The impact of school sixth form size on educational attainment of pupils at Key Stage 5

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The impact of school sixth form size on educational attainment of pupils

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Views expressed in this report are those of the researcher and not necessarily those of the Welsh Government

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Glossary

Term	Definition
Collinearity	See Multicollinearity below.
FSM	A Free School Meal (FSM) is a school meal provided to a child or young person during a school break and paid for by Government. For a child to qualify for a free school meal in England and Wales, their parent or carer must be in receipt of a qualifying welfare benefit. As such FSM eligibility is often used as a proxy for deprivation in education research.
GCSE	General Certificate of Secondary Education
Heteroscedasticity	In regression analysis heteroscedasticity means a situation in which the variance of the dependent variable (Y) varies across the levels of the independent data (X). Heteroscedasticity can bias the probability bands around parameter estimates because regression analysis is based on an assumption of equal variance across the levels of the independent data.
KS2	The National Curriculum is divided into Key Stages that children are taken through during their school life. Key Stage 2 (KS2) applies to children aged 7-11 years.
KS4	The National Curriculum is divided into Key Stages that children are taken through during their school life. Key Stage 4(KS4) applies to children aged 14-16 years.
KS4 Level 2 Inclusive score	The proportion of pupils achieving the equivalent of 5 A*-C grades at GCSE (including maths and English/Welsh)
KS4 capped average points score	The best eight results from all qualifications approved for use in Wales at the age of 16. It is calculated by dividing the total number of points achieved by students in their best 8 subjects, by the number of eligible students.
KS5	The National Curriculum is divided into Key Stages that children are taken through during their school life. Key

	Stage 5 (KS5) applies to children aged 16-19 years.
LSOA	Super Output Area (LSOAs) are a geography for the collection and publication of small area statistics. They are used on the Neighbourhood Statistics site and across National Statistics. A LSOA has an average of roughly 1,500 residents and 650 households. Measures of proximity (to give a reasonably compact shape) and social homogeneity (to encourage areas of similar social background) are also included.
Multicollinearity	In statistics, multicollinearity (also known as collinearity) is a phenomenon in which two or more predictor variables in a multiple regression model are highly correlated, meaning that one can be linearly predicted from the others with a substantial degree of accuracy. In this situation the coefficient estimates of the multiple regression may change erratically in response to small changes in the model or the data. Multicollinearity does not reduce the predictive power or reliability of the model as a whole, at least within the sample data set; it only affects calculations regarding individual predictors. That is, a multiple regression model with correlated predictors can indicate how well the entire bundle of predictors predicts the outcome variable, but it may not give valid results about any individual predictor, or about which predictors are redundant with respect to others.
OLS	Ordinary Least Squares (OLS) or linear least squares is a method for estimating the unknown parameters in a linear regression model, with the goal of minimizing the differences between the observed responses in some arbitrary dataset and the responses predicted by the linear approximation of the data.
PLASC	Pupil Level Annual School Census (PLASC) is an electronic collection of pupil and school level data

	provided by all maintained sector primary, middle, secondary, nursery and special schools in January each year.
Probit	A probit model or regression is appropriate for estimating the effects of independent variables on a binary dependent variable. It assumes that the probability of a positive outcome is determined by the standard normal cumulative distribution function.
ROC	The Receiver Operating Characteristic Curve (ROC) is a plot of the sensitivity or ability of the statistical model to predict an event correctly.
SEN	Children with Special Educational Needs (SEN) are defined by the Education Act 1996 as having considerably greater difficulty in learning than others the same age. SEN includes consideration for communication, physical and sensory, emotional difficulties that require support, and includes children who are not necessarily disabled.
Statistical significance	Statistical significance is a result that is not likely to occur randomly, but rather is likely to be attributable to a specific cause. Statistical significance can be strong or weak. The level at which one can accept whether an event is statistically significant is known as the significance level or p-value. As a matter of good scientific practice, a significance level is chosen before data collection and is often set to 0.05 (5%). If the p-value is less than the significance level (e.g., $p < 0.05$), then an investigator may conclude that the observed effect actually reflects the characteristics of the population rather than just sampling error.
vif	The variance inflation factor (vif) quantifies the severity of multicollinearity in an ordinary least squares regression analysis. It provides an index that measures how much

	the variance (the square of the estimate's standard error of an estimated regression coefficient is increased because of collinearity. The 'variance inflation factor' (vif) is commonly employed to assess whether this is a problem. A vif value greater than10 may indicate potential difficulties.
WIMD	Welsh Index of Multiple Deprivation (WIMD) is the official measure of relative deprivation for small areas in Wales. It is designed to identify those small areas where there are the highest concentrations of several different types of deprivation.

1. Executive summary

Background

1.1 The Learning and Skills (Wales) Measure 2009 provides a statutory basis for 14-19 Learning Pathways. It places an obligation on 16-18 years education providers to develop a local curriculum offer of at least 30 course options, including a minimum of five general courses and five vocational courses. This offer is to be in collaboration with other post-16 providers.

1.2 Delivering the 30 course options is more challenging for schools with small sixth forms. This has led to concerns over the ability of such schools to deliver the curriculum cost- effectively and with the maximum benefit for learners.

1.3 The literature on school performance also raises questions over what is the most effective size of a sixth form school[1,2,3]   and the potential negative impact on KS4 attainment in schools where small sixth forms may be subsidised from non-sixth form budgets.

1.4 In light of the above concerns the Welsh Government commissioned an analysis of the impact of school sixth form size on educational attainment of pupils at Key Stage 5 (KS5), controlled for exam scores two years earlier (i.e. KS4).

Method

1.5 This analysis has been conducted on individual pupil data from the Pupil Level Annual Schools Census (PLASC) and Welsh Examinations Database for the years 2011-2014.

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[1]Ofsted. (1996). *Effective sixth forms*. London: Ofsted.
http://ofsted.gov.uk/resources/effective-sixth-forms

[2]Audit Commission. (1996). *Trading Places. The Supply and Allocation of School Places*. London: Audit Commission.
http://archive.audit-commission.gov.uk/auditcommission/subwebs/publications/studies/studyPDF/1182.pdf

[3]Estyn. (2013). *School size and educational effectiveness*. Cardiff: Estyn.
http://www.estyn.gov.uk/english/docViewer/295686.3/school-size-and-educational-effectiveness-december-2013/?navmap=30,163

1.6   Pupil total point score per qualification at 18 (KS 5) was the main outcome variable. Additional measures of educational attainment were also used: pupils achieving at least three A*-A at A level and those awarded at least three A*-C grades at A level. The additional measures of educational attainment were included to enable better differentiation of pupil attainment, as over the past five years the average proportion of pupils achieving the Level 3 Threshold at KS5l has been 96.7 per cent.[4]

1.7   To allow the estimation of 'value added' in the sixth form, controls were included for individual pupil's KS4 level 2 inclusive and KS4 capped average points score.

1.8   In addition to number of pupils in a school's sixth form, other possible influences on educational attainment were used in the estimation, including school size, school type (i.e. the governance structure, including faith-based or non-faith-based), school location (rural or urban), value added between Key Stage 2 (KS2) and KS4, medium of provision (e.g. English, Welsh, bilingual) and the socio-economic profile of pupils (e.g. whether eligible for free school meals).

Findings

1.9   Whether sixth form size has an impact upon sixth form educational performance varies according to the measure of sixth form performance used i.e. A level Point Scores, A*-C grade at A level, or A*-A grade at A level. Regression analysis found no good evidence that A level point scores were diminished or increased by larger sixth forms, over the range of sixth form size in Wales, when many controls were included. Defining sixth form size as the total of Year12, Year 13 and Year14 pupils, the minimum sixth form size was 12 pupils and the maximum 492 pupils.

1.10   A particular control was the excess of Year 12 over Year 13 pupils, which was associated with substantially lower individual pupil A level

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[4] Source: Table 3 in SDR 151/2015 *Examination results in Wales, 2014/15 (Provisional)*.
http://gov.wales/docs/statistics/2015/150924-examination-results-2014-15-provisional-en.pdf

points scores. The reason for this is unknown and warrants further investigation.

1.11 The same is true for three A*-C grade A level performance; when Year 12 numbers are the same as Year13 there is no size effect on sixth form performance.

1.12 However, for three A*-A levels, a larger sixth form does appear to be beneficial over the entire size range currently observed in Wales. A pupil's chance of achieving these grades approximately doubles between sixth form sizes of around 100 (five per cent probability) and 500 (11 per cent probability). As noted above, the maximum sixth form size in the dataset analysed was 492 pupils, while the average sixth form size was 226 pupils. A caveat is that this achievement measure, and the three A*-C grade indicator, are considered experimental; as they are still being developed internally by the Welsh Government, and are not at present used by schools.

1.13 School-level value added between KS2 and KS4 has no independent influence on a pupil's A level point score educational value added in the sixth form. Since pupils generally remained at the same school this may suggest that there is no educational advantage from linking education between 11 and 16 with that between 16 and 18. The same is true for the probability of a pupil gaining at least three A*-C grades at A level and for achieving at least three As at A level.

1.14 The pupil based deprivation measure (i.e. FSM eligibility), consistently influenced A level score across models, regardless of sixth form size, but school-based deprivation (i.e. the proportion of pupils who, in January 2014, lived in the top 20 per cent deprived LSOAs from WIMD 2014) did not. The school-based deprivation measure does have an influence on the chances of a student obtaining at least three A*-A grades.

1.15 With regards to ethnicity, ethnic categories with more than 250 cases were included as separate variables in the analysis (i.e. 'White British' (91.79 per cent), 'Information refused' (0.89 per cent), 'Bangladeshi'

(0.7 per cent), 'Information not obtained'(0.67 per cent), and 'Pakistani' (0.55 per cent), see Appendix B, Table 10). Pupils with 'White British' (WBRI) ethnicity performed less well than others, with around 44 A level points less in one model, as did pupils in schools with high proportions of such pupils in the sixth form. Pupils in schools with a relatively high proportion of Bangladeshi pupils achieved lower A level score value added. Controls for eligibility for free school meals included in the model demonstrated that the effect of high proportions of Bangladeshi pupils was not due to their associated levels of FSM eligibility. Moreover, Pakistani pupils with an average 19 per cent FSM eligibility, compared to an average 21 per cent for Bangladeshi pupils, did not experience a similar A level performance. A difference between Pakistani and Bangladeshi pupils was the proportion of those pupils in the sixth form. Pakistani sixth form pupils were found to be less concentrated by school than Bangladeshis; the highest proportion of Pakistani sixth form pupils was 14 per cent.

1.16   Female pupils consistently achieved higher A level score value added than males, but pupils at schools with a higher proportion of females in the sixth form did not perform better. The female score approximately offsets the 'White British' performance so that female pupils of this ethnicity achieve about the average point score.

1.17   Pupils at English medium schools had lower A level scores than those at bilingual or Welsh medium schools.

1.18   School location (i.e. whether based in a rural or urban area)[5] itself had little effect on individual pupil A level score value added.

1.19   Class size data for sixth forms was not available and therefore the impact on educational achievement, if any, could not be assessed.

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[5]Location classifications used are those employed by the ONS: Hamlet and Isolated Dwelling - Sparse; Hamlet and Isolated Village – Less sparse; Village - Sparse; Village – Less sparse; Town and Fringe – Sparse; Town and Fringe – Less sparse; Urban – Sparse; and Urban – Less sparse.

Conclusions

1.20   The analysis suggest that the number of pupils in a sixth form does not affect their educational performance as measured by A level point score, or at least three A*-C grade A levels. But larger numbers in Year 12 and the excess of Year 12 numbers over Year 13 do adversely affect scores. The reasons for this result remain to be investigated.

1.21   There is also evidence that the probability of a student achieving at least three A* or A grade A levels is related to sixth form size. Between sixth form sizes of 100 and 500, the probability of this success doubles (from five per cent to 11 per cent), holding constant a very wide range of controls. This level of performance is boosted by a large Year 13 and by a smaller Year 12. However, as noted, this achievement measure and the three A*-C grade indicator are still under development by Welsh Government, they are not currently used by schools, and the experimental nature of these measures should be borne in mind when considering this result.

2. Background

2.1 The Welsh education system examines pupils at 16 years and at 18 years. Currently most pupils attend a school that covers teaching for both sets of exams. Compulsory schooling ends at 16.

2.2 A level exams at 18 are more specialised than GCSEs at 16; pupils typically study only three subjects. Consequently the teaching of 16-18 year olds – in 'sixth forms'- is typically in smaller groups than for younger ages. With high staff-student ratios, sixth form teaching is expensive, but sometimes is regarded by teachers as more rewarding[6,7].

2.3 The prospect of budget cuts focuses attention on the possibility of reducing sixth form costs. This might be achieved by consolidating or closing sixth forms. But would educational performance suffer?

2.4 In a study published in 2006[8] I found a negative sixth form effect on pre-sixth form pupils. Apparently pupils below the age of 16 in schools with sixth forms performed less well than in schools with no sixth forms. This may have been because with fixed school resources sixth forms diverted educational attention from younger pupils.

2.5 The purpose of the present study is to assess whether larger or smaller sixth form size is associated with stronger or weaker pupil educational achievement.

2.6 In contrast to the 2006 study that employed school level data, the present exercise uses pupil level 'educational value added' data, but within a school panel that allows in principle for the identification of individual school effects. Several dependent variables of the educational process or production function are utilised to ensure that

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[6]Ofsted. (1996). *Effective Sixth Forms*. HMSO: Norwich.
[7]Estyn. (2005). *Post-16 provision in schools - factors that influence the capacity of school sixth forms to meet the needs and aspirations of learners*. Cardiff: Estyn
[8]Foreman-Peck, J., and Foreman-Peck, L.. (2006). Should schools be smaller? The size-performance relationship for Welsh schools. *Economics of Education Review*, Vol. 25 (2), pp. 157-171.

findings are robust to the outcome specification. Pupil total point score per qualification at 18 (Key Stage 5) is the main outcome variable.

3. Methodology

3.1   This study uses data from the Pupil Level Annual Schools Census (PLASC)[9] and the Welsh Examinations Database for the years 2011-2014.

3.2   The contribution of a sixth form to an individual pupil's educational achievement is usually thought of in terms of 'value added'; that is the performance, controlling for the standard of the student just before they entered the sixth form.

3.3   Value added requires first an educational attainment indicator that constitutes the dependent variable of our models. Three measures of educational attainment have been used: A level point score, pupils achieving at least three A or A* grades at A level and those awarded at least three A*-C grades at A level. The second and third measures are still in development by Welsh Government, and have not yet been validated with schools and teachers. Their average, minimum and maximum values are shown in Table 1. The mean point score over the 2011-2014 period was 813 although the highest score was 2,155. Over this period 58 percent of sixth formers achieved at least three A* to C grade A levels, but only seven percent achieved at least three A* or A grade A levels.

3.4   Two controls for pupil standard at entry to the sixth form are used. One is the KS4 capped average total points score ('ks4_capped~s' in Table 1), that caps the total number of courses that can be included at the equivalent of 8 full GCSEs, because the vast majority of pupils take at least this number of courses. There is no requirement for it to contain English and mathematics. The principle behind the measure

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[9]http://www.adls.ac.uk/welsh-government/welsh-pupil-level-annual-schools-census-and-pupil-attainment-dataset/

is to avoid favouring pupils taking a large number of subjects at GCSE as does a simple points score. The capped indicator is not available for 2011 unlike the KS4 level 2 measure ('ks4_l2incl~e' in Table 1).

3.5 The second control is the KS4 level 2 inclusive, a binary pupil-level variable. The Level 2 inclusive performance indicator measures achievement in a volume of learning equivalent to 5 GCSEs at grades A*-C and which must include a GCSE in both English/Welsh and Mathematics. Table 1 shows that 81 per cent of sixth form pupils achieved this level.

3.6 Sixth form size is the sum of Year12, Year13 and Year14 pupils in a school. Table 1 show that over the years 2011-2014 the average sixth form had about 226 pupils, but the smallest included only 12 pupils while the largest consisted of 492.

Table 1: Sixth form size and educational achievement: The key statistics 2011-2014

Variable	Observations	Mean	Std. Dev.	Min	Max
A level points	48,705	812.92	343.00	0.00	2,155
A*-C A level	48,759	0.58	0.49	0.00	1
A*- A A level	46,774	0.07	0.26	0.00	1
ks4_capped~s	34,959	378.19	53.37	6.25	551
ks4_l2incl~e	46,915	0.81	0.39	0.00	1
sixth form size (pupils)	48,308	225.89	101.04	12.00	492

Note: ks4_capped~s = the capped average total points score at GCSE; ks4_l2incl~e =KS4 level 2 inclusive, a binary pupil-level variable. The Level 2 inclusive performance indicator measures achievement in a volume of learning equivalent to 5 GCSEs at grades A*-C and which must include a GCSE in both English/Welsh and Mathematics. Each observation is a sixth form pupil.

3.7 The method used was a regression analysis to see how educational attainment varies with sixth form size, controlling for a range of other influences.

3.8 The inferences that can be drawn from a regression model depend upon the disturbance term (a variable capturing all the other influences not included in the statistical model which influence the

dependent variable) being randomly distributed across cases (pupils here). However, individual pupils' educational achievement in their specific schools may well be correlated because of the quality of teaching and pupil factors that are not measured by the variables included in the present study. In this instance the disturbance term may become clustered by school. This increases the true standard errors of the estimated coefficient compared with the unclustered standard errors. Where the disturbance term is clustered by school, the reliability of the estimate is reduced; the standard errors of the estimated regression coefficients are increased. Failure to take this effect into account may lead to reporting a significant sixth form size effect on A level points score when, with corrected standard errors, the effect is not statistically significant i.e. there is actually no impact of sixth form size.

3.9   Fixed and random school effects in panel estimation involve similar corrections. These panel methods are not favoured here[10]because they reduce or eliminate the chances of establishing the impact of school level controls (Tables 4 and 5). However, time fixed effects are generally included in the model, although even here there is some question as to whether individual pupils KS2 and KS4 scores would be more informative without these fixed effects.

3.10   Including a greater number of controls in the model reduces the chances that the coefficients estimated for the key variables are not biased by a correlation with these controls. Omitting an important control could mean the estimated effect of, say, sixth form size on educational performance is biased upwards or downwards. On the other hand the more variables included in the model, the higher the chance that one or more will correlate with a group of others so that the variable wrongly appears to be of no importance (statistically insignificant). Large schools for 11 to 16 year olds tend also to have large sixth forms, and large year 12 numbers. Each of these may

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[10] Although one example is included in Table 2 and Appendix C shows qualitatively similar panel results to those discussed in the main text.

exercise different effects on A level performance, but separating their impacts could be problematic[11]. For these reasons first the impact of sixth form size is tested in a simple model before checking the result in a model with many controls.

3.11   Controls include:

- School size (number of pupils aged 11-16),
- school type (i.e. faith-based and non-faith-based),
- school location (rural or urban),
- value added between KS2 and KS4,
- medium of provision (e.g. English, Welsh, Bilingual),
- socio-economic profile of pupils (e.g. whether eligible for free school meals),
- area based school level deprivation,
- Special Educational Needs (SEN).

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[11]The variance inflation factor (vif) quantifies the severity of multicollinearity in an ordinary least squares regression analysis. It provides an index that measures how much the variance (the square of the estimate's standard deviation) of an estimated regression coefficient is increased because of collinearity. The 'variance inflation factor' (vif) is commonly employed to assess whether this is a problem. A vif score greater than 10 may indicate potential difficulties.

4. Findings

4.1 This chapter describes the analytical approach employed to analyse the attainment data. A number of statistical models were developed using an iterative approach. Table 2 below summarises findings from the full model (see Tables 5 and 6).

Table 2: Summary of key significant variables

Independent Variable	Dependent Variable		
	A level point score	A*-A grade at A level	A*-C grade at A level
Sixth form size	X	✓	X
Year 12 > Year 13	✓	X	X
School type (governance)	X	X	X
Location (rural / urban)	X	X	X
Language of provision	✓	X	X
Pupil-based deprivation	✓	✓	✓
School-based deprivation	X	✓	X
Ethnicity	✓		
Gender	✓	X	✓

Note: Cells with a ✓indicate that the variable has an effect upon the dependent variable.
Cells with a X indicate that the variable does not have an effect upon the dependent variable.

4.2 The initial model is a simple specification. Equation 3.1 (see Table 3) shows that a quadratic specification for sixth form size is not statistically different from zero. The two terms ('sixth form size' and 'squared sixth') are highly collinear (vif 20). The simpler linear specification of equation 3.2 that excludes 'squared sixth' is also statistically insignificant. So also are the time indicators; they, show that the years 2014 ('time4') and 2013 ('time3') were no different from

2012 (here the base year). An additional test of sixth form size was whether pupils eligible for free school meals performed differently in large or small sixth forms. This is tested by the interaction term 'Sixth*fsm'. The statistical insignificance of this interaction term shows that they do not (Equation 3.3). However, pupils eligible for free school meals ('ks4_free school meal') on average achieved an A level point score 95 less than others (Equation 3.4). The adjusted r squared statistics shows that just over one third of the variation in pupils' A level scores are explained by these simple models; almost two thirds is determined by individual and here unmeasured influences.Although all school-level characteristics are not time invariant Equation 3.5 assumes as an approximation that school effects are fixed. The coefficient on sixth form size becomes negative but, as in the other equations, is not statistically significant.

Table 3: Ordinary Least Squares (OLS) regressions on pupil-level sixth form data 2012-2014 (dependent variable A level point score)

Variable	Eqn. 3.1	Eqn. 3.2	Eqn. 3.3	Eqn. 3.4	Eqn. 3.5#
Sixth form size	0.0122	0.0539	0.0495	0.0436	-0.1664
Squared sixth	0.0001				
ks4_capped~s	3.3953***	3.3958***	3.3575***	3.3581***	3.2442***
ks4_l2incl~e	43.6033***	43.6483***	38.1609***	38.1523***	24.0409***
time3	-7.8498	-7.8080	-6.9945	-6.9725	-10.3096
time4	3.2366	3.2244	4.0443	4.0494	2.6886
ks4_free school meal			-71.6888***	-95.0691***	-45.7242***
Sixth*fsm			0.1111		
_cons	5.0e+02***	-5.0e+02***	-4.8e+02***	-4.8e+02***	-3.8e+02***
r^2_adjusted	0.3465	0.3466	0.3494	0.3495	0.3514
N	34,585	34,585	34,585	34,585	34,585

Notes: * $p<0.05$; ** $p<0.01$; *** $p<0.001$. Standard errors clustered at school level.
 # School fixed effect panel.

4.3   Because the KS4 capped control is not available for 2011 the above results exclude that year. Equation 4.1 of the following Table 4 therefore checks that there is no sixth form size effect for A level

points score when 2011 is included in the sample, by excluding KS4 capped from the model. A similar result to those of Table 3 is obtained except that the explanatory power of the equation is halved.

4.4   Equation 4.2 (Table 4) shows that larger sixth forms ('sixth') are associated with higher chances of a student achieving at least three A*-As at A level. The marginal effect at the mean of 226 pupils is 0.00014. Increasing the sixth form by another 100 pupils would raise the probability of a student achieving three As by 1.4 per cent. However, the explanatory power of the equation (indicated by ROC)[12], like that of equation 4.1 is poor. This is because the capped KS4 score ('ks4_capped~s') is excluded in order for the equation to achieve convergence.[13]

Table 4: Pupil A level achievement

Variable	Eqn. 4.1	Eqn. 4.2	Eqn. 4.3	Eqn. 4.4
Dependent var.	A Level Points	3 A*-A A Levels	3 A*-C A levels	3 A*-C A levels
Indep. var.	OLS	Probit	Probit	Probit
Sixth	0.1587	0.0012***	0.0002	0.0005
ks4_l2incl~e	304.2300***	1.1002***	0.2219***	1.1363***
ks4_capped~s			0.0163***	
time2	-20.4154*	-0.0690*		0.0543*
time3	-17.3029	-0.1062**	0.0161	0.1082***
time4	8.5559	-0.0772**	0.0512	0.2087***
ks4_fsm	-131.713***	-0.4868***	-0.2339***	-0.4473***
_cons	561.4776***	-2.6545***	-6.0801***	-0.8573***
Statistics				
r^2_adjusted	0.1558			
N	46484	44965	34581	46480
ROC		0.65	0.81	0.67

Note: * p<0.05; ** p<0.01; *** p<0.001.Standard errors clustered at school level

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[12]The Receiver Operating Characteristic Curve (ROC) is a plot of the sensitivity of the model to predict an event correctly.
[13]Non-convergence of a model indicates that the coefficients are not meaningful because the iterative process was unable to find appropriate solutions.

4.5   Equations 4.3 and 4.4 in Table 4 show that whether or not the capped KS4 score is included does not affect the conclusion that sixth form size has no effect on the chances of a pupil achieving three A*-C grade A levels.

4.6   Ramsey reset tests of the equations of Table 1 (not reported) indicate that there are variables omitted from the specification[14]. We therefore consider a fuller model. In this fuller model of Table 5 the variables combined explain about 40 per cent of the variation in pupils' A level scores. Although the sixth form size has a negative coefficient it is not significantly different from zero at the five per cent level. Also, the size of the school below the sixth also is not a statistically significant influence on pupils' A level point score.

4.7   There is a substantial difference between numbers of pupils in Year 12 and Year 13 of sixth forms.

4.8   Equation 5.2 in Table 5 therefore includes the difference between numbers in Year 12 and Year 13 as an explanatory variable ('Yr12-Yr13'). This variable is negative and not statistically significant. Dividing the sixth form into the two years, 12 and 13 (and ignoring year 14 because it is small) in equation 5.4, shows that the Year 12 numbers coefficient is significantly negative, with no Year 13 positive effect. The reason for this is unknown and warrants further investigation, but could point to factors such as pupils initially enrolled into sixth forms leaving education entirely, or subsequently move to the FE sector for their A levels, but reduce staff-student ratios before they move.

4.9   The mean Year 12 numbers pull down the A level score by about 110 points per pupil for the average sixth form (-127*0.8651=110), while larger pupil numbers below the sixth form increase pupil score by about 120 points, for the average school (919*0.1311=120), according to Equation 5.4, (a qualification is that the level of statistical

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[14]The Ramsey Regression Equation Specification Error Test (RESET) test is a general specification test for the linear regression model. More specifically, it tests whether non-linear combinations of the fitted values help explain the response variable.

significance is not high for the second outcome). The two effects pull in opposite directions and their strengths are sufficiently similar that for the average school there is no net impact on A level scores of Year 12 numbers and pupils below the sixth form.

Table 5: A level points score: full model part A

Variable	Eqn. 5.1	Eqn. 5.2	Eqn. 5.3	Eqn. 5.4	Eqn. 5.5
Sixth form size	-0.3994	-0.3545			
Sub A level pupils	0.1255	0.1300*	0.0383	0.1311*	
Yr12-Yr13		-0.5063	-0.6420*		
Year12_pup~s				-0.8651**	-0.9929*
Year13_pup~s				0.1448	
All pupils					0.1321*
Female	41.7561***	41.8536***	41.9621***	41.8601***	41.8615***
Female school	-26.2121	-20.1419	2.1184	-20.3482	-20.6195
ks4_l2incl~e	34.7526***	34.0112***	35.4001***	33.9938***	33.9876***
ks4l2inclu~d VA	-1.2112	-1.2761	-1.5139	-1.2772	-1.275
ks4_capped~s	3.2027***	3.1915***	3.1852***	3.1914***	3.1915***
ks4capped VA	0.0122	0.0119	0.01	0.0119	0.0119
r2_a	0.392	0.3931	0.3908	0.3932	0.3932

Note:These equations also include as controls; FSM eligibility, deprivation, special educational needs, ethnic background, time, location, school type, age range and school medium. * $p<0.05$; ** $p<0.01$; *** $p<0.001$. Standard errors clustered at school level.

4.10   If there is educational synergy or complementarity between sixth form performance and pre-16 achievement in the same school then there should be a positive effect of the KS4 value added indicators (VA) on A level value added. Neither the capped nor the level two indicator are statistically different from zero in the A level point score equations of Table 5, implying that there is no pupil educational benefit from linking the two levels (capped and inclusive) in the same organisation.

4.11   Female pupils on average score about 42 points more than males. There are considerably more females than male pupils in sixth forms -

almost 20 per cent more. But attendance at schools with larger proportions of females does not improve student scores.

4.12   In Table 6 we report other sections of Equation 5.4 from Table 5. The coefficients show no substantive difference from Equations 5.1to 5.3. Pupils eligible for free school meals achieved about 54 fewer A level points than average. The area based school level deprivation indicator,[15] however, was not statistically significant. Special educational needs categories School Action Plus('sen3') were about 30 points down, and Statemented ('sen4') about 40 points up from the average.

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[15]This is defined as the proportion of pupils who as at January 2014 lived in the top 20% deprived LSOAs from WIMD 2014.

Table 6: Pupils' A level points score: Equation 5.4 from Table 5 continued

Variable	Coefficient Value	Variable	Coefficient Value
ks4_fsm	-53.9176***	time3	-7.5029
Deprivation	-0.4474	time4	12.7611
sen1	5.9966	loc2	60.8292
sen3	-30.3496*	loc3	81.1558
sen4	40.6906*	loc4	15.249
WBRI school	-710*	loc5	22.0143
indiv WBRI	-44.4415***	loc6	-77.8065
nobt school	-1100**	loc7	70.7346
nobt indiv	-51.3392**	type1	-73.4989
'refused ' school	262.7352	type3	-72.7868
indiv. 'refused'	-15.8304	type4	-11.8372
Bangladesh school	-2900***	range1	(omitted)
individ Bangladesh	-70.2981***	range2	-210***
Bangla*fsm	143.4366***	range3	(omitted)
Pakistan school	460.5867	welsh7	-24.0985
indiv. Pakistan	-23.7472	welsh6	-89.9712
		welsh5	-85.8416*
		welsh4	-120*
		welsh3	-79.1961
		welsh2	-110*

Note: * $p<0.05$; ** $p<0.01$; *** $p<0.001$. Standard errors clustered at school level. 'nobt' = ethnicity not obtained; 'refused'=refused ethnicity question. 'Ks4_fsm' free school meal eligibility at ks4; 'sen' = special educational needs category (see Appendix). 'loc' is urban/rural and population density of school location (see Appendix). 'Type' is school type, type1 is community school. 'Range' is age range of school; range 4 is secondary ages 11-18, range 2 is 'Middle School (ages 3-19)' . 'Welsh' is Welsh medium category. 'welsh5' is English medium, 'welsh7' is Welsh medium. The Appendix includes definitions and magnitudes of categories.

4.13 All ethnic categories with more than 250 cases were included as separate variables in the analysis i.e. 'White British' (91.79 per cent), 'Information refused' (0.89 per cent), 'Bangladeshi' (0.7 per cent), 'Information not obtained'(0.67 per cent), and 'Pakistani' (0.55 per cent) (see Appendix B, Table 10).'White British' (WBRI) pupils probably scored 44 points less than the remainder of the population.

4.14 Three schools had more than 10 per cent of the sixth form where the ethnicity was recorded as 'not obtained'. Pupils in these schools

('nobt') were likely to achieve substantially lower A level points than average and there was also an adverse individual effect. Individuals who refused to give their ethnicity and schools with a high proportion of refusers did not achieve higher or lower A level scores than average.

4.15 School-level parameters for proportions of these categories in the sixth form were not well defined, when statistically significant. Interpretation of these coefficients would therefore be unreliable.

4.16 The regression equation coefficients of Table 6 (rounded) indicate that, controlling for many variables including FSM score, regardless of their school, individual Bangladeshi-ethnicity pupils were likely to achieve 70 fewer A level points. However, the positive coefficient on the interaction between FSM eligibility and Bangaldeshi ethnicity implies that on balance a Bangladeshi-ethnicity student eligible for free school meals was likely to achieve slightly more A level points (19) than the average for other pupils (-70*Bangla +143Bangla*fsm - 54 *fsm). The fourth largest category distinguished by ethnic identification, Pakistani, shows no statistically significant school or individual effect in this model.

4.17 The third block of variables of the model (columns 3 and 4 of Table 6) includes statistically insignificant time indicators for the academic years 2012 and 2013('time3' and 'time4'). The location variables (loc), with a base of 'Hamlet and isolated dwellings', are also statistically insignificant, as is the type of school governance('school type'), The age range of the school ('range2') for middle schools covering ages 3-19 years was found to be significant. The negative significant coefficient for 'Middle School ages 3-19' indicates that pupils at this school type achieve 210 fewer A level points.

4.18 The base case for Bilingual Schools was 'AB'. The 'AB' language secondary school category is defined as a bilingual secondary school (Category 2A) where at least 80% of subjects apart from English and Welsh are taught only through the medium of Welsh to all pupils, and

one or two subjects are taught to some pupils in English or in both languages. Pupils from the largest school language category, English medium schools[1] (Welsh5) had A level scores that were on average lower by 85 points than the base case – AB Bilingual Schools. Pupils at Welsh medium schools[2] ('Welsh7') performed no differently from the base case.

4.19   Changing the dependent variable to 'at least three A*-C grade A levels' suggests no statistically significant size effects either of the sixth form, of year 12, or of the rest of schools (Appendix A, Table 8). But when the KS4 capped controls are excluded (and the sample therefore increased to include 2011) the coefficients on Year 12 and Year13 when both variables are included are significant but equal and opposite so in effect cancel each other out (Equation 3, Appendix A, Table 8). The remainder of the effects are broadly similar to the A level points model (i.e. Table 5) except that there is some evidence of an improvement in pupil performance in the most recent year ('time4').

4.20   Turning to the 'at least three A*-A grade A levels' full model (Appendix A, Table 9), there is a tendency for a deterioration of performance in the years after 2011 (see negative 'time' coefficients 'time2', 'time3' and 'time4', Appendix A, Table 9). Year 13 size is helpful for student chances, four times as much as numbers in Year 12 are harmful for this probability. A larger school size below the sixth form is detrimental for this measure of student A level performance. Females no longer have the advantage they had with the other two dependent variables and the area-based school-level deprivation measure is a significant negative influence on student performance. There are some marked differences between equations 1 and 2 of Table 9. In equation 1, where the capped score is included, a pupil with a higher KS4 level 2 inclusive score will be less likely to achieve at least 3A*-

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[1] An English medium (EM) secondary school is one where one or two subjects may be taught through the medium of Welsh as an option.
[2]A Welsh medium (WM) secondary school is one where all subjects (including RE and PSE) apart from English are taught through the medium of Welsh to all pupils, although some schools may introduce English terminology in one or two subjects.

As at A level. But in equation 2, KS4 level2 becomes a positive influence when the capped score is excluded.

4.21   Table 7 shows how the probability of a pupil achieving at least three A*-A grade A levels varies with sixth form size. It is predicted by equation 1 of Table 9 (see Appendix A). With a sixth form of 100, the chance of a pupil achieving the target exam score is just over five per cent. With a sixth form of 500 the chance more than doubles to just over 11 per cent. The 95 per cent confident intervals around these two margins show that the estimates are significantly different from each other. The 95 per cent upper limit for the sixth form of 100 is 6.6 per cent whereas the 95 per cent lower limit is eight per cent for the sixth form of 500.

Table 7: Sixth form size and the probability of a pupil achieving at least three A*-A grade A levels

Pupils	Margin	Std.Err	Z statistic
50	0.051	0.007	7.84
100	0.056	0.005	10.77
150	0.062	0.004	16.46
200	0.068	0.002	30.02
250	0.074	0.002	41.58
300	0.080	0.003	23.48
350	0.087	0.006	14.81
400	0.095	0.009	10.8
450	0.102	0.012	8.56
500	0.111	0.015	7.14

4.22   Sixth form class size has not been included as an independent contributor to A level educational achievement in this analysis. Because some A level subjects are more popular than others, a sixth form may include very large classes (for English say) and very small classes (for Classics say). This implies that average class size may reflect the mix of subjects offered. An approximation could be constructed by counting the number of pupils sitting an exam in each subject. But when that figure is large (which it may be for popular

subjects) then some assumptions would be required about the size at which a group is split into two classes.

5. Conclusions

5.1 The analysis suggest that the number of pupils in a sixth form does not affect their educational performance as measured by A level point score, or at least three A*-C grade A levels. But larger numbers in Year 12 and the excess of Year 12 numbers over Year 13 do adversely affect scores. The reasons for this result remain to be investigated.

5.2 There is also evidence that the probability of a student achieving at least three A* or A grade A levels is related to sixth form size. Between sixth form sizes of 100 and 500, the probability of this success doubles (from five per cent to 11 per cent), holding constant a very wide range of controls. This level of performance is boosted by a large Year 13 and by a smaller Year 12. However, as noted, this achievement measure and the three A*-C grade indicator are still under development by Welsh Government, they are not currently used by schools, and the experimental nature of these measures should be borne in mind when considering this result.

Appendix A:Probit equations

Table 8: Probit equation for 'at least three A-C grade A levels'

Variable	Equation 1	Equation 2	Equation 3
sixth form size	-0.0008		
sub A level pup	0.0004	0.0004	0.0003
year12_pup~s		-0.0022	-0.0029**
year13_pup~s		0.0008	0.0029*
Female	0.2536***	0.2542***	0.3277***
female school	-0.0232	-0.0092	0.2013
ks4_l2incl~e	0.2253***	0.2236***	1.0731***
ks4l2inclu~d VA	-0.0047	-0.0049	-0.0024
ks4_capped~s	0.0159***	0.0159***	
ks4capped VA	0	0	
ks4_fsm	-0.1617***	-0.1576***	-0.3364***
Deprivation	-0.0011	-0.0007	-0.003
sen1	0.0463	0.0479	-0.1686***
sen3	-0.1836**	-0.1808**	-0.3336***
sen4	-0.0421	-0.043	-0.3662***
WBRI school	-2.2984*	-2.3462*	-2.0918*
indiv WBRI	0.0189	0.0198	-0.0806*
nobt school	-3.7681**	-3.8336**	-2.8789*
Indiv nobt	-0.0369	-0.033	-0.0459
Refused school	-0.3979	-0.7369	0.7187
indiv. 'refused'	0.1486	0.152	0.0149
Bangladesh school	-10.0353***	-9.9821***	-7.9945***
individ Bangladesh	-0.1224	-0.1152	-0.1172
Bangla*fsm	0.3612	0.3592	0.3584*
Pakistan school	-0.8548	-0.8137	-0.6475
indiv. Pakistan	0.0594	0.0634	0.0262
time2			0.0302
time3	0.0257	0.023	0.0814**
time4	0.0966*	0.0985*	0.2154***
loc2	0.2063	0.2033	0.1496
loc3	0.3332	0.3339	0.2923
loc4	0.0828	0.0751	0.0044
loc5	0.3016	0.2968	0.2525
loc6	-0.3503	-0.3454	-0.1807
loc7	0.3194	0.3126	0.3074

type1	-0.2575	-0.2411	-0.2571*
type3	-0.199	-0.1878	-0.2075
type4	0.118	0.1271	-0.1002
range1	(omitted)	(omitted)	(omitted)
range2	-0.6662***	-0.6804***	-0.6613***
range3	(omitted)	(omitted)	(omitted)
welsh7	-0.1142	-0.1115	-0.0898
welsh6	-0.4543*	-0.4481*	-0.3742
welsh5	-0.4375**	-0.4263**	-0.3767**
welsh4	-0.6794**	-0.6514**	-0.2893
welsh3	-0.3068	-0.2906	-0.3291
welsh2	-0.5307**	-0.5246**	-0.4067*
_cons	-3.4946**	-3.4744**	1.4801
ROC	0.8285	0.8287	0.7346
N	33909	33909	44998

Note: * $p<0.05$; ** $p<0.01$; *** $p<0.001$. Standard errors clustered at school level.

Table 9: Probit equation for 'at least three A*-A grade A levels'

Variable	Equation 1	Equation 2
sixth form size	0.0014**	
sub A level pup	-0.0003*	-0.0002
year12_pup~s		-0.0012*
year13_pup~s		0.0047***
Female	-0.1217***	0.0369
female school	-0.9237	-0.2717
ks4_l2incl~e	-0.4822***	1.0348***
ks4l2inclu~d VA	-0.004	-0.0039
ks4_capped~s	0.0289***	
ks4capped VA	0	
ks4_fsm	-0.0574	-0.4263***
deprivation	-0.0038	-0.0072***
sen1	0.0191	-0.3069***
sen3	0.28	-0.2838**
sen4	0.3035	-0.1588
WBRI school	-0.1703	-0.9706*
indiv WBRI	-0.0976	-0.2523***
'nobt' school	1.0634	0.4997
Indiv 'nobt'	-0.1568	-0.1835
'Refused' school	3.1646	1.5038
indiv. 'refused'	-0.0153	-0.1275
Bangladesh school	0.1427	-0.4508
individ Bangladesh	-0.4962	-0.3929
Bangla*fsm	0.7777*	0.4529
Pakistan school	-4.0222	-3.4556*
indiv. Pakistan	-0.3121	-0.2193*
time2		-0.0864**
time3	-0.1051*	-0.1322***
time4	-0.1595***	-0.1081***
loc2	-0.2971**	-0.0907
loc3	-0.2817*	-0.1121
loc4	-0.1739	-0.0436
loc5	-0.1725	-0.0273
loc6	-0.2321	0.0637
loc7	-0.2045	-0.1053
type1	-0.1047	-0.1052*
type3	0.1276	0.0931

type4	-0.2291	-0.1798
range1	(omitted)	(omitted)
range2	0.2505	0.0768
range3	(omitted)	(omitted)
welsh7	0.1794	0.0612
welsh6	0.0772	-0.0668
welsh5	0.009	-0.1450*
welsh4	-0.0501	-0.1491
welsh3	-0.2728*	-0.1574
welsh2	-0.0215	-0.0568
_cons	-11.7754***	-0.8531
ROC	0.9191	0.6959
N	32970	43538

Appendix B: Variable definitions and frequencies

Table 10: Ethnicity categories

WBRI	WBRI	White - British	White - British
WOTH	WOTH	Any other White background	Any other White background
WOTH	WALB	Any other White background	Albanian
WOTH	WBOS	Any other White background	Bosnian-Herzegovinian
WOTH	WBUL	Any other White background	Bulgarian
WOTH	WCRO	Any other White background	Croatian
WOTH	WCZE	Any other White background	Czech
WOTH	WFRE	Any other White background	French
WOTH	WGER	Any other White background	German
WOTH	WGRE	Any other White background	Greek/Greek Cypriot
WOTH	WHUN	Any other White background	Hungarian
WOTH	WITA	Any other White background	Italian
WOTH	WKOS	Any other White background	Kosovan
WOTH	WLAT	Any other White background	Latvian
WOTH	WLIT	Any other White background	Lithuanian
WOTH	WMAL	Any other White background	Maltese
WOTH	WMON	Any other White background	Montenegran
WOTH	WPOL	Any other White background	Polish
WOTH	WPOR	Any other White background	Portuguese
WOTH	WRMA	Any other White background	Romanian
WOTH	WRUS	Any other White background	Russian
WOTH	WSCA	Any other White background	Scandinavian
WOTH	WSER	Any other White background	Serbian
WOTH	WSVK	Any other White background	Slovakian
WOTH	WSVN	Any other White background	Slovenian
WOTH	WSPA	Any other White background	Spanish
WOTH	WTUR	Any other White background	Turkish/Turkish Cypriot
WOTH	WUKR	Any other White background	Ukranian
WOTH	WEUR	Any other White background	White European Other
WOTH	WOTW	Any other White background	Other White
WOTH	WEEU	Any other White background	White Eastern European
WOTH	WWEU	Any other White background	White Western European
WIRT	WIRT	Traveller	Traveller
WIRT	WITH	Traveller	Traveller of Irish Heritage
WIRT	WNAG	Traveller	'New' Traveller

WIRT	WOCC	Traveller	Occupational Traveller
WIRT	WOTT	Traveller	Other Traveller
WROM	WROM	Gypsy/Gypsy Roma	Gypsy/Gypsy Roma
WROM	WBGR	Gypsy/Gypsy Roma	British Gypsy/Gypsy Roma
WROM	WGRO	Gypsy/Gypsy Roma	Gypsy/Gypsy Roma from Other Countries
WROM	WOGR	Gypsy/Gypsy Roma	Other Gypsy/Gypsy Roma
MWBC	MWBC	White and Black Caribbean	White and Black Caribbean
MWBA	MWBA	White and Black African	White and Black African
MWAS	MWAS	White and Asian	White and Asian
MOTH	MOTH	Any other Mixed background	Any other Mixed background
MOTH	MWCH	Any other Mixed background	White and Chinese
MOTH	MWOE	Any other Mixed background	White and Any Other Ethnic Group
MOTH	MABL	Any other Mixed background	Asian and Black
MOTH	MACH	Any other Mixed background	Asian and Chinese
MOTH	MAOE	Any other Mixed background	Asian and Any Other Ethnic Group
MOTH	MBCH	Any other Mixed background	Black and Chinese
MOTH	MBOE	Any other Mixed background	Black and Any Other Ethnic Group
MOTH	MCOE	Any other Mixed background	Chinese and Any Other Ethnic Group
MOTH	MOTM	Any other Mixed background	Other Mixed background
AIND	AIND	Indian	Indian
APKN	APKN	Pakistani	Pakistani
APKN	AMPK	Pakistani	Mirpuri Pakistani
APKN	AOPK	Pakistani	Other Pakistani
ABAN	ABAN	Bangladeshi	Bangladeshi
AOTH	AOTH	Any other Asian background	Any other Asian background
AOTH	AAFR	Any other Asian background	African Asian
AOTH	AKAS	Any other Asian background	Kashmiri
AOTH	ANEP	Any other Asian background	Nepali
AOTH	ASNL	Any other Asian background	Sinhalese
AOTH	ASLT	Any other Asian background	Sri Lankan Tamil
AOTH	AOTA	Any other Asian background	Other Asian
BCRB	BCRB	Caribbean	Caribbean
BAFR	BAFR	African	African
BAFR	BGHA	African	Ghanaian

BAFR	BNGN	African	Nigerian
BAFR	BSLN	African	Sierra Leonian
BAFR	BSOM	African	Somali
BAFR	BSUD	African	Sudanese
BAFR	BAOF	African	Other Black African
BOTH	BOTH	Any other Black background	Any other Black background
BOTH	BEUR	Any other Black background	Black European
BOTH	BNAM	Any other Black background	Black North American
BOTH	BOTB	Any other Black background	Other Black
CHNE	CHNE	Chinese or Chinese British	Chinese or Chinese British
CHNE	CHKC	Chinese or Chinese British	Hong Kong Chinese
CHNE	CMAL	Chinese or Chinese British	Malaysian Chinese
CHNE	CSNG	Chinese or Chinese British	Singaporean Chinese
CHNE	CTWN	Chinese or Chinese British	Taiwanese
CHNE	COCH	Chinese or Chinese British	Other Chinese
OOTH	OOTH	Any other ethnic background	Any other ethnic background
OOTH	OAFG	Any other ethnic background	Afghanistani
OOTH	OARA	Any other ethnic background	Arab
OOTH	OEGY	Any other ethnic background	Egyptian
OOTH	OFIL	Any other ethnic background	Filipino
OOTH	OIRN	Any other ethnic background	Irani
OOTH	OIRQ	Any other ethnic background	Iraqi
OOTH	OJPN	Any other ethnic background	Japanese
OOTH	OKOR	Any other ethnic background	Korean
OOTH	OKRD	Any other ethnic background	Kurdish
OOTH	OLAM	Any other ethnic background	Latin/South/Central American
OOTH	OLIB	Any other ethnic background	Libyan
OOTH	OLEB	Any other ethnic background	Lebanese
OOTH	OMAL	Any other ethnic background	Malay
OOTH	OMRC	Any other ethnic background	Moroccan
OOTH	OPOL	Any other ethnic background	Polynesian
OOTH	OTHA	Any other ethnic background	Thai
OOTH	OVIE	Any other ethnic background	Vietnamese
OOTH	OYEM	Any other ethnic background	Yemeni
OOTH	OOEG	Any other ethnic background	Other ethnic group
REFU	REFU	Unknown or not stated	Information refused
NOBT	NOBT	Unknown or not stated	Information not obtained

Table 11: All categories under Ethnicity with more than 250 cases

Category	Ethnicity	Freq.	Per cent
ABAN	Bangladeshi	327	0.7
AOPK	Pakistani	256	0.55
NOBT	Information not obtained	312	0.67
REFU	Information refused	416	0.89
WBRI	White - British	43,061	91.79
Total		**46,915**	**100**

Note: After Bangladeshis (ABAN) and 'natives'(WBRI) the two largest categories are 'refused' (REFU) and 'not obtained' (NOBT)'.

Table 12: SchoolType (GovernanceStatus)

Category	Description	Freq.	Per cent	Cumulative Per cent
CO	Community	40,522	83.19	83.19
FO	Foundation	3,503	7.19	90.39
VA	Voluntary Aided	4,137	8.49	98.88
VC	Voluntary Control	546	1.12	10.00
Total		**48,708**	**100.00**	

School language categories

1. **Welsh-Medium Secondary School:** All subjects (including RE and PSE) apart from English are taught through the medium of Welsh to all pupils, although some schools may introduce English terminology in one or two subjects.

2. **Bilingual secondary school:** The bilingual category has 4 sub-divisions according to the percentage of subjects taught through the medium of Welsh andwhether there is parallel provision in English. The categories anddefinitions do not reflect the number or proportion of pupils taking advantage of provision in Welsh in a school.

   (i) **Bilingual [AB] Bilingual Secondary School Category 2A**
   At least 80% of subjects apart from English and Welsh are taught only through the medium of Welsh to all pupils. One or two subjects are taught to some pupils in English or in both languages.

(ii) Bilingual [BB] Bilingual Secondary School Category 2B

At least 80% of subjects (excluding Welsh and English) are taught through the medium of Welsh but are also taught through the medium of English.

(iii) Bilingual [CB] Bilingual Secondary School Category 2C

50 - 79% of subjects (excluding Welsh and English) are taught through the medium of Welsh but are also taught through the medium of English.

(iv) Bilingual [CH] Bilingual Secondary School Category 2Ch

All subjects, except Welsh and English taught to all pupils using both languages.

3. **English (with Significant Welsh) [EW]:** Predominantly English medium secondary school with significant use of Welsh: 20-49 % of subjects are taught through the medium of Welsh but are also taught in English.

4. **English medium [EM]:** Predominantly English medium secondary school where one or two subjects may be taught through the medium of Welsh as an option.

Table 13: School language - medium of provision

Language Code	Freq.	Per cent	Cumulative Per cent
AB	1,523	3.13	3.13
BB	2,871	5.89	9.02
CB	1,751	3.59	12.62
CH	58	0.12	12.74
EM	34,274	70.37	83.10
EW	2,412	4.95	88.05
WM	5,819	11.95	100.00
Total	**48,708**	**100.00**	

Table 14: SEN status

Category	Freq.	Per cent	Cumulative Per cent
School Action	2,054	4.38	4.38
No Special Provision	43,499	92.72	97.10
School Action Plus	842	1.79	98.89
Statemented	520	1.11	100.00
Total	**46,915**	**100.00**	

Table 15: School range

Age range	Freq.	Per cent	Cumulative Per cent
Middle School (ages 3-16)	51	0.10	0.10
Middle School (3-19)	318	0.65	0.76
Secondary (11-16)	74	0.15	0.91
Secondary (11-18)	48,265	99.09	100.00
Total	**48,708**	**100.00**	

Appendix C: Alternative estimation models

This Appendix shows that the conclusion from Tables 3 , 5-6 and Tables 8-9 are robust to different estimation methods. Equation 16.1 shows that a school fixed effect regressions on A level points with a restricted specification (comparable to that of Table 3) gives qualitatively similar results. In particular with heteroscedasticity robust standard errors the sixth form size coefficient is not significantly different from zero . Equation 16.2 is a random school effects probit of the probability of pupils achieving 3 A*-C grade A levels. With heteroscedasticity robust standard errors again, sixth form size is not statistically significant. Equation 16.3 is a restricted specification random effects probit for three or more A*or A grade A levels that shows a significant positive sixth form coefficient.

Table 16: Outputs from alternative estimation models

Variable	Equation 16.1	Equation 16.2	Equation 16.3
	A level points	3 A*-C A levels	3 A*-A levels
	School fixed effects OLS	Random effects probit	Random effects probit
sixth form size	-0.287	0.0002	0.0008***
ks4_l2incl~e	268.9101***	1.1214***	1.0627***
Free school meals	-95.9634***	-0.3527***	-0.4174***
time2	-21.2495*	0.0501	-0.0775**
time3	-24.7480*	0.0933**	-0.1217***
time4	3.8311	0.1978***	-0.0889***
_cons	691.4614***	-0.8101***	-2.5982***
r^2 within	0.1278		
r^2 between	0.2305		
r^2 overall	0.1342		
Log likelihood constant only		-30535.813	-11876.97
Log pseudolikelihood		-26418.588	-11167.543
pseudo R^2		0.1348	0.0597
N	46484	46480	44965