School accountability reforms in Norway: The increase in special education placements

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Abstract

The present paper analyses the relationship between Norwegian school reform implementing and the use of special education. After the implementation of the reform "Kunnskapsløftet" ("Knowledge promotion") in 2006, the level of special education has increased dramatically, and I investigate through different empirical strategies, whether this growth is due to the reform implementations in the municipalities or not. The municipalities have implemented the reform to a varying degree, and at different points of time. I exploit these variations in my analyses. To solve endogeneity problems, I present different strategies. To solve problems by unobservable correlations I use an instrumental variable strategy. To exploit variations in the time of reform implementation I present a Jacobsen, Lalonde, Sullivan (1993) strategy. At last I do a difference in difference strategy to analyze an example of reform implementation in a Norwegian municipality. Independent of strategies I find that the increase in the proportion of students receiving special education placements is significantly lower in municipalities with a high degree of reform implementation.

1. Introduction

Evidence form the existing international literature on the effects of accountability is mixed. As to intended effects, several studies suggest that high-stakes testing may be effective at raising student achievement (i.e, Carnoy and Loeb 2002, Jacob 2005, Dee and Jacob 2011 and Hanushek and Raymond 2005), but Ladd (2009) find small achievement benefits from accountability policies in Dallas in the 90s. As to unintended effects, some authors have highlighted aspects of strategically response form schools. For example, there are some evidence that schools respond to accountability pressure by differentially reclassifying low-achieving students as learning disabled so that their scores will not count against the school in accountability systems (See Cullen and Reback (2006), Figlio and Getzler (2006), Jacob (2005)).

In Norway a national reform involving aspects like testing, decentralization and accountability was decided in parliament in 2006. From the same year we have witnessed a large expansion in the number of special education placements in the Norwegian elementary school. Figure 1 shows the development in the proportion of students with special education placement over the last decade. We see no growth in the very first years in the figure, but we observe a clear acceleration after 2006. This growth is similar in both primary and lower secondary schools.

(Figure 1 about here)

Much of the public debate focuses on that Norwegian school actors must have responded to accountability in the same way as school actors elsewhere, by strategically reclassifying low-achieving students as learning disabled. Unfortunately, due to the lack of a counterfactual the hypothesis that the increase in special education placements is caused by the reform cannot easily be investigated. However, there is substantial evidence that the municipalities, that oversee the schools, have implemented the reform to various degrees and at different point of time. As much as two thirds of the municipalities have not introduced the accountability elements contained in the reform by 2009. In Figure 2, I show the development of special education placements separately for implementing and non-implementing municipalities. As shown there, the reform implementing municipalities have experienced less growth in placements compared to non-implementing municipalities.

On one hand, it seems likely that accountability systems will increase the demand for special education placements by teachers and parents. On the other hand, in an accountability system the authorities that oversee the schools might be better equipped to keep costs and special education placements down. The relative strength of these parties will likely be determined by the design of the

accountability system. In the empirical analyses, I exploit the fact that the municipalities, that oversee the schools, have implemented accountability systems to a varying degree.

My empirical strategy is to exploit the variation in reform implementation across the municipalities to investigate whether the reform, when properly implemented, causes less rapid growth in special education placements.

The investigations are executed in the following way. From surveys to the chief executives in the municipalities a reform implementation index is generated. This measure is used in three different identification strategies where I try to estimate the relationship between governing systems in Norwegian municipalities and the level of special education. First, I go through an instrumental variable strategy where municipal reform implementation is instrumented with variables that are exogenous to special education placements. Second, I exploit variations in the timing of reform implementations in Norwegian municipalities, following the identification strategy first presented in in Jacobsen, Lalonde & Sullivan (1993). The special education in the years after the reform will be compared with the special education level many years prior to the reform and in the next step compared to a national trend. In this strategy I can distinguish between short and long term effects. Neither of these analyses pays much attention to the exact design of the governing systems that are established in the municipalities. Finally, I therefore perform a difference in differences analyses for one municipality for which I know have added accountability elements in 2009.

A naïve introductory OLS-analysis indicates that the level of special education is lower in municipalities with a high degree of reform implementation, given their level before the reform. Instrumenting the degree of reform implementation I find even stronger results. An one standard deviation increase in the degree of reform implementation increases the level of special education with 1,7 percentage points. However, I go on with difference in difference and JLS analyses. These analyses confirm my earlier results, and the coefficients are comparable with my instrumental variable analyses. The JLS strategy gives some additional understanding about the differences in trends in the use of special education between reformed municipalities and non-reformed municipalities.

The rest of the paper is organized as follows. Section 2 provides a discussion a three-tier principal agent framework as well as some important literature. I do not set up any technical model, but discuss the mechanisms as a motivation for my empirical analyses. Section 3 presents the data, institutional settings and empirical strategy. Section 4 provides results and section 5 concludes.

2. Literature and theoretical considerations

As presented in the introduction there is a large empirical literature on the effects of accountability systems, mostly from the United States. Studying this literature, we can distinguish between intended and unintended effects of implementing such reforms. The present paper focuses on the unintended effects and there is a growing empirical literature on such effects. One example from the literature is on school principals/teachers reclassifying students as learning disabled to take them out of the testing pool. Figlio and Getzler (2006) find that following the introduction of the FCAT testing program low-performing students from low socioeconomic backgrounds were significantly and substantively more likely to be reclassified into disability categories exempted from the accountability system. Another example is Cullen and Reback (2006), who exploit the discontinuity in rewards in Texas's accountability system to show that school responds to incentives to shape test pool. Jacob (2005) also finds evidence that suggests that teachers responded strategically to the accountability policy, particularly in terms of special education placements and grade retention. Nevertheless, he finds no effect on the proportion of students who participated on the standardized achievement exams.

2.1 Theoretical considerations

The relationship between school owner, school leader, teachers and parents in the special education decision-making might be understood in a principal-agent framework with asymmetric information. I will discuss this framework below. Tirole (1986) and Laffont and Tirole (1993) are early contributions to this literature. Dal Bo (2006) provides an up-to- date presentation of the three-tier hierarchy model to understand regulatory capture. This framework should be transferable to the decision-making of selecting students to special education. The essential contribution in such a framework is that it allows for a third part in the principal-agent model. On one side we have the school owner as the principal and the teacher as the agent. However, an important part in the special education decisions is the school leader, and he will be in some kind of a middle position. I do not set up a technical model in this section, but rather discuss the main arguments and implications for my empirical strategy. I use this to motivate my analyses.

An essential part of the model is the degree of asymmetry. As in Dal Bo(2006), the agent has full information. He knows the qualities of the student group and the educational setting. Most importantly, he knows the true need of special education in his group. The principal (school owner) has less information, but wants to maximize student performance relative to a budget constraint. The teacher also wants to maximize student performance, but does not pay as much attention to the

municipality budget constraint. The school leader's (regulator in the model by Dal Bo) role depends on the organization of the municipality. If the special education expenditures are included in the budget transfers the school leader will probably tend to sympathize with the school owner. In the opposite case, the expenditures for special education is taken out of the school budget transfers, the school leader will tend to sympathize with the teacher, caring less about the budget constraint. The asymmetric information will result in teachers reporting higher needs for special education than necessary in order to acquire more resources. The lack of information for the school owner will give him less power to counteract.

The focus in my empirical analyses is how this relationship between the principal and agent is affected by a change in the governing system. Essentially, this will affect the asymmetry of information. There are two main components of the reform, accountability and decentralization. These two parts have to be discussed apart. First, decentralized authority will lead to more power for the school leader to decide the level of special education. The school leader will have the authority to take decision on special education placements within the school budget. In this situation, and especially if there are hard budget constraints, the school leader will tend to sympathize with the principal in the model, and provide more information to the principal, which will give the principal more opportunities to counteract when the agent acquire more special education resources. Second, the accountability part of the reform also provides more information to the principal in the model. This information comes for possible two sources. First, more testing will give the principal essential information about student performance and quality of the educational setting. Secondly, systematically evaluations will provide information on other aspects of the teachers, school organization and also qualities of students and the educational setting. The asymmetry of information will play a less important role, and the information advantage of the teachers has diminished.

On the other side, if the level of special education is decided outside the school budget transfers, a higher degree of decentralization under an accountability system may lead to an increase in the level of special education. Under these circumstances the school leader will see more special education as an increase in the total school budget. In addition, reclassifying students as disabled will increase average students' performance (disabled students does not take part in national tests). However, this is an empirical issue.

3. Data and Empirical strategy

98 percent of primary and lower secondary schools are owned and fully financed by the municipalities. It is the local councils who decide the number of schools, locations and budgets. It is in addition the local councils who decide their governing systems, such as the degree of decentralization of the decision making authority and the degree of accountability.

The national government influences the constraints of the municipality through different channels. The municipalities' revenue is mostly determined by grants and local taxes determined by the national government. Up until "Kunnskapsløftet", there existed many strict national rules and regulations that influenced the working of the educational sector, as for example a class size rule for the student-teacher ratio. Still, they have in Norway, national exams, tests and curriculum decided at the national level.

"Kunnskapsløftet" was both a decentralization reform and an accountability reform. There was decentralization both from the national level to the municipality level and from the municipality level to the school level. The first part was mainly through the abolishment of national regulations. In addition the reform encouraged municipalities to decentralize decision-making authority. Also, the reform was an accountability reform. One important tool in this part of the reform was the introduction of national tests. There have been national tests for 5th and 8th graders since 2007 and for 9th graders since 2010. The municipalities were encouraged to form their governing systems such as school principals were held accountable for student performance. National tests were disclosed publicly at the municipality levels. Newspapers do also provide rankings on school level. One important implication of this publicity of the results from national tests is that it provides important information to all parties. It provides information for the school owner about qualities of students and the educational setting. It does also provide important information for the school principal and teachers. Also important, it provides essential information to the parents on their children's performances, and the performances of their children's peers. Based on this information, education-oriented parents will acquire more resources to their children, in order to improve performances.

3.1 Data

I use data from different data sources. First, I use school data from the school administrative system in Norway (GSI, Grunnskolens informasjonssystem). From this system I can identify schools, and find their level of special education, use of assistants, group size and some information about the

teachers. In addition, I have merged these data with some observable information about the municipalities. These data are provided by Statistics Norway.

Two surveys to the Norwegian municipalities are used to generate information about reform implementation. Both surveys are provided by researchers at the Centre for Economic Research at NTNU (Strøm et al, 2009). School owners are asked about their governing systems; whether they are decentralized and whether/how school principals are held accountable for students' performance. 297 of the 434 municipalities have answered the first questionnaire. A randomly chosen sample of 117 municipalities answered the last questionnaire.

The dependent variable in my main analyses is the proportion of students at the school who have special education placements; that is, the number of students receiving special education divided by the number of students at the school. Figure 1 illustrated the development in the dependent variable over time. It has increased from about 6 % to about 9 % in few years. This increase is in all levels, both in primary and lower secondary school. The lower secondary school has a higher level of special education than the primary school. The proportion of students with special education placements increases with student age.

The explanatory variable of interest is a reform implementation index. This index has two main components. First, we have one component describing the decentralization of decision-making authority between the owner and the school principals. This component is captured by the following questions: the extent to which the school principal, within a given budget, is free to decide on *personnel matters* such as the number of teachers, the amount of special education and the number of assistants (a total of seven questions), and the extent to which the principal is free to decide on *class size, on teaching methods, on innovation and updating of the teacher staff* (a total of seven question). The school owners have indicated the degree of decentralization on each of these questions on a 1-5 scale, where 1 is no decentralization and 5 is full decentralization. A presentation of the questions with descriptive statistics is presented in the Appendix. The average degree of decentralization in Norwegian municipalities is 4 on a 1-5 scale. Second, we have an accountability part. This part is captured by two questions: whether the school principals have signed a contract with explicit student performance objectives, and whether the school owner systematically evaluates the school principals. Information about these questions and some descriptive statistics are presented in the Appendix. About one third of the municipalities have school leader contracts, and about the same proportion do systematic evaluations.

The total reform implementation index is generated by adding up the two components. The decentralization index is in the first place an index ranging from 1-35. The accountability component

has the value 2 if the municipalities both have this contract with the school principal and doing systematically evaluations and the value 0 if the school owner answered *no* on both questions. If the school owner answered 1 on one of the questions and 0 on the other the index takes the value one. At last the two components standardized with a mean of 0 and a standard deviation of 1, and added together. Thereafter, they are standardized once more.

Other explanatory variables included in my models are time dummies, the education level in the municipality, proportion of youths, a herfindahl index capturing the party fragmentation of the local council, proportion of socialists and some aggregated school data such as assistants, class size and education level among teachers. Descriptive statistics are given in table 1.

Table 1 also provides descriptive statistics for important subsamples. First, I am able to compare the group of municipalities that responded on the survey with the group of municipalities that did not respond. These subgroups share many of the same characteristics, but the respondents have more inhabitants on average. I am also able to compare the municipalities with a more than average degree of reform implementation with those municipalities with a lower than average degree of reform implementation. The low reform implementation municipalities have populations that are smaller and less educated. Among the municipalities with a higher than average reform implementation, the number of inhabitants is more than 25000 on average. In low degree of reform implementation municipalities the size is about 6000. The education level in the municipalities with the higher degree of reform implementation is also higher. 17 % of the inhabitants do have longer education. In the opposite group, this share is 14 %. These are obvious large and important differences between these two groups, and I control for these observable characteristics. Most likely, there will also be differences in unobservable characteristics. This pattern will be discussed in the empirical strategy.

3.2 Empirical strategy

I use several empirical strategies in this paper. In order to establish a point of reference, I run a simple OLS when estimating the following equation:

(1) $SE_{mt} = \beta_0 + \beta_1 REF_m + \beta_2 X_{mt} + \beta_3 Z_{mt} + u_{mt}$

Where SE is the special education level in municipality m, at time t. REF is the standardized index for reform implementation in municipality m in the year 2009. X is a vector of municipality characteristics, such as educational level, proportion of youths, and proportion of socialists in the local council, a herfindahl index, number of inhabitants and so on. Z is a vector of school

characteristics, such as use of assistants, student-teacher ratio, teacher education and enrollment. u is an error term. The school characteristics are aggregated to the municipality level.

3.2.1 Instrumental variable strategy

Municipalities decide themselves whether to implement the national reform or not and on what time to implement, making REF an endogenous variable in equation (1). Municipalities with a high degree of accountability and decentralization are for example more often large municipalities with highly educated parents. Table 1 confirms this. However, we control for that in our OLS regression. Still, there might be unobservable differences between municipalities. As an example; if, among the highly educated parents, there are some that are more reform-friendly, and have higher ambitions for their children, they will put pressure on the municipalities for accountability reforms and in addition, demand special education services. This is to say, that we might witness that the municipalities that have installed accountability systems experience strong growth in the fraction of students eligible to special education. Of course, some highly educated parents might put pressure on the municipalities for accountability reforms, without demanding more special resources. A priori it is hard to tell how parents behave. I therefore need an instrumental variable strategy.

To solve this endogeneity problem, we need more credible strategies. In the present paper I present three possible solutions that all have their strengths and weaknesses and I start with an instrumental strategy. The instrument I use is municipal discretional income. This instrument is used in many municipal analyses on Norwegian data. See for instance Bonesrønning (2011). Municipal discretional income consists mainly of two parts. First, it is municipal taxes. Some of the municipal taxes are decided on the municipality level. The municipalities may chose the level of municipal tax rates within an interval decided on the national level. In fact, almost all municipalities have chosen the highest possible *tax rate*. Second, the discretional income consists of national transfers. These are decided on the national level and based on observable municipal characteristics, such as the number of inhabitants and factors that capture cost disadvantages. I control for many of these observable characteristics in my analyses.

By using discretional income as an instrument, the first stage equation performs very well; the discretional income is a strong determinant of the degree of reform implementation. The structural equation in table A1 indicates that these variables have no impact on the level of special education. The coefficient is not significant at conventional levels. The instrument should satisfy the criteria for a valid instrument. However, one should not pin one's faith in such models. Is there any reason that discretional income could affect the level of special education? In using instrumental variable

strategies, one should concern that municipalities that share the same observable characteristics, such as the level of discretional income, number of inhabitants and other observable characteristics, share the same unobservable characteristics as well. In particular, potential Tiebout sorting should be considered. Inhabitants may sort themselves into municipalities based on the criteria deciding the level of discretional income, as for example the level of taxes and number of inhabitants. However if such selectivity processes exist, we would have observed some municipality with the same level of discretional income characterized by for example low educated inhabitants increasing the probability of having a high level of special education. Other municipalities with approximately the same level of discretional income will be characterized by highly educated inhabitants and low level of special education. By controlling for the level of highly educated inhabitants I take away much of this particula worry. Identification is based on the assumption that these effects are quantitatively unimportant.

There are two weaknesses with this strategy. First, I do not exploit variations in the time of implementation. This could give additional information about the importance of some elements of the reform and most importantly information about short and long run effects. Secondly, the reform implementation index may be inaccurate, in the sense that it does not take into account that some elements of the reform are more important than others. However the reform implementation index is only included in the first stage, and is not interpreted directly. I will go through some other strategies under to address these weaknesses.

3.2.2 JLS Strategy

To exploit variations in the time of implementation I will perform a strategy first introduced by Jacobsen, Lalonde & Sullivan (1993). More recently the strategy is used I Couch & Placzek (2010). The survey provided by Strom et.al (2009) provides information about the year in which the municipalities responded on "Kunnskapsløftet" by changing their governing system. I estimate a model in order to allow for variation across both time and school characteristics. I pool all information for schools in the years between 2003 and 2010, and introduce a series of dummy variables for the years before or after the reform implementation. Accordingly, I let D^k_{smt}=1 if, in period t, school s, in municipality m had implemented the reform k years earlier (or if k is negative, municipality m implemented the reform k years later).

The statistical model is given in the following equation

$$(2)\ Y_{smt} = \alpha_m + \lambda_t + X_{smt}\beta + \sum_{k \geq -7} D^k_{smt}\delta_k + \varepsilon_{smt}$$

Here is Y the level of special education in school s in municipality at time t. α is the municipality fixed effect. It captures the impact of permanent differences among schools in observed and unobserved characteristics. Λ is a set of time dummies that captures the general time pattern of special education in the Norwegian school system. X is a set of time varying controls on the school level. The variables of interests are the reform dummies, the D's. D^k_{smt} where k is in the interval of [-4 years or more before, 6 years or more after] jointly represent the time of reform implementation. In particular δ_k is the effect of reform implementation on the level of special education k years after. In the empirical work I allow for 12 dummies in the interval and the level of special education these years are compared to their level more than four years before implementing the reform. The differences will then be compared to the national trend. Since very few municipalities implemented new reform early in the period, we have quite few observations more than 6 years after reform. The model is estimated by OLS. This estimation generalizes the "difference in differences" methods, which uses a comparison group to estimate the changes that would have occurred in the absence of reform, by accounting for the effects of time-varying variables and by allowing the effects of implementations to vary by the number of years relative to reform.

In addition to be more flexible in distinguishing between short and long term effects, a JLS strategy is also more robust, by using more variations in data. I do not need to condition my analyses on one change, in one municipality at one point of time. However, most important for my discussion is that this analysis makes me able to distinguish between short terms and long terms effects.

3.2.2 Difference in difference analyzes

Reforms implemented in Norwegian municipalities after "Kunnskapsløftet" works among two dimensions. First, more and more municipalities introduces governing systems characterized by decentralization. In detail this means that the schools, either represented by the teacher or the principal, are given more authority to decide the level of resources and what combinations of resources they prefer. Secondly, reforms implemented latest years are characterized by more accountability. This means that school principals are to a higher degree held responsible for their results. Table 2 gives indications on the importance of these dimensions of the reform. Neither of the earlier strategies takes into account the importance of these reforms. By using differences in difference approach with one municipality as treatment group, I analyze one type of municipality reform that took place in the period after the national reform "Kunnskapsløftet". In order to analyze the role of accountability, I ideally should have a municipality that has had decentralized authorities for a long period but changes its governing system by introducing accountability.

In differences in difference analyses we are in need of suitable treatment and control groups. I follow Jacob (2005) in order to choose participants in these groups. The survey provided by Strom et.al (2009) reports the level of reform implementation in the municipalities and provides information about the year in which they changed their governing system. This gives me the opportunity to pick municipalities that changed their governing systems in 2007-2009 after the national reform implementation in "Kunnskapsløftet", preferably in 2008 to have more observations the years after the reform. Strict criteria are as the following: A municipality larger than 25000 inhabitants, high degree of reform implementation after the change and a change in the governing system in 2007-2009. Ideally, the change should be along the accountability dimension of the reform implementation index. One single municipality stands out, the municipality of Sarpsborg. It has about 52 000 inhabitants, a high degree of reform implementation, and they changed their governing system in 2008 as a response to the national reform. The change consisted mainly of the introduction of systematic evaluations and leader contracts with the principaks. To analyze whether the increase in the special education level in Sarpsborg is different from other municipalities, I estimate a standard difference in difference model. The first difference is the change in the level of special education in the municipality of Sarpsborg before and after the change in the governing system. If the level of special education in Sarpsborg is higher after the reform implementation this might be an effect of these new policies. However, the increase might also be the result of other factors on the national or regional level. To control for those factors, I take the second difference, which is the change in the level of special education for the control groups. By following Jacob (2005) I choose other large cities within the same county as control group. Counties in Norway are not responsible for primary and lower secondary schools in Norway. Still, there are examples on the county administration in a role as coordinator on projects where the municipalities in the same county are cooperating. Neighbor municipalities do also face much of the same environment, and national regulations may in some case be conditional upon geography.

There are three large cities in Østfold, except Sarpsborg; Fredrikstad, Moss and Halden. Our data do not provide information about their governing systems, but by interviewing the chief executive in these municipalities, I have got sufficient information. This information means that Moss cannot be a suitable part of the control group. They made an administrative change in 2008 that may create noise in my estimates. However, through these interviews I know for sure that the other two large municipalities, Halden and Fredrikstad did not have any political or administrative changes in their governing systems in the period 2006-2010. I present analyzes with Halden and Fredrikstad as parts in the control group.

This DD-approach rests on the assumption that the before-after difference for the control group would have been the before-after difference for the treated group in the absence of the reform. With the DD-approach the treatment effect (δ) can be found as:

$$(3)\ \delta = (SE^{S}_{after} - SE^{S}_{before}) - (SE^{C}_{after} - SE^{C}_{before})$$

Where SE^{S}_{after} is the level of special education in Sarpsborg after the change in their governing systems. SE^{S}_{before} is the level of special education before the change. SE^{C}_{after} and SE^{C}_{before} is the level of special education before and after the local change in Sarpsborg for the control group. These are assumed to be unaffected of a local municipality reform in Sarpsborg. I estimate δ with a regression model which has the following form:

$$(4)\ SE_{sm} = \alpha + \lambda S + \gamma T + \delta S * T + \beta X_{sm} + \varepsilon_{sm}$$

Where S is a dummy, which has the value 1 if the schools is in the municipality of Sarpsborg and the value 0 if the school is in the control group. T is a dummy which has a value 1 for the period after the change in Sarpsborg, and the value 0 for the period before. X is a vector of controls. ε_{sm} is a school specific error term. The parameter of interest is δ, which is the difference-in-difference estimator.

This last approach will give us a single example of one type of reform that was implemented in the municipality of Sarpsborg in 2008. However, it will highlight the role of accountability in estimating the effects of Norwegian school reforms. As discussed above, the instrumental variable strategy does not take into account what elements of the reform implementation index that are the most important. This example from the municipality of Sarpsborg, estimate the role of a change in the accountability part of the governing system. Sarpsborg has for a long time had decentralized authority, and the change in 2008 did not affect the balance between school owner and school leader. However, the change in Sarpsborg mad school principal more responsible for their results, through more systematically evaluations of the schools, and through the introduction of leader contracts with the school principals.

4. Results

OLS and IV

In this section I provide evidence on the effects of Norwegian reform implementing on the use of special education. I present evidence from different empirical strategies, as presented earlier. First, I present the naïve OLS results based on the model in equation 1. To control for the initial level of

special education, I have included the level of special education in 2005. I also include time dummies. Table 3 gives the results.

The table has seven columns. The first five is estimated by OLS and by adding more and more controls, the sixth column are estimated by the instrumental variable strategy and is discussed in section 4.1. The variable of interest is the accountability index. Column (1), without controls indicates a negative relationship between the level of accountability and the level of special education. However, the effect is small. In column (2), where we control for the level of special education in 2005, the effect becomes a little larger. Including time dummies does not change the estimate for the reform implementation index very much. In column (4), when I include additional controls at the municipality level as the proportion of inhabitants in the municipality that are highly educated, the number of inhabitants proportion of socialists in the local council and a herfindahl index, the coefficient drops, but not very much.

Instrumenting the level of accountability by the discretional income per inhabitant makes the effect considerably stronger. In fact, the absolute value of the reform index coefficient reported in column (6) is 7 times the absolute value of the reform index in column (5). At first thought, this is not as expected. We have already seen that the estimate for the reform index decreases in absolute value when we control for municipality characteristics. However, there are reasons for why the unobservable differences might work in the opposite direction. A hypothesis is that the most educated-oriented parents have strongly supported accountability reforms at the local level at the same time as some of them have been demanding additional resources for their own children.

Figures 3-6 illustrate some of these unobservable differences, motivated by the last example. First, figure 4 illustrates the increase in special education when the population is divided into subsamples by parental education. We see that schools with a low level of parental education have more special education. However, the increase is in the level of special education last years is almost as high among schools with highly educated parents as in schools with a low level of parental education. The percentage increase is in fact higher among highly educated. Figures 5 and 6 divide the sample further. Figure 5 illustrates the special education increase in municipalities with a high degree of reform implementation, while figure 6 illustrates the situation in low reform implementation municipalities. These figures illustrate that the increase in special education is larger among schools with highly educated parents than among schools with lower educated parents. In municipalities with a low degree of reform implementation, we do not see this pattern. These illustrations suggest that unobservable differences in parental characteristics between different types of municipalities

create a downward bias (in absolute value) in my OLS estimates. This bias has the opposite sign as observable characteristics among parents.

Importantly, the coefficients in table 3 have all the same sign, and in that sense the instrumental variable strategies confirms the OLS results – There is a negative relationship between the level accountability in the municipality and the level of special education. An increase in the degree of reform implementation of one standard deviation decreases the level of special education by almost two percentage points, given the level of special education before the reform.

JLS

To address the fact that my IV-estimates do not exploit the variations in the time of implementation, I now report the results from using the JLS strategy discussed above. The results are given in table 4. First I interpret the time trend. As figure 1 suggested, the time trend in table 4 that the proportion of students with special education replacements increases with about 3 percentage points in 10 years. More important in the model, all the dummy coefficients are negative, meaning that the difference in the special education level relative to a period many years prior to the reform is lower in reformed municipalities than in the non-reformed. This is as suggested from figure 2. In the years prior to reform the reformed municipalities have about 0,7 to 0,9 percentage points lower level of special education. That is, municipalities that is going to do a change in their governing system have a lower level of special education. What is important, and that confirms my earlier analyzes is that this difference increases. In the years after the reform the increase in the special education level is significantly lower in reform municipalities than in the non-reformed. The level is between 0,9 to 2 percentage points lower in the reformed municipalities (after they actually have reformed). The difference in the level of special education remains approximately constant the first three years after the reform, but increases dramatically the next years. However, the last dummy coefficient is smaller than many of the others. The reason for this is probably that the municipalities that implemented reforms many more than 6 years where not much influenced by the national reform and these reforms differ from the reforms implemented in the years after "Kunnskapsløftet". Another explanation is that the long term effects are lower than the short term effects. The coefficients increases rapidly in the first years after the reform, but are then almost constant and decreases for the last dummy. There are also fewer observations in this category.

Table 5 has two columns, and the only difference between them is that I in the second column concentrate the analyses on the municipalities with more than 5000 inhabitants. Column 2 must only be seen on as a robustness analyses. The reason for throwing out the small municipalities is that they have a small administration and may not be capable of follow up the schools to that extent an

accountability system requires. The results are extremely robust for narrowing the sample in this sense.

Both the strategies presented so far (IV and JLS) communicate much of the same impression. Municipalities that in the period 2003-2010 have changed their governing system in the direction of more accountability, seem to have more "control" in deciding the level of special education both before and after the reform. However, both analyses indicate that the reform has made the reformed municipalities even more equipped to handle the increase in special education.

DIFFERNCES IN DIFFERENCE

None of the analyses above take into account the fact that some elements of a reform might be more important than others. I go on by giving one example of reform implementation. I choose municipalities as treatment group and control group. The criteria for selection is widely discussed in the empirical strategy

I use the municipality of Sarpsborg to evaluate the effect on the use of special education from changing the governing system into a more accountability focused system. The results are given in table 5. First, I run a simple before/after analyses, but I go on by taking the second difference when introducing control groups. The first control group I introduce, is all the rest of municipalities in Norway. This indeed, is a complex group containing municipalities with both a high and a low degree of accountability systems, and in addition other municipalities that might have made a change in their governing system in the period. Therefore, I proceed by picking other municipalities as control group. As discussed above, I follow Jacob (2005) and pick municipalities in the same district, in the same county (Østfold) as Sarpsborg. There are three other large municipalities in this county, Fredrikstad, Halden and Moss. I drop Moss out of the analyses since I after conversations with their administrative leader know that they also did a change in their administrative system the same year. Fredrikstad and Halden work as a credible control group. Large municipality in the same area as Sarpsborg, but that did not change their governing system in the period.

Table 5 provides the results from models described above. The simple before/after analyses give no significant increase in the level of special education, after the change in the governing system in Sarpsborg. None of the time dummies are significant at conventional levels. Controlled for time varying school- and municipality characteristics, I find no significant difference in the level of special education before and after the reform. Column 2-4 provides difference in difference analyses with all municipalities in Norway as a control group. These analyses indicate that the increase in Sarpsborg is significantly lower than in the rest of the country. As discussed above, all municipalities in Norway is

a very complex control group, and in column 5 I present a more suitable group following the strategy in Jacob (2005). The difference in difference term is negative here too, but not significant at conventional levels. Still, the results are very comparable across columns. The results are also comparable with the analyses presented earlier. The difference in difference estimator tells us that, significantly the special education level is 1,3 percentage points lower in Sarpsborg after their governing change compared to the control group.

THEORETICAL DISCUSSION OF THE RESULTS

In elucidation of the principal-agent model, one can think of the increase in special education after the reform implementation as the sum of actions from the principal and the agent. The school owner (principal) will have other opportunities to affect the educational setting in a new context after the reform implementation. The results of these new opportunities may dampen the reactions form the schools and teachers (agent). We can think of the situation before the reform implementation as a situation where there exists asymmetric information. With a higher degree of evaluation, accountability and testing, some of this asymmetry disappears. On the other hand, more decentralization may give the principal less control with the agent's actions. Nevertheless, as seen in table 2 many municipalities were decentralized among many dimensions before the implementation of the national reform (kunnskapsløftet), but the main differences were in the degree of accountability. If decentralization means that expenditures to special education is fully covered over the individual school budget, more decentralization will make the school leader sympathizing more with the school owner, as discussed in the theoretical framework. The empirical analyses so far, support the discussion in the theoretical framework.

Conclusion

Motivated by a principal-agent framework, the present paper analyses the relationship between Norwegian reform implementation and the use of special education. By using OLS, Instrumental variables, difference-in-difference analyses and a JLS-strategy, I find that the special education increase is lower in reform implementation municipalities than others. The IV- estimates are larger than the OLS-estimates and are highly significant. A one standard deviation increase in the reform implementation index decreases the special education with between 1 and 2 percentage points. My JLS analyses confirm these sizes. The difference between the level of special education between reformed and non-reformed municipalities is larger after the reform implementation. The difference is about 1,3 percentage points. These estimates are comparable to the results in my difference in difference analyses. Using the municipality of Sarpsborg as treatment group, I find that the increase

in special education is 1,3 percentage points lower in Sarpsborg after their change in the governing system, compared to control groups, which did not change.

A suggestive interpretation of the results provided above is that accountability systems might increase the demand for special education. There might be stronger incentives for the teacher and/or parents to acquire more resources to the class. However, I have presented evidence that suggests a stronger power with the authorities that oversee the schools. These seems to be better equipped to keep costs and special education down at its normal level, and in this way repeal the increased demand from teachers and parents.

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Tables and figures

Table1: Descriptive statistics

Variable	All municipalities	Survey municipalities	Non-survey municipalities	High degree of reform implementation	Low degree of reform implementation
Proportion of youths (0-16)	0,2	0,2	0,19	0,2	0,2
Proportion of highly educated	0,14	0,15	0,14	0,17	0,14
Number of inhabitatnts	11442	13970	7219	25441	6964
Proportion of socialists in the municipal council	38,5	38,5	*	38	38,9
Herfindahl index	24,6	24,6	*	22,6	25,8
Use of assistants	19,5	19,7	19,2	19,2	20
Proportion of teacher without authorization	0,04	0,04	0,04	0,03	0,04
Student-teacher ratio	0,1	0,11	0,1	0,11	0,1

Table 2: The components in a reform implementation index 2009-2010

	2009	2010
Decentralization	3,9	3,78
Systematic evaluations	32,7	71,5
Leader contracts	34,9	38,5

Table 3: The relationship between reform implementation and the level of special education.

Municipality level analyses

VARIABLES	OLS	OLS	OLS	OLS	OLS	IV
			Proportion of students receiving special education			
Reform index	-0.00222***	-0.00269***	-0.00268***	-0.00228**	-0.00209**	-0.0164**
	(0.000786)	(0.00102)	(0.000991)	(0.00104)	(0.00104)	(0.00779)
Speciale education level in 2005		4.724***	4.752***	4.660***	4.647***	4.690***
		(0.314)	(0.310)	(0.315)	(0.317)	(0.311)
Year 2007			-0.0226***	0	0	
			(0.00251)	(0)	(0)	
Year 2008			-0.0138***	0.00850***	0.00811***	0.00852***
			(0.00266)	(0.00232)	(0.00232)	(0.00261)
Year 2009			-0.00666**	0.0154***	0.0151***	0.0157***
			(0.00275)	(0.00241)	(0.00242)	(0.00271)
Year 2010			0	0.0219***	0.0217***	0.0222***
			(0)	(0.00248)	(0.00249)	(0.00281)
Proportion of inhabitants between 0 and 16 years old				-0.109**	-0.101**	-0.0712
				(0.0442)	(0.0445)	(0.0507)
Proportion of highly educated inhabitants				0.0195	0.0217	0.0798**
				(0.0219)	(0.0223)	(0.0396)
Number of inhabitants				-6.98e-08***	-6.66e-08***	-3.60e-08
				(2.15e-08)	(2.09e-08)	(2.39e-08)
Proportion of socialists in the local council				0.0151**	0.0158**	0.0105
				(0.00731)	(0.00728)	(0.00868)
Herfindahl index				-0.0167	-0.0177	-0.0145
				(0.0125)	(0.0123)	(0.0122)
Use of assistants					4.40e-05*	4.00e-05
					(2.45e-05)	(2.50e-05)
Proportion of teacher without approved education					5.04e-05	-0.0261
					(0.0272)	(0.0333)
Student-teacher ratio					-0.0246	-0.00382
					(0.0226)	(0.0142)
Constant	0.0754***	0.0477***	0.0583***	0.0548***	0.0549***	0.0315*
	(0.000724)	(0.00253)	(0.00302)	(0.0123)	(0.0125)	(0.0167)
Obs	2,005	1,004	1,004	996	996	996
R-squared	0.004	0.229	0.291	0.306	0.311	0.164

Table 4: JLS strategy of short and long run effects of reform implementation on the level of special education

	The level of special education	
	All municipalities	Municipalities with more the 5000 inhabitants
4 years before	-0.00741***	-0.00730***
	(0.00242)	(0.00239)
3 years before	-0.00758***	-0.00783***
	(0.00248)	(0.00247)
2 years before	-0.00903***	-0.00906***
	(0.00258)	(0.00260)
1 year before	-0.00876***	-0.00916***
	(0.00271)	(0.00276)
Reform implementation year	-0.00968***	-0.0100***
	(0.00285)	(0.00295)
1 year after	-0.00859***	-0.00874***
	(0.00306)	(0.00319)
2 years after	-0.0103***	-0.0107***
	(0.00351)	(0.00365)
3 years after	-0.00980**	-0.0103**
	(0.00391)	(0.00408)
4 years after	-0.0160***	-0.0168***
	(0.00500)	(0.00517)
5 years after	-0.0208***	-0.0211***
	(0.00520)	(0.00538)
6 years after	-0.0202***	-0.0206***
	(0.00538)	(0.00560)
More than 6 years after	-0.0134**	-0.0136**
	(0.00533)	(0.00569)
Time trend	0.00291***	0.00289***
	(0.000302)	(0.000341)
School time varying controls	X	X
Municipality fixed effects	X	X
Constant	-5.800***	-5.776***
	(0.606)	(0.682)
Observations	6,205	5,421
R-squared	0.321	0.323
Number of municipalities	79	40

**Table 5: Before after analyses and difference in difference analyses for the reform in Sarpsborg.**

VARIABLES	Sarpsborg	All municipalities	All municipalities	All municipalities	Halden and fredrikstad as control group
		Proportion of students receiving special education			
Year2009	0.0133				
	(0.00840)				
Year2010	-0.00683				
	(0.0168)				
Time trend	-0.0213		0.00358***	0.00323***	0.000583
	(0.0160)		(0.000236)	(0.000334)	(0.00229)
The school is in Sarpsborg		-0.0237***	-0.0236***	-0.0292***	-0.0110
		(0.00188)	(0.00191)	(0.00193)	(0.0135)
Dummy variable for the time period after the reform		0.0221***	0.00783***	0.00762***	0.0111**
		(0.000927)	(0.00138)	(0.00136)	(0.00477)
Difference in difference ectimatior		-0.0128***	-0.0129***	-0.0119***	-0.00954
		(0.00395)	(0.00398)	(0.00389)	(0.00664)
Constant	42.89	0.0659***	-7.111***	-6.344***	-1.139
	(31.13)	(0.000393)	(0.473)	(0.669)	(4.633)
Observations	160	23,201	23,201	23,077	505
R-squared	0.288	0.031	0.040	0.075	0.416

NOTE: Robust standard errors clustered at the school level level. The models include all the same controls as in table 3.
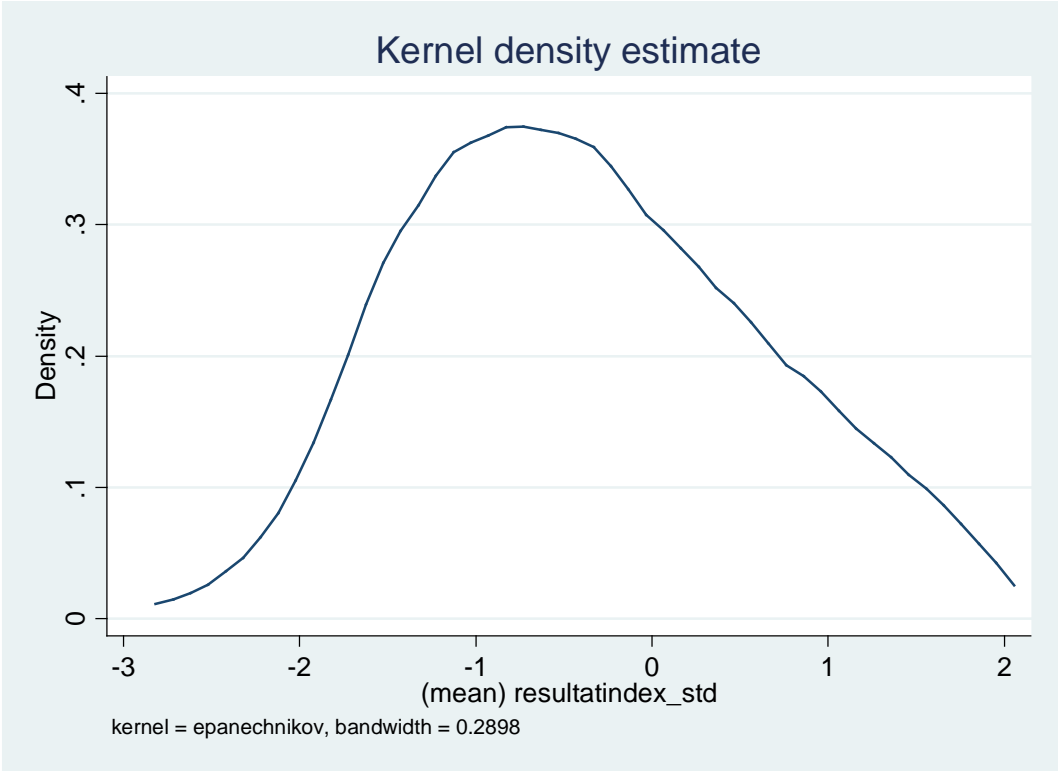
**FIGURE 1: The growth of special education in Norwegian schools since 2003.**
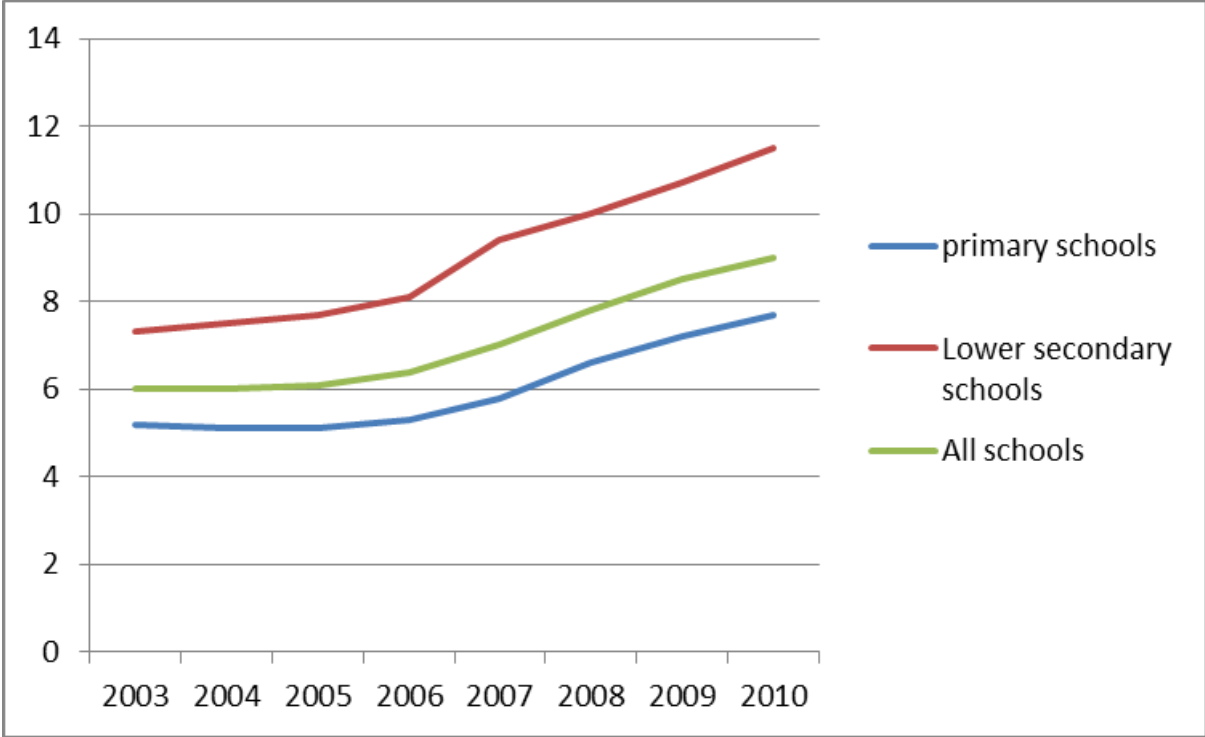
Figure 2: The growth in special education for reformed and non-reformed municipalities
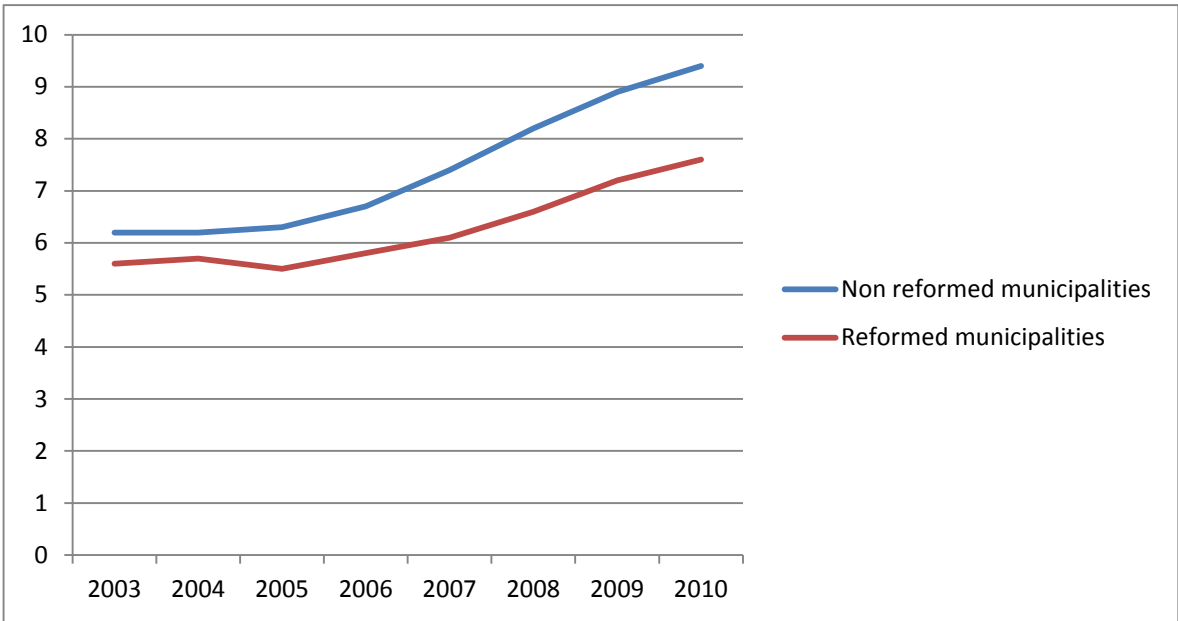
Figure 3: Kernel density estimate of the reform implementation index

Kernel density estimate

kernel = epanechnikov, bandwidth = 0.2898

Figure 4: The special education increase for different level of parental education
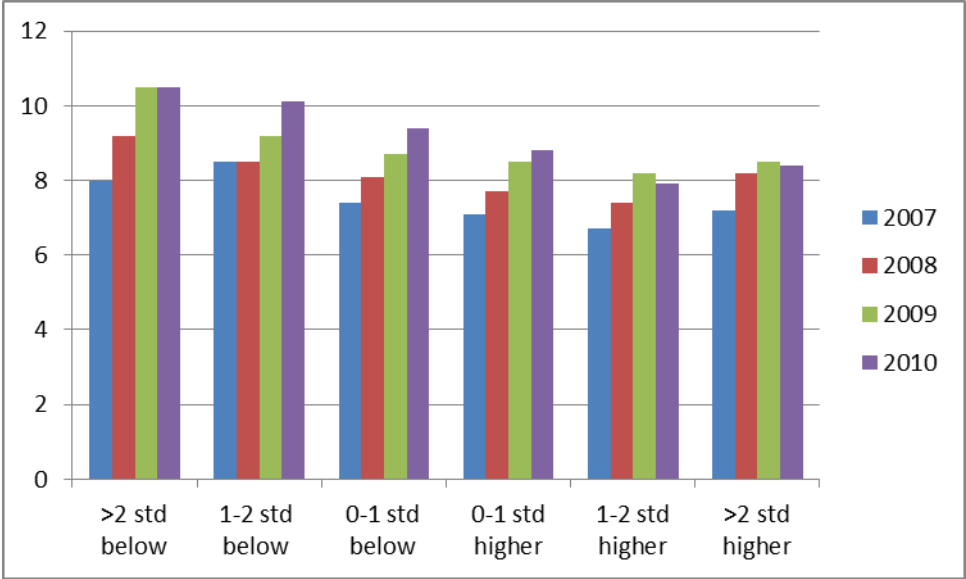
Figure 5: The special education increase for different level of parental education in municipalities with a high degree of reform implementation.
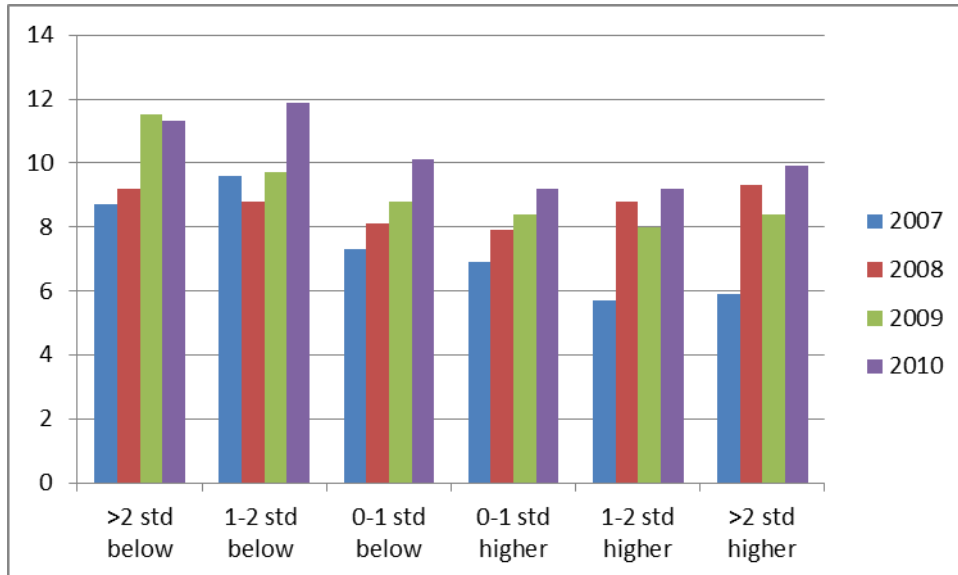
Figure 6: The special education increase for different level of parental education in municipalities with a low degree of reform implementation.
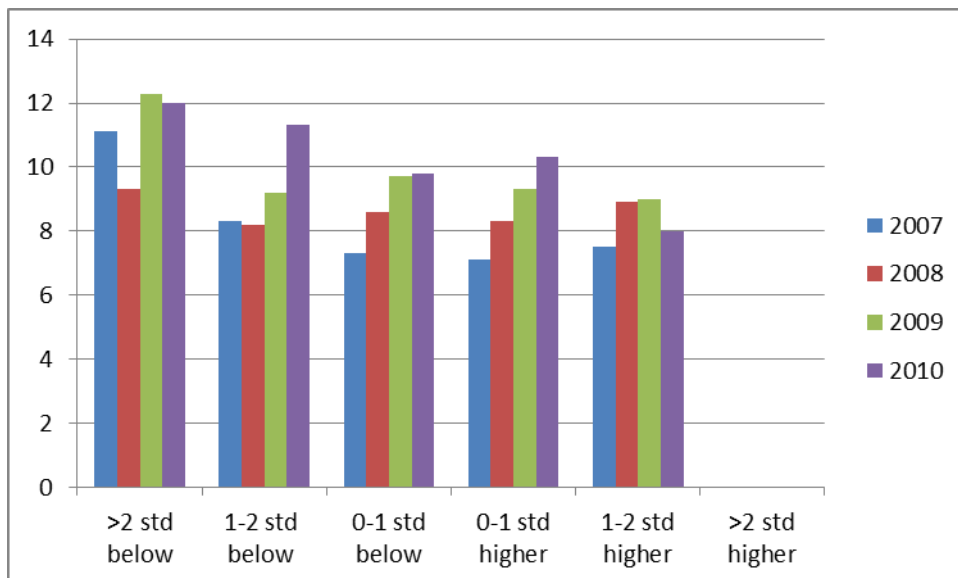
Appendix

Table A1: Structural equation

VARIABLES	The proportion of students receiving special education
Reform index	-0.000712
	(0.000714)
The level of special education in 2005	3.959***
	(0.202)
Discretional income per inhabitant	0.000144
	(0.000137)
Constant	0.0279***
	(0.00872)
Observations	1,989
R-squared	0.358

The reform implementation index

The reform implementation index has two main components:

A decentralization- of-decisions index

A degree- of- accountability index

The decentralization index is based on the following two blocks of questions to the school owners:

1. How free are your elementary school principals to decide on the following issues within the budget restriction:

-the number of teacher manyears, the number of assistant manyears, the number of special education manyears, the allocation of teacher manyears across grades, the allocation of assistant manyears across grades, the allocation of special resources across grades, the allocation of money across teacher manyears and support staff ("Labor inputs")

2. To what degree can the school principals decide on:

- the class and group organization, teaching methods, curriculum, targeted areas, innovation activities, pedagogical issues, development of teacher skills ("Organization and innovation")

The answers to the total of 14 questions are added to generate an overall decentralization index:

Variable	Obs	Mean	Std. Dev.
Labor inputs	256	25.52	7.10
Organization and innovation	263	28.95	3.99
Decentralization	251	54.64	9.29

The accountability index is based on the following three questions to the school owners:

1. Do the contracts with the school principals contain a number of agreed-on common goals for the school activities? ("Common goals")

2. Do the school owners carry out systematic evaluations of the school principals? ("Systematic evaluations")

Variable	Obs	Mean	Std. Dev.
Common goals	269	.33	.47
Systematic evaluations	269	.35	.48

The answers to the 2 questions are added together as described in the main body of the paper. Thereafter the reform implementation index is generated by first standardizing the decentralization and the accountability indices, adding, and then standardizing once more.