RESEARCH

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The Early Impact of Aimhigher: Excellence Challenge on Pre-16 Outcomes: An Economic Evaluation

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Executive summary

This paper looks at the impact of the Aimhigher: Excellence Challenge programme on pupils who have been exposed to it for one year. Both linear regression and propensity score matching techniques are used to compare to outcomes of individuals in Aimhigher: Excellence Challenge schools with those in a set of comparison schools. In both cases, time-constant factors that influence the outcomes we are looking at are differenced out using a 'difference in differences' methodology.

The Aimhigher: Excellence Challenge intervention seeks to encourage more young people to participate in tertiary education. Our analysis considers two year groups – those who have just finished year 9 or year 11. We find evidence that being part of the Aimhigher: Excellence Challenge programme (in Excellence in Cities areas) leads to an improvement in the proportion (by 4.6 percentage points) of year 9 pupils attaining levels 4, 5 or 6 in Key Stage 3 mathematics in year 9, but that this year group do not show a statistically higher proportion intending to participate in higher education. The year 11 analysis does show a higher proportion of pupils intending to take part in Higher Education (by 3.9 percentage points) as a result of the Aimhigher: Excellence Challenge policy. There is also a significant improvement in nearly all measures of this group's GCSE results, with an average improvement on the total points scored of 2.5. Our matching analysis acts as a robustness check on the regression results; we find that matching shows similar or larger estimates for the impact of Aimhigher: Excellence Challenge on exam results, but lower for the education intentions.

In the last part of the paper we show the range of cost per pupil that would be consistent with Aimhigher: Excellence Challenge passing a cost benefit analysis, on the basis of the increased (gross) wages due to either a 1.8 percentage point or a 3.9 percentage point increase in participation in Higher Education. We find that for the policy to yield a rate of return of at least 3.5%, it would need to cost no more than £537 per pupil if the impact of the policy was to increase HE participation by 3.9 percentage points, and no more than £248 per pupil if the impact of the policy was to increase HE participation by 1.8 percentage points.

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1. Introduction

The Aimhigher: Excellence Challenge programme of interventions seeks to encourage young people to participate in tertiary education by providing them with additional support and information. The policy is aimed particularly at young people from groups that have traditionally had low Higher Education participation rates.

Aimhigher: Excellence Challenge, initially introduced as Excellence Challenge, is closely linked to Excellence in Cities (EiC) and has been introduced in the Phase 1 and 2 EiC areas and the Education Action Zone (EAZ) areas from September 2001 (it has later been introduced in the EiC Phase 3 areas). The variants of the policy differ in these two types of area. In both cases the Aimhigher: Excellence Challenge programme seeks to encourage participation in Higher Education, but the Excellence in Cities areas also benefit from special support for young people deemed to be gifted and/or talented. The analysis in this paper will not include the EAZ areas as direct estimation of the impact of Aimhigher: Excellence Challenge is not possible due to the characteristics of the pupils in those areas[2]. This paper presents the quantitative effects of the first full year of Aimhigher: Excellence Challenge since its introduction. The policy is being evaluated by a consortium using pupil level data. Aimhigher: Excellence Challenge was introduced in September 2001 and data was collected in Spring 2002 and Spring 2003 for the purposes of the evaluation in schools in both areas covered by Aimhigher: Excellence Challenge and comparison areas. The

[2] Comparing the samples from the EAZ areas with the comparison areas shows statistically significant differences in terms of school leaving intentions and support provided by parents and schools, once personal characteristics have been controlled for. The magnitude of the differences, and their variation by the year 9 and 11 samples, mean that even a difference–in–differences approach would be unlikely to yield meaningful results. There are significant systematic differences between the samples which do not provide sufficient common support for matching analysis to be undertaken and impose unrealistic assumptions of any results obtained by linear regression. The EAZ sample varies significantly from the comparison sample according to ethnicity, parental education, use of English in the home and eligibility for free school meals. Excluding the EAZ schools from the analysis reduces the size of the pilot sample by around 20%.

data from Spring 2002 are used as "pre-policy" data as Aimhigher: Excellence Challenge had only been in place for 6 months and so was unlikely to have had much effect. The data from Spring 2003 is used in this paper to look at the effect of the policy based on 18 months' exposure – although this corresponds to only one complete school year. The comparison areas used in this paper are the Excellence in Cities Phase 3 areas, which had not yet seen the introduction of Aimhigher: Excellence Challenge when our data were collected. While other areas could have been selected to act as a comparison to the Aimhigher: Excellence Challenge areas, the EiC Phase 3 areas were specifically selected to resemble the EiC Phase 1 and 2 areas (in particular in terms of the proportion of pupils eligible for free school meals) and are therefore well suited as comparisons for Aimhigher: Excellence Challenge. Using the EiC Phase 3 areas also has the advantage of enabling the impact of EiC to be differenced out in the analysis, thus allowing an estimation of the impact of Aimhigher: Excellence Challenge over and above that of EiC. In addition, all the EiC areas are urban and relatively disadvantaged. Of course, differences between the Aimhigher: Excellence Challenge (EiC Phase 1 and 2) and EiC Phase 3 areas will still exist, and our evaluation methods will seek to control for these through use of the pupil level data collected for this purpose. The collection of data from the early days of the introduction of the policy strengthens the ability of our analysis to account for underlying differences between the young people who reside in Aimhigher: Excellence Challenge areas and those from comparison areas. It is due to significant pre-policy differences between the EAZ areas and the EiC Phase 3 (comparison) areas, however, that leads to us being unable to credibly draw conclusions about the impact

of Aimhigher: Excellence Challenge in the EAZ areas and so the analysis in this paper does not consider them[3].

The Aimhigher: Excellence Challenge policy is intended to be implemented on pupils in years 8 to 13. If effective it will lead to higher proportion of pupils exposed to it staying in education both beyond year 11 (age 16) and at age 18. With data available from only after a year of the policy being in place, we are neither in a position to view the actual Higher Education choices made by those who were exposed to it, nor to estimate any effect on individuals exposed for the whole four years that pupils will be ultimately exposed to the policy for. Instead, we are able to look at the effect that Aimhigher: Excellence Challenge has so far had on those exposed to it for a full year, in terms of their stated intention about when they will leave full time education and on their education ability, as measured by their performance at Key Stage 3 (age 14) and GCSE examinations.

We estimate these impacts using two methodologies – both of which exploit the existence of pre-Aimhigher: Excellence Challenge data. In both cases we use a difference-in-differences approach which compares the outcomes of interest in the Aimhigher: Excellence Challenge areas with the comparison EiC Phase 3 schools both before and after Aimhigher: Excellence Challenge was introduced. Where the two methodologies differ is in how they control for the effect of characteristics of the young people in the samples on the outcomes. The first method uses a linear regression approach while the second uses a 'matching' approach which balances out the different characteristics in our sample to create similar groups of young people. While matching is less rigid in its assumptions than regression approaches, it requires rich data and large datasets to overcome its absence of identification assumptions. It is

[3] See Emmerson and Frayne (2003), or footnote 2.

also a computationally very complex procedure and we are not able to calculate standard errors for our estimates as using matching in a 'difference-in-differences' model (with four samples) is considerably more complex than comparing just two samples. In this paper, matching therefore serves as verification on the regression estimates. More details on both procedures can be found in section 3.

The structure of the paper is as follows. Section 2 presents the pupil level data used in the analysis. Section 3 discusses both the linear regression and the 'matching' methodologies. In Section 4 we present the results of our analyses using these methodologies. In Section 5 we use the results from the regression 'difference-in-differences' to conduct a Cost-Benefit Analysis. Section 6 concludes.

2. Data Description

The quantitative evaluation of Aimhigher: Excellence Challenge is being undertaken using pupil level data collected in the Aimhigher: Excellence Challenge pilot areas and a selection of comparison areas. The data consist of merged data from pupil-level questionnaires and the National Pupil Database (NPD) which contains the Pupil Level Annual School Census (PLASC) and attainment data. The questionnaire data focus on attitudes to education, future expectations, and also includes some background characteristics about young people's families. The NPD contains administrative records of pupil-level attainment at Key Stage 2 (usually taken at age 11), Key Stage 3 (usually taken at age 14) and school-level data as well some basic background characteristics such as gender and the schools attended. This pupil-level background data is supplemented with data from The Pupil Level Annual School Census (PLASC) which was first collected in 2002. It contains pupil-level information such as ethnicity, mother tongue, postcode, entitlement to Free School Meals and status with regard to special educational needs. The information on the pupils in the

Aimhigher: Excellence Challenge and comparison areas is crucial to the analysis, as it allows us to control for the fact that different areas will contain pupils with different backgrounds and prior experiences of education.

The analysis in this paper looks at pupils who have just finished year 9 and year 11. The year 9 pupils have just taken their Key Stage 3 exams and we look at whether there is an improvement in these results that can be attributed to the Aimhigher: Excellence Challenge programme. The year 11 pupils will just have taken their GCSE exams. In both cases our analysis uses the administrative data to control for prior attainment and estimate whether Aimhigher: Excellence Challenge has caused a value added to the exam results of the pupils exposed to the policy. Key Stage 3 results are therefore used as a control variable in the year 11 sample, while administrative information on Key Stage 2 is used as a control variable for both the year 11 and year 9 samples[4].

The analysis of the pre-pilot data, Emmerson and Frayne (2003), presents a comparison of the Aimhigher: Excellence Challenge areas with the comparison samples. Although our methodology allows us to control for some of the differences between the areas, it is not always possible to do so with confidence where there are large systematic differences. As shown in Emmerson and Frayne (2003), this is the case between the Education Action Zones (EAZ) schools and the Excellence in Cities (EiC) Phase 3 sample – our comparison sample. For this reason, this and subsequent analyses considers only the EiC Phase 1 and 2 areas as the Aimhigher: Excellence Challenge pilot areas.

[4] Once the policy has been in place for a number of years, the Key Stage 3 results will be an outcome of the policy for the year 11 pupils too, and so it would not be possible to control for them when analysing future year 11 pupils.

2.1 Outcome measures

Aimhigher: Excellence Challenge seeks to increase the proportion of young people participating in tertiary education. If this is significantly increased – and the increase is large enough given the cost of the programme – then the programme will be judged to be a success. As it is only in the early stages, this paper looks at intermediate outcomes which are indications of whether the policy is having an early effect or not. The outcomes measures that we focus on are recent exam results and pupils' answers to when they think they might leave full time education. Young people intending to stay in education for longer are likely to be motivated to work harder for their exams (and therefore obtain better results) and to declare their staying on intention when asked. By focusing on these outcome measures we can see if the policy is having an effect so far.

For the year 9 sample we focus on whether the pupils attained Key Stage 3 at level 4 or above in English, Mathematics and Science.[5] The Key Stage 3 exams are taken at the end of year 9 and so are an ideal measure of whether Aimhigher: Excellence Challenge has had an impact on the pupils after being exposed to the policy for year. For the year 11 sample, we look at their GCSE results. We present aggregate measures such as their total GCSE score[6], their total score for their eight best GCSEs, their average GCSE score, total number of GCSEs at grades A* to C and their results in English and Maths GCSE. Again, these exams will have just been taken after a year's exposure to Aimhigher: Excellence Challenge.

[5] In this analysis, all observations with missing information on test marks (e.g. due to absences etc.) are treated as having zero marks and included in the analysis (see table 1.1 for the original data). The national statistics published showing the percentage of pupils reaching the target level include pupils where there is missing information on Key Stage results, so including observations with missing data in our analysis makes our results comparable. However, our results are robust to the exclusion of these observations.

[6] This allocated a mark of 8 for each A*, 7 for each A, 6 for each B, 5 for each C, 4 for D, 3 for E, 2 for F and 1 for G.

For both years we also look at the pupils' self reported intended education leaving age.

In Tables 2.1 to 2.4, we show summary statistics for the outcome variables for the pupils in both our Aimhigher: Excellence Challenge and comparison schools for the sample that has been exposed to Aimhigher: Excellence Challenge for a year (the post-policy sample) and the baseline sample that wasn't exposed to Aimhigher: Excellence Challenge (the pre-policy sample) for pupils that have just finished years 9 and 11[7].

Tables 2.1 and 2.2 show the outcomes variables for the year 9 pupils. Prior to the policy being introduced, Table 2.1 shows that there was little statistically different between the Aimhigher: Excellence Challenge pilot and comparison samples. The only marked difference is that fewer pupils in the pilot sample attained Levels 4, 5 or 6 in Key Stage 3 English or Maths. 75.4% of those in the pilot areas attained it in English and 67.5% in Maths, compared with 78.2% and 71.2% respectively in the comparison areas. All other differences are too small to be statistically significant.

Amongst the post-policy year 9 sample (Table 2.2), the differences in the proportion of pupils attaining Key Stage 3 in English and Maths between Aimhigher: Excellence Challenge pilot and comparison samples are no longer significant[8]. This would indicate an improvement in the pilot schools relative to the comparison schools. However, the purpose of this paper is to see whether there is an improvement that can be attributed to the Aimhigher: Excellence Challenge programme. For example, it could be that the post-policy sample differs from the pre-policy one in the background characteristics of the pupils. Our analysis will control for this. Other differences in the

[7] Compared with all maintained schools secondary schools in England, the Aimhigher:Excellence Challenge pilot sample have lower attainment results at Key Stage 3 and GCSE and a higher eligibility for free school meals, on average.

[8] The difference in the marks for Science are not statistically different from zero in either the pre-policy or post-policy samples.

raw scores presented in Table 2.2 include a significantly higher incidence of missing Key Stage 3 data in our pilot areas and fewer pupils stating that it is their intention to leave full time education at 18.

Tables 2.3 and 2.4 present equivalent figures for the year 11 post-policy and pre-policy samples. Looking at the pre-policy figures in Table 2.3, there are a number of statistically significant differences between the pilot and comparison samples, with the pilot samples showing lower GCSE results on all measures (although the GCSE English grades are not statistically different). They are also more likely to state that they intend to leave school at age 16 and less likely to leave at 20 or over.

The post-policy sample presented in Table 2.4 shows better GCSE results for the pilot sample compared with the comparison sample and more pupils saying they intend to leave school at either 16 or 20 or over. Taken at face value, these would indicate a marked improvement in the Aimhigher: Excellence Challenge areas. However, as with the year 9 sample, these results are crude and do not take into account any of the underlying characteristics that may differ between the samples and explain these differences in outcomes. The methodologies described below allow us to estimate the changes in the outcome variables taking underlying characteristics into account.

2.2 Background characteristics

Tables 2.5 to 2.8 present the distribution of characteristics that our analysis controls for, for Aimhigher: Excellence Challenge pilot and comparison areas for both the pre and post policy samples. They show that are systematic differences between the samples and the years. Our analysis controls for this in two different ways, depending on the methodology used.

The year 9 pre-policy samples indicate that, on average, the pupils in the Aimhigher: Excellence Challenge schools have more educated parents, but similar levels of deprivation. 15% of pupils in the pilot schools had mothers and 16% fathers who are university educated, while in the comparison areas the corresponding numbers are 9% and 11%. Pupils in the Aimhigher: Excellence Challenge schools also had more books in their houses with 16% having over 3 bookcases, 13% 2 bookcase and 20% 1 bookcase. In the comparison sample the corresponding percentages were 12%, 12% and 17%. Nevertheless, there are marginally more pupils in the Aimhigher: Excellence Challenge sample qualifying for free school meals (25%) than in the comparison sample (24%). Table 2.5 also shows that the Aimhigher: Excellence Challenge pupils have better Key Stage 2 results in Maths, English and Science with a higher proportion of pupils reaching levels 5 or 6 in all subjects. The table also highlights the different ethnic composition of our two samples, with the Aimhigher: Excellence Challenge sample being less likely to have a minority ethnic background and having with a higher proportion of black and lower proportion of Asian background pupils than in the comparison schools.

Table 2.6 shows that, compared to Table 2.5, the post-policy sample differs in composition from the pre-policy sample. The differences between the Aimhigher: Excellence Challenge and comparison samples in 2003 are less marked. The differences in parental education, books in the house and Key Stage 2 results are marginal and in the case of books and English Key stage results, in the opposite direction of the 2002 sample. The Aimhigher: Excellence Challenge pupils have a higher eligibility for free school meals and the ethnic backgrounds of the pilot and comparison sample are much more similar than in the pre-policy sample. These

differences between the pre and post-policy sample highlight the need to control for sample composition when conducting any analysis.

Table 2.7 shows the year 11 pre-policy sample characteristics. On average the Aimhigher: Excellence Challenge individuals show slightly higher levels of deprivation than the comparison sample with lower parental education, fewer pupils living in houses with 2 or 3 bookcases of books, higher eligibility to free school means. They have slightly worse than average Key Stage 2 results, but better Key Stage 3 results. Their ethnic background differs too, with fewer minority ethnic pupils in the Aimhigher: Excellence Challenge schools than in the comparison schools, with a markedly lower proportion of pupils coming from Asian backgrounds.

Finally, our year 11 post-policy sample's characteristics are summarised in tables 2.8. The Aimhigher: Excellence Challenge pupils show lower levels of deprivation than the comparison pupils, with higher levels of parental education, more books in the house, lower eligibility for free school meals and better Key Stage 2 and Key Stage 3 results. The marked differences in ethnicity are present in this sample too, though.

3. Methodology

The methodologies we use seek to control for the differences in composition in our sample across pilot and comparison areas and time. In both cases, the background characteristics that we control for are the ones summarised in Tables 2.5 to 2.8. Both methodologies use a 'difference-in-differences' approach to subtract out the effect of pre-policy differences in the two areas. They differ in how they control for background characteristics. Here we provide a brief discussion of the two methodologies used. For more details see, for example, Blundell and Costa Dias (2000).

3.1. Difference-in-differences using a regression approach

The 'difference-in-differences' methodology involves comparing outcomes in the 'treatment' group (in our case the sample going to schools where Aimhigher: Excellence Challenge is implemented) with those in the comparison group before and after the policy was introduced. The advantage of this approach is that it 'differences out' any time-constant effect of factors that may be correlated with the outcome of interest and whether the school is in the treatment group. This is the case even if any such factors are unobserved – as long as any effect they have on the outcomes we are interested in do not change over time, this methodology will subtract them out. As the samples in both the pilot and comparison areas are not a panel over time, but contain a different year of pupils for the pre-policy and post-policy data, the assumption that any unobservables have no different impact over time relies on unobservables' impacts not being cohort specific in a way that differs systematically between the pilot and comparison areas.

'Difference-in-differences' therefore allows to control for certain factors that we may not be able to observe (subject to the conditions outlined), but we also need to control for factors that we can observe. In this case it is the composition of our samples in terms of the background characteristics of the pupils. In this paper we use both a regression approach and a matching approach. The regression approach is more restrictive in the assumptions that it makes in terms of how the various characteristics affect our outcomes. Matching has the advantage of making fewer implicit assumptions and of comparing only similar individuals when yielding results. However, because we are using it in a 'difference-in-differences' model, it is computationally complex and we are not able to estimate the statistical significance of

the results obtained. We therefore use it as additional analysis to the regression approach, rather than as a methodology that can be used on its own.

3.2. Difference-in-differences using a regression approach

The 'difference-in-differences' regression model described below is used in the evaluation of Excellence in Cities. Further details can be found in Machin *et al.* (2003). The model can be written as follows[9]:

$$Y_{ist} = \beta Aimhigher_s * D_{t=2003} + \lambda\ Aimhigher_s + \gamma X_{ist} + D_t + \varepsilon_{ist} \qquad (1)$$

where Y_{ist} denotes pupil *i*'s outcome (such as an exam result) in school *s* in year *t*. Aimhigher is a school level dummy variable indicating whether the school is an Aimhigher: Excellence Challenge school[10], X denotes pupil characteristics, D_t is a set of year dummies indicating whether the individual is in the pre or post-policy sample and ε is an error term.

The term of interest is $Aimhigher_s * D_{t=2003}$ as it picks up the effect of being in an Aimhigher: Excellence Challenge school in the post-policy year over and above being in such a school in the previous year and being in any school post-policy and controlling for all other observable characteristics. Hence, β is the main coefficient of interest. It captures shifts in the outcome measure within treatment schools vis-à-vis control schools that occur after the policy is introduced.

3.2. Propensity score matching

The second methodology uses propensity score matching to balance the distribution of observable characteristics between those pupils in Aimhigher: Excellence Challenge schools and those in the comparison non- Aimhigher:

[9] This equation is estimated by Ordinary Least Squares regression.
[10] A dummy variable is a variable which takes the value 0 or 1. In this case, Aimhigher=1 if the school is an Aimhigher: Excellence Challenge school; Aimhigher =0 otherwise.

Excellence Challenge schools. Under the assumption that we take into account all characteristics which could affect the outcomes of interest and that might vary over time between the four groups, then any remaining 'difference-in-difference' in outcomes can be attributed to the policy.[11] We still allow for the possibility that there may be unobservable characteristics that affect the outcomes of interest – as long as any correlation between these and the group to which pupils belong does not change over time.[12]

In order to undertake matching we divide the pupils into four groups as shown in table 3.1. We then estimate two propensity scores as using two probit models. The first represents the probability of being in an Aimhigher: Excellence Challenge school, with whether or not the pupil attends an Aimhigher: Excellence Challenge school being the dependent variable and all of the observable background characteristics as regressors. Then, for each pupil, estimated coefficients are used to estimate the probability that he/she attends an Aimhigher: Excellence Challenge school. This probability is used as a propensity score. We repeat an equivalent exercise for the propensity to be in the post-policy year and obtain a second propensity score for each pupil.

Table 3.1 Groups used for propensity score matching

	Aimhigher: Excellence Challenge school	Comparison school
Pre-policy (year 2002)	P_0	C_0
Post-policy (year 2003)	P_1	C_1

[11] For more details see, for example, Heckman, Ichimura and Todd (1997).
[12] It is not possible to test this assumption – if it is violated then the results could be biased.

We then compare the outcomes of pupils in the group P_1 with individuals in the other 3 groups who have similar estimated propensity scores.[13] This allows us to estimate what the outcomes we are interested in would have been for individuals in group P_1 they had been in the other 3 groups (the 3 counterfactual outcomes). If we denote $Y_i(P_1)$ to be an illustrative outcome observed for individual i in group P_1, and $Y_{esti}(P_0)$, $Y_{esti}(C_1)$, $Y_{esti}(C_0)$ to be our estimates of the what the outcome would have been had the individual been in one of the other groups, we estimate the impact of Aimhigher: Excellence Challenge on the policy by taking the difference between the pilot and comparison sample post-policy, adjusting for what it would have been pre policy; namely $(Y_i(P_1) - Y_{esti}(C_1)) - (Y_{esti}(P_0) - Y_{esti}(C_0))$

One of the main differences between the matching and the regression methodologies lies in the parts of the sample that are used. In matching, individuals in group (P_1) are only compared with those who are similar to them in terms of the propensity scores. This means that if two samples are very different in their characteristics and hence in their propensity scores no comparison can and will be made. In practical terms, it means that a smaller proportion of the sample is used in the estimates and new matched samples are constructed out of which the estimation occurs. These samples will closely resemble the parts of the P_1 sample that can be found in the other groups[14]. In the regression approach the entire sample is used, with

[13] We are able to match on just the two propensity scores rather than separately on all characteristics using a theorem by Rosenbaum and Rubin (1983). Kernel based matching is used with a bandwidth of of 1.06*(square root of the estimated variance)*(sample size ^(-1/5)) using Silverman's rule i.e. outcomes of individuals in the group P_1 are compared to individuals in the other groups whose propensity scores are within those bandwidths.

[14] If there is a characteristic that is not found in all 4 samples (for example if one sample contained only girls) then the new constructed samples and parts of P_1 that are used in the final estimation will not contain any individuals with the missing characteristic (boys). This means that matching is not appropriate for very different samples and is the reason why the EAZ schools are exluded from our analysis. Where matching shows samples that are too different, care should also be taken in interpreting regression results as estimation there will rely strongly on assumptions made about the regressors affect the outcome variables. Broadly similar estimates from matching and regression techniques are encouraging as they indicate low reliance on the exact specification of the model.

the specification providing the means for comparing sometimes quite different individuals.

Of course, the matching cannot control for all characteristics – only those contained in the data. This will not affect our results so long as the way these vary by whether a pupil is an Aimhigher: Excellence Challenge area or not has not changed over time, or if they are uncorrelated with the outcomes of interest.

4. Main Results

4.1. Difference-in-Differences regression estimates

Tables 4.1 and 4.2 show the results of the regression 'difference-in-differences' analysis for years 9 and 11 respectively. The first two columns with results show the result of running regression (1) on the sample containing individuals in Aimhigher: Excellence Challenge pilot and comparison school, both before and after the introduction of the policy. The table gives resulting estimate of the β coefficient that pick up the Aimhigher: Excellence Challenge effect and its standard error. A positive β coefficient indiciates a positive difference associated with being in a post-policy Aimhigher: Excellence Challenge school. An asterisk on the coefficient denotes significance at 95% significance level.

The next 4 columns show the coefficient and standard error on the dummy variable indiciating being in an Aimhigher: Excellence Challenge school on the pre-policy and post-policy samples separately. These columns pick up the difference in the outcomes in any one year associated with being in an Aimhigher: Excellence Challenge school. For the pre-policy (year 1) estimates a non-zero result does not tell us anything about the effect of the policy, but rather points to underlying differences between the two area samples. The post-policy estimates also need to be considered carefully as they will be the combination of the effect of the policy and any systematic

differences between the two areas. The 'difference-in-differences' estimator is a more sophisticated method for subtracting the underlying year 1 difference from the observed year 2 post-policy difference. It is not usually possible to obtain an accurate estimate of this 'difference in differences' estimate directly from these two separate regression.

4.2. The impact of Aimhigher: Excellence Challenge on Year 9 pupils using linear regression 'difference-in-differences' analysis

Table 4.1 shows that Aimhigher: Excellence Challenge does not yet appear to have affected year 9 pupils' intended school leaving ages after a full year's exposure. Although being in an Aimhigher: Excellence Challenge school in year 9 increases the probability of a pupil stating that they will leave full time education at age 20 or over by 2.0 percentage points (and decreases the probability of saying they will leave at age 18 by 1.8 percentage points), the overall difference in the 'difference in differences' estimates once the responses from the pre-policy year have been taken into account is not significant at conventional levels.

The only significant effect is that pupils are on average (by 4.6 percentage points) more likely to attain levels 4, 5 or 6 at Key Stage 3 Mathematics as a result of exposure to Aimhigher: Excellence Challenge. This is a positive outcome for the policy. The lack of impact on intended school leaving ages should perhaps not be viewed negatively as this cohort of pupils has not had the intended length of exposure to Aimhigher: Excellence Challenge and is also two years away from their decision about whether to continue with non-compulsory schooling.

4.3. The impact of Aimhigher: Excellence Challenge on Year 11 pupils using linear regression 'difference-in-differences' analysis

Aimhigher: Excellence Challenge has so far had more significant effects on the year 11 sample. In particular the proportion of pupils exposed to Aimhigher: Excellence Challenge who state that will remain in full time education until at least the age of 20 is 3.9 percentage points higher than it would be in the absence on the policy.

Aimhigher: Excellence Challenge also appears to have led to an improvement in GCSE results. All measures of GCSE results except the mark in GCSE mathematics show an improvement caused by being in a school that was subject to the Aimhigher: Excellence Challenge programme. The average GCSE English mark is 0.2 marks higher (where an improvement of 1 represents a higher grade), while pupils are on improving their total GCSE marks by 2.5 points (corresponding, on average, to a an increase of between 2 and 3 grades in one GCSE) and the marks in their 8 best subjects by 1.6 marks. They are improving their average GCSE mark by 0.1 points and obtaining 0.3 more GCSEs at marks A* to C than in the absence of the policy. Table 4.2 also shows that in our data, we have less missing information on the English GCSE marks.

These year 11 results are encouraging as they are showing a positive impact of Aimhigher: Excellence Challenge both on young people's Higher Education intentions and on the skills that will help them both reach Higher Education but also successfully participate in it. The positive results on all but one GCSE measures indicates that the positive impact is across the board.

4.5. Propensity Score Matching

The results from propensity score matching cannot serve as an estimation in their own right, as they do not contain standard errors (due to computational difficulties in estimating them with four samples and large sample sizes), but closeness to the regression estimates would increase our confidence in the latter. Tables 4.3 and 4.4 present the matching estimates for years 9 and 11 respectively, by showing the matched outcome variable as estimated for the different groups and, in the last column, the estimate of the 'difference in differences'.

The positive impact of 4.6 percentage points on the percentage of year 9 individuals who attain Key Stage 3 maths at levels 4,5 or 6 seems robust to the matching results, which if anything indicate a slightly higher effect of 6.9 percentage points. This is within the 95% confidence interval of the regression approach and points to the actual effect being, if anything, at the upper ends of the confidence interval of the 4.6 point estimate.

For the year 11 sample, the exam result estimates that are significant in the regression analysis also show similar, or larger in absolute value, estimates than using the matching approach. This adds weight to the estimates from the regression analysis and indicates that the results obtained were not dependent on the exact parametric specification used.

The increase in the proportion of pupils stating that they intend to leave school at age 20 or over is less evident in the matching results, with an increase of 1.8 percentage points compared with the 3.9 from the regression estimates. While this is smaller, it may still not be statistically different from the 3.9 estimate – although it is also possible that it is consistent with zero effect. Conversely a much larger coefficient (4.7) from the matching approach appears on the likelihood of pupils stating that they

will leave school at 18. As Aimhigher: Excellence Challenge is aimed specifically at increasing the number of young people going on to tertiary education, this is encouraging as it shows that the direction of change is the desired one.

The matching analysis allows some deconstruction into the differences in the outcomes of interest in our samples. In particular, the improved exam results for the Aimhigher: Excellence Challenge post-policy sample for both year 9 and year 11 seem as much driven by a deterioration in the comparison areas as by an improvement in the pilot areas. As long as we are confident that we have adequately controlled for unobservable factors, this may simply be a reflection of the difficulty of the tests in that particular year.

5. Cost Benefit Analysis

The aim of Aimhigher: Excellence Challenge is to increase the proportion of young people participating in Higher Education. The analysis presented in section 4 points to an increase in the proportion of young people stating that it was their intention to study at a university or other higher education instiution . If this does materialise, the policy will have gone at least way to achieving its objectives. However, in deciding whether this is sufficient to make the policy desirable, the magnitude of the impact needs to be considered in the context of its costs. This section presents the results of a Cost Benefit Analysis, which relates the cost of the policy to the rate of return that it yields based on the results of section 4.

The year 9 results and the impact of Aimhigher: Excellence Challenge on GCSE results is not considered in this section. The reason for this is that while they are welcome effects of policy, it is too early to fully assess the impact of Aimhigher: Excellence Challenge on young people's futures based on the results after one year. In

addition, the benefit of improved exam results is not as directly calculable as that of a university education and is linked to this improvement – to assess the impact of both the possible increase in Higher Education participation and the improved GCSE results would be to double count the impact of the policy. We therefore look at whether Aimhigher: Excellence Challenge would pass a Cost Benefit Analysis if it leads to an increase in the proportion of young people participating in Higher Education by 3.9 percentage points – as indicated by our results in table 4.2. The improved GCSE results we have observed are consistent with an increase in the proportion of young people going on to Higher Education so focusing on the increased participation is an inclusive approach.

In order to estimate the rate of return of Aimhigher: Excellence Challenge we compare the costs and benefits of the policy from its introduction until retirement from the labour market (assumed to be age 65). In doing so, we discount the costs and benefits to a common year at the start of the policy. The benefits to individuals from taking part in Higher Education are measure in terms of the higher expected wages earned by graduates of tertiary education. We do not include any wider benefits to society of having a more highly educated workforce (beyond the higher taxes paid out of the gross wages); if these were estimated and included the rate of return of the policy for a given cost would be higher (for example any increased productivity of firms that is not reflected in higher gross wages). Conversely we do not allow for any negative impacts such as lower graduate wages as a result of increased Higher Education participation. The costs are incurred by both the young people – who forsake wages in order to put off entering the labour market for 3 years while they take their degree – and to the government which pays for the policy while it operates.

At present the per pupil cost of the policy is not known to us, so we present our results as a function of the possible costs. When the policy has been fully implemented on a cohort we will be able to compare the benefits of the policy to the full cost of implementing for its full intended length. The indicative impacts estimated in this paper come from comparing pupils exposed to the policy for over a full year to those with very little exposure. The effect of the policy estimated here therefore results from a year's spending on Aimhigher: Excellence Challenge. Nevertheless, in the Cost Benefit analysis when estimating the costs of Aimhigher: Excellence Challenge we calculate the cost of policy as being the cost that would have been incurred has the policy been in place from age 13 to 16. If the effect of the policy, once it has been fully applied to a cohort, is similar to our estimates in this paper, this will be correct costing to include in the Cost Benefit analysis. Of course, it would be more realistic to compare the benefits as estimated now with the cost incurred by the current cohort (so one year's spending) for the Cost Benefit analysis; however, we have chosen not to do this to make the results of the Cost Benefit analysis more tractable for assessing the policy as a whole once it has run its course. Including just the costs for one year would lead to the results not being applicable to the whole policy once it has run its course unless we took the cost to be the total cost (irrespective of how many years it was spread over) rather than an annual cost – if we wanted to do this we would multiply the 'break even' policy costs shown further down this section by just over 4.

We measure the increased earnings of graduates by applying the wage returns to a marginal learner completing a degree (compared to obtaining at least a Level 2 qualification) to the profile of gross wages estimated from the 2002–03 Family

Resources Survey[15]. The wage returns are estimated by Dearden et al (2004) as being 15.0% for men and 22.6% for women. In our analysis we weight these to obtain an average (constant) wage return from Higher Education of 18.6%.

The rate of return of the policy measures equalises the total discounted benefit to the total discounted cost, where discounting is done using a rate of return (using rates of 2½%, 3½%, 5% and 7½%). It measures the return that you would obtain for your money if you funded this policy with it[16]. For a given impact (in our case an increase in the proportion of young people participating in Higher Education by 3.9 percentage points), a higher cost to achieve this impact leads to a lower rate of return, while a lower cost is consistent with a higher rate of return. As mentioned, the costs relate to the annual cost of the policy running from year 8 to year 11, even though the benefits come from just one year's exposure to the policy.

Table 5.1 shows the relationship between the costs of the policy and the annual rate of return, for both the impact on participation in higher education as estimated by the linear regression model and the central outcome from the matching. (So it provides the cost for which the net present of the policy would be zero for a given rate of return). Focusing first on the 3.9 percentage point increase in participation that the linear regression model estimates, for the policy to provide an annual real rate of

[15] We assume that wages grow in real terms by 2% per year. Of course, it is likely that future wage growth and earning profiles will differ to current or past ones. This particularly the case for women, as different cohorts do not have the same experiences of the labour market or the same level of employment. If women have higher employment rates in the future, our analysis will underestimate the benefit of the policy. However, if this increased employment leads to downward revision to wages the net result would be smaller.

[16] Denoting the cost per pupil in year t as Ct, the average percentage point increase in higher education participation as λ, the return in terms of wages of an extra year's education as r and expected wages in a given year by wt, R solves:

$$\sum_{t=1}^{4} \frac{C_t}{(1+R)^t} + \sum_{t=7}^{9} \frac{w_t}{(1+R)^t} = \sum_{t=10}^{53} \frac{\lambda r w_t}{(1+R)^t}$$

The costs are estimated as the cost of providing the policy for the four years up to the end of year 11, the three years' foregone earnings due to participating in higher education rather than entering the labour market.

For more details on the methodology see Krueger and Whitmore (1999).

return of at least 2½% per annum, the annual cost per pupil must not exceed £725. A higher cost of the policy points to a lower rate of return as the benefit does not change. A lower cost per annum, however, would lead to a higher rate of return for the policy. For example, a rate of return of 3½% would be achieved for an annual cost of £537 – the lower cost means that the value of money is higher. In order for a 7.5% rate of return to materialise, the annual cost per pupil would need to be £160.

Of course the lower impact suggested by the matching analysis means that for a given annual rate of return to be delivered, the cost per pupil must be smaller. For a rate of return of 2½% to be achieved, the annual per pupil cost must not exceed £334 – while a rate of return of 3½% would by achieved with an annual per pupil cost below £248. In order for a 7.5% rate of return to materialise, the annual cost per pupil would need to be £73.

In order to make the calculations set out in table 5.1, we must assume that we know the impact of the policy as estimated by the regression analysis. If the impact turns out to be higher, as the matching analysis might suggest, then the rates of return illustrated would be consistent with a higher cost of the policy. Once the cost of the policy is known the results in table 5.1 can be used to estimate the approximate rate of return that the policy yields.

6. Conclusions

This paper looks at the impact that the Aimhigher: Excellence Challenge programme has had on pupils who have been exposed to it for a year. The analysis looks at questionnaire data and exam results for pupils who completed years 9 or 11 in 2003. The analysis is undertaken using both regression and matching methodologies; in both cases time-constant effects have been differenced out.

The Aimhigher: Excellence Challenge intervention seeks to encourage young people to take part in tertiary education. In order to obtain an estimate of the early impact of Aimhigher: Excellence Challenge this analysis has focused on pupil's intended school leaving age (as stated in questionnaire data) and on the exam results that were obtained after a year's exposure to the policy. For year 9 pupils, the exam outcomes were their Key Stage 3 results, while for the year 11 pupils their GCSE results were available.

The results of the regression methodology show that the Aimhigher: Excellence Challenge programme has not yet affected the intended school leaving age of the year 9 pupils, in a statistically significant way. However, there is a significant increase in the proportion (by 4.6 percentage points) of pupils attaining Key Stage 3 Mathematics at levels 4, 5 or 6 as a result of the policy. These results are robust to the matching analysis, which, if anything, indicates a higher positive effect on Key Stage 3 Mathematics.

A positive impact of Aimhigher: Excellence Challenge is more in evidence for the year 11 pupils. The Aimhigher: Excellence Challenge policy is estimated to have increased the proportion of that year group stating that they intend to participate in tertiary education by 3.9 percentage points using the linear regression methodology. There have also been significant improvements in the GCSE results of pupils exposed to Aimhigher: Excellence Challenge according to all but one measures – only the mark in GCSE Maths has not shown a statistically significant improvement due to the policy. The improvements in exam results are consistent with the results of the matching analysis, although the estimated impact of Aimhigher: Excellence Challenge on increasing the proportion of pupils intending to take part in higher education is less in evidence using matching.

The Aimhigher: Excellence Challenge programme has therefore already had a positive impact on outcomes that are related to more young people taking part in tertiary education, despite it not having been implemented yet for the entire duration that is anticipated. Whether or not it is a desirable policy will, at least in part, depend on how much it costs per pupil and what rate of return of the policy is seen as sufficient. We have shown estimates of the per pupil cost for which the policy would pass a cost benefit analysis for a range of rates of return. These are based on the financial benefits of the policy as measured by increased gross wages to pupils participating in tertiary education. We use the regression results on the year 11 sample for the analysis and find that for a rate of return of 5% to materialise the policy must cost no more than £342 per pupil. A lower rate of return of 2.5% can be achieved with a cost of £725, while for the rate to be 7.5% the policy would need to cost no more than £160 per pupil.

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Table 2.1 Summary statistics for outcome variables for year 9 pre-policy sample (2002)

	Pilot areas (Aimhigher: Excellence Challenge) Mean	Comparison areas (EiC Phase 3) Mean	Difference	Result of t-test t-stat
Likely to leave full time education at…				
Age 16	11.9	11.5	0.4	0.395
Age 17	5.8	5.3	0.5	0.779
Age 18	13.6	14.4	-0.8	0.772
Age 20 +	33.2	32.4	0.8	0.534
Not sure/no answer	6.0	5.7	0.2	0.343
Attained level 4, 5 or 6 in Key Stage 3…				
English	75.4	78.2	-2.9	-2.2287
Maths	67.5	71.2	-3.7	2.632
Science	77.3	77.8	-0.5	-0.432
No result/missing data on Key Stage 3…				
English	2.9	2.5	0.3	0.693
Maths	3.1	3.3	-0.2	0.446
Science	3.5	3.8	-0.4	-0.702
Sample size	7692	1273		

Note: figures may not sum due to rounding

Table 2.2 Summary statistics for outcome variables for year 9 post-policy sample (2003)

	Pilot areas (Aimhigher: Excellence Challenge)	Comparison areas (EiC Phase 3)		Result of t-test
	Mean	Mean	Difference	t-stat
Likely to leave full time education at…				
Age 16	11.8	11.0	0.9	1.241
Age 17	5.9	6.3	-0.4	0.810
Age 18	12.7	14.3	-1.5	2.028
Age 20 +	32.6	31.1	1.6	0.152
Not sure/no answer	6.8	8.9	-2.0	0.353
Attained level 4, 5 or 6 in Key Stage 3…				
English	77.3	77.2	0.1	0.063
Maths	67.6	65.6	2.0	1.907
Science	77.6	77.5	0.0	0.051
No result/missing data on Key Stage 3…				
English	4.2	4.9	-0.8	-1.693
Maths	18.7	21.8	-3.1	3.552
Science	2.9	2.9	0.1	0.0221
Sample size	8503	2729		

Note: figures may not sum due to rounding

Table 2.3 Summary statistics for outcome variables for year 11 pre-policy sample (2002)

	Pilot areas (Aimhigher: Excellence Challenge) Mean	Comparison areas (EiC Phase 3) Mean	Difference	Result of t-test t-stat
Likely to leave full time education at…				
Age 16	15.1	9.9	5.2	3.852
Age 17	4.1	4.1	-0.0	0.026
Age 18	24.7	22.5	2.1	1.302
Age 20 +	34.4	44.6	-10.2	5.545
Not sure/no answer	5.7	3.6	2.1	2.410
Mark in…				
GCSE English	4.8	5.0	-0.1	1.880
GCSE Maths	4.2	4.4	-0.2	2.740
Total GCSEs taken	41.0	45.3	-4.3	6.296
8 best GCSEs taken	35.5	38.0	-2.6	4.939
Average GCSE mark	4.3	4.5	-0.2	4.245
Number of GCSEs A* to C	4.8	5.3	-0.5	3.585
No result/missing data …				
GCSE English	1.8	1.7	0.0	0.067
GCSE Maths	1.1	0.8	0.3	0.796
Aggregate GCSE results	0.3	0.7	-0.4	1.772
Sample size	7083	751		

Note: figures may not sum due to rounding

Table 2.4: Summary statistics for outcome variables for year 11 post-policy sample (2003)

	Pilot areas (Aimhigher: Excellence Challenge) Mean	Comparison areas (EiC Phase 3) Mean	Difference	Result of t-test t-stat
Likely to leave full time education at…				
Age 16	12.1	10.0	2.1	2.491
Age 17	4.2	4.7	-0.6	-1.069
Age 18	22.2	22.0	0.2	0.195
Age 20 +	38.1	33.8	4.3	3.442
Not sure/no answer	5.9	9.9	-4.0	-6.395
Mark in…				
GCSE English	4.9	4.5	0.4	9.162
GCSE Maths	4.2	3.9	0.2	5.100
Total GCSEs taken	42.1	39.9	2.2	4.697
8 best GCSEs taken	35.8	34.0	1.9	5.430
Average GCSE mark	4.2	4.0	0.2	5.818
Number of GCSEs A* to C	5.1	4.7	0.4	4.261
No result/missing data …				
GCSE English	1.5	2.8	-1.3	-3.988
GCSE Maths	1.3	1.5	-0.2	-0.731
Aggregate GCSE results	0.4	0.5	-0.1	0.488
Sample size	9637	1812		

Note: figures may not sum due to rounding

Table 2.5 Summary background statistics, for the year 9 pre-policy sample, by whether individuals are in an Aimhigher: Excellence Challenge school or not

	Pre-policy year 9 pilot sample				Pre-policy year 9 comparison sample			
		Percentiles				Percentiles		
	Mean	25	50	75	Mean	25	50	75
Male	0.50	0	1	1	0.55	0	1	1
Lives with mother/step mother	0.91	1	1	1	0.93	1	1	1
Lives with father/stepfather	0.73	0	1	1	0.81	1	1	1
Lives with mother & father	0.70	0	1	1	0.78	1	1	1
Lives with other adult	0.01	0	0	0	0.01	0	0	0
Lives only with children	0.00	0	0	0	0.00	0	0	0
Number of children in household	1.31	0	1	2	1.31	0	1	2
Mother educated to secondary school level	0.62	0	1	1	0.56	0	1	1
Mother attended college	0.34	0	0	1	0.27	0	0	1
Mother university educated	0.15	0	0	0	0.09	0	0	0
Don't know mother's education	0.35	0	0	1	0.41	0	0	1
Mother's education missing	0.07	0	0	0	0.07	0	0	0
Father educated to secondary school level	0.55	0	1	1	0.52	0	1	1
Father attended college	0.29	0	0	1	0.26	0	0	1
Father university educated	0.16	0	0	0	0.11	0	0	0
Don't know father's education	0.38	0	0	1	0.42	0	0	1
Father's education missing	0.11	0	0	0	0.09	0	0	0
Mother/step mother works full time	0.38	0	0	1	0.34	0	0	1
Mother/step mother works part time	0.24	0	0	0	0.20	0	0	0
Mother/step mother doesn't works	0.25	0	0	0	0.31	0	0	1
Mother/step mother work status missing	0.05	0	0	0	0.07	0	0	0
Father/step father works full time	0.53	0	1	1	0.55	0	1	1
Father/step father works part time	0.07	0	0	0	0.07	0	0	0
Father/step father doesn't works	0.09	0	0	0	0.12	0	0	0
Father/step father work status missing	0.05	0	0	0	0.06	0	0	0
Other adult works	0.01	0	0	0	0.01	0	0	0
Other adult doesn't work	0.01	0	0	0	0.00	0	0	0
Other adult work status missing	0.50	0	1	1	0.00	0	0	0
White	0.63	0	1	1	0.49	0	0	1
Asian background	0.12	0	0	0	0.34	0	0	1
Black	0.07	0	0	0	0.03	0	0	0
Other ethnic group	0.09	0	0	0	0.08	0	0	0
Ethnicity missing	0.09	0	0	0	0.07	0	0	0
Never speak English at home	0.03	0	0	0	0.02	0	0	0
Sometimes speak English at home	0.09	0	0	0	0.17	0	0	0
Always speak English at home	0.84	1	1	1	0.78	1	1	1
Home language missing	0.04	0	0	0	0.03	0	0	0
Few books at home	0.16	0	0	0	0.21	0	0	0
1 Bookshelf	0.25	0	0	1	0.29	0	0	1
1 Bookcase	0.20	0	0	0	0.17	0	0	0
2 Bookcases	0.13	0	0	0	0.12	0	0	0
3 Bookcases	0.16	0	0	0	0.12	0	0	0
Books in home missing	0.06	0	0	0	0.04	0	0	0
Eligible for free school meals	0.25	0	0	0	0.24	0	0	0
Some special educational needs	0.18	0	0	0	0.22	0	0	0
Key Stage 2 English below level	0.04	0	0	0	0.07	0	0	0
Key Stage 2 English level 3	0.21	0	0	0	0.26	0	0	1
Key Stage 2 English level 4	0.48	0	0	1	0.48	0	0	1
Key Stage 2 English levels 5 or 6	0.19	0	0	0	0.13	0	0	0
Key Stage 2 Maths below level	0.04	0	0	0	0.05	0	0	0
Key Stage 2 Maths level 2	0.01	0	0	0	0.01	0	0	0

Key Stage 2 Maths level 3	0.22	0	0	0	0.31	0	0	1
Key Stage 2 Maths level 4	0.45	0	0	1	0.42	0	0	1
Key Stage 2 Maths levels 5 or 6	0.23	0	0	0	0.15	0	0	0
Key Stage 2 Science below level	0.02	0	0	0	0.03	0	0	0
Key Stage 2 Science level 2	0.00	0	0	0	0.01	0	0	0
Key Stage 2 Science level 3	0.16	0	0	0	0.24	0	0	0
Key Stage 2 Science level 4	0.49	0	0	1	0.49	0	0	1
Key Stage 2 Science levels 5 or 6	0.26	0	0	1	0.17	0	0	0

Table 2.6 Summary background statistics, for the year 9 post-policy sample, by whether individuals are in an Aimhigher: Excellence Challenge school or not

	Post-policy year 9 pilot sample				Post-policy year 9 comparison sample			
		Percentiles				Percentiles		
	Mean	25	50	75	Mean	25	50	75
Male	0.51	0	1	1	0.51	0	1	1
Lives with mother/step mother	0.89	1	1	1	0.85	1	1	1
Lives with father/stepfather	0.71	0	1	1	0.71	0	1	1
Lives with mother & father	0.68	0	1	1	0.67	0	1	1
Lives with other adult	0.01	0	0	0	0.01	0	0	0
Lives only with children	0.00	0	0	0	0.00	0	0	0
Number of children in household	1.38	0	1	2	1.25	0	1	2
Mother educated to secondary school level	0.59	0	1	1	0.56	0	1	1
Mother attended college	0.31	0	0	1	0.31	0	0	1
Mother university educated	0.14	0	0	0	0.13	0	0	0
Don't know mother's education	0.34	0	0	1	0.30	0	0	1
Mother's education missing	0.11	0	0	0	0.16	0	0	0
Father educated to secondary school level	0.52	0	1	1	0.51	0	1	1
Father attended college	0.27	0	0	1	0.26	0	0	1
Father university educated	0.14	0	0	0	0.13	0	0	0
Don't know father's education	0.37	0	0	1	0.33	0	0	1
Father's education missing	0.14	0	0	0	0.19	0	0	0
Mother/step mother works full time	0.37	0	0	1	0.36	0	0	1
Mother/step mother works part time	0.22	0	0	0	0.22	0	0	0
Mother/step mother doesn't works	0.23	0	0	0	0.19	0	0	0
Mother/step mother work status missing	0.08	0	0	0	0.08	0	0	0
Father/step father works full time	0.49	0	0	1	0.51	0	1	1
Father/step father works part time	0.07	0	0	0	0.05	0	0	0
Father/step father doesn't works	0.09	0	0	0	0.07	0	0	0
Father/step father work status missing	0.07	0	0	0	0.07	0	0	0
Other adult works	0.01	0	0	0	0.01	0	0	0
Other adult doesn't work	0.01	0	0	0	0.00	0	0	0
Other adult work status missing	0.00	0	0	0	0.00	0	0	0
White	0.65	0	1	1	0.62	0	1	1
Asian background	0.09	0	0	0	0.11	0	0	0
Black	0.08	0	0	0	0.05	0	0	0
Other ethnic group	0.09	0	0	0	0.09	0	0	0
Ethnicity missing	0.09	0	0	0	0.12	0	0	0
Never speak English at home	0.02	0	0	0	0.01	0	0	0
Sometimes speak English at home	0.07	0	0	0	0.07	0	0	0
Always speak English at home	0.85	1	1	1	0.82	1	1	1
Home language missing	0.06	0	0	0	0.10	0	0	0
Few books at home	0.16	0	0	0	0.13	0	0	0

1 Bookshelf	0.25	0	0	1	0.22	0	0	0
1 Bookcase	0.18	0	0	0	0.19	0	0	0
2 Bookcases	0.12	0	0	0	0.13	0	0	0
3 Bookcases	0.15	0	0	0	0.15	0	0	0
Books in home missing	0.10	0	0	0	0.15	0	0	0
Eligible for free school meals	0.25	0	0	1	0.18	0	0	0
Some special educational needs	0.19	0	0	0	0.15	0	0	0
Key Stage 2 English below level	0.05	0	0	0	0.04	0	0	0
Key Stage 2 English level 3	0.19	0	0	0	0.18	0	0	0
Key Stage 2 English level 4	0.47	0	0	1	0.47	0	0	1
Key Stage 2 English levels 5 or 6	0.23	0	0	0	0.25	0	0	1
Key Stage 2 Maths below level	0.04	0	0	0	0.04	0	0	0
Key Stage 2 Maths level 2	0.01	0	0	0	0.01	0	0	0
Key Stage 2 Maths level 3	0.22	0	0	0	0.24	0	0	0
Key Stage 2 Maths level 4	0.47	0	0	1	0.47	0	0	1
Key Stage 2 Maths levels 5 or 6	0.22	0	0	0	0.20	0	0	0
Key Stage 2 Science below level	0.02	0	0	0	0.01	0	0	0
Key Stage 2 Science level 2	0.00	0	0	0	0.01	0	0	0
Key Stage 2 Science level 3	0.11	0	0	0	0.13	0	0	0
Key Stage 2 Science level 4	0.49	0	0	1	0.48	0	0	1
Key Stage 2 Science levels 5 or 6	0.34	0	0	1	0.32	0	0	1

Table 2.7 Summary background statistics, for the year 11 pre-policy sample, by whether individuals are in an Aimhigher: Excellence Challenge school or not

	Pre-policy year 11 pilot sample				Pre-policy year 11 comparison sample			
		Percentiles				Percentiles		
	Mean	25	50	75	Mean	25	50	75
Male	0.50	0	1	1	0.44	0	0	1
Lives with mother/step mother	0.90	1	1	1	0.93	1	1	1
Lives with father/stepfather	0.75	1	1	1	0.79	1	1	1
Lives with mother & father	0.72	0	1	1	0.76	1	1	1
Lives with other adult	0.02	0	0	0	0.01	0	0	0
Lives only with children	0.00	0	0	0	0.00	0	0	0
Number of children in household	1.18	0	1	2	1.29	0	1	2
Mother educated to secondary school level	0.73	0	1	1	0.71	0	1	1
Mother attended college	0.31	0	0	1	0.35	0	0	1
Mother university educated	0.12	0	0	0	0.15	0	0	0
Don't know mother's education	0.23	0	0	0	0.26	0	0	1
Mother's education missing	0.07	0	0	0	0.05	0	0	0
Father educated to secondary school level	0.67	0	1	1	0.69	0	1	1
Father attended college	0.27	0	0	1	0.34	0	0	1
Father university educated	0.13	0	0	0	0.17	0	0	0
Don't know father's education	0.26	0	0	1	0.27	0	0	1
Father's education missing	0.09	0	0	0	0.06	0	0	0
Mother/step mother works full time	0.44	0	0	1	0.40	0	0	1
Mother/step mother works part time	0.22	0	0	0	0.22	0	0	0
Mother/step mother doesn't works	0.21	0	0	0	0.27	0	0	1
Mother/step mother work status missing	0.03	0	0	0	0.03	0	0	0
Father/step father works full time	0.58	0	1	1	0.63	0	1	1
Father/step father works part time	0.04	0	0	0	0.03	0	0	0
Father/step father doesn't works	0.10	0	0	0	0.10	0	0	0
Father/step father work status missing	0.03	0	0	0	0.03	0	0	0
Other adult works	0.01	0	0	0	0.00	0	0	0

Other adult doesn't work	0.01	0	0	0	0.00	0	0	0
Other adult work status missing	0.00	0	0	0	0.00	0	0	0
White	0.78	1	1	1	0.58	0	1	1
Asian background	0.06	0	0	0	0.26	0	0	1
Black	0.03	0	0	0	0.05	0	0	0
Other ethnic group	0.06	0	0	0	0.07	0	0	0
Ethnicity missing	0.07	0	0	0	0.04	0	0	0
Never speak English at home	0.02	0	0	0	0.01	0	0	0
Sometimes speak English at home	0.05	0	0	0	0.10	0	0	0
Always speak English at home	0.88	1	1	1	0.87	1	1	1
Home language missing	0.05	0	0	0	0.03	0	0	0
Few books at home	0.16	0	0	0	0.14	0	0	0
1 Bookshelf	0.25	0	0	0	0.26	0	0	1
1 Bookcase	0.21	0	0	0	0.20	0	0	0
2 Bookcases	0.13	0	0	0	0.14	0	0	0
3 Bookcases	0.16	0	0	0	0.19	0	0	0
Books in home missing	0.06	0	0	0	0.05	0	0	0
Eligible for free school meals	0.19	0	0	0	0.16	0	0	0
Some special educational needs	0.14	0	0	0	0.21	0	0	0
Key Stage 2 English below level	0.04	0	0	0	0.05	0	0	0
Key Stage 2 English level 3	0.26	0	0	1	0.29	0	0	1
Key Stage 2 English level 4	0.48	0	0	1	0.39	0	0	1
Key Stage 2 English levels 5 or 6	0.14	0	0	0	0.21	0	0	0
Key Stage 2 Maths below level	0.04	0	0	0	0.05	0	0	0
Key Stage 2 Maths level 2	0.01	0	0	0	0.02	0	0	0
Key Stage 2 Maths level 3	0.28	0	0	1	0.31	0	0	1
Key Stage 2 Maths level 4	0.45	0	0	1	0.38	0	0	1
Key Stage 2 Maths levels 5 or 6	0.16	0	0	0	0.19	0	0	0
Key Stage 2 Science below level	0.03	0	0	0	0.04	0	0	0
Key Stage 2 Science level 2	0.01	0	0	0	0.01	0	0	0
Key Stage 2 Science level 3	0.22	0	0	0	0.26	0	0	1
Key Stage 2 Science level 4	0.49	0	0	1	0.46	0	0	1
Key Stage 2 Science levels 5 or 6	0.18	0	0	0	0.18	0	0	0
Key Stage 3 English below level	0.08	0	0	0	0.06	0	0	0
Key Stage 3 English level 3	0.05	0	0	0	0.05	0	0	0
Key Stage 3 English level 4	0.04	0	0	0	0.04	0	0	0
Key Stage 3 English level 5	0.21	0	0	0	0.26	0	0	1
Key Stage 3 English level 6	0.39	0	0	1	0.34	0	0	1
Key Stage 3 English levels 7 or 8	0.22	0	0	0	0.16	0	0	0
Key Stage 3 Maths below level	0.07	0	0	0	0.11	0	0	0
Key Stage 3 Maths level 2	0.01	0	0	0	0.03	0	0	0
Key Stage 3 Maths level 3	0.01	0	0	0	0.01	0	0	0
Key Stage 3 Maths level 4	0.08	0	0	0	0.09	0	0	0
Key Stage 3 Maths level 5	0.22	0	0	0	0.21	0	0	0
Key Stage 3 Maths level 6	0.26	0	0	1	0.22	0	0	0
Key Stage 3 Maths levels 7 or 8	0.23	0	0	0	0.18	0	0	0
Key Stage 3 Science below level	0.15	0	0	0	0.24	0	0	0
Key Stage 3 Science level 2	0.01	0	0	0	0.01	0	0	0
Key Stage 3 Science level 3	0.01	0	0	0	0.01	0	0	0
Key Stage 3 Science level 4	0.11	0	0	0	0.11	0	0	0
Key Stage 3 Science level 5	0.24	0	0	0	0.29	0	0	1
Key Stage 3 Science level 6	0.32	0	0	1	0.26	0	0	1
Key Stage 3 Science levels 7 or 8	0.22	0	0	0	0.17	0	0	0
Key Stage 3 data missing	0.05	0	0	0	0.12	0	0	0

Table 2.8 Summary background statistics, for the year 11 post-policy sample, by whether individuals are in an Aimhigher: Excellence Challenge school or not

	Post-policy year 11 pilot sample	Post-policy year 11 comparison sample

		Percentiles				Percentiles		
	Mean	25	50	75	Mean	25	50	75
Male	0.47	0	0	1	0.46	0	0	1
Lives with mother/step mother	0.89	1	1	1	0.86	1	1	1
Lives with father/stepfather	0.73	0	1	1	0.70	0	1	1
Lives with mother & father	0.70	0	1	1	0.67	0	1	1
Lives with other adult	0.02	0	0	0	0.01	0	0	0
Lives only with children	0.00	0	0	0	0.01	0	0	0
Number of children in household	1.51	0	1	2	1.47	0	1	2
Mother educated to secondary school level	0.70	0	1	1	0.62	0	1	1
Mother attended college	0.33	0	0	1	0.26	0	0	1
Mother university educated	0.14	0	0	0	0.08	0	0	0
Don't know mother's education	0.24	0	0	0	0.28	0	0	1
Mother's education missing	0.08	0	0	0	0.13	0	0	0
Father educated to secondary school level	0.65	0	1	1	0.58	0	1	1
Father attended college	0.31	0	0	1	0.26	0	0	1
Father university educated	0.16	0	0	0	0.10	0	0	0
Don't know father's education	0.27	0	0	1	0.29	0	0	1
Father's education missing	0.11	0	0	0	0.15	0	0	0
Mother/step mother works full time	0.40	0	0	1	0.32	0	0	1
Mother/step mother works part time	0.21	0	0	0	0.17	0	0	0
Mother/step mother doesn't works	0.24	0	0	0	0.31	0	0	1
Mother/step mother work status missing	0.05	0	0	0	0.06	0	0	0
Father/step father works full time	0.54	0	1	1	0.49	0	0	1
Father/step father works part time	0.05	0	0	0	0.04	0	0	0
Father/step father doesn't works	0.10	0	0	0	0.12	0	0	0
Father/step father work status missing	0.04	0	0	0	0.04	0	0	0
Other adult works	0.01	0	0	0	0.01	0	0	0
Other adult doesn't work	0.01	0	0	0	0.00	0	0	0
Other adult work status missing	0.00	0	0	0	0.00	0	0	0
White	0.65	0	1	1	0.44	0	0	1
Asian background	0.13	0	0	0	0.27	0	0	1
Black	0.06	0	0	0	0.07	0	0	0
Other ethnic group	0.08	0	0	0	0.11	0	0	0
Ethnicity missing	0.08	0	0	0	0.11	0	0	0
Never speak English at home	0.02	0	0	0	0.02	0	0	0
Sometimes speak English at home	0.07	0	0	0	0.11	0	0	0
Always speak English at home	0.85	1	1	1	0.77	1	1	1
Home language missing	0.05	0	0	0	0.10	0	0	0
Few books at home	0.15	0	0	0	0.16	0	0	0
1 Bookshelf	0.24	0	0	0	0.28	0	0	1
1 Bookcase	0.19	0	0	0	0.20	0	0	0
2 Bookcases	0.14	0	0	0	0.11	0	0	0
3 Bookcases	0.19	0	0	0	0.11	0	0	0
Books in home missing	0.07	0	0	0	0.10	0	0	0
Eligible for free school meals	0.22	0	0	0	0.26	0	0	1
Some special educational needs	0.13	0	0	0	0.13	0	0	0
Key Stage 2 English below level	0.04	0	0	0	0.04	0	0	0
Key Stage 2 English level 3	0.25	0	0	0	0.29	0	0	1
Key Stage 2 English level 4	0.48	0	0	1	0.48	0	0	1
Key Stage 2 English levels 5 or 6	0.16	0	0	0	0.11	0	0	0
Key Stage 2 Maths below level	0.04	0	0	0	0.05	0	0	0
Key Stage 2 Maths level 2	0.01	0	0	0	0.02	0	0	0
Key Stage 2 Maths level 3	0.31	0	0	1	0.36	0	0	1
Key Stage 2 Maths level 4	0.41	0	0	1	0.36	0	0	1
Key Stage 2 Maths levels 5 or 6	0.16	0	0	0	0.12	0	0	0
Key Stage 2 Science below level	0.02	0	0	0	0.03	0	0	0

Key Stage 2 Science level 2	0.01	0	0	0	0.01	0	0	0
Key Stage 2 Science level 3	0.23	0	0	0	0.28	0	0	1
Key Stage 2 Science level 4	0.51	0	1	1	0.49	0	0	1
Key Stage 2 Science levels 5 or 6	0.15	0	0	0	0.09	0	0	0
Key Stage 3 English below level	0.08	0	0	0	0.10	0	0	0
Key Stage 3 English level 3	0.06	0	0	0	0.07	0	0	0
Key Stage 3 English level 4	0.03	0	0	0	0.03	0	0	0
Key Stage 3 English level 5	0.20	0	0	0	0.20	0	0	0
Key Stage 3 English level 6	0.35	0	0	1	0.36	0	0	1
Key Stage 3 English levels 7 or 8	0.24	0	0	0	0.22	0	0	0
Key Stage 3 Maths below level	0.08	0	0	0	0.07	0	0	0
Key Stage 3 Maths level 2	0.01	0	0	0	0.01	0	0	0
Key Stage 3 Maths level 3	0.01	0	0	0	0.01	0	0	0
Key Stage 3 Maths level 4	0.09	0	0	0	0.10	0	0	0
Key Stage 3 Maths level 5	0.21	0	0	0	0.22	0	0	0
Key Stage 3 Maths level 6	0.25	0	0	1	0.26	0	0	1
Key Stage 3 Maths levels 7 or 8	0.23	0	0	0	0.21	0	0	0
Key Stage 3 Science below level	0.02	0	0	0	0.01	0	0	0
Key Stage 3 Science level 2	0.01	0	0	0	0.01	0	0	0
Key Stage 3 Science level 3	0.01	0	0	0	0.01	0	0	0
Key Stage 3 Science level 4	0.08	0	0	0	0.10	0	0	0
Key Stage 3 Science level 5	0.22	0	0	0	0.26	0	0	1
Key Stage 3 Science level 6	0.33	0	0	1	0.35	0	0	1
Key Stage 3 Science levels 7 or 8	0.24	0	0	0	0.18	0	0	0
Key Stage 3 data missing	0.07	0	0	0	0.03	0	0	0

Table 4.1 Regression difference in differences estimates of Aimhigher: Excellence Challenge's impact on year 9 pupils

	Year 9					
	Diff-in-diff estimate		Year 1 estimate		Year 2 estimate	
Likely to leave full time education at…	coefficient	Standard error				
Age 16	-1.3	(1.0)	1.4	(0.9)	0.0	(0.7)
Age 17	-1.5	(0.9)	0.6	(0.7)	-0.8	(0.5)
Age 18	-0.9	(1.3)	-0.8	(1.1)	-1.8*	(0.7)
Age 20 +	2.4	(1.6)	-0.5	(1.3)	2.0*	(0.2)
Don't know	0.3	(1.7)	0.3	(1.4)	0.4	(1.0)
Answer missing	1.1	(0.7)	-1.0	(0.5)	0.1	(0.4)
Attained level 4, 5 or 6 in Key Stage 3…						
English	2.5	(1.4)	-1.2	(1.2)	0.7	(0.8)
Maths	4.6*	(1.5)	-2.0	(1.1)	2.4*	(0.9)
Science	1.2	(1.4)	-0.1	(1.2)	0.6	(0.8)
No result/missing data on Key Stage 3…						
English	-1.2	(0.7)	0.0	(0.5)	-1.0*	(0.4)
Maths	-1.0	(1.1)	-0.2	(0.5)	-3.2*	(0.8)
Science	0.5	(0.7)	-0.6	(0.6)	0.0	(0.4)

Note: * indicates statistical significance at the 5% level.

Table 4.2 Regression difference in differences estimates of Aimhigher: Excellence Challenge's impact on year 11pupils

	Year 11					
	Diff-in-diff estimate		Year 1 estimate		Year 2 estimate	
Likely to leave full time education at…	coefficient	Standard error				
Age 16	-1.2	(1.5)	1.8	(1.3)	1.0	(0.8)
Age 17	-0.2	(0.9)	-0.3	(0.8)	-0.7	(0.5)
Age 18	1.0	(1.9)	-1.7	(1.7)	-0.9	(1.1)
Age 20 +	3.9*	(1.9)	-1.1	(1.6)	2.9*	(1.1)
Don't know	-2.3	(1.7)	1.3	(1.5)	-1.1	(1.0)
Answer missing	-1.2	(0.8)	0.0	(0.7)	-1.1*	(0.5)
Mark in…						
GCSE English	0.2*	(0.0)	-0.0	(0.3)	0.3*	(0.0)
GCSE Maths	0.0	(0.0)	-0.0	(0.0)	0.0	(0.0)
Total GCSEs taken	2.5*	(0.5)	-2.4*	(0.4)	0.5	(0.3)
8 best GCSEs taken	1.6*	(0.3)	-1.2*	(2.6)	0.5*	(0.2)
Average GCSE mark	0.1*	(0.0)	-0.1	(0.0)	0.1*	(0.0)
Number of GCSEs A* to C	0.3*	(0.1)	-0.2*	(0.1)	0.1	(0.1)

No result/missing data …						
GCSE English	-1.2*	(0.6)	0.5	(0.5)	-1.1*	(0.3)
GCSE Maths	-0.5	(0.5)	0.8*	(0.4)	0.2	(0.3)
Aggregate GCSE results	0.3	(0.3)	-0.4	(0.2)	0.0	(0.2)

Note: * indicates statistical significance at the 5% level.

Table 4.3 Matching difference in differences estimates of Aimhigher: Excellence Challenge effects for year 9

	Pilot area post-policy P_1	Comparison area post-policy C_1	Pilot area pre-policy P_0	Comparison area pre-policy C_0	Aimhigher: Excellence Challenge effect $(P_1 - C_1) - (P_0 - C_0)$
Likely to leave full time education at…					
Age 16	11.6	10.7	10.8	12.0	2.0
Age 17	5.9	5.5	6.1	5.2	-0.4
Age 18	12.9	13.3	14.9	14.7	-0.7
Age 20 +	32.8	33.8	32.8	31.9	-1.9
Don't know					
No answer	6.4	7.3	6.1	5.9	-1.1
Attained level 4, 5 or 6 in Key Stage 3…					
English	77.5	74.9	77.8	78.1	2.9
Maths	67.5	67.5	63.5	70.4	6.9
Science	77.7	77.3	77.1	78.4	1.8
No result/missing data on Key Stage 3…					
English	4.1	2.7	4.7	2.3	-1.0
Maths	18.9	2.9	24.3	3.0	-5.3
Science	2.8	3.4	2.7	4.4	1.1

Note: figures may not sum due to rounding

Table 4.4 Matching difference in differences estimates of Aimhigher: Excellence Challenge effects for year 11

	Pilot area post-policy P_1	Comparison area post-policy C_1	Pilot area pre-policy P_0	Comparison area pre-policy C_0	Aimhigher: Excellence Challenge effect $(P_1 - C_1) - (P_0 - C_0)$
Likely to leave full					

time education at…					
Age 16	13.9	15.1	12.3	12.2	-1.2
Age 17	4.8	3.8	5.7	4.0	-0.7
Age 18	24.8	25.0	26.1	31.0	4.7
Age 20 +	31.0	32.1	28.0	30.9	1.8
Don't know					
No answer	6.8	7.0	8.5	5.1	-3.7
Mark in…					
GCSE English	4.5	4.6	4.2	4.4	0.2
GCSE Maths	3.7	3.8	3.6	3.7	0.0
Total GCSEs taken	42.1	41.0	39.9	45.3	6.5
8 best GCSEs taken	35.8	35.5	34.0	38.0	4.4
Average GCSE mark	4.2	4.3	4.0	4.5	0.5
Number of GCSEs A* to C	5.1	4.8	5.0	5.3	0.7
No result/missing data …					
GCSE English	1.7	2.3	3.3	2.0	-1.9
GCSE Maths	1.5	1.5	1.6	0.9	-0.6
Aggregate GCSE results	0.4	0.3	0.5	0.7	0.3

Note: figures may not sum due to rounding

Table 5.1 The combinations of cost and rate of return required to pass a simple Cost Benefit Analysis under a 3.9 and 1.8 percentage point increase in Higher Education participation

Increase in tertiary education due to policy	Equivalent Real rate of return	Equivalent Annual cost of policy
3.9 percentage points	2.5%	£725
3.9 percentage points	3.5%	£537
3.9 percentage points	5.0%	£342
3.9 percentage points	7.5%	£160
1.8 percentage points	2.5%	£334
1.8 percentage points	3.5%	£248
1.8 percentage points	5.0%	£158
1.8 percentage points	7.5%	£73

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