 | | 0.108*** | 0.041*** | 0.042*** | | 0.127*** | 0.079*** | 0.071*** |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.007) | (0.007) |
| KS3 Absences: 100+ | | 0.183*** | 0.094*** | 0.092*** | | 0.207*** | 0.136*** | 0.124*** |
| | | (0.003) | (0.002) | (0.002) | | (0.007) | (0.006) | (0.006) |
| IDACI: 1 (most deprived) | | 0.155*** | 0.071*** | 0.029*** | | 0.183*** | 0.106*** | 0.035*** |
| | | (0.003) | (0.003) | (0.002) | | (0.007) | (0.007) | (0.006) |
| 2 | | 0.102*** | 0.035*** | 0.014*** | | 0.134*** | 0.067*** | 0.024*** |
| | | (0.003) | (0.002) | (0.002) | | (0.007) | (0.006) | (0.006) |
| 3 | | 0.055*** | 0.014*** | 0.004* | | 0.081*** | 0.038*** | 0.018** |
| | | (0.002) | (0.002) | (0.002) | | (0.007) | (0.006) | (0.006) |
| 4 | | 0.022*** | 0.000 | 0.000 | | 0.035*** | 0.010 | 0.011 |
| | | (0.002) | (0.002) | (0.001) | | (0.007) | (0.006) | (0.006) |
| IDACI: 5 (least deprived) | | | | | | | | |
| Born in January | | | | | | | | |
| February | | 0.004 | -0.002 | -0.000 | | 0.009 | 0.005 | 0.007 |
| | | (0.003) | (0.002) | (0.002) | | (0.009) | (0.007) | (0.007) |
| March | | 0.012*** | 0.001 | 0.003 | | 0.029*** | 0.016* | 0.014* |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.007) | (0.007) |
| April | | 0.013*** | -0.002 | -0.001 | | 0.018* | 0.003 | 0.006 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.007) | (0.007) |
| May | | 0.021*** | -0.002 | -0.001 | | 0.038*** | 0.009 | 0.008 |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.007) | (0.007) |
| June | | 0.026*** | -0.001 | -0.000 | | 0.048*** | 0.017* | 0.018* |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.007) | (0.007) |
| July | | 0.031*** | -0.001 | 0.000 | | 0.044*** | 0.009 | 0.008 |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.007) | (0.007) |
| August | | 0.037*** | -0.002 | -0.000 | | 0.069*** | 0.023** | 0.025*** |
| | | (0.003) | (0.002) | (0.002) | | (0.008) | (0.007) | (0.007) |
| September | | -0.094*** | -0.003 | -0.012 | | -0.130** | -0.025 | -0.035 |
| | | (0.017) | (0.015) | (0.014) | | (0.048) | (0.043) | (0.042) |
| October | | -0.083*** | 0.002 | -0.008 | | -0.112* | -0.014 | -0.024 |
| | | (0.017) | (0.015) | (0.014) | | (0.048) | (0.043) | (0.042) |
| November | | -0.082*** | -0.002 | -0.011 | | -0.108* | -0.018 | -0.027 |
| | | (0.017) | (0.015) | (0.014) | | (0.048) | (0.043) | (0.042) |
| Born in December | | -0.076*** | -0.000 | -0.010 | | -0.095* | -0.010 | -0.018 |
| | | (0.017) | (0.015) | (0.014) | | (0.048) | (0.043) | (0.042) |
| Born in 1993 | | | | | | | | |
| Born in 1994 | | -0.071*** | -0.002 | -0.012 | | -0.090 | -0.016 | -0.025 |
| | | (0.017) | (0.015) | (0.014) | | (0.048) | (0.042) | (0.041) |
| KS2 Science Test Score | | | -0.016*** | -0.016*** | | | -0.018*** | -0.018*** |
| | | | (0.000) | (0.000) | | | (0.000) | (0.000) |
| Constant | 0.178*** | 0.094*** | 1.076*** | 1.098*** | 0.369*** | 0.241*** | 1.241*** | 1.284*** |
| | (0.002) | (0.017) | (0.016) | (0.015) | (0.004) | (0.049) | (0.044) | (0.043) |
| Observations | 482720 | 482720 | 482720 | 482720 | 77058 | 77058 | 77058 | 77058 |
| Adjusted R-squared | 0.049 | 0.169 | 0.384 | 0.417 | 0.010 | 0.119 | 0.342 | 0.392 |
| Outcome Proportion | 0.209 | 0.209 | 0.209 | 0.209 | 0.437 | 0.437 | 0.437 | 0.437 |
| School FE | No | No | No | Yes | No | No | No | Yes |

*Notes: Table reports estimated coefficients and standard errors (in parentheses) from linear probability models. The full sample includes all KS3 pupils, and the subsample is restricted to KS3 pupils excluded in either KS3 or KS4 (or both). FE denotes fixed effects. Outcome proportion reports the proportion of pupils receiving a teacher assessment level below 5. Statistical significance denoted as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

**Table A7: Pooled Linear Estimates of the Effect of Exclusion on the Probability of a Teacher Assessment Level below 5 by Model Specification: 2008/09 KS3 Cohort**

| | (1) | (2) | (3) |
|---|---|---|---|
| | | ***English*** | |
| Excluded (Ref: Not Excluded) | 0.324*** | 0.131*** | 0.125*** |
| | (0.003) | (0.003) | (0.003) |
| Observations | 787058 | 787058 | 787058 |
| Number of pupils | 393529 | 393529 | 393529 |
| Adjusted R-squared | 0.020 | 0.251 | 0.302 |
| Outcome mean/proportion | 0.214 | 0.214 | 0.214 |
| | | ***Maths*** | |
| Excluded (Ref: Not Excluded) | 0.261*** | 0.098*** | 0.091*** |
| | (0.003) | (0.003) | (0.003) |
| Observations | 783510 | 783510 | 783510 |
| Number of pupils | 391755 | 391755 | 391755 |
| Adjusted R-squared | 0.015 | 0.201 | 0.245 |
| Outcome mean/proportion | 0.204 | 0.204 | 0.204 |
| | | ***Science*** | |
| Excluded (Ref: Not Excluded) | 0.304*** | 0.144*** | 0.137*** |
| | (0.003) | (0.003) | (0.003) |
| Observations | 784530 | 784530 | 784530 |
| Number of pupils | 392265 | 392265 | 392265 |
| Adjusted R-squared | 0.023 | 0.185 | 0.243 |
| Outcome mean/proportion | 0.177 | 0.177 | 0.177 |
| Key Stage Year Dummy | Yes | Yes | Yes |
| Pupil Attributes | No | Yes | Yes |
| School FE | No | No | Yes |
| Pupil FE | No | No | No |

*Notes: Table reports exclusion coefficients and standard errors (in parentheses) from pooled linear regressions. Each coefficient is from a separate regression and expressed relative to not-excluded pupils. The analysis sample is a balanced panel of pupils pooled over KS2 (2005/06) and KS3 (2008/09) assessment years. Pupil attributes include gender, year of birth, month of birth, ethnic group, identified SEN, FSM eligibility, absences, and area Income Deprivation Affecting Children Index quintile. Standard errors are clustered by pupil. FE denotes fixed effects. Statistical significance denoted as follows: $^{*}$ $p < 0.05$, $^{**}$ $p < 0.01$, $^{***}$ $p < 0.001$.*

**Table A8: Estimated Effects of Exclusion on the Probability of a Teacher Assessment Level below 5 by Model Specification: 2008/09 KS3 Cohort, Subsample**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | | ***English*** | | |
| Excluded KS3 (Ref: Excluded KS4 only) | 0.102*** | 0.036*** | 0.030*** | 0.031*** |
| | (0.004) | (0.004) | (0.003) | (0.003) |
| Observations | 73285 | 73285 | 73285 | 73285 |
| Adjusted R-squared | 0.010 | 0.131 | 0.373 | 0.416 |
| Outcome mean/proportion | 0.404 | 0.404 | 0.404 | 0.404 |
| | | ***Maths*** | | |
| Excluded KS3 (Ref: Excluded KS4 only) | 0.080*** | 0.028*** | 0.027*** | 0.027*** |
| | (0.004) | (0.004) | (0.003) | (0.003) |
| Observations | 74739 | 74739 | 74739 | 74739 |
| Adjusted R-squared | 0.006 | 0.108 | 0.444 | 0.471 |
| Outcome mean/proportion | 0.345 | 0.345 | 0.345 | 0.345 |
| | | ***Science*** | | |
| Excluded KS3 (Ref: Excluded KS4 only) | 0.095*** | 0.038*** | 0.032*** | 0.030*** |
| | (0.004) | (0.004) | (0.003) | (0.003) |
| Observations | 76524 | 76524 | 76524 | 76524 |
| Adjusted R-squared | 0.008 | 0.116 | 0.339 | 0.383 |
| Outcome mean/proportion | 0.412 | 0.412 | 0.412 | 0.412 |
| Pupil Attributes | No | Yes | Yes | Yes |
| KS2 Test Score | No | No | Yes | Yes |
| School Fixed Effects | No | No | No | Yes |

*Notes: Table reports exclusion coefficients and standard errors (in parentheses) from linear regressions. Teacher assessment outcome is equal to 1 if a pupil is awarded a level below 5, and equal to 0 if 5 or above. Analysis sample includes all KS3 pupils taking KS3 assessments in 2008/009 who were excluded in either KS3 or KS4 (or both). Each coefficient is from a separate regression and expressed relative to pupils not excluded in KS3. Pupil attributes include gender, year of birth, month of birth, ethnic group, identified SEN, FSM eligibility, KS3 absences, and area Income Deprivation Affecting Children Index quintile. KS2 test score is subject-specific. Standard errors are clustered by school. Statistical significance denoted as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

**Table A9: Estimated Fully Adjusted Effects of the Number and Type of Exclusion on Achievement**

| | Standardised Test Score | | | TA level < 5 | | |
|---|---|---|---|---|---|---|
| | English | Maths | Science | English | Maths | Science |
| No. and Type of Exclusion KS3 (Ref: Not Excluded KS3) | | | *Full Sample* | | | |
| 1 TE only | -0.199*** | -0.122*** | -0.103*** | 0.082*** | 0.047*** | 0.081*** |
| | (0.004) | (0.005) | (0.006) | (0.003) | (0.002) | (0.003) |
| 2 TEs only | -0.288*** | -0.155*** | -0.143*** | 0.123*** | 0.077*** | 0.119*** |
| | (0.006) | (0.008) | (0.011) | (0.005) | (0.004) | (0.005) |
| 3 TEs only | -0.321*** | -0.176*** | -0.218*** | 0.156*** | 0.098*** | 0.149*** |
| | (0.009) | (0.011) | (0.014) | (0.006) | (0.006) | (0.006) |
| 4 TEs only | -0.354*** | -0.194*** | -0.263*** | 0.180*** | 0.120*** | 0.146*** |
| | (0.012) | (0.015) | (0.019) | (0.008) | (0.007) | (0.008) |
| 5+ TEs only | -0.432*** | -0.212*** | -0.332*** | 0.200*** | 0.140*** | 0.180*** |
| | (0.008) | (0.011) | (0.014) | (0.006) | (0.005) | (0.006) |
| 1+ PEs | -0.422*** | -0.213*** | -0.295*** | 0.208*** | 0.149*** | 0.206*** |
| | (0.022) | (0.028) | (0.038) | (0.016) | (0.015) | (0.015) |
| Observations | 488436 | 500512 | 506112 | 471066 | 474786 | 482720 |
| Adjusted R-squared | 0.693 | 0.500 | 0.262 | 0.399 | 0.441 | 0.417 |
| Outcome mean/proportion | 0.04 | 0.04 | 0.02 | 0.198 | 0.172 | 0.209 |
| No. and Type of Exclusion KS3 (Ref: Excluded KS4 only) | | | *Subsample* | | | |
| 1 TE only | -0.009 | 0.002 | 0.000 | 0.006 | 0.005 | 0.009** |
| | (0.005) | (0.007) | (0.008) | (0.004) | (0.003) | (0.004) |
| 2 TEs only | -0.110*** | -0.044*** | -0.033** | 0.042*** | 0.028*** | 0.046*** |
| | (0.007) | (0.010) | (0.012) | (0.005) | (0.005) | (0.005) |
| 3 TEs only | -0.152*** | -0.072*** | -0.099*** | 0.071*** | 0.046*** | 0.076*** |
| | (0.010) | (0.012) | (0.015) | (0.007) | (0.006) | (0.007) |
| 4 TEs only | -0.192*** | -0.095*** | -0.141*** | 0.092*** | 0.066*** | 0.074*** |
| | (0.012) | (0.016) | (0.021) | (0.009) | (0.008) | (0.008) |
| 5+ TEs only | -0.272*** | -0.114*** | -0.205*** | 0.116*** | 0.088*** | 0.107*** |
| | (0.009) | (0.012) | (0.015) | (0.006) | (0.006) | (0.006) |
| 1+ PEs | -0.250*** | -0.118*** | -0.167*** | 0.127*** | 0.104*** | 0.135*** |
| | (0.022) | (0.030) | (0.038) | (0.017) | (0.015) | (0.016) |
| Observations | 73072 | 77632 | 79294 | 73568 | 75226 | 77058 |
| Adjusted R-squared | 0.637 | 0.418 | 0.290 | 0.411 | 0.476 | 0.396 |
| Outcome mean/proportion | -0.63 | -0.38 | -0.28 | 0.438 | 0.357 | 0.437 |
| Pupil Attributes | Yes | Yes | Yes | Yes | Yes | Yes |
| KS2 Test Score | Yes | Yes | Yes | Yes | Yes | Yes |
| School Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes: Table reports estimated coefficients and standard errors (in parentheses) from the fully adjusted model 4 specification. Analysis sample includes all KS3 pupils. Each coefficient is from a separate regression and expressed relative to pupils not excluded in KS3 (full sample) or pupils excluded in KS4 only (subsample). TE denotes temporary exclusion and PE denotes permanent exclusion. Pupil attributes include gender, year of birth, month of birth, ethnic group, identified SEN, FSM eligibility, KS3 absences, and area Income Deprivation Affecting Children Index quintile. KS2 test score is subject-specific. Standard errors are clustered by school. Statistical significance denoted as follows: * p < 0.05, ** p < 0.01, *** p < 0.001.*

**Table A10: Differences in Prior Achievement and Proportion Undergoing Assessment by Analysis Sample Membership: Pupils Permanently Excluded during KS3**

| | Mean/ proportion | | Number of Pupils | | Difference | P-value of Difference |
|---|---|---|---|---|---|---|
| | **Retained** | **Dropped** | **Retained** | **Dropped** | **D-R** | ***p*** |
| *Mean KS2 Test Score* | | | | | | |
| English | 44.95 | 41.28 | 1198 | 1245 | -3.66 | 0.000 |
| Science | 50.52 | 48.44 | 1278 | 1351 | -2.08 | 0.000 |
| Maths | 51.97 | 48.76 | 1245 | 1294 | -3.21 | 0.000 |
| *Proportion Missing KS3 Test Score* | | | | | | |
| English | 0.35 | 0.51 | 1356 | 1580 | 0.16 | 0.000 |
| Maths | 0.27 | 0.32 | 1356 | 1580 | 0.05 | 0.006 |
| Science | 0.26 | 0.36 | 1356 | 1580 | 0.09 | 0.000 |
| *Proportion Missing KS3 TA* | | | | | | |
| English | 0.34 | 0.53 | 1356 | 1580 | 0.19 | 0.000 |
| Maths | 0.32 | 0.53 | 1356 | 1580 | 0.21 | 0.000 |
| Science | 0.33 | 0.53 | 1356 | 1580 | 0.20 | 0.000 |

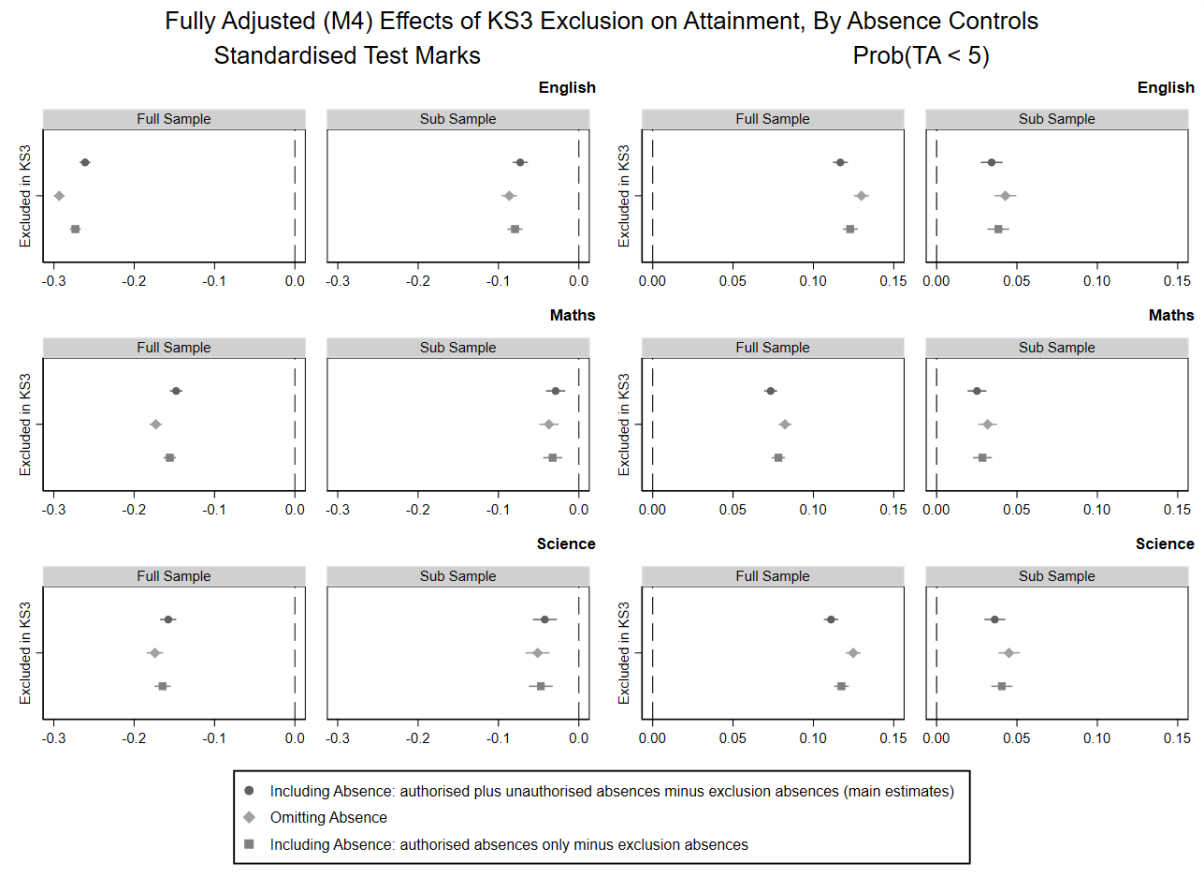
*Notes: Sample includes pupils with at least one permanent exclusion during KS3. Columns 1 and 2 report mean KS2 test scores, the proportion with a missing KS3 test score, and the proportion with a missing KS3 teacher assessment level, separately if a pupil is included in the main analysis sample (Retained) or omitted due to sample restrictions (Dropped). Columns 3 and 4 report the number of pupils with non-missing values in each group. Column 5 reports group difference in means/proportions, and column 6 reports the associated p-value.*

**Table A11: Estimated Fully Adjusted Differential Effects of Exclusion on Achievement by Cohort Size**

| | Standardised Test Score | | | TA level < 5 | | |
|---|---|---|---|---|---|---|
| | English | Maths | Science | English | Maths | Science |
| | | | ***Full Sample*** | | | |
| Excluded KS3 | -0.235*** | -0.128*** | -0.161*** | 0.117*** | 0.082*** | 0.110*** |
| (Ref: Not Excluded KS3) | (0.008) | (0.009) | (0.012) | (0.005) | (0.004) | (0.005) |
| Excluded x 151-200 | -0.022* | -0.011 | -0.001 | 0.001 | -0.005 | -0.002 |
| | (0.010) | (0.011) | (0.015) | (0.007) | (0.006) | (0.006) |
| Excluded x 201-250 | -0.038*** | -0.030* | 0.015 | 0.002 | -0.014* | 0.005 |
| | (0.010) | (0.012) | (0.016) | (0.007) | (0.006) | (0.006) |
| Excluded x 251-650 | -0.043*** | -0.037** | -0.004 | -0.008 | -0.017* | 0.001 |
| | (0.012) | (0.013) | (0.018) | (0.008) | (0.007) | (0.007) |
| Observations | 488436 | 500512 | 506112 | 471066 | 474786 | 482720 |
| F-test statistic | 6.45 | 3.75 | 0.69 | 0.63 | 3.05 | 0.50 |
| p-value | 0.00 | 0.01 | 0.56 | 0.60 | 0.03 | 0.69 |
| | | | ***Subsample*** | | | |
| Excluded KS3 | -0.081*** | -0.032* | -0.026 | 0.035*** | 0.029*** | 0.036*** |
| (Ref: Excluded KS4 only) | (0.011) | (0.013) | (0.017) | (0.008) | (0.007) | (0.007) |
| Excluded x 151-200 | 0.012 | 0.002 | -0.019 | -0.003 | 0.007 | -0.007 |
| | (0.014) | (0.017) | (0.022) | (0.010) | (0.008) | (0.009) |
| Excluded x 201-250 | 0.005 | 0.008 | -0.014 | 0.005 | -0.012 | 0.004 |
| | (0.014) | (0.018) | (0.022) | (0.010) | (0.009) | (0.009) |
| Excluded x 251-650 | 0.015 | 0.002 | -0.031 | -0.006 | -0.011 | 0.003 |
| | (0.015) | (0.019) | (0.024) | (0.011) | (0.009) | (0.010) |
| Observations | 73072 | 77632 | 79294 | 73568 | 75226 | 77058 |
| F-test statistic | 0.45 | 0.07 | 0.59 | 0.45 | 2.70 | 0.66 |
| p-value | 0.72 | 0.98 | 0.62 | 0.71 | 0.04 | 0.58 |

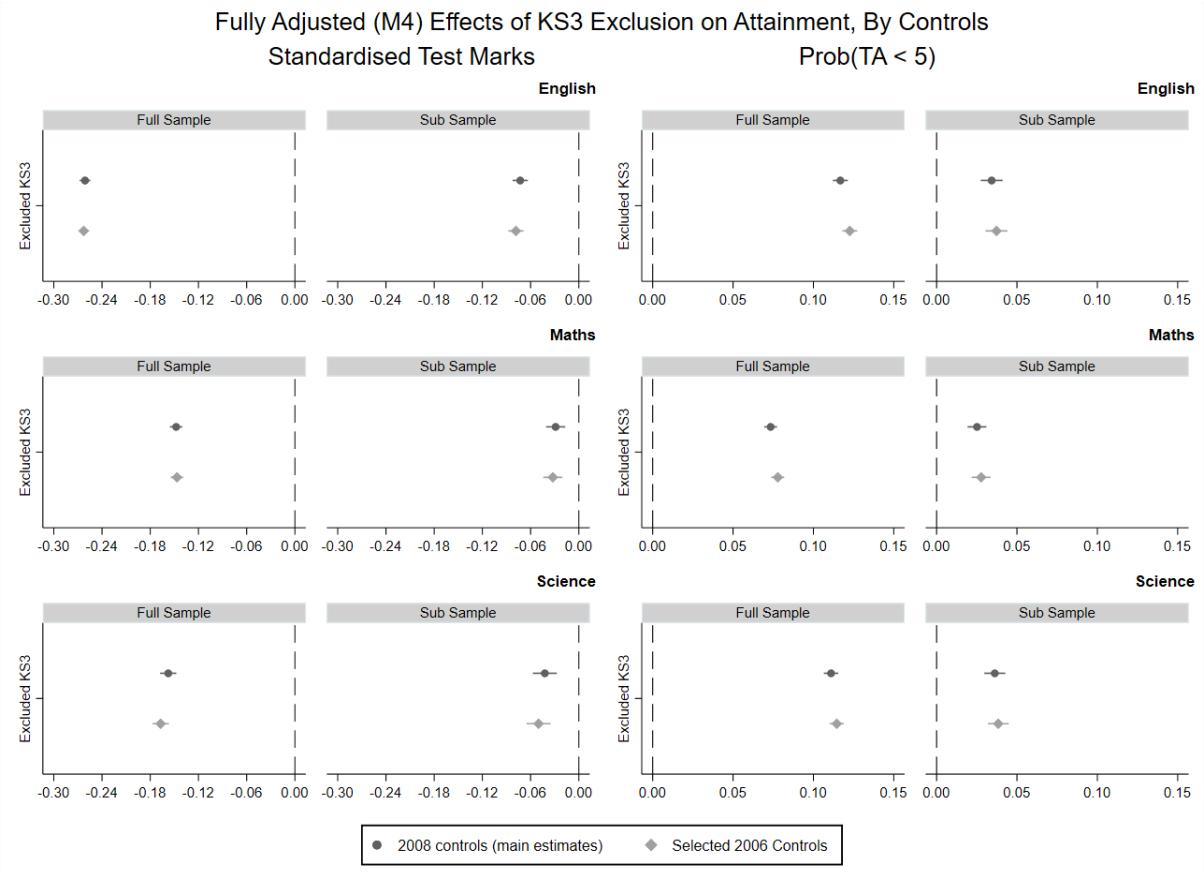
*Notes: Table reports estimated main exclusion coefficient and interactions with categorical cohort size (number of KS3 pupils in assessment year) from the fully adjusted model 4 specification. Coefficients are expressed relative to pupils not excluded in KS3 (full sample) or pupils excluded in KS4 only (subsample). Models include pupil characteristics, KS3 absences, area IDACI quintile, subject-specific KS2 test score, cohort size, and school fixed effects. Standard errors, clustered by school, are shown in parentheses. Main cohort size coefficient not estimable. The main exclusion coefficient shows the effect of exclusion among pupils in cohorts with fewer than 151 pupils. The F-test statistic, and associated p-value, tests whether the interaction coefficients are jointly equal to zero. Statistical significance denoted as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.*

**Figure A1: Estimated Fully Adjusted Effects of Exclusion on Achievement, using Alternative Absence Covariates or Omitting Absence**



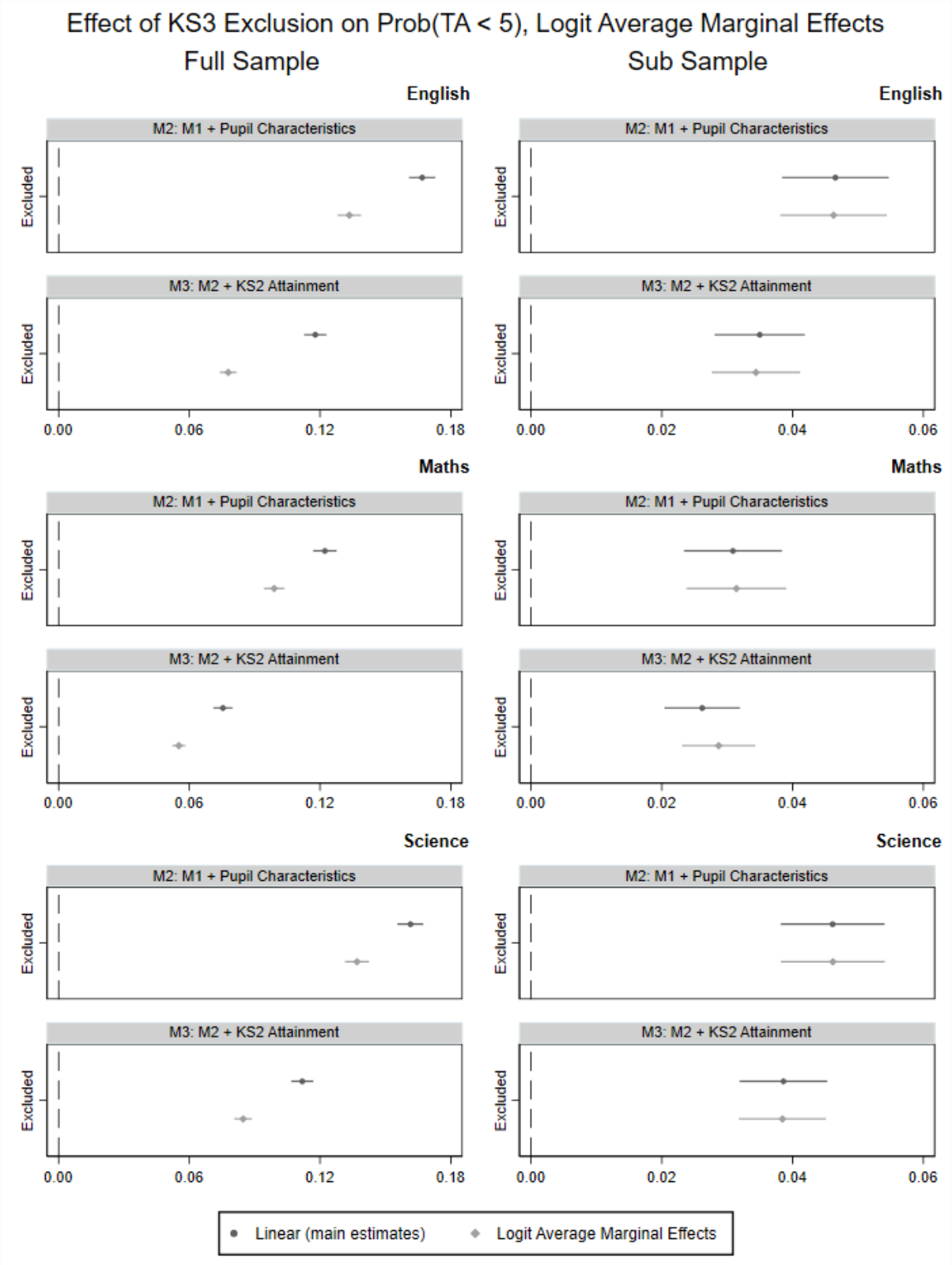

*Notes: Figure displays exclusion coefficients and 95% confidence intervals from the fully adjusted model 4 specification. Each coefficient is from a separate regression and expressed relative to pupils not excluded in KS3 (full sample) or pupils excluded in KS4 only (subsample). Models include pupil characteristics, KS3 absences, area IDACI quintile, subject-specific KS2 test score, and school fixed effects. Main estimates adjust for total absences (authorised plus unauthorised) less exclusion-related absences during KS3. Alternative specifications omit the absence control entirely or additionally subtract unauthorised absences.*

**Figure A2: Estimated Fully Adjusted Effects of Exclusion on Achievement, using Selected Covariates from First KS3 Year (2005/06)**




*Notes: Figure displays exclusion coefficients and 95% confidence intervals from the fully adjusted model 4 specification. Each coefficient is from a separate regression and expressed relative to pupils not excluded in KS3 (full sample) or pupils excluded in KS4 only (subsample). Models include pupil characteristics, KS3 absences, area IDACI quintile, subject-specific KS2 test score, and school fixed effects. Main estimates adjust for selected pupil attributes measured in the final year of KS3 (2007/08) when outcomes are measured. Alternative estimates measure ethnic group, SEN, FSM eligibility, and IDACI quintile in the first year of KS3 (2005/06).*

**Figure A3: Estimated Effects of Exclusion on the Probability of a Teacher Assessment below Level 5, using a Logit Model**




*Notes: Figure displays coefficients and average marginal effects of exclusion and 95% confidence intervals from specifications 2 and 3, with effects expressed relative to pupils not excluded in KS3 (full sample) or pupils excluded in KS4 only (subsample). Main estimates obtained from a linear model. Alternative estimates are from a logit model. Model 4 (inclusive of school fixed effects) not estimated due to the large number of fixed effects.*