The international platform of Ludwig-Maximilians University's Center for Economic Studies and the Ifo Institute

Working Papers
www.cesifo.org/wp

Are Non-Eligible Students Affected by Special Education?

Jon Marius Vaag Iversen
Hans Bonesrønning
Ivar Pettersen

CESIFO WORKING PAPER NO. 4156
CATEGORY 5: ECONOMICS OF EDUCATION
MARCH 2013

Presented at CESifo Area Conference on The Economics of Education, September 2012

CESifo
Center for Economic Studies & Ifo Institute

CESifo *Working Paper No. 4156*

Are Non-Eligible Students Affected by Special Education?

Abstract

We investigate whether the academic performance of non-eligible students – in an institutional setting of full inclusion - are affected by special education resources. Special education resources are per definition provided in a compensatory manner, and are increasingly being targeted to misbehaving students. The hypothesis is thus that special education resources might dampen the negative externalities associated with misbehaving students, and thus work to improve the performance of non-eligible students. We take advantage of a large, across-the-board increase in the proportion of eligible students, and combine fixed effects with an IV-approach, to identify the causal effects of special education on the academic performance of non-eligible students. We find that non-eligible students are positively affected by an increase in *the number of hours in special education per eligible student*.

JEL-Code: I200, I280, H520.

Keywords: student achievement, special education, externalities.

Jon Marius Vaag Iversen
Center for Economic Research
Norwegian University of Science and Technology
Trondheim / Norway
jon.iversen@svt.ntnu.no

Hans Bonesrønning
Norwegian University of Science and Technology
Trondheim / Norway
hansbo@svt.ntnu.no

Ivar Pettersen
Center for Economic Research
Norwegian University of Science and Technology
Trondheim / Norway
ivar.pettersen@svt.ntnu.no

This paper has received financial support from the Norwegian Research Council. It has benefited from comments from Regina T. Riphahn and seminar participants at the area conference on the Economics of Education at CESifo 2012, and at the Norwegian University of Science and Technology. We also would like to thank several of the researchers involved in the project “Education 2011” organized by Statistics Norway for valuable comments.

INTRODUCTION

Special education is specially designed instruction that aims at improving the performance of students, who because of a disability, do not benefit from ordinary classroom teaching. Many countries practice full inclusion policies, implying that eligible students are treated within their ordinary classrooms. The purpose of the present paper is to investigate whether special education resources provided in an institutional setting of full inclusion have non-intentional effects by benefitting non-eligible students. This issue is actualized by the observation that many countries recently have experienced large increases in the proportion of students that are deemed eligible to special education. Many of the "new and non-core" special education students are deemed eligible due to misbehavior in class.

The paper addresses a heated – but not very informed - discussion whether all types of eligible students should be offered special education within class or out of class. See Bateman (1996) and Crockett and Kauffman (1999) for early overviews of the US discussions of this issue. The present paper use data from the Norwegian elementary school. Norwegian national guidelines state that all students benefit from inclusion. This view is challenged by people who argue that non-eligible students are negatively affected by inclusion, and that - at least some - misbehaving students might benefit from being treated by specialists, in separation from well-behaving students. Neither party can back their point of view by much empirical evidence. The purpose of the present paper is to contribute to this discussion by providing one piece of empirical evidence related to the performance of non-eligible students.

The most likely mechanism linking the performance of non-eligible students to the presence of eligible students is identified by Lazear (2001), who conceptualize education production as a public good with congestion. That is, effective teaching time is determined by the

probability that the students misbehave in class. Many of the core special education categories of students are most likely *not* associated with high probabilities of misbehavior. Students that have visual or hearing impairments fall into this category. When special resources are allocated to these types of students, non-eligible students might be affected by a more generous student-to-teacher ratio. Existing evidence indicates that any positive effects associated with a more generous student-to-teacher ratio are likely to be small. When special education resources are allocated to students that are eligible to special education due to behavioral problems, the special resources might dampen or eliminate misbehavior/negative externalities, and thereby increase effective teaching time and improve teacher-student relationships. In such cases, special education resources might potentially have significant positive effects on the performance of non-eligible students.

There is quite a lot of evidence from around the world that negative externalities are present in classrooms. In the US, 85 percent of teachers, and 73 percent of parents say that "school experience of most students suffers at the expense of a few chronic offenders" (Public Agenda, 2004). The present study uses Norwegian data. This country ranks top in the PISA-studies when it comes to student misbehavior. For instance, 40 percent of the 15 years old students that participate in the PISA-studies report that all or most of the lessons are characterized by disruptions and noise. However, these investigations do not link disruption to particular subgroups of students. Turning to empirical analyses, Figlio (2007), Bonesrønning (2008), Carrell and Hoekstra (2010), Fletcher (2010) and Lavy and Schlosser (2010) provide evidence that negative externalities are related to "boys named Sue", students from dissolved families, students that have experienced domestic violence or are mentally unstable, or simply are boys. Many of the students under scrutiny in these analyses might be exposed to treatment by special education resources, but none of the studies cited above raise the issue whether the

negative externalities are affected by such treatment. Carrell and Hoekstra (2010) come closest when they worry that their results will be biased towards zero if the level of domestic violence in a school-grade-year is correlated with common shocks. The allocation of special education resources might be an example of such a shock.

Empirical studies showing how non-eligible students are affected by the presence of eligible students, or by special education resources, are rare. We are aware of just two earlier contributions. Friesen, Hickey and Krauth (2010) find that attending schools with a higher percentage of students with learning disabilities or behavioral disorders has a small negative impact on the reading and numeracy test scores of non-disabled students. Hanushek, Kain and Rivkin (2002) find that the achievement growth for non-eligible students is positively related to the proportion of special education students. They investigate a number of potential mechanisms, but alternative specifications only reinforce their central result that disabled students do not harm the academic achievement of their peers.

Estimating the effects of special education on the performance of non-eligible students entails several econometric problems. Perhaps the most serious and obvious is that the amount of special education reflects unobserved characteristics of students, teachers, school principals and school owners (the municipalities). We deal with these challenges by exploiting that the introduction of a national education reform with accountability elements in 2006 was followed by a strong increase in the proportion of eligible students. Thus, identification is based on the time trend in special education: we investigate whether the 5^{th} grade non-eligible students belonging to the 2009-cohort - due to more excessive use of special education resources - was exposed to better learning environments than the 5^{th} grade non-eligible students belonging to the 2007-cohort. By using adjacent cohorts of students, we introduce

school-by-grade level fixed effects to get rid of time-invariant between-school variation in special education that reflects unobserved teacher and school principal quality, and municipality fixed effects to get rid of time-invariant unobserved school owner characteristics. We are then left with variation in special resources across adjacent cohorts within schools. This variation is due both to unobserved student and teacher quality and a school-specific time trend. We apply an IV-strategy which removes the variation due to unobserved student and teacher quality. Importantly, the school fixed effects do away with time invariant factors that cause the time trends to differ across schools.

Another econometric problem is that the estimates for the proportion of eligible students might be upward biased due to a "mechanical" positive relationship between the proportion of eligible students and student performance insofar that the students that are taken out of the testing pool and provided special education, perform below the population average. We deal with this potential problem by excluding from the analyses the student subgroups that are most likely to be deemed eligible to special education. That is, by dropping the students at the margin of being deemed eligible to special education, we identify the effects of special education for subgroups of non-eligible students for whom their composition is not affected by the increase in the proportion of eligible students, thus preventing that the estimated effects reflect changes in the composition of the treatment group. This strategy has the weakness that it does not account for the fact that the effects of special education might differ across student subgroups.

To increase the transparency of the analyses, the rigorous part of the paper is preceded by some exploratory analyses. The purpose is to highlight why, and under what conditions, special resources might affect the performance of non-eligible students. This part provides evidence that students who are exposed to classmates that are deemed eligible to special

education, report relatively more noise and disorder, and that the performance of individual students is negatively associated with the proportion of eligible students in the grade. Importantly, the exploratory part also provides indicative evidence that the negative association between the proportion of eligible students and the achievements of non-eligible students is weaker when more special resources are allocated per eligible student, and when the eligible students are offered their own lessons in separation from non-eligible classmates. The latter findings might potentially indicate that the negative externalities decrease or disappear when the misbehaving students are segregated out of ordinary classrooms. Consistent with these findings, the instrumental variable, fixed effects analyses provide significant positive estimates for the amount of special resources per eligible student on the performance of non-eligible students.

The rest of the paper is organized as follows. The next section provides some descriptive statistics, and notably, a description of the treatment variables. Thereafter we present the exploratory analyses and the more rigorous analyses. The last section offers some concluding remarks.

DATA, DESCRIPTIVE STATISTICS AND MEASURES OF TREATMENT

We briefly describe our data, and go on by describing the construction of the three key variables that are used to characterize treatment, which are the number of hours in special education per student, the number of hours in special education per eligible student, and the proportion of eligible students.

Data

The Norwegian Government introduced nationwide tests in mathematics, reading in Norwegian and English language for 5th graders in 2007 as part of an accountability reform. We take advantage of these tests and use administrative records for three consecutive cohorts of 5th grade students (2007-2009) in the Norwegian elementary school. Statistics Norway has linked the national test results to individual (gender, ethnicity, birth order) and family characteristics (mother's and father's education, mother's and father's income, family size, family structure) for the entire population of 5th graders. Detailed information about school enrollment and school inputs is provided by the national Elementary School Information System (GSI). Our information about special education resources comes from this source. The national tests are taken early in the fall of the 5th grade and we use information about school inputs for the preceding school year, that is, when the students were in the 4th grade. In addition, we exploit data from a yearly survey provided to all students from the 5th grade and onwards to assess the classroom climate. No descriptive statistics for the individual and family background characteristics are presented in the paper, but such information is available upon request.

Our outcome measure is generated from the national test results. The 5th grade students sit mandatory tests in mathematics, reading in Norwegian, and reading and writing in English in the start of the fall semester. The tests have different scales. We have standardized the tests, added the results, and then standardized once more. The outcome measure thus has a mean of 0 and standard deviation equal to 1. It is an issue whether these practices of aggregating across different subjects conceal important between-subject differences. Investigations show that reporting separate results for each subject add little additional insights, perhaps because the Norwegian elementary school system practices home classes.

All non-eligible students sit the tests (if not absent on the days the test are taken), while eligible students can apply for exemption. Clearly, the school actors' incentives are to encourage special education students to apply for exemption because this is an easy way to improve on average student achievement. We know that approximately 10 percent of the students do not participate in the tests, which is substantially above the proportion of students that receive special education. In 2008 the participation rate varied from 78.6 to 95.1 percent among the 19 counties in Norway. The county with the lowest participation rate had a proportion of eligible students equal to 7.9 percent this year, while the county with the highest participation rate had a proportion of eligible students equal to 4.2 percent. In all counties the participation rate is lower than the proportion of non-eligible students. Unfortunately, the eligible students are not identified in the data, and we do not know the number of eligible students that have applied for exemption. Although it is likely that most of the special education students are among the 10 percent of students that do not sit the tests, we cannot say this for sure. Initially, we include all students that have participated in all three tests. The potential biases these practices introduce to our analyses are evaluated by first regressing the share of eligible students against student body characteristics, and thereafter using the information from this analysis to exclude from the analyses the student subgroups that most likely receive special education resources.

Special resources

The Norwegian elementary school is embedded in a federal system, where multi-purpose municipalities (about 430) run the public elementary and lower secondary schools (a total of about 2900) subject to national laws and regulations. The municipalities are financed by local taxes – tax rates set by the national government - and national grants. Special education is handled within this system as follows. The right to special education is regulated by national

law. The law says that students that do not benefit from the ordinary teaching are entitled to special education. Entitlement is determined by experts hired by the municipalities. Eligible students are assigned to one of the following categories: visual or hearing impairment, communication problems, brain damages, learning disabilities, concentration problems, or misbehavior (related to ADHD, other diagnoses or no specific diagnoses). Having received a diagnosis, eligible students are assigned a total number of hours in special education per year. This decision is made within the municipality. In a survey to the municipalities in 2009, about half of the municipalities answered that this decision was taken at the municipal level, while the other half answered that this decision was decentralized to the schools. In the former case, the municipal officers allocate the total educational budget in the municipalities to the local school, determining the allocation of resources between special education and alternative uses for each of them. In the latter case, the schools face a within-year fixed budget, and have to allocate their resources between alternative uses. Our econometric specifications, to be presented below, reflect this variation in decision-making authority.

The organization of special education is guided by the principle of full inclusion. Thus, most students that are deemed eligible are taught in ordinary classes by adding a special education teacher or an assistant. Alternatively, the special education students are taught in smaller groups of eligible students for a limited number of hours, or sometimes tutored (alone) for a limited number of hours. Only students with the most serious kinds of retardation are taught in special schools. In 2001 2.1 percent of the students in the capital of Oslo and 0.4 percent of the students in the rest of the country were enrolled in special schools.

From 2006 and onwards the Elementary School Information System ("GSI") has reported the amount of special education resources by grades in schools. Taking account of the existing

institutions, we derive three measures from these statistics; the proportion of students that are deemed eligible, the number of hours in special education per eligible student by grades in schools, and the product of these two measures which is the number of hours in special education per student in the grade. We have also considered a fourth measure; which is the fraction of eligible students that are taught in groups with other eligible students, that is, separated from non-eligible students.

Descriptive statistics are reported in Table 1. In 2006 5.6 percent of the students in the 4th grade were deemed eligible students. By 2008, this proportion had increased to 7.4 percent of the 4th grade students, implying that the proportion of eligible students has increased by more than 30 percent over the three-year period. An important feature is that boys are much more likely to be deemed eligible than girls. Roughly, there are 3 eligible boys per each eligible girl.

(Table 1 about here)

For 4th graders the number of hours in special education per eligible student per year declined from 156 hours in 2006, to 152 hours in 2007 and 146 hours in 2008. This decline is not sufficient for the special education budget to stay fixed throughout the period. Additional resources are provided – in principle these resources might come from an expanding educational budget or from reallocation of resources. In the latter case, special education is financed by cutting back on ordinary teaching, building maintenance or other inputs. It seems that the major part of the increase in special education hours per student is financed by expanding the total municipality budgets to education. Elsewhere we have shown that the municipalities' incomes have increased in the period, and that the number of hours in special education has increased when municipalities' incomes have increased. The raw data show that the number of students per (ordinary) teacher has not decreased in the actual period: in 2006 and 2007 there were on average 9.9 students per teacher, in 2008 the number was 10.0. As an

additional exercise, we have investigated whether ordinary teacher man-years are substituted for special education. This is done by regressing special education hours per student against ordinary teaching hours per student (both variables measured at the municipality level) while controlling for a number of time-varying municipality characteristics and municipality fixed effects. For the period we are investigating here, the point estimate for ordinary teaching hours per student is -0.15 and highly insignificant, indicating that there is no statistical significant input substitution between ordinary teacher man-years and special education resources. Thus, it basically seems like the decision makers face an increasing budget, but still they have been forced to make a trade-off between the proportion of eligible students and the number of special education hours per eligible student.

While the expansion of special education has not affected the number of teachers per student, it is paralleled by an increase in the proportion of uncertified teachers, from 2.4 percent in 2006 to 4.1 percent in 2008.

As mentioned above, we have also considered a direct measure of segregation. The percentage of boys that receive special education in groups with other eligible students – that is, segregated from their non-eligible classmates - has increased from below 4 percent in 2007 to 5.5 percent in 2009. National experts on special education have told us that these statistics are less reliable than the other statistics on special education. Their argument is that the school principals' incentives to report correct numbers to the national data base differ across items: the organization of special education is a controversial issue, so reporting high numbers of students that are treated outside their home classes might lead to potential sanctions by national government bodies, while the numbers of students and hours to special education are part of the school budget implying that the numbers reported to national data base have to be identical to the numbers that appear in the budget.

Here we therefore report analyses that use the number of hours in special education per eligible students to characterize one dimension of treatment. Regrettably, the number of hours per eligible students is a somewhat noisy and imprecise measure of segregation because some schools use these resources to separate out the special education students completely, while others do not. Thus, some schools might achieve a lot more segregation if they lump hours of special education together and provide special education for a group of students instead of providing it on a one-to-one basis within the ordinary classroom. We have investigated whether the less reliable measure of segregated special education provides different results, but this is not the case. These results have the same flavor to them, but are less precise than those presented below.

We also would like to know how special resources are allocated across different categories of eligible students. Notably, we would like to know the proportion of misbehaving students within this subgroup. The Elementary School Information System provides no inform about this, so we have been searching for information elsewhere. First, the Norwegian Institute for Public Health (NIPH) states that by 2005 1.1 percent of the Norwegian population less than 18 years has an ADHD diagnosis. There is an overrepresentation of children aged 12-15 years, and four out of five with an ADHD diagnosis is a boy. Further, NIPH states that the proportion of the population with an ADHD-diagnosis is rapidly increasing, reflecting that about 3-5 percent of the young population actually carry this disease. In the elementary school, students with an ADHD-diagnosis are automatically classified as being eligible to special education. Second, in two surveys to more than 2000 elementary school teacher in 2006 and 2008 (Nordahl and Hausstätter (2009)) classified about 10 percent of the boys and 2 percent of the girls to the two categories "students with behavior problems, but not ADHD" and "students with ADHD". Here we have performed a regression analysis with the proportion of

eligible students at the grade level as the dependent variable, and student body characteristics as independent variables. The hypothesis underlying this exercise is that core special education categories as visual and hearing impairment are randomly allocated across gender and family background characteristics, while misbehaviors are not. Finding that special education is associated with student and family characteristics will thus be an indication that this student subgroup contains misbehaving students. All the independent variables are aggregated to the grade level, and we have used data from three years. Table 2 reports the results.

(Table 2 about here)

Column 1 includes the proportion of boys as the only independent variable together with year dummies. Additional student body characteristics are included in columns 2-4, and school fixed effects are added in column 5. The point estimate for the proportion of boys is strongly significant throughout the table; indicating that an increasing proportion of boys in the grade causes more eligible students. Also, there are indications that the proportion of eligible students is systematically related to socioeconomic characteristics of the family. The point estimate for the proportion of students from intact families is significant throughout the table. This finding is consistent with the empirical literature on family dissolution, which provides evidence that children from dissolved families are more likely to misbehave compared to students from intact families (e.g. Ermisch and Francesconi (2001) and Painter and Levine (2000)). The estimates for father's education and earnings are significant in specifications that exploit all kinds of variation, but become insignificant when fixed school effects are included. Running the equations reported in Table 2 separately for the proportions of eligible boys and girls respectively, it is evident that only the proportion of eligible boys is significantly associated with the proportion of intact families (not reported in tables). These latter findings

are consistent with Bertrand and Pan (2011) who report that boys' non-cognitive skills are negatively affected by growing up in a single parent family.

EXPLORATORY ANALYSES: SPECIAL EDUCATION AND NEGATIVE EXTERNALITIES

In this section we report results from exploratory analyses that will be helpful in making sense of the more rigorous, but less transparent, analyses that are presented later on. We start out by investigating whether eligible students carry negative externalities. Two exercises are provided towards this end. First, we investigate whether the occurrence of noise and disorder in teaching situations, as reported by the students themselves, is related to the proportion of eligible students. Data from the national annual survey to students is used. The survey is voluntary for 5^{th} and 6^{th} grade students, and mandatory for 7^{th} grade students, implying that the number of respondents is much higher in the 7^{th} grade than in the 5^{th} grade, and that analyses of the latter data are not clouded by selectivity problems. We therefore report results from using data from the 7^{th} grade, but using the 5^{th} grade surveys generates the same patterns. An indicator for the occurrence of noise and disorder is generated by combining the answers to two questions/statements to the students: "To what extent are you disturbed by misbehaving classmates during the work sessions?" and "I am often disturbed by other students when I am working at school." The noise and disorder indicator; which is increasing in the occurrence of disruption, is a grade level variable. It is regressed against the proportion of eligible students in the grade while controlling for socioeconomic characteristics of the student body. The point estimate for the proportion of eligible students is positive and significant at the 5 percent level, indicating that there is more noise and disorder in schools/grades where a large fraction of students are deemed eligible to special education. These results are reported in Appendix Table 1.

Second, we have investigated the relationship between student performance and the proportion of eligible students. The estimated equation has the standardized score for each student– aggregated over the three tests in Mathematics, reading in Norwegian and reading and writing in English – as its dependent variable and the proportion of eligible students in the grade as the independent variable of key interest. A number of controls at the individual student level - gender, ethnicity, birth order, parents' education and earnings, family size and family structure – are included together with a few school characteristics, such as school size, resource measures and other peer characteristics. This equation is estimated for each of the three years for which we have data. As can be seen from Table 3, the number of students is somewhat below 50 000 students for each year. The cohort sizes are slightly above 60 000 students each year, implying that about 20 percent of the 5^{th} grade population is excluded from the analyses. About 10 percent of the students do not sit the tests, and the rest 10 percent is excluded due to lack of information about individual and family background characteristics. As argued above, it is pretty safe to assume that very few special education students are represented in the regression analyses. The point estimates for the proportion of eligible students are negative and highly significant for all three years.

(Table 3 about here)

Moreover, the negative effect associated with eligible students is of considerable size: an increase in the proportion of eligible students with 30 percent is associated with a performance decline of 0.12 standard deviations for non-eligible students. Our preferred interpretation of these estimates is that non-eligible students experience quite large negative effects from belonging to classrooms where many classmates are deemed eligible to special education. We are agnostic about why students are deemed eligible: This could be, for instance, because of an unfavorable student composition (the subgroup of eligible students

contains many misbehaving students), or because the teachers are of poor quality (which simultaneously leads to poor performance and many misbehaving students). At this stage, no attempts are made to sort out these explanations.

We have investigated whether these negative effects are dampened when more eligible students are treated in (more or less) isolation from non-eligible students, as indicated by the number of hours of special education per eligible student. For this purpose, the population of schools is separated into two categories; schools that use less than and more than the average number of hours of special education per eligible students, respectively. The education production function is estimated for both these subsamples using data for three year and a school fixed effects specification. The results are reported in Table 4.

(Table 4 about here)

The point estimates for the proportion of eligible students are -0.603 and significant at 1 percent for schools that use less, and -0.048 and statistically insignificant for schools that use more, than the average hours of special education per eligible student. These results might *indicate* that schools, by excluding eligible students from the ordinary classrooms or from negative interactions with classmates, are able to reduce the potential negative externalities that are associated with this student subgroup. We find similar results when the schools are partitioned into two groups based on the provision of segregated special education (not reported). These intuitive results are established without paying any attention to the inherent endogeneity problems. Nonetheless, this exploratory part motivates a hypothesis that non-eligible students might be positively affected by special education resources when the schools use these resources to increase the number of hours in special education per eligible student (which, for a fixed special education budget is equal to reducing the number of eligible students).

RIGOROUS ANALYSES: ARE NON-ELIGIBLE STUDENTS POSITIVELY AFFECTED BY SPECIAL EDUCATION RESOURCES?

The identification strategy

The exploratory analyses reported above indicate that special education resources are allocated in a compensatory way, that is, more special resources go to poor learning environments. To identify causal effects of special education resources on the performance of non-eligible students, we thus have to address the challenges related to two-way causality. We start out from the following equation:

$$A_{ijmt} = \alpha_j + \delta_m + \beta_1 SE_{jmt} + X_{ijmt}\beta_2 + Z_{jmt}\beta_3 + \sum \gamma_t D_t + \varepsilon_{ijmt} \quad (1)$$

where A_{ijmt} is achievement for the non-eligible student *i* in school *j* in municipality *m* in year *t*, α_j is a school-by-grade fixed effect, δ_m is a municipality fixed effect, SE_{jmt} is special education in school *j* in municipality *m* in year *t*. Inspired by the exploratory analysis we use three different measures of special education, the number of special education hours per student and its two components, which are the proportion of eligible students and the number of special education hours per eligible student. X_{ijmt} is a vector of control variables at the individual student level, Z_{jmt} is a vector of time-varying school inputs other than special education and D_t are year dummies.

The municipality fixed effects eliminate the time-invariant-between-municipality variation which is due to unobserved school owner characteristics and other time-invariant factors that are not included in the analyses. The municipality fixed effects are interacted with year dummies, to allow the time-invariant municipality factors to exercise varying influence over the years. The school-by-grade fixed effects eliminate the between-school-by-grade-variation in the special education measures which is due to unobserved, time-invariant teacher and

school principal quality. The remaining variation in special education resources across adjacent cohorts within schools then reflects a combination of observed and unobserved student body characteristics, unobserved teacher characteristics, and increased generosity towards maladaptive students. Importantly, the proportion of students receiving special education has increased at all grade levels. As already mentioned, in the period 2006-2008 the proportion of eligible students in the 4^{th} grade increased by 33.6 percent (from 5.55 percent points to 7.42 percent points), and in the grades 5-7 the proportion increased between 13.4 and 23.7 percent – the across-grades differences reflecting that early intervention is prioritized. We use this across-the-board increase in special education eligibility to facilitate identification. This is achieved by instrumenting the applied measure of special education for the 5^{th} grade students (i.e. the special education they were exposed to in 4^{th} grade) with the average special education used from the 5^{th} to the 7^{th} grade level in the same school in the same year.

All the three measures of special education at the 5^{th} - 7^{th} grades in the same school in the same year are highly correlated with the respective measures at the 4^{th} grade. The validity of the instrument thus hinges on whether the exclusion restriction is fulfilled. There are no obvious mechanisms that mediate influences from the special resources in higher grades to the performance of students in lower grades. At least, the application of school fixed effects, which remove the effects from time-invariant teacher quality, makes this less of a worry.

The results

All regression analyses presented in this section use the standardized score for individual students - aggregated over the three tests in mathematics, reading in Norwegian and reading

and writing in English - as the dependent variable. In Table 5, treatment is measured by the number of hours in special education per student. As mentioned above, it is convenient to think of this measure as the product of the proportion of eligible students and the number of hours per eligible student.

(Table 5 about here)

Each cell in Table 5 shows the estimated coefficient on the special resources measure from a separate regression using data for three adjacent cohorts of students. Column 1 presents OLS estimates controlling for individual and family characteristics and year dummies. In column 2 school fixed effects are included. Column 3 is similar to column 2 except that the treatment variable is instrumented. In the specification reported in column 4 we have added municipality fixed effects interacted with time dummies to take care of potential influential time-invariant municipality factors that simultaneously affect student achievement and special education resources. In this way we allow the unobserved municipality factors to exercise varying influences over the actual time period.

The point estimate for the number of hours in special education per student is negative and significant in column 1, close to zero and insignificant in column 2, and positive and significant in columns 3 and 4. The negative point estimate reported in column 1 indicates that there are negative externalities related to eligible students, or alternatively, that more special resources are used in classrooms with low quality teachers. These effects dominate any positive effects of special resources on student achievement. The change in the point estimate between columns 1 and 2 indicates that the negative estimate in column 1 incorporates between-school variation in unobserved student and teacher quality. Still, the column 2-estimate is most likely biased downwards due to within-school across-adjacent-cohorts variation in unobserved student and teacher characteristics. The IV-approach

effectively takes away the within-school across-adjacent-cohort variation in special education resources that is due to unobserved student or teacher characteristics in those cohorts. Identification is thus based on the across-the board increase in special education in the period 2007-2009. The IV-estimate of 0.0036 reported in column 3 is nine times larger than the OLS-estimate reported in column 2; which we think is consistent with the existing empirical evidence that the within-school variation in teacher quality is likely to be quite substantial (see for instance Chetty, Friedman and Rockoff (2012)). In other words, the sign of the OLS-bias is as expected because it seems likely that teachers of low quality simultaneously provide poor teaching and have the kinds of disciplinary problems that lead to an increasing number of diagnoses. The point estimate reported in column 4 is based on the within-grades-in-school-within-municipality variation in special education where an instrument is used to remove the suspect variation in special education across adjacent cohorts. This estimate is statistical significant and somewhat larger than the point estimate reported in column 3 – indicating that time-invariant unobserved municipality characteristics work to bias the point estimate downwards.

To evaluate the size of the effect reported in column 4, consider a school that has 40 students in the 5^{th} grade. We assume that two of the 40 students (5 percent) are eligible to special education, each with 150 hours of special education per year. Then an additional 200 hours of special education hours are provided. At this stage, we do not care how these resources are used. It suffice to state that this equals an increase in special education of five hours per student; which, using the estimate from column 4, is transformed into (0.0047* 5=) 0.0235 standard deviations in academic performance for non-eligible students.

This seems like fairly small effects. However, there are reasons to believe that this analysis conceals the potential effects of special education resources on non-eligible students'

performance. The exploratory analyses presented earlier indicate that the positive effect of special education, as reported in Table 5, depend on how the total number of special education hours is allocated among the students. This hypothesis is investigated by characterizing treatment by the number of hours per eligible student and the proportion of eligible students, respectively. These measures have to be included one at a time in the equation to be estimated due to strong partial correlation. Columns 1- 3 of Table 6 report the results from using the number of hours in special education per eligible student as the measure of treatment. The treatment variable is instrumented using the same approach as above, that is, we have used the number of hours in special education in the 5^{th}-7^{th} grades as our instrumental variable. School-by-grade fixed effects, and municipality fixed effects interacted with year dummies, are included successively in columns 2 and 3.

(Table 6 about here)

The point estimate for the hours of special education per eligible student is positive in all the three specifications that are reported in the table, varying from 0.0002 and statistically insignificant in column 1 to 0.00046 and statistically significant in column 3. To evaluate the size of the latter effect we return to the school with 40 5^{th} graders, of which two initially are exposed to 150 hours each of special education per year. Assume once more that the school is provided with 200 more hours to use on special education, and is free to decide on the allocation of these resources. We consider the following alternatives. The school allocates equal amounts of the available resources (now a total of 500 hours) to the two existing special education students, that is, 250 hours per eligible student, or alternatively, the school allocates an equal number of hours to four students, that is, 125 hours per student. According to the point estimate in Table 6, column 3, the former alternative will, compared with the latter, lead to (0.00046*125 =) 0.06 standard deviations better performance for non-eligible students.

This example then illustrates that the effect of increasing special education resources per student might depend on how the additional resources are allocated across the student body. A tentative interpretation is that the learning environment improves more if the special education resources are concentrated among a few eligible students (perhaps a few chronic offenders?) compared to an alternative where the special education resources are spread thinly over more students.

In columns 4 and 5, treatment is characterized by the proportion of eligible students. We have instrumented this variable using the same approach as above. The point estimate is statistically significant and negative in both cases, indicating that the non-eligible students are worse off when the school classifies a large proportion of the students as eligible to special education. Note that this result is the opposite of what one might expect if the characteristics of the average non-eligible student are improved by the allocation of more students with less favorable characteristics to the subgroup of eligible students.

As suggested above, the nearby explanation for the negative point estimate is that this is an indirect effect mediated through the budget constraint. The descriptive statistics presented earlier indicate that, even though the schools do not operate under fixed special education budgets, the two variables - the proportion of eligible students and the number of special education hours per eligible student - move in opposite directions. The negative point estimate for the proportion of eligible students in column 3 then echoes the positive point estimate for the hours of special education per eligible student in column 2. Using the point estimate in column 3, increasing the proportion of diagnoses from 5 (2 out of 40) to 10 percent (4 out of 40) while keeping the total special education budget constant – as in the example presented above – leads to a performance deterioration of (1.75*0.05=) 0.09 standard deviations. In absolute value, this effect is somewhat larger than the effect calculated above.

We could think of other mechanisms influencing the negative point estimate for the proportion of eligible students. For instance, diagnoses might have a stigmatizing effect, that is, misbehaving students might respond to a diagnosis by increasing their misbehavior. For instance, Morgan, Farkas and Hibel (2010) find that special education in some cases has a negative effect on children's externalizing behaviors (which is a measure capturing the frequencies of arguing, fighting, showing anger, acting impulsive, and disturbing the classroom). These are not mutually exclusive explanations, but cannot be sorted out unless much more black box information is provided.

A robustness check

All the education production function specifications reported above might potentially include a small fraction of eligible students. These practices, which are dictated by the nature of the available data, potentially introduce a bias to our analyses. There are at least two problems to consider. First and much highlighted, some schools might use special education placements strategically to keep low performing students out of the testing pool. As long as these are time-invariant behaviors, the school fixed effects approach will take care of this. Second, in the current data schools increase special education placements over time, implying that the estimates for the proportion of eligible students are biased upwards because there will be a "mechanical" positive relationship between the proportion of eligible students and student performance insofar that the students that are taken out of the testing pool and provided special education, perform below the population average. We have evaluated this bias by excluding from the analyses the student subgroups that are most likely to be deemed eligible to special education. From Table 2 it is evident that students with less educated parents and students from dissolved families are overrepresented among eligible students. We have therefore estimated all the relevant equations by first excluding students with parents that are

educated at the lower secondary school or below, thereafter by excluding students from dissolved families, and finally, by excluding both students that have parents that are educated at the lower secondary level or below and students from dissolved families. Then we are left with subgroups that are basically not affected by the increase in the proportion of eligible students, thus preventing that the estimated effects reflect changes in the composition of the treatment group. The point estimates change somewhat, but none of the results differ much from the results reported above. These results are not reported in the tables, but are available on request.

DISCUSSION AND CONCLUDING REMARKS

The main purpose of this paper has been to investigate whether special education resources affect the performance of non-eligible classmates. The data come from the Norwegian elementary school which is characterized by full inclusion, large proportions of eligible students and generous amounts of special resources. The investigations start out by providing evidence that there seems to be substantial negative externalities associated with the subgroup of students that are deemed eligible to special education, potentially reflecting that this subgroup contains a non-negligible fraction of misbehaving boys. Thus, the question addressed in the paper is actually whether special education resources work to dampen such negative externalities.

We have addressed the challenges related to the endogeneity of the special education resources by pooling data for three adjacent cohorts of 5^{th} graders and by combining school and municipality fixed effects with an instrumental variable approach, basically exploiting the rapid, across-the-board, increase in the proportion of students deemed eligible to special education in the period under scrutiny. That is, the panel nature of our data allows us to

compare cohorts with low proportions of eligible students to cohorts with high proportions of eligible students in the same school and grade in a different year. There is no idiosyncratic within-grade-across year variation in the proportion of eligible students that can be exploited, so we use an iv-approach to deal with this worry.

The evidence indicates that non-eligible students are positively affected by the number of hours of special education per eligible student, and negatively associated by an increase in the proportion of eligible students. The favored interpretation of these results is that it matters quite a lot how the special education budget is allocated across the students. The following example illustrates. Making the assumption that all schools have the same size of 40 5^{th} graders and have 500 hours of special education hours to allocate, then, if all schools switch from allocating 125 hours to each of 4 students to allocating 250 hours to each of 2 students, the performance of the non-eligible students will improve by at least 0.06 standard deviations. This seems like a considerable effect following from a reallocation of resources within a fixed budget.

We end the paper by pointing to two issues for future research. First, it is not obvious that the school owners or school leaders can exercise much discretion with respect to the use of special education resources. In Norway, students who do not benefit from ordinary teaching, have a legal right to special education. There is a lot of anecdotal evidence saying that parents and teachers advocate eagerly for eligibility. The school owners or school leaders cannot overrule a decision of eligibility, but can adjust the number of hours per eligible student. The data used in this analysis reveal patterns of special education resources that are consistent with such behaviors. One topic for further research is how school leaders, and the local governments, seek to gain more control over the use and allocation of special education resources. A specific research question is whether local governments that have introduced

accountability systems are more likely to exercise control over their special education resources.

The second research topic requires an opening-up of the classroom black box to access information about student and teacher behavior. The most likely mechanism underlying the findings reported in this paper is that non-eligible students benefit from the use of special education resources because negative externalities are reduced: misbehaving students are taken out of the classroom, or are taken care of, by additional teachers within the classroom. In the present paper we have provided some scattered and indirect evidence that this might be the driving mechanism, but this topic would certainly gain from more thoroughly investigations.

Appendix Table 1 The relationship between noise and disorder and the proportion of eligible students

	Noise and disorder	Noise and disorder	Noise and disorder
Proportion of eligible students	0.63***		0.63***
	(-2.73)		(-2.73)
# students	0.00036***	0.00031**	0.00036***
	(-2.69)	(-2.32)	(-2.69)
Proportion of boys	0.014	0.059	
	(-0.084)	(-0.35)	
Mothers' education – average	-0.069	-0.072	-0.070
	(1.42)	(1.45)	(1.43)
Fathers' education – average	0.064	0.059	0.064
	(-1.27)	(-1.17)	(-1.28)
Family structure – average	-0.38***	-0.38***	-0.38***
	(2.89)	(2.89)	(2.89)
Constant	6.28***	6.19***	6.27***
	(32.0)	(32.0)	(36.7)
Observations	2013	2013	2013
Adjusted R-squared	0.015	0.010	0.016

Note: *** p<0.01, ** p<0.05, * p<0.1 Robust t-statistics in parentheses

Appendix Table 2 The relationship between hours of special education per student and municipality size

VARIABLES	Hours of special education per student	Hours of special education per student
Method	OLS	FE
Population (ln)	-0.45***	-0.70***
	(-3.12)	(-2.92)
Revenues per inhabitant (ln)	6.06***	0.25*
	(7.09)	(1.69)
Share 0-5 yrs	-17.7	-2.18
	(-1.31)	(-1.42)
Share 6-15 yrs	-19.3**	-3.53***
	(-2.26)	(-2.81)
Share 67+	-18.5***	-2.42*
	(-3.10)	(-1.93)
Share 67-80 år	7.10***	-0.031
	(2.59)	(-0.094)
Scattered settlement	1.56***	0.12
	(3.04)	(0.55)
Observations	3346	3340
R^2_{adj}	0.210	-0.047
#municipalities		419

Note: *** p<0.01, ** p<0.05, * p<0.1 Robust t-statistics in parentheses

REFERENCES

Bateman, B. (1996). Better IEPs: How to develop legally correct and educationally useful programs. Longmont, CO: Sopris West.

Bertrand, M., & Pan, J. (2011). The trouble with boys: social influences and the gender gap in disruptive behavior. NBER Working paper #17541.

Bonesrønning, H. (2008). Peer group effects in education production: is it about congestion? *Journal of Socio-Economics*, 37: 328-342.

Carrell, S.C., & Hoekstra, M.L. (2010). Externalities in the classroom: how children exposed to domestic violence affect everyone's kids. *American Economic Journal: Applied Economics*, 2(1): 211-228.

Chetty, R., Friedman, J.N., & Rockoff, J.E. (2011). The long-term impact of teachers: teacher value-added and student outcomes in adulthood. NBER Working paper #17699.

Crockett, J., & Kauffman, J. (1999). The least restrictive environment: Its origins and interpretations in special education. Mahwah, NJ: Lawrence Erlbaum Associates.

Ermisch, J.F., & Francesconi, M. (2001). Family structure and children's achievements. *Journal of Population Economics,* 14, 249-270.

Figlio, D.N. (2007). Boys named Sue: Disruptive children and their peers. *Education Finance and Policy*, 2(4): 376-394.

Fletcher, J (2010). Spillover effects of inclusion of classmates with emotional problems on test scores in early elementary school. *Journal of Policy Analysis and Management*, 29(1): 69-83.

Friesen, J., Hickey, R., & Krauth, B. (2010). Disabled peers and academic achievement. *Education Finance and Policy*, 5(3): 317-348.

Hanushek, E.A., Kain, J.F., & Rivkin, S.G. (2002). Inferring program effects for special population: does special education raise achievement for students with disabilities? *Review of Economics and Statistics*, 84(4): 584-599.

Lavy, V., & Schlosser, A. (2011). Mechanisms and impacts of gender peer effects at school. *American Economic Journal: Applied Economics*, 3(2), 1-33

Lazear, E. P. (2001). Educational Production, *The Quarterly Journal of Economics* 110(4), 777-803-693.

Morgan, P.L., Farkas, G., & Hibel. J. (2010). A propensity score matching analysis of the effects of special education services. *Journal of Special Education*, 43(4), 236-254.

Nordahl, T. & Hausstätter, R.S. (2009). Spesialundervisningens forutsetninger, innsatser og resultater. Hedmark University College.

Painter, G., & Levine, D.I. (2000). Family structure and youths' outcomes: which correlations are causal? *Journal of Human Resources* 35, 524-549.

Public Agenda (2004). Education : Teaching Interrupted: Do Discipline Policies in Today's Public Schools Foster the Common Good? Accessed at: http://www.publicagenda.org/research/research_reports_details.cfm?list=3

The Norwegian Institute of Public Health (2012): Facts about ADHD http://www.fhi.no/eway/default.aspx?pid=233&trg=MainLeft_5648&MainArea_5661=5648:0:15,2917:1:0:0:::0:0&MainLeft_5648=5544:60586::1:5647:2:::0:0

Table 1 Descriptive statistics. Measures of treatment

	2006	2007	2008
Proportion of eligible students	5.65	6.42	7.42
#hours of special education per eligible student	156	152	146

Table 2 Determinants for the proportion of eligible students

VARIABLES	Proportion of eligible students-grade level	Proportion of eligible students-grade level	Proportion of eligible students-grade level	Proportion of eligible students-grade level	Proportion of eligible students-grade level
Proportion of boys	0.038***	0.039***	0.039***	0.037***	0.033***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.007
Proportion of students from intact families			-0.018***	-0.021***	-0.019**
			(0.002)	(0.002)	(0.009)
Father's education – garde average		-0.014***	-0.0088***	-0.0044***	-0.0019
		(0.0002)	(0.0003)	(0.0003)	(0.003)
Father's earnings – grade average			-2.57e-08***	-1.80e-08***	-2.57e-09
			(1.13e-09)	(1.09e-09)	(9.03e-09)
Constant	0.027***	0.086***	0.090***	0.069***	0.057***
	(0.001)	(0.001)	(0.002)	(0.002)	(0.013)
Observations	145,547	145,547	145,547	145,547	145,547
R-squared	0.013	0.039	0.045	0.085	0.020
# schools					2,428

Note: *** p<0.01. All specifications include year dummies. The two specifications to the right also include the number of students in the grade.

Table 3 The relationship between performance at national tests and the proportion of eligible students in the grade. 2007-2009.

VARIABLES	2007	2008	2009
Proportion of eligible students	-0.390***	-0.353***	-0.435***
	(0.089)	(0.086)	(0.081)
Observations	49,901	47,979	47,521
R-squared	0.133	0.133	0.128

Note: *** p<0.01. Control variables are gender, immigrant status, parents' education and earnings, family structure, family size and birth order, school size, peer group characteristics and measures of purchased inputs (teacher-student ratio, proportion of non-certified teachers).

Table 4 The relationship between student achievement and the proportion of eligible students in schools that use less and more than the average number of hours of special education per eligible student

	National tests			
VARIABLES	Less than the average number of hours per eligible student	More than the average number of hours per eligible student	Less than 100 hours per student per year	More than 200 hours per student per year
Proportion of eligible students	-0.603***	-0.0476	-0.590***	0.0517
	(0.138)	(0.172)	(0.186)	(0.235)
Observations	82,184	63,752	46,515	39,421
R-squared	0.101	0.093	0.106	0.092
#schools	1,753	1,816	1,191	1,413

Note: *** p<0.01. Control variables are gender, immigrant status, parents' education and earnings, family structure, family size and birth order, school size, peer group characteristics and measures of purchased inputs.

Table 5 The casual effect of the number of hours of special education per student on the achievement of non-eligible students.

VARIABLES	OLS	FE_S	IV& FE_S	IV& FE_S& FE_M
#Hours of special education per student	-0.0043***	0.0004	0.0036**	0.0047**
	(-9.26)	(0.08)	(2.38)	(2,76)
Individual controls	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes
Observations	149622	149622	149451	148448
R^2	0.126	0.096	0.096	0.110

Note: Robust t-statistics in parentheses. *** p<0.01, ** p<0.05. Individual control variables are gender, immigrant status, mother's and father's education, mother's and father's earnings, family structure, family size, birth order.

Table 6 The casual effect of hours of special education per eligible student on the achievement of non-eligible students.

VARIABLES	FE_S	$IV\&FE_S$	$IV\&FE_S\&FE_M$	$IV\&FE_S$	$IV\&FE_S\&FE_M$
#hours per eligible student	0.0002	0.00019	0.00046*		
	(0.87)	(0.85)	(1.74)		
Proportion of eligible students				-1.43*	-1.75**
				(-1.66)	(-2.48)
Individual controls	Yes	Yes	Yes	Yes	Yes
School inputs	Yes	No	No	No	No
Year dummies	Yes	Yes	Yes	Yes	Yes
Observations	134363	134363	134363	146703	146703
R-squared	0.098	0.098	0,113	0.095	0.107
#Schools	2055	2055	1868	2390	2390

Note: Robust t-statistics in parentheses. *** p<0.01, ** p<0.05. Individual control variables are gender, immigrant status, mother's and father's education, mother's and father's earnings, family structure, family size, birth order.