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An analysis of the educational progress of children with special educational needs

Claire Crawford[*], **Anna Vignoles** [†]

Abstract. One in five children in England are recorded as having some kind of special educational need, meaning that they receive additional help in school; yet there is very little evidence of the effect of such assistance on pupil's academic progress. This is at least partly because it is usually very difficult to define an appropriate control group for pupils with special educational needs. To overcome this issue, we make use of extremely rich data from the Avon Longitudinal Study of Parents and Children to assess the academic progress of pupils between Key Stages 1 and 2 (ages 7 and 11). Specifically, we compare the progress of children who have been formally identified by the SEN system as having non-statemented (less severe) needs with the progress of children who do not have SEN label, but whose class teacher reports that they exhibit behaviour which suggests that they might have special educational needs. Our results suggest that, despite our very similar control group, pupils with a SEN label still score about 0.3 standard deviations lower at Key Stage 2 than otherwise identical pupils without a SEN label. This is perhaps not an entirely unexpected result, given that there is no compulsion in the system for non-statemented SEN funding to be spent on children with special educational needs and in any case additional resources may not close the gap completely. Nonetheless, such a result clearly has significant policy implications: schools are provided with resources to help children with special educational needs and if these resources are not improving academic outcomes for these children, then this should be of concern to both parents and policymakers alike.

JEL classification: I2, H52.

Keywords: special educational needs, educational attainment, propensity score matching.

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1. Introduction

In England, just over one in five children are recorded as having some kind of special educational need (SEN), meaning that they require additional support to aid their learning. This proportion peaks amongst 9 year olds (at over 25%)[1] and has been steadily increasing over time. The 2010 Lamb Inquiry into Special Educational Needs and Parental Confidence (Lamb, 2010) and the 2010 Ofsted Special Educational Needs and Disability Review (Ofsted, 2010) both stressed the need to better monitor the progress of pupils with SEN and in particular to avoid low expectations of the academic achievement of these children. Ofsted (2010) also questioned whether too many children are being identified as having special educational needs and claimed that "effective identification and good-quality provision was not common". These criticisms of the system motivate our paper. There is a pressing public policy need to compare the academic performance of children identified as having special educational needs with that of other children as they progress through the education system, as a means of evaluating the likely effectiveness of SEN provision in schools. The purpose of this paper is to address this evidence gap, by examining whether primary school pupils identified as having (non-statemented (less severe) special educational needs make more or less academic progress than otherwise identical pupils who are not identified as having special educational needs.

The effect of SEN provision on the outcomes of those who receive assistance is a significant education policy issue not only because it involves a large minority of each cohort of students, but also because significant resources are spent supporting pupils with special educational needs. Expenditure on SEN provision amongst local authorities in England has been increasing in recent years, from £3.8bn in 2004-05 to £4.1bn in 2005-06, constituting around 13% of all education spending (House of Commons Education and Skills Committee, 2006). The SEN funding system is, however, remarkably opaque and there is a dearth of evidence on its effectiveness in terms of aiding pupil progress, an issue highlighted by Audit Commission (2002) and House of Commons Education and Skills Committee (2006). While we are unable to address the issue of funding directly, a key motivation for this paper is the need to provide robust quantitative evidence on the

[1] Authors' calculations based on DfE (2010).

academic progress of children with special educational needs, to inform policymakers about the likely effectiveness of SEN funding.

Of course the lack of evidence on the progress made by children with special educational needs is partly attributable to the classic evaluation problem, namely that it is difficult to find an appropriate control group against which to compare the academic achievement of pupils with SEN. For example, children with special educational needs are more likely to be from socio-economically disadvantaged families and are also more likely to be low achievers than children who do not have special educational needs (Ofsted, 2010). They may also differ from other children in typically unobserved ways; for example, they may have lower IQ or difficulty concentrating in class.

A common approach taken by economists to solve this problem is to use individual fixed effects models, whereby the problem of a control group is solved by comparing individuals to themselves. This approach relies on changes in individuals' SEN status over time to identify the model, and assumes that any unobserved pupil factors that might be correlated with SEN status and academic achievement (e.g. IQ) are fixed over time. Examples of work that makes use of this approach to analyse the impact of SEN programmes on academic performance include a seminal US study by Hanushek et al. (2002), and a recent UK study by Meschi & Vignoles (2010) focusing on secondary school pupils. The problem with fixed effect models, however, is that they assume there are no time varying unobserved characteristics correlated with the explanatory variable of interest, i.e. SEN status, and the dependent variable, i.e. academic achievement. Yet of course changes in SEN status may be brought about by changes in individuals' academic progress, making the change in SEN status endogenous.

An alternative approach to identifying the effect of SEN status on educational attainment is to make use of instrumental variables techniques. For example, Keslair et al. (2009) investigated the impact of having moderate special educational needs by using an instrument exploiting the fact that, for a given level of prior attainment, there is variation in the likelihood of being labelled SEN across schools. Using administrative data on primary schools in England, they found no significant effect on academic performance

(either positive or negative) of being identified as having moderate special educational needs. One of the main problems with this type of approach, however, is that the possibility of heterogeneous effects of the SEN programme is problematic. As we discuss in detail below, there are strong reasons to believe that the SEN programme – and hence the treatments received – are likely to be heterogeneous, potentially undermining the instrumental variables approach to address this question.

In this paper, we instead make use of an incredibly rich birth cohort data set, the Avon Longitudinal Study of Parents and Children (ALSPAC), to try to take account of selection into the SEN treatment group on the basis of a very wide range of observable characteristics. The use of ALSPAC data enables us to control for factors that are usually unobserved in other survey data and certainly not included in administrative datasets, such as IQ and clinic measures of attention and behaviour, which may be particularly relevant for identifying children with special educational needs. Specifically, we make use of these rich data to identify a more appropriate control group against which to compare the academic progress of pupils with special educational needs, using ordinary least squares (OLS) and propensity score matching methods.

The main limitation of our approach is that we are only able to take account of selection on observables, hence the quality of the data we use is central to the plausibility of our results. The ALSPAC data includes a variety of measures of cognitive, socio-emotional and behavioural development of children at multiple points in time (as assessed by parents, teachers and health care professionals), as well as the usual family background and school characteristics. Moreover, the primary school teachers of the ALSPAC cohort members were asked a series of questions that could be used to identify children with some form of special educational need. Given that teachers are arguably best able to judge whether a child is having difficulties accessing the curriculum or coping in school, our proposed control group is children who did not have a SEN label (i.e. were not formally identified by the education system as having SEN, and hence were not subject to any specific SEN intervention), but whose teacher suggests that they may have some kind of special educational need.

Within this restricted sample, we would hope that the allocation of SEN labels is close to random once we have controlled for the rich set of observable characteristics available in ALSPAC, but this is, in essence, an un-testable identifying assumption. Moreover, we cannot bound our estimates of the effect of SEN labels on attainment, because it is plausible that there are unobserved characteristics working in opposite directions. On the one hand, if "pushy parents" want to obtain the maximum possible support for their child by getting them labelled, and also work closely with them at home to ensure that they perform to the best of their ability in school, then we may be under-estimating the true effect of SEN labels on attainment, because there is an unobserved characteristic that is positively correlated with both SEN labelling and attainment. If, on the other hand, those who are labelled are more likely to be those from the very bottom of the needs distribution, with unobserved characteristics that are negatively correlated with attainment, then we may be over-estimating the effect of SEN labelling on attainment. To our mind, the evidence suggests that the latter is more likely than the former, but we cannot rule out the former.

Aside from the issue of selection on observables, there are some other potential difficulties with our approach: the ALSPAC study focuses on individuals born in a relatively small area (Avon, in the south west of England), which means that we not only have considerably smaller sample sizes than in administrative data studies, but that the results may not be generalisable across England, not least because the range of SEN treatments in evidence may be more homogeneous in Avon than across the country as a whole. The measures that we use to define our control group are also focused on behavioural rather than physical needs which means that our results may not be representative of the academic progress of individuals with all types of special educational needs. Nonetheless we argue that these data allow us to investigate more carefully than has hitherto been possible whether pupils who have been formally identified as having special educational needs make more or less academic progress than similar children who have not.

This paper now proceeds as follows: Section 2 discusses the policy framework for identification of and provision for children with special educational needs in England,

Section 3 describes the data that we use and Section 4 discusses the methodology that we adopt. Section 5 presents our main results, on the relative academic progress of primary school pupils with non-statemented SEN labels compared to otherwise identical pupils without SEN labels using OLS and propensity score matching techniques. Section 6 concludes.

2. Special Educational Needs Policy in England

While a complete account of the workings of the special educational needs system in England is beyond the scope of this paper, this section aims to highlight some of the key features that are relevant to our analysis.

The 2001 Special Educational Needs Code of Practice is, in theory at least, the current basis for categorising students in terms of the extent of their special educational needs. Over the period covered by our data, the Education Act (1996) and the Code of Practice on the Identification and Assessment of Special Educational Needs (1994) formed the relevant legislation addressing SEN provision. While the specific categories of special educational needs changed between 1998 (when the oldest ALSPAC cohort members turned seven) and 2001, the main features of the SEN system remained unaltered. In particular, the key features of the system both in 1998 and today are that: a) the majority of children identified as having special educational needs will have their needs met within a mainstream school, and b) a minority of children with special educational needs require additional support that is identified in a "statement", for which resources are provided by their local authority (see below for further details).

The criteria used to classify a child as having special educational needs have certainly changed somewhat over time, but the main issue relevant to this paper is heterogeneity in the identification of and provision for special educational needs at a given point in time. Ofsted (2010) found that around half of the schools they visited used low attainment and slow academic progress as the principal indicator for a child having special educational needs, rather than any specific medical or learning difficulty. Moreover, there is evidence of significant variation both within and between local authorities in terms of the

identification of children with special educational needs (Lamb, 2010; Ofsted, 2010), even amongst children with similar levels of (low) achievement (Keslair et al, 2009). Keslair et al also show that pupils with the same levels of (low) achievement are more likely to be given a SEN label in schools with high average attainment than in schools with low average attainment, a finding which is confirmed by this study.

As has been said, children with the most severe special educational needs are given a *statement* of their needs, which clearly specifies what the child is entitled to in the way of additional support. Local authorities are responsible for assessing applications for statements, determining the resources needed by the child and funding this additional provision. This system provides a clear incentive for local authorities to under-identify and under-resource the needs of statemented SEN pupils (Lamb, 2010). Schools, by contrast, have an incentive to help pupils with the most severe needs to secure SEN statements, since this brings additional resources to the school. Given these pressures, the issue of whether SEN statements adequately identify the actual needs of children is hotly contested (Lamb, 2010; Ofsted, 2010). Nonetheless, the proportion of primary and secondary school pupils with a statement of special educational needs has changed very little over the past ten years, hovering around 3%. There was, however, an upward trend in the 1990s. In 1993, for example, just 2.3% of pupils had a statement of SEN. It is also worth noting that the proportion of children with statements is/was lower for primary schools than secondary schools (1.3% vs. 2.4% respectively in 1998) (DfES, 1998)

The proportion of primary and secondary school students with statements of special educational needs also varies by local authority and in Avon – the area in which our study is based – the proportion is marginally higher than the national average. In 1998, the proportions of children with a statement of SEN in our data by local authority were as follows: Bath/North East Somerset (2.7%), City of Bristol (4.0%), North Somerset (3.1%) and South Gloucestershire (3.1%). This compares to a national average of 2.9%.

While the proportion of children with a statement of special educational needs has remained relatively constant over the last decade or so, the proportion of primary and secondary school pupils identified as having *non-statemented* (less severe) special

educational needs has been changing over time. In 1998, 18.4% of primary school pupils were identified as having non-statemented special educational needs (the corresponding figure for secondary school pupils was 15.6%) (DfES, 1998). This had fallen to 15.7% by 2005-06 before rising again to18.5% in 2009-10 (DfE, 2010). Again, this varies by local authority, and in 1998, the proportions of primary school children with non-statemented SEN in Avon were as follows: Bath/North East Somerset (17.2%), the City of Bristol (22.6%), North Somerset (17.1%) and South Gloucestershire (17.0%).

Unlike pupils with a SEN statement, pupils with non-statemented needs receive a range of different resources and support, depending on their school, local authority and personal circumstances. Administrative data does not record the type of intervention experienced by these groups of children; nor is it available in the survey data that we use. Hence whilst we adopt conventional evaluation terminology and think about children with SEN labels as receiving a "treatment", whose effect on progress we are trying to evaluate, we are aware that the treatment (and hence the potential effects of the treatment) received by these pupils is extremely heterogeneous (Ofsted, 2010).

In the most recent administrative data, it is possible to identify a child's primary special educational need. (Unfortunately we cannot observe this information for the period covered by our data, hence this information should be viewed as indicative only.) Amongst children with non-statemented SEN at age 11 in 2008-09, around 33% have moderate learning difficulties, 20% have behavioural, emotional or social difficulties, and 5% have Autistic Spectrum Disorder (Meschi & Vignoles, 2010). Hence more than half of those with non-statemented special educational needs have some form of behaviour based need. Thus, by focusing largely on reports of behaviour and attention to identify an appropriate control group for our analysis (see Section 3 for more details), we are nonetheless focusing on what constitutes a relatively large proportion of the pupils with non-statemented special educational needs.

Within the non-statemented SEN group there are two distinct categories of provision: "school action" (14.5% of pupils in Year 6 (age 10/11) in 2009-10) and "school action plus" (8% of pupils in Year 6 in 2009-10). School action refers to pupils whose special

educational needs are being met by the school from within their existing budget. Schools that identify a child as requiring school action will themselves determine the level of additional support necessary for the pupil and provide it from within existing resources. School action is likely to mean that the child needs a relatively low level intervention, e.g. some help from a teaching assistant or additional monitoring by their class teacher. School action plus implies that the child needs help from outside the school (e.g. from an educational psychologist or speech and language therapist) to fully address their needs. As with school action, the level of support necessary is determined by the school and interventions are funded from within the existing school budget. Although these precise categories of SEN have changed since 1998, the period relevant to our data, there was at that time still a distinction between children whose special educational needs were met by the school and those who needed additional support from outside the school.

As non-statemented SEN provision is funded from within school resources, this could provide an incentive for schools to under-identify pupils' special educational needs. On the other hand, all schools have a "notional" SEN budget, i.e. part of their dedicated schools grant which is supposed to fund non-statemented provision (as well as the additional learning needs of other types of pupils, such as those eligible for free school meals): of the £4.9bn spent on SEN in 2007-08, the Audit Commission estimated that £2bn was allocated to mainstream schools directly via their dedicated schools grant.[2] Schools may therefore have an incentive to identify *more* pupils as having non-statemented SEN in order to increase the amount of dedicated schools grant they receive. Having said this, however, the notional SEN budget is not ring-fenced, i.e. there is no compulsion for schools to spend the additional money that they receive on children with special educational needs. This means that it is possible that non-statemented SEN expenditure may impact largely on children *without* special educational needs, either because the money is spent on improving teaching across the board, or because the provision of additional support for disruptive pupils may improve the learning conditions for other pupils in the class.

[2] Source: http://www.sen-aen.audit-commission.gov.uk/static.aspx?page=intro2a.

Aside from the financial ramifications associated with labelling children as having special educational needs, there are (at least) two other obvious motivations that might affect the proportion of children that schools choose to label. First is the fact that having a high proportion of children with special educational needs may deter the parents of children without such needs from applying to that school. Second, as noted in Ofsted (2010): *"Some schools visited believed that identifying more pupils with special educational needs resulted in a positive influence on the school's contextual value-added score [used to derive league table positions]. This provided an incentive for higher levels of pupils to be identified as having special educational needs."*

These features of the SEN system have implications for our analysis. First, we focus on the academic progress of children with non-statemented SEN (and ignore those with statemented SEN), largely because we are more likely to be able to match those children with less severe needs to similar children without SEN labels, i.e. we are more confident about finding an appropriate control group. Second, there are many reasons why we might not necessarily expect to observe a systematic positive relationship between SEN labelling and academic progress (even with an otherwise identical control group). We return to this issue in the discussion of our results.

3. Data

We use the Avon Longitudinal Study of Parents and Children (ALSPAC) for our analysis.[3] ALSPAC is a longitudinal survey that has followed the children of around 14,000 pregnant women whose expected date of delivery fell between 1st April 1991 and 31st December 1992, and who were resident in the Avon area of England at that time. This means that ALSPAC cohort members were born in one of three academic years: 1990-92 (sitting Key Stage 1 in 1997-98 and Key Stage 2 in 2001-02), 1991-92 (sitting Key Stage 1 in 1998-99 and Key Stage 2 in 2002-03) and 1992-93 (sitting Key Stage 1 in 1999-2000 and Key Stage 2 in 2003-04).

[3] See http://www.bristol.ac.uk/alspac/sci-com/ for more details on the ALSPAC data resource.

ALSPAC cohort members and their families have been surveyed via high frequency postal questionnaires from the time of pregnancy onwards, with information collected on a wide range of family background characteristics, including mother's and father's education and occupational class, income, housing tenure, and so on. Key Stage test results (at ages 7, 11, 14 and 16), plus limited personal characteristics – including special educational needs status – have also been linked in from administrative sources.

These characteristics are typically available in most English longitudinal surveys. In addition, however, ALSPAC cohort members have been monitored through a number of hands-on clinics, during which staff administer a range of detailed physical, psychometric and psychological tests. This provides us with a series of measures which may be particularly relevant to the identification of children with non-statemented special educational needs – including IQ, various measures of non-cognitive skills, such as the Strengths and Difficulties Questionnaire (SDQ), and a range of clinical assessments of behavioural difficulties, like identification of children with Attention Deficit Hyperactivity Disorder (ADHD).

Our sample comprises those individuals for whom we observe Key Stage 1 and Key Stage 2 scores, SEN status (taken from administrative data at age 10/11) and indicators of special educational needs from a teacher questionnaire at age 10/11 (described in more detail below). As has already been said, our analysis focuses on the academic progress of pupils with non-statemented SEN labels, so we exclude pupils with SEN statements from our sample. We also exclude SEN pupils who attend special or independent schools. This leaves us with a total sample of 7,742 pupils attending 278 different schools. Amongst these schools, the proportion of children with special educational needs ranges from 0.9% to 36.2% (which corresponds to the 87th percentile amongst non-special, non-independent schools in England as a whole).

Appendix Table A1 provides some selected descriptive statistics of the individuals in our sample, together with a comparison to the relevant school-age population in England (from the National Pupil Database). Our sample appears to be nationally representative of England, at least in terms of Key Stage 2 achievement and the proportion of children with

special educational needs. However, the sample we are using has a far lower proportion of children who are eligible for free school meals (a proxy for low family income) than the national average; it also contains a very small proportion of children who are of non-white ethnic origin. This reflects the nature of the Avon geographical area and suggests that some caution is needed before generalising results to England, at least in terms of ethnicity and socio-economic status.

Construction of an appropriate control group

Central to our analysis is the construction of an alternative measure of "special educational needs" using information collected from teachers, which will form the basis of a control group against which to compare the progress of children who have been formally identified as having SEN. These measures are taken from a questionnaire completed by the child's class teacher when they are in Year 6 (age 10/11) and are binary – taking value one if any of the factors considered suggests that the child may have special educational needs, and zero otherwise. Our indicator of special educational needs according to the child's class teacher is constructed from the following data:

- Child exhibits 'abnormal' behaviour based on SDQ scores[4];
- Child has severe attention difficulties which interfere with his/her school work;
- Child has severe behavioural difficulties which interfere with his/her school work.

18% of our sample has been formally identified by the school system as having non-statemented SEN (25% for boys, 11% for girls). By contrast, 28% of our sample would be identified as having special educational needs according to these teacher reports (38%

[4] The SDQ is a short behavioural screening questionnaire for children aged between 3 and 16. It comprises five questions in each of five sections, designed to capture emotional symptoms, conduct problems, hyperactivity/inattention, peer relationship problems and pro-social behaviour. Respondents are presented with a series of statements about the child's behaviour and asked to decide whether the statement is "not true" (receiving a score of zero), "somewhat true" (receiving and score of one) or "certainly true" (receiving a score of two). A total SDQ score is calculated by summing together scores from the emotional symptoms, conduct problems, hyperactivity/ inattention and peer relationship problems components, giving a maximum score of 40. Children are judged to exhibit 'abnormal' behaviour if they score 17 or above on the mother completed questionnaire, and 16 or above on the teacher completed questionnaire. 4.8% of our sample exhibit 'abnormal' behaviour according to their mother (at age 9), and 8.9% according to their teacher (at age 10). See http://www.sdqinfo.com/b1.html for more details.

for boys, 18% for girls). Thus the teacher reports suggest a relatively higher incidence of special educational needs than the formal SEN system, particularly for boys.

We argue that children whose teacher reports them as having special educational needs will constitute a good control group against which to compare the progress of children who have been formally identified as having non-statemented SEN. It is important, therefore, to consider the correlation between the non-statemented SEN label and the teacher report that a child has special educational needs. Clearly if the correlation between the formal label and the teacher reports is too high we cannot use the latter to identify a control group, since most pupils reported by their teacher as having special educational needs would also have a formal non-statemented SEN label. However, some degree of positive correlation would suggest that both measures are identifying children with similar characteristics. In fact 63% of pupils with non-statemented SEN labels were identified by teachers as having special educational needs, whilst of those pupils who the teacher thought had SEN, only 40% had been formally identified by the system. The fact that the correlation is less than 100% also suggests that teachers are not simply reflecting the child's formal SEN status in their answers to questions about whether the child has special educational needs.

In the analysis that follows, we make two comparisons:

1) Between all children with and without a non-statemented SEN label (this can be regarded as the benchmark against which to judge the success of our control group using teacher reports of special educational needs);
2) Between all children with a SEN label and all children without a SEN label but whose teacher reports that they have some form of special educational need (this comparison restricts our control group);

Table 1 selectively compares the characteristics of each of these groups in turn. The top panel highlights the substantial differences between children with and without a non-statemented SEN label. For example, children with a non-statemented SEN label score almost five points (equivalent to around 1.3 standard deviations) lower at Key Stage 1, on

average, than children without a SEN label. They also tend to have lower IQs, are significantly more likely to be male and eligible for free school meals, and significantly less likely to be in the top quintile of the family income distribution. The large and significant differences between these two groups suggests that simply comparing the progress of children with and without a SEN label is likely to be problematic.

The bottom panel of Table 1 compares children with a non-statemented SEN label to children without a SEN label but whose teacher thinks that they have special educational needs. These two groups are more similar than those described above, although the children without a label still have significantly higher Key Stage 1 test scores and significantly higher IQ scores than those with a label. Interestingly, there are now only small differences in socio-economic status between the two groups, with children labelled as having non-statemented SEN slightly *more* likely to come from the richest families than children without a label but whose teacher thinks they have special educational needs. Our preferred specification will thus focus on a comparison between children labelled as having special educational needs and children who are not formally labelled as having special educational needs, but whose teacher regards them as having such needs.

We have undertaken numerous robustness checks of our proposed control group by constructing alternatives on the basis of different combinations of the above teacher reports, as well as on the basis of mother[5] and clinic[6] reports of special educational needs from around the same age: none would lead us to make materially different conclusions about the academic progress of children labelled as having SEN.

[5] Maternal measures are based on the following: child exhibits 'abnormal' behaviour based on SDQ scores at age 9; has severe attention difficulties which interfere with school work at age 10; has speech development problems at age 10; scores more than 1 standard deviation above average on the Social and Communication Disorders Checklist (designed to identify autistic symptoms) at age 10. Only 6% of our sample has special educational needs according to maternal reports.

[6] Clinic measures are based on the following: child scores more than 1.5 standard deviations below average in attention tasks at age 8 or 11; has borderline personality disorder at age 11; has ADHD or a related disorder as determined by a psychiatrist (based on mother and teacher reports of behaviour) at age 7. Only 10% of our sample has special educational needs according to clinic measures.

4. Modelling approach

We start by estimating rich OLS models, using a carefully selected control group (based on pupils whose teachers regard them as having certain types of special educational needs, as discussed above), as per equation 1:

$$KS2_{is} = \alpha + \beta_1 KS1_{is} + \beta_2 SEN_{is} + \beta_3 X_{is} + \beta_4 Sch_s + e_{is} \quad (1)$$

where $KS1$ and $KS2$ are standardised average point scores for individual i in school s[7], SEN is an indicator for whether the child is formally identified as having non-statemented special educational needs (i.e. has a non-statemented SEN label), X is a vector of other individual characteristics, Sch is a vector of school characteristics (including the proportion of children in the school with SEN labels), and e is an individual level error term. (See Table 2 for the full list of characteristics included in our models.)

Note that we have chosen not to include fixed or random school effects in our model, both because Clarke et al (2010) showed that they made little or no difference to estimates of the effect of SEN labels on progress, and because it seems unlikely that labels will be (close to) randomly allocated amongst children with similar observed characteristics (including prior attainment) who attend the same school. To see what difference this decision makes to our results, however, we also ran a specification including fixed effects (i.e. replacing Sch with a vector of school dummies u in equation 1 above). (Results available on request.) We find that the raw OLS differences between children with and without a SEN label are slightly larger if we include school fixed effects – confirming our theory that the selection issue is likely to be greater within schools than between schools – but the conditional OLS results are almost identical whether we include school fixed effects or merely control for school characteristics. We thus proceed *without* school fixed effects.

[7] Note that we include quintiles of attainment at age 7 (with the lowest quintile as the omitted category). We have experimented with other linear and non linear specifications (e.g. including quadratic terms) and this does not substantially change our results. By controlling for prior attainment, our model is estimating the change in attainment between age 7 and age 11.

Since the ALSPAC dataset contains such a wealth of information that is normally missing from standard survey datasets – such as IQ, various measures of non-cognitive skills and behaviours, and additional school characteristics – we anticipate that a rich OLS strategy may be adequate. However, such models may produce biased estimates because they:

- Implicitly extrapolate across non-comparable individuals (common support problem);
- May not weight comparable individuals correctly;
- Typically assume that the effect of SEN status is constant across individuals.

While some of these assumptions can be relaxed in an OLS framework (for example, by using fully interacted linear matching models to allow the effect of SEN status to vary by every observable characteristic in the model – see Blundell et al, 2005, for more details), the robustness of matching estimators, as well as the diagnostic statistics they provide (indicating how well our treatment and control groups have been balanced) make matching an attractive alternative to OLS models. With this in mind, our main estimates of the effect of SEN labels on academic progress are based on propensity score matching models (see Imbens, 2004, or Blundell & Costa Dias, 2000, for an extensive review of different matching methods).

The propensity score is obtained by running a probit of the treatment indicator (in this case whether or not the child has a SEN label) on the same set of covariates as in our OLS model, and calculating the predicted probability of being treated. This propensity score is used to judge how 'similar' children with and without SEN labels are to one another. The next step is to match or re-weight the control group to look as similar as possible to the treatment group. There are various ways to do this (see Blundell et al, 2005, for an overview). Here, we use kernel-based propensity score matching, in which every child in the control sample is re-weighted on the basis of their similarity to a given child in the treatment sample. Specifically, this is done using an Epanechnikov kernel and a bandwidth of 0.06. Once these weights have been assigned, the average treatment on the treated (equivalent to β_2 in equation 1 above) is calculated as follows:

$$\beta_2 = E[Y|SEN=1] - E[Y|SEN^{matched}=0] \quad (2)$$

Note that we restrict the calculation of β_2 to individuals on the "common support". This means that we exclude from our analysis pupils with SEN labels whose propensity score lies outside the range of propensity scores amongst pupils without SEN labels. Interestingly, this restriction excludes relatively few individuals from our analysis.

The criteria we will use to judge the success or otherwise of this matching process are:

a) Median bias: indicates the median percentage distance (across all matching variables) between the matched samples in terms of observed characteristics. Ideally, we would like to see a sizeable reduction in the median bias before and after matching.
b) Pseudo R-squared: indicates the explanatory power of a model of the treatment indicator on the matched samples using a full set of covariates. Ideally, we would be looking for close to zero explanatory power when using the matched samples.

It is worth remembering, however, that both OLS and matching models will only produce unbiased estimates of the effect of non-statemented SEN status on academic progress if we are able to fully control for the selection of pupils into labels on the basis of observable characteristics. Despite the incredible richness of our data, we recognise that, in the absence of experimental data, we cannot conclusively ascribe causality to the relationships that we observe.

5. Results

We now move on to discuss our results. We start by comparing and contrasting the determinants of pupils' special educational needs status according to: a) whether or not they have a non-statemented SEN label (Column 1 of Table 2) and, b) teacher reports of the child having some kind of special educational need (Column 2 of Table 2), on the basis of two simple probit models. (Note that Column 1 is the same model that is used to calculate the propensity scores for our initial kernel matching estimates, where we use all children without a SEN label as a potential control group for children with a SEN label. Column 3 of Table 2 presents results from the first stage of our preferred matching estimates, where we use children without a SEN label but whose teacher thinks they have special educational needs as a potential control group.) We present these estimates both

for the readers' interest, and to illustrate the extent to which the two labels are picking up children with similar or dissimilar characteristics.

It is clear from Table 2 that, in line with the findings of Ofsted (2010), prior attainment plays a key role in determining who receives a non-statemented SEN label. Key Stage 1 (KS1) test scores are by far the strongest predictor of formal SEN status, with children in the top quintile of the KS1 distribution 15.4 percentage points less likely to be labelled as having non-statemented SEN than children in the bottom quintile. IQ measured at age 8 also seems to play a small role over and above the effect of Key Stage 1 scores, with pupils in the fourth quintile of the IQ distribution around 3.5 percentage points less likely to be identified as having a non-statemented SEN label than pupils in the bottom quintile. Table 2 also suggests a strong relationship between Key Stage 1 attainment and teacher identification of children with special educational needs; indeed, it is stronger than for the formal SEN labelling process itself: for example, children in the top quintile of the KS1 distribution are 26 percentage points less likely to be regarded as having special educational needs by their teacher, compared to 15 percentage points less likely to have been given a formal SEN label. Conditional on everything else, there is no correlation between IQ and teacher reports of special educational needs.

Reassuringly, Table 2 also suggests that children whose teacher thinks they have special educational needs are more likely to have been formally identified as having non-statemented SEN (after controlling for other characteristics), although these correlations are modest in size. For example, children whose teacher reports that they have severe behavioural difficulties which interfere with their learning are 9.8 percentage points more likely to receive a SEN label. Table 2 also shows that these teacher reports of special educational needs are (collectively) more highly correlated with formal SEN labelling than either the available mother or clinic reports, providing some additional justification for our choice of control group.

Pupils who are eligible for free school meals are 2.4 percentage points more likely to be formally identified as having non-statemented special educational needs, even after controlling for richer measures of family income. Interestingly, this relationship is much

stronger when we consider teacher reports, with FSM pupils 10 percentage points more likely than non-FSM pupils to be regarded as having special educational needs by their teacher. Teachers are also substantially more likely to identify boys as having SEN.

There is also some association between school characteristics and the likelihood of being labelled as having non-statemented SEN. Conditional on everything else, there is some evidence that children in more advantaged schools (with a lower proportion of FSM pupils, and a higher proportion of pupils reaching the expected level) are more likely to be given a non-statemented SEN label, confirming the findings of Keslair et al. (2009) that labelling is partly driven by the characteristics of your peers.

Estimates of the relationship between SEN status and academic progress

We now move on to discuss our main results, from models of the relationship between having a non-statemented SEN label and academic progress between ages 7 and 11. The coefficient estimates for SEN status are presented in Table 3, with all other coefficient estimates (from the OLS models) shown in Appendix Table A3.

Columns 1 to 3 of Table 3 focus on the comparison between all children with a non-statemented SEN label and all children without a non-statemented SEN label. Column 1 presents the results from a "raw" OLS model, which includes only SEN status and prior attainment at age 7. These results indicate that having a non-statemented SEN label is associated with significantly lower Key Stage 2 scores, even after taking into account prior attainment: pupils with special educational needs score, on average, 0.398 standard deviations lower at Key Stage 2 than pupils with the same prior attainment who do not have special educational needs.

In Column 2, we additionally control for the very broad range of covariates described in Table 2, including indicators of socio-economic status, IQ, non-cognitive skills and a range of school characteristics. Surprisingly, the magnitude of the coefficient on SEN status changes very little, despite the addition of this rich set of controls, with children labelled as having non-statemented SEN still scoring 0.361 standard deviations lower at Key Stage 2 than otherwise identical children without SEN. This suggests that children

with special educational needs are different from those without, in ways that are not accounted for by the extremely rich array of characteristics included in our model, which in turn implies that children without special educational needs are sufficiently different from those with non-statemented SEN that they make an inadequate control group.

Column 3 presents the results from a propensity score matching model using the same covariates as in Column 2. In this case, the matching seems to have been carried out quite successfully, both because there has been a substantial reduction in the median bias (of nearly 85%) and because we are relatively unable to explain the allocation of SEN labels across pupils using our full set of covariates (the pseudo R-squared is less than 2%). We have also lost less than 1% of our sample to common support.

Table 4 additionally illustrates the extent to which matching has increased the similarity of children with and without SEN labels, by comparing the means of a number of key characteristics amongst our matched treatment and control samples. This table shows that matching has eliminated all of the significant differences in socio-economic characteristics (including eligibility for free school meals and household income) that we saw in our samples beforehand (in Table 1), and has also substantially reduced (but not eliminated) the differences in IQ and prior attainment. Figure 1 further illustrates the effects of matching on Key Stage 1 attainment across the full distribution.

The results of this matching exercise suggest that children with non-statemented SEN score, on average, 0.408 standard deviations lower at Key Stage 2 than otherwise identical children without SEN. While this estimate is statistically indistinguishable from those obtained using the OLS models, it is interesting that the magnitude of the coefficient from the matching model is actually *larger* than that obtained from the rich OLS model (in Column 2), providing further evidence that the OLS model comparing children with and without special educational needs may not be an appropriate way of estimating the effect of non-statemented SEN status on academic progress.

With this in mind, we now move on to discuss the results obtained from our preferred specification, which compares children with a non-statemented SEN label with children

without a non-statemented SEN label, but whose class teacher reports that they may have special educational needs. (Note that if a child has a non-statemented SEN label *and* their teacher thinks that they may have special educational needs, then they will be in the treatment group.)

Columns 4 and 5 of Table 3 present the results from our rich OLS and matching models respectively. Again, the matching appears to have been carried out fairly successfully, with a 65% reduction in the median bias, a pseudo R-squared of less than 6%, and less than 1% of our sample lost to common support. Table 4 shows that matching has also eliminated all of the significant differences in socio-economic characteristics, and has reduced the difference in Key Stage 1 scores by slightly more than the model above (although it has performed slightly worse in terms of IQ). Again, Figure 1 illustrates the effects of matching on Key Stage 1 attainment across the full distribution.

The estimates shown in Columns 4 and 5 of Table 3 show that, even once we restrict attention to our preferred control group, there is still a large and significant negative relationship between SEN status and Key Stage 2 scores, in both the OLS and matching models. For example, the matching model suggests that children with a non-statemented SEN label score, on average, 0.361 standard deviations lower at Key Stage 2 than otherwise identical children without a SEN label but whose class teacher reports that they may have special educational needs. This is a somewhat surprising result, but, as described above, does not seem to arise from a lack of overlap between the two groups.

Discussion of results

So whichever control group we use – and despite the rich array of controls in our models – we find a persistent negative association between having non-statemented special educational needs and academic progress between ages 7 and 11. There are a number of potential explanations for this:

1) The fact that non-statemented SEN funding is not ring-fenced means that resources may not be targeted directly on children with special educational needs and may instead be used to improve teaching across the board. If such interventions have a

more positive effect on children without SEN than on those with SEN, then we might find a negative association between SEN status and academic progress.

2) Even if non-statemented SEN funding is spent on children with special educational needs, however, it may be that the provision they receive is at best ineffective and at worst detrimental to their progress. For example, Blatchford et al (2009) suggest that there is a negative association between the amount of support a pupil receives from a teaching assistant and their subsequent academic attainment. Given that teaching assistants are often used to provide support for children with special educational needs, this may provide a plausible explanation for our findings.
3) Pupils who are labelled as having special educational needs may feel stigmatised, or may suffer from low self-esteem as a result of being labelled, which may have a detrimental effect on their progress.
4) Similarly, teachers may have lower expectations of children labelled as having special educational needs and may consequently not push them to achieve their full potential. Ofsted (2010) recognised this as a real possibility, and said that "in too many cases, there was a culture of excuses" for the poor attainment of children with SEN.

Of course, we cannot rule out the possibility that children with non-statemented SEN labels differ in unobserved ways from children without such labels, even if their teachers believe that they have special educational needs. If such unobserved characteristics are negatively correlated with academic progress, then this might explain our results.

Interestingly, however, we do find some evidence of heterogeneity in the effectiveness of SEN interventions across schools, which may suggest that our results are not entirely driven by differences in unobservable characteristics. For example, Table 5 compares the relative progress of children with and without a SEN label in the following schools[8]:

- Schools in which at least 80% of children reach the expected level at Key Stage 2 vs. schools in which less than 80% of children reach the expected level;

[8] Appendix Table A4 makes further comparisons by school type, the proportion of children in a school with special educational needs, the pupil-teaching assistant ratio and the extent to which schools communicate with the parents of children with special educational needs.

- Schools with an above median proportion of children eligible for free school meals vs. schools with a below median proportion of children eligible for free school meals.

These results suggest that, while children with special educational needs always lag behind those without such needs, they seem to make relatively greater progress in more advantaged schools. For example, in schools in which at least 80% of children reach the expected level at Key Stage 2, children with a non-statemented SEN label score, on average, 0.272 standard deviations lower than children without a SEN label, while in schools in which fewer than 80% reach the expected level, they score, on average, 0.497 standard deviations lower.[9] These figures are very similar if we compare children in schools with an above vs. below median proportion of children eligible for free school meals. This may suggest that advantaged schools are making more effective use of their SEN budget, or that higher standards and/or expectations across the board have a positive influence on those with special educational needs. Either way, there may be something more to be learnt from the way in which more advantaged schools help their children with special educational needs.

6. Conclusions

In this paper, we have tried to assess the effectiveness of interventions designed to help children with special educational needs, by comparing the relative academic progress of those with non-statemented SEN labels with an otherwise identical group without such labels. This is potentially problematic, since children with special educational needs are likely to differ in many ways from children without such needs. To get around this problem, we have made use of the incredibly rich ALSPAC dataset, which has two main advantages over other data that has been used to address this issue:

1) It includes a very wide range of observable characteristics that are likely to be relevant for both academic progress and the identification of children with special

[9] These results come from Column 5 of Table 5 and are based on a propensity score matching model using our preferred control group of children whose teacher thinks they have special educational needs. These estimates are statistically different from one another.

educational needs – such as IQ and various measures of non-cognitive skills – which we can include as controls in our model;

2) It includes specific information from teachers, mothers and clinicians about whether a child exhibits signs of behaviour-based special educational needs which we can use to construct an appropriate control group against which to compare the progress of children with non-statemented special educational needs.

Using our preferred specification, we find that children identified as having non-statemented special educational needs make significantly less progress between Key Stage 1 and Key Stage 2 (age 7 and 11) than otherwise identical children whose class teacher reports that they may have special educational needs. This is perhaps not an entirely unexpected result, given that there is no compulsion in the system for school action and school action plus funding to be spent on children with special educational needs, and that there is some evidence that teachers expect children with SEN labels to make less progress than those without (Ofsted, 2010). Nonetheless, such a result clearly has significant policy implications: schools are provided with significant resources to help children with non-statemented special educational needs and if these resources are not improving academic outcomes for these children, then this should be of concern to both parents and policymakers alike.

Of course, there are a number of caveats that should be borne in mind when interpreting our results. First, we cannot rule out the possibility that our findings are driven by the existence of unobserved characteristics that are correlated with both special educational needs status and academic progress – although the fact that we control for a very rich set of individual and school characteristics makes it somewhat less likely that this explanation alone is driving our results. Second, our results may be most relevant for children with behaviour-related special educational needs, as the survey instruments that we use to construct our control group are behaviour-focused. Third, we must acknowledge that it is possible for school action and school action plus interventions to be having positive impacts on outcomes that we do not measure, such as behaviour or attendance, although this would not reassure us about the apparently negative impact on educational progression. Finally, it may be that non-statemented SEN provision has

beneficial impacts on other children in the class who do not have special educational needs, perhaps by ensuring better classroom control or enabling the teacher to set a faster pace. If this occurs, then the academic achievement of children without special needs will be higher and the relative achievement of pupils with non-statemented SEN even lower. Future research could usefully pursue this line of inquiry.

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Tables

Table 1 Comparison of means amongst treatment and control groups

	Treatment (1)	Control (2)	Difference (1-2)
	SEN label	*No SEN label*	
Average Key Stage 1 score	11.27	15.947	-4.677**
IQ score at age 8	90.074	104.971	-14.897**
Male	0.689	0.463	0.225**
Eligible for free school meals (FSM)	0.228	0.105	0.124**
Non-white	0.068	0.049	0.019**
Born in August	0.126	0.083	0.043**
Birthweight < 2.5 kg	0.073	0.046	0.027**
Top quintile of income distribution	0.143	0.203	-0.060**
Father professional/managerial class	0.039	0.085	-0.046**
Mother's highest qualification: degree	0.035	0.089	-0.054**
Ever in financial difficulties	0.271	0.203	0.068**
Ever lived in social rented accommodation	0.376	0.198	0.179**
Abnormal behaviour (mother SDQ at age 9)	0.126	0.033	0.093**
% pupils in school eligible for FSM	16.002	13.751	2.251**
Observations	1,397	6,345	
	SEN label	*No SEN label but teacher thinks child has SEN*	
Average Key Stage 1 score	11.27	14.407	-3.137**
IQ score at age 8	90.074	100.312	-10.238**
Male	0.689	0.626	0.063**
Eligible for free school meals (FSM)	0.228	0.184	0.044**
Non-white	0.068	0.058	0.010**
Born in August	0.126	0.094	0.032**
Birthweight < 2.5 kg	0.073	0.043	0.030**
Top quintile of income distribution	0.143	0.137	0.005**
Father professional/managerial class	0.039	0.062	-0.023**
Mother's highest qualification: degree	0.035	0.067	-0.032**
Ever in financial difficulties	0.271	0.234	0.037*
Ever lived in social rented accommodation	0.376	0.314	0.062**
Abnormal behaviour (mother SDQ at age 9)	0.126	0.069	0.057**
% pupils in school eligible for FSM	16.002	16.742	-0.740**
Observations	1,397	1,307	

Table 2 Characteristics of children labelled as having special educational needs

	Children with a non-statemented SEN label	Children whose teacher thinks they have SEN	Children with a SEN label whose teacher thinks they have SEN
Prior attainment			
2nd quintile of Key Stage 1 scores	-0.105**	-0.125**	-0.320**
Middle quintile of Key Stage 1 scores	-0.148**	-0.215**	-0.397**
4th quintile of Key Stage 1 scores	-0.137**	-0.229**	-0.383**
Top quintile of Key Stage 1 scores	-0.154**	-0.260**	-0.368**
IQ			
2nd quintile of IQ scores at age 8	-0.022	-0.037	-0.083
Middle quintile of IQ scores at age 8	-0.031*	-0.031	-0.128
4th quintile of IQ scores at age 8	-0.035**	-0.048	-0.065
Top quintile of IQ scores at age 8	-0.031	-0.035	-0.149

Table 2 continued

	Children with a non-statemented SEN label	Children whose teacher thinks they have SEN	Children with a SEN label whose teacher thinks they have SEN
Other measures of special educational needs			
Teacher reports			
Abnormal behaviour based on SDQ at age 10	0.048**		0.094**
Attention difficulties that interfere with learning	0.036**		0.078**
Behavioural difficulties that interfere with learning	0.098**		0.174**
Mother reports			
Abnormal behaviour based on SDQ at age 9	0.011		0.078
Attention difficulties that interfere with learning	0.115**		0.304**
Problems with speech development	-0.010		-0.125
Severe social or communication problems	-0.001		0.086
Clinic reports			
Scores significantly below average on attention tasks	0.002		-0.080
Child diagnosed with borderline personality disorder	-0.003		0.053
Psychiatric assessment of ADHD/related disorders	0.059*		0.180**
Selected individual characteristics			
Eligible for free school meals	0.024*	0.100**	0.051
Male	0.049**	0.179**	0.149**
Non-white	-0.001	0.002	0.065
Birthweight < 2.5 kg	0.030	-0.042	0.076
2nd quintile of income distribution	-0.018	-0.008	-0.108*
3rd quintile of income distribution	-0.013	0.018	-0.050
4th quintile of income distribution	-0.007	0.005	-0.054
Top quintile of income distribution	0.024	-0.032	-0.083
dadclass==ii	0.016	-0.002	0.155
dadclass==iii (non-manual)	0.022	0.008	0.165
dadclass==iii (manual)	0.037	-0.008	0.098
dadclass==iv	0.044	0.024	0.152
dadclass==v	0.043	-0.000	0.099
Mother's highest qualification: vocational	-0.006	-0.000	0.018
Mother's highest qualification: O-level	0.002	0.018	0.019
Mother's highest qualification: A-level	-0.004	0.031	0.021
Mother's highest qualification: degree	0.009	0.069	0.070
Ever in financial difficulties	0.007	-0.019	-0.059
Ever lived in social rented accommodation	0.009	0.064**	0.085
Selected school characteristics			
% pupils eligible for free school meals	-0.002*	0.000	-0.004*
% pupils reaching Level 4 in English/Maths/Science	0.002**	0.000	0.003
Observations	7,741	7,741	2,190

Notes: results from three probit models which also control for a range of other individual and school characteristics. Individual: child's month of birth, whether English is an additional language (EAL), a multiple birth indicator, family size, mother's age, mother's marital status at birth, mother's occupational class, father's education, whether the child was breastfed, parenting scores, whether the child was frequently read to, child's depression score, locus of control, whether the child likes school, self-perceived reading and maths ability, and whether they have ever played truant. School: % of pupils reaching expected level at KS2, school and class size, pupil-teacher and pupil-teaching assistant ratios, % EAL pupils, % non-white pupils, % statemented and non-statemented SEN pupils, school type, headteacher tenure, whether achievement is a high priority for the school, whether all teachers expect good behaviour from pupils, whether all teachers support the aims of the school, and whether parents are kept informed about their child's progress. These coefficient estimates can be found in Appendix Table A2. Note that the estimates from Columns 1 and 3 are based on the same model that is used to calculate the propensity score for each of our matching estimates.

Table 3 Relationship between SEN label and standardised Key Stage 2 scores

	Kids with SEN label vs. kids without SEN label			Kids with SEN label vs. kids without SEN label but whose teacher thinks they have SEN	
	Raw OLS	OLS	Matching	OLS	Matching
SEN label	-0.398** [0.034]	-0.361** [0.031]	-0.408** [0.042]	-0.375** [0.037]	-0.361** [0.065]
Observations	7,742	7,742	7,732	2,704	2,686
% lost to common support			< 1%		< 1%
Pseudo R-squared			0.019		0.055
Median bias (MB)			2.067		2.383
% reduction in MB			84%		65%

Notes: the raw OLS model only includes Key Stage 1 quintiles and a set of cohort dummies; all other models include a full set of controls (as per Table 2 and Appendix Table A2). OLS models cluster standard errors at school level. "Median bias" indicates the median percentage distance (across all matching variables) between the matched samples in terms of observed characteristics. "Pseudo R-squared" indicates the explanatory power of a model of the treatment indicator on the matched samples using a full set of covariates. A full set of coefficient estimates from each of the OLS models is given in Appendix Table A3.

Table 4 Comparison of means amongst treatment and matched control groups

	Treatment (1)	Matched control group (2)	Difference (1-2)
	SEN label	*No SEN label*	
Average Key Stage 1 score	11.276	11.918	0.642**
IQ score at age 8	90.122	91.587	1.465**
Male	0.687	0.669	-0.018
Eligible for free school meals (FSM)	0.228	0.228	-0.001
Non-white	0.068	0.073	0.005
Born in August	0.126	0.131	0.005
Birthweight < 2.5 kg	0.072	0.06	-0.011
Top quintile of income distribution	0.139	0.14	0.002
Father professional/managerial class	0.039	0.049	0.01
Mother's highest qualification: degree	0.034	0.046	0.012*
Ever in financial difficulties	0.27	0.289	0.019
Ever lived in social rented accommodation	0.379	0.374	-0.005
Abnormal behaviour (mother SDQ at age 9)	0.121	0.104	-0.017
% pupils in school eligible for FSM	16.061	16.335	0.274
Observations	1,388	6,344	
	SEN label	*No SEN label but teacher thinks child has SEN*	
Average Key Stage 1 score	11.284	11.817	0.532**
IQ score at age 8	90.308	88.358	-1.950**
Male	0.687	0.732	0.045*
Eligible for free school meals (FSM)	0.227	0.248	0.021
Non-white	0.068	0.072	0.004
Born in August	0.126	0.134	0.008
Birthweight < 2.5 kg	0.072	0.071	-0.001
Top quintile of income distribution	0.143	0.138	-0.005
Father professional/managerial class	0.039	0.033	-0.007
Mother's highest qualification: degree	0.036	0.037	0.001
Ever in financial difficulties	0.268	0.292	0.023
Ever lived in social rented accommodation	0.377	0.376	-0.001
Abnormal behaviour (mother SDQ at age 9)	0.121	0.099	-0.022
% pupils in school eligible for FSM	16.062	17.14	1.079*
Observations	1,379	1,307	

Notes to Table 4: the treatment group is restricted to those on the common support. The characteristics of the matched control groups are weighted using the weights created by the propensity score matching process. The unweighted means for these groups are shown in Table 1.

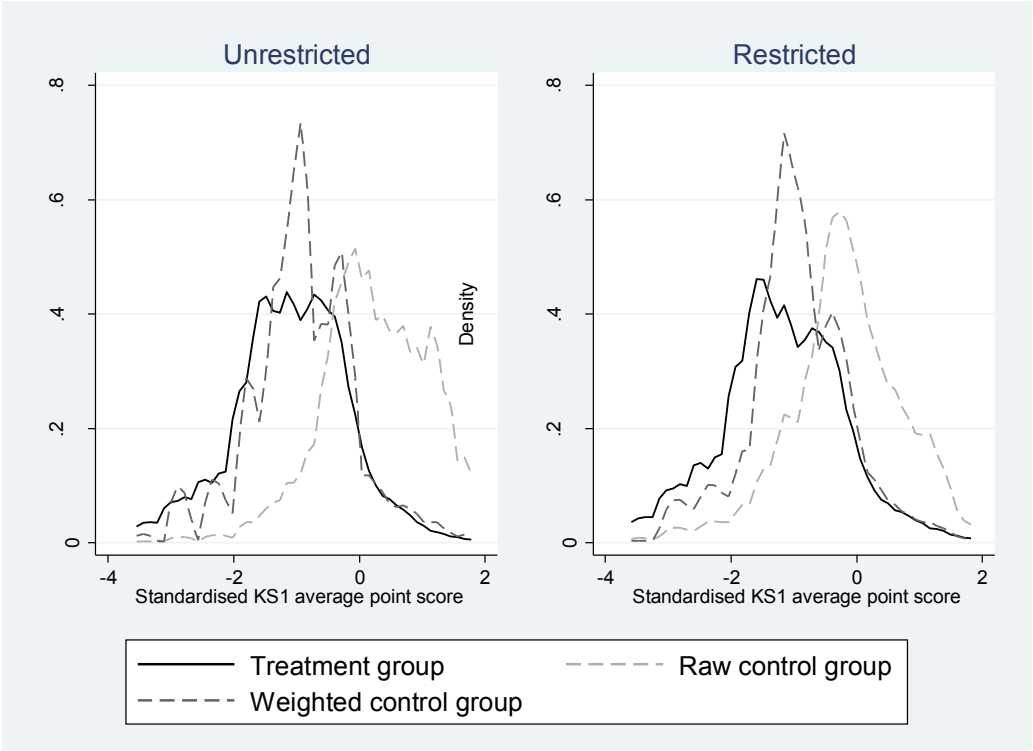
Table 5 Relationship between SEN label and KS2 scores: differences by schools

	Kids with SEN label vs. kids without SEN label			Kids with SEN label vs. kids without SEN label but whose teacher thinks they have special educational needs	
	Raw OLS	OLS	Matching	OLS	Matching
	By proportion of children reaching expected level at Key Stage 2				
At least 80%	-0.360**	-0.286**	-0.328**	-0.304**	-0.272**
	[0.04]	[0.032]	[0.057]	[0.045]	[0.089]
Observations	4,100	4,100	4,078	1,300	1,195
Pseudo R-squared			0.052		0.116
Median bias			2.714		6.931
Less than 80%	-0.551**	-0.454**	-0.466**	-0.429**	-0.497**
	[0.046]	[0.050]	[0.062]	[0.059]	[0.088]
Observations	3,587	3,587	3,568	1,383	1,341
Pseudo R-squared			0.029		0.053
Median bias			3.200		3.154
	By proportion of children eligible for free school meals				
Below median	-0.328**	-0.293**	-0.313**	-0.296**	-0.267**
	[0.037]	[0.033]	[0.054]	[0.054]	[0.104]
Observations	3,686	3,686	3,630	1,120	1,031
Pseudo R-squared		0.041		0.154	
Median bias		3.476		5.770	
Above median	-0.500**	-0.431**	-0.462**	-0.423**	-0.462**
	[0.051]	[0.049]	[0.057]	[0.054]	[0.083]
Observations	4,056	4,056	4,042	1,584	1,559
Pseudo R-squared			0.026		0.064
Median bias			2.263		4.287

See notes to Table 3.

Figures

Figure 1 Comparison of Key Stage 1 scores amongst treatment and control groups, before and after matching



Notes: kernel density graphs produced using an Epanechnikov kernel. The "unrestricted" results compare those with a non-statemented SEN label with those without. The "restricted" results compare those with a non-statemented SEN label with those without but whose teacher thinks they have special educational needs.

Appendix

Table A1 Description of our sample

	Our sample	Pupils in England taking Key Stage 2 in 2001-02, 2002-03 or 2003-04
Individual characteristics		
Child achieved expected level at Key Stage 2	81.5%	85.4%
Child has non-statemented special educational needs	18.0%	19.8%
Child eligible for free school meals	12.7%	17.0%
Child of non-white ethnic origin	5.2%	18.8%
School characteristics		
Child attends a community school	67.6%	67.8%
Average school size	299 pupils	321 pupils
Average KS2 class size	27 pupils	26 pupils
Observations	7,742	1,754,133

Notes: characteristics of all pupils in England based on authors' calculations from National Pupil Database.

Table A2 Characteristics of children labelled as having special educational needs

	Children with a non-statemented SEN label	Children whose teacher thinks they have SEN	Children with a SEN label whose teacher thinks they have SEN
Remaining individual characteristics from PLASC			
English is an additional language	-0.011	-0.046	-0.114
Born in October	0.010	-0.020	0.033
Born in November	-0.022	-0.028	-0.045
Born in December	-0.014	-0.028	-0.053
Born in January	0.029	0.024	0.142*
Born in February	0.018	-0.024	0.057
Born in March	0.001	-0.006	0.012
Born in April	0.010	-0.021	0.034
Born in May	0.009	-0.046	-0.013
Born in June	-0.003	-0.038	-0.032
Born in July	-0.013	-0.053*	-0.016
Born in August	0.001	-0.039	0.012
Remaining individual characteristics from ALSPAC			
Twin/triplet	-0.005	-0.000	-0.025
Number of younger siblings	-0.001	0.005	0.025
Number of older siblings	-0.004	-0.010	-0.003
Birthweight > 4.5 kg	-0.012	-0.002	-0.111
Child was breastfed	0.011	-0.003	0.058
Standardised average of mother's parenting scores	0.008	0.021	0.006
Standardised average of partner's parenting scores	-0.006	-0.004	0.011
Mother reads frequently to child	-0.015	-0.013	-0.009
Partner reads frequently to child	0.025*	-0.005	0.071
Partner never reads to child	0.012	0.028	-0.015

Table A2 continued

	Children with a non-statemented SEN label	Children whose teacher thinks they have special educational needs	Children with a SEN label whose teacher thinks they have SEN
Remaining ALSPAC characteristics continued			
Mother's age at birth 20-24	-0.001	0.019	0.074
Mother's age at birth 25-29	0.003	0.026	0.085
Mother's age at birth 30-34	0.011	0.021	0.106
Mother's age at birth 35+	0.028	0.087	0.212*
Mother married at birth	-0.014	-0.035	-0.072
Mother cohabiting at birth	-0.015	-0.026	-0.099
Ever been a single mother	-0.021	0.007	-0.033
mumclass==ii	-0.006	-0.021	0.087
mumclass==iii (non-manual)	-0.007	-0.049	0.165
mumclass==iii (manual)	0.007	0.003	0.216
mumclass==iv	-0.005	-0.010	0.168
mumclass==v	-0.003	0.007	0.230
Father's highest qualification: vocational	-0.010	-0.044*	0.019
Father's highest qualification: O-level	0.001	-0.022	-0.040
Father's highest qualification: A-level	0.004	-0.017	0.008
Father's highest qualification: degree	0.001	-0.041	0.007
Always lived in owner-occupied housing	0.024	0.004	0.099
Child's depression score	0.003	0.010**	0.015**
Child has internal locus of control	-0.010	-0.047*	-0.073
Child has external locus of control	-0.012	0.005	-0.088
Child likes school	-0.009	-0.049*	0.005
Self-perceived reading ability	-0.024**	-0.011	-0.051*
Self-perceived maths ability	-0.007	0.002	0.031
Child has ever played truant	0.103	0.258*	0.213
Remaining school characteristics			
School size	0.000	-0.000	-0.000
Average KS2 class size	0.000	0.003	-0.001
Pupil-teacher ratio	0.001	-0.004	0.008
Pupil-teaching assistant ratio	-0.000	0.001	-0.001
% non-white pupils	-0.003*	0.001	-0.008*
% pupils with English as an additional language	0.006**	-0.002	0.015**
% pupils with statemented SEN	0.002	0.006	0.002
% pupils with non-statemented SEN	0.006**	0.001	0.014**
Voluntary aided or foundation school	0.020	0.020	-0.021
Voluntary controlled school	0.024	-0.016	0.063
Headteacher tenure: 1-2 years	-0.000	-0.050	0.035
Headteacher tenure: 3-9 years	-0.011	-0.032	-0.050
Headteacher tenure: 10+ years	0.009	-0.052	0.007
Achievement is a high priority for the school	-0.032	-0.047	-0.098*
All teachers expect good behaviour from pupils	0.014	-0.018	0.026
All teachers support the aims of the school	0.021	0.010	0.065
Parents are kept informed about child's progress	0.014	0.036	0.024
Observations	7,741	7,741	2,190

Notes: results from three probit models. Note that the estimates from Columns 1 and 3 are based on the same model that is used to calculate the propensity score for each of our matching estimates. The main coefficient estimates can be found in Table 2.

Table A3 Other determinants of attainment at Key Stage 2

	Kids with SEN label vs. kids without SEN label		Kids with SEN label vs. kids without SEN label but whose teacher thinks they have special educational needs
Prior attainment			
2nd quintile of Key Stage 1 scores	0.648**	0.513**	0.521**
Middle quintile of Key Stage 1 scores	1.146**	0.910**	1.001**
4th quintile of Key Stage 1 scores	1.537**	1.199**	1.206**
Top quintile of Key Stage 1 scores	1.996**	1.517**	1.501**
Other measures of SEN			
Teacher reports			
Abnormal behaviour based on SDQ		-0.102*	-0.086*
Attention difficulties		-0.131**	-0.149**
Behavioural difficulties		-0.147**	-0.166**
Mother reports			
Abnormal behaviour based on SDQ		-0.049	-0.080
Attention difficulties		0.018	-0.043
Problems with speech development		-0.009	-0.064
Social or communication problems		0.048	0.047
Clinic reports			
Significantly below average attention		-0.171**	-0.268**
Borderline personality disorder		0.036	0.029
ADHD/related disorders		0.049	0.090
PLASC individual characteristics			
Eligible for free school meals		-0.136**	-0.102*
Male		0.149**	0.224**
Non-white		-0.033	-0.079
English is an additional language		-0.017	-0.002
Born in October		0.018	0.042
Born in November		-0.021	-0.097
Born in December		0.003	0.005
Born in January		0.021	-0.010
Born in February		-0.109**	-0.234**
Born in March		-0.029	0.035
Born in April		-0.089*	-0.052
Born in May		0.030	0.018
Born in June		-0.072*	-0.103
Born in July		-0.067*	-0.108
Born in August		-0.025	-0.062
ALSPAC individual characteristics			
Twin/triplet		0.020	0.056
Number of younger siblings		0.020	0.022
Number of older siblings		0.008	0.023
Birthweight < 2.5 kg		-0.040	-0.025
Birthweight > 4.5 kg		-0.004	0.131
Child was breastfed		0.066**	0.156**
Std mean of mother's parenting scores		-0.015	-0.012
Std mean of partner's parenting scores		0.007	-0.019
Mother reads frequently to child		-0.005	0.013
Partner reads frequently to child		-0.016	-0.015
Partner never reads to child		-0.010	-0.060
Mother's age at birth 20-24		-0.096*	-0.189*
Mother's age at birth 25-29		-0.068	-0.137
Mother's age at birth 30-34		-0.082	-0.231*
Mother's age at birth 35+		-0.051	-0.128

Table A3 continued

	Kids with SEN label vs. kids without SEN label		Kids with SEN label vs. kids without SEN label but whose teacher thinks they have SEN
ALSPAC characteristics continued			
Mother married at birth		0.118	0.219
Mother cohabiting at birth		0.122	0.186
Ever been a single mother		0.016	0.005
2nd quintile of income distribution		0.019	0.006
3rd quintile of income distribution		0.003	-0.074
4th quintile of income distribution		0.049	0.081
Top quintile of income distribution		0.025	0.038
mumclass==ii		-0.018	0.013
mumclass==iii (non-manual)		0.017	0.078
mumclass==iii (manual)		-0.019	0.055
mumclass==iv		-0.050	-0.088
mumclass==v		-0.008	0.170
dadclass==ii		-0.008	-0.092
dadclass==iii (non-manual)		-0.007	-0.120
dadclass==iii (manual)		-0.019	-0.095
dadclass==iv		0.041	-0.055
dadclass==v		0.034	-0.043
Mother's highest qual: vocational		0.003	0.077
Mother's highest qual: O-level		0.053*	0.090
Mother's highest qual: A-level		0.106**	0.151*
Mother's highest qual: degree		0.170**	0.146
Father's highest qual: vocational		0.038	0.072
Father's highest qual: O-level		0.087**	0.112**
Father's highest qual: A-level		0.083**	0.149**
Father's highest qual: degree		0.085**	0.055
Ever in financial difficulties		0.019	-0.041
Ever lived in social rented accomm.		0.020	0.024
Always owned own home		-0.022	-0.017
2nd quintile of IQ scores at age 8		0.227**	0.317**
Middle quintile of IQ scores at age 8		0.334**	0.355**
4th quintile of IQ scores at age 8		0.397**	0.536**
Top quintile of IQ scores at age 8		0.500**	0.582**
Child's depression score		-0.006	-0.007
Child has internal locus of control		0.016	-0.054
Child has external locus of control		-0.045	-0.053
Child likes school		-0.035	-0.098
Self-perceived reading ability		0.012	0.013
Self-perceived maths ability		0.053**	0.059**
Child has ever played truant		0.156	0.205
School characteristics			
% pupils reaching Level 4		0.023**	0.029**
School size		-0.000	-0.000
Average KS2 class size		-0.000	0.003
% pupils eligible for FSM		-0.001	-0.001
Pupil-teacher ratio		0.002	0.005
Pupil-teaching assistant ratio		0.008**	0.010**
% non-white pupils		0.000	-0.005
% pupils with EAL		0.005	0.017*
% pupils with statemented SEN		0.017	0.021
% pupils with non-statemented SEN		0.004	0.009
Voluntary aided or foundation school		-0.026	-0.110
Voluntary controlled school		-0.086**	-0.118*

Table A3 continued

	Kids with SEN label vs. kids without SEN label		Kids with SEN label vs. kids without SEN label but whose teacher thinks they have SEN
School characteristics continued			
Headteacher tenure: 1-2 years		-0.058	-0.065
Headteacher tenure: 3-9 years		-0.074	-0.106
Headteacher tenure: 10+ years		-0.137**	-0.206**
Achievement high priority for school		0.003	0.047
All teachers expect good behaviour		0.035	0.004
All teachers support aims of school		0.046	0.065
Parents kept informed about progress		-0.002	0.048
Observations	7,742	7,742	2,704
R-squared	0.573	0.671	0.581

Notes: the raw OLS model only includes Key Stage 1 quintiles and a set of cohort dummies; all other models include a full set of controls (as per Table 2 and Appendix Table A2). OLS models cluster standard errors at school level. The main coefficient estimates can be found in Table 3.

Table A4 Relationship between SEN label and KS2 scores: differences by schools

	Kids with SEN label vs. kids without SEN label			Kids with SEN label vs. kids without SEN label but whose teacher thinks they have special educational needs	
	Raw OLS	OLS	Matching	OLS	Matching
	By proportion of children with special educational needs				
Above median	-0.385**	-0.374**	-0.445**	-0.360**	-0.379**
	[0.046]	[0.043]	[0.055]	[0.050]	[0.074]
Observations	3,894	3,894	3,873	1,581	1,442
Pseudo R-squared			0.028		0.040
Median bias			2.255		3.231
Below median	-0.400**	-0.348**	-0.387**	-0.419**	-0.473**
	[0.051]	[0.046]	[0.065]	[0.060]	[0.116]
Observations	3,848	3,848	3,827	1,123	1,080
Pseudo R-squared			0.042		0.130
Median bias			2.802		5.468
	By school type				
Community	-0.388**	-0.353**	-0.405**	-0.356**	-0.335**
	[0.048]	[0.043]	[0.057]	[0.055]	[0.087]
Observations	4,370	4,370	4,351	1,622	1,573
Pseudo R-squared			0.035		0.070
Median bias			2.87		3.507
Non-community	-0.417**	-0.368**	-0.396**	-0.410**	-0.386**
	[0.046]	[0.044]	[0.064]	[0.063]	[0.092]
Observations	3,372	3,372	3,348	1,082	939
Pseudo R-squared			0.041		0.077
Median bias			2.006		5.571
	By pupil-teaching assistant ratio				
Above median	-0.465**	-0.413**	-0.526**	-0.471**	-0.884**
	[0.065]	[0.057]	[0.076]	[0.072]	[0.075]
Observations	2,351	2,351	2,329	779	743
Pseudo R-squared			0.036		0.000
Median bias			2.180		14.355
Below median	-0.344**	-0.312**	-0.315**	-0.351**	-0.343**
	[0.065]	[0.060]	[0.092]	[0.081]	[0.155]
Observations	2,348	2,348	2,313	886	802
Pseudo R-squared			0.092		0.160
Median bias			5.110		6.060
	By school communication (with parents) regarding special educational needs policy				
Below average	-0.373**	-0.359**	-0.377**	-0.354**	-0.322**
	[0.047]	[0.041]	[0.062]	[0.049]	[0.101]
Observations	3,582	3,582	3,571	1,310	1,255
Pseudo R-squared			0.032		0.101
Median bias			2.122		4.851
Above average	-0.326**	-0.3**	-0.337**	-0.343**	-0.311**
	[0.051]	[0.050]	[0.072]	[0.074]	[0.099]
Observations	2,900	2,900	2,861	997	859
Pseudo R-squared			0.062		0.071
Median bias			3.262		4.571

Notes: the raw OLS model only includes Key Stage 1 quintiles and a set of cohort dummies; all other models include a full set of controls (as per Table 2 and Appendix Table A2). OLS models cluster standard errors at school level. "Median bias" indicates the median percentage distance (across all matching variables) between the matched samples in terms of observed characteristics. "Pseudo R-squared" indicates the explanatory power of a model of the treatment indicator on the matched samples using a full set of covariates.