Public Funding in the Educational Sector and its Effect on Test Scores*

Evidence from Uganda

Martina Björkman**

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Abstract

This paper uses a difference-in-difference approach to evaluate a public policy program in the primary education sector in Uganda and more specifically, if it had an effect on the pupils educational performance, i.e. on average test scores in standardized test. The program was introduced in the 1990s by the government of Uganda, and two key components in the program were a per-student capitation grant disbursed directly to the schools and the removal of user fees in primary schools. In this study, I evaluate if the public grants disbursed to the primary schools had any effect on the district average test score in the Primary Leaving Exam. The effect is estimated on district level, and the study uses the variation between districts in exposure to the capitation grant program to identify treatment and non-treatment district. I find that the capitation grant was indeed successful: on average, pupils in districts which were highly exposed to the per-capitation grant program scored 0.42 standard deviations (1.46 points) better in the Primary Leaving Exam than pupils in districts that were less exposed to the program. This corresponds to an improvement of roughly 6 percent in test score of the average pupil in Uganda. Further, the result is robust to controlling for income per capita.

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**Institute for International Economic Studies, Stockholm University. Email: martina.bjorkman@iies.su.se

1 Introduction

An educated population is an important foundation for a country to be able to establish sustainable economic growth, and especially so in developing countries. According to the World Bank (1997), education raises productivity, reduces fertility, and improves child health. Despite this fact many school age children in developing countries fail to attend and complete primary school. In 2002, more than 130 million primary-school-age children in developing countries were not attending school.[1] Being aware of the benefits with an educated population, donors and educational policymakers have increased their efforts in the education sector and are now trying to improve the quality of, and the environment in schools.[2] A measure taken by the government of Uganda, to encourage school attendance and improve the learning environment is increased public expenditure on primary education for classroom constructions, increased teacher salaries and other non-wage expenditures. The government of Uganda has also implemented the Universal Primary Education program and hence, removed user fees in primary schools in order to make education available for all children in the country. With this reform program the Ugandan government aims to fulfill its mission to eradicate illiteracy while providing every child with the basic skills and knowledge so the he or she can take advantage of the environment for both self and national development.[3] According to official statistics, Uganda spent approximately 8 percent of the GNP on primary education in mid 1990s. The main public program in the education sector was a per-student capitation grant supposed to cover the schools' non-wage expenditures. The intention of the capitation grant was to enable the school itself to determine what it needed to spend the grant on in order to improve the learning experiment and environment for the pupils. Presumably, the outcome of the per-student capitation program was an enhanced school environment, as well as an increased quality at the schools. This paper quantify the effect of the per-student capitation grant on educational achievements of the students, estimated on a district level, and using data on test scores of the Primary Leaving Exam (PLE) from all Grade 7 pupils in Uganda in 1996 and 2002. In this paper I take advantage of the variation between districts in program exposure to estimate the outcome.

[1] From the Millennium Report (2002), UN
[2] I.e. one of UN´s eight Millennium Development Goals established in 2002, is to ensure that, by 2015, all children will complete a full course of primary education.
[3] According to the Ministry of Education and Sports, Uganda.

During recent years there has been an increasing contribution to the research field on how to reform and deliver education in developing countries. A great amount of studies consider the importance of the effect of reduced cost of schooling and hence, increased enrollment. Duflo (2001) studies a governmental initiated school construction program in India between 1973 and 1978 and its effect on education and wages. Her findings conclude that the construction of primary schools in India led to an increase in education and earnings. Vermeersch (2002) examines the effects of subsidized school meals in the pre-school in Kenya on school participation, educational achievement, and school finance. She finds higher school participation in the treatment schools than in the control schools, and she also finds that the meal programs led to higher test scores in schools with well-educated teachers. All of the above studies find that policy programs had a significant impact on the enrollment.

A second type of studies performed on the educational sector in developing countries is focusing on how to improve test scores of students in the primary school. Angrist et. al., (2001) look at a Colombian program that provides pupils from poor neighbourhoods with vouchers, allocated through a lottery that covers half the cost of private secondary school. They find that the lottery winners score significantly higher on the standardized tests, compared to their classmates who did not win a voucher. Kremer, Miguel, and Thornton (2003) study the impact of a merit scholarship program for girls in Kenya by using a randomized evaluation approach. Girls were informed that if they scored well on the academic exam their school fees would be paid and they would receive a large cash grant for the following two years. This program showed persistent gains of 0.2-0.3 standard deviations in academic exam scores in one of the two districts studied. Another study examining interventions to increase the learning environment in primary schools and the impact on test scores is Glewwe, Kremer, Moulin, and Zitezewitz's (2000) study, which analyses the effect of flip charts on test score in rural Kenyan schools. The prospective study of 178 schools, divided in treatment and control schools, provide no evidence of increased test scores as a result of the flip charts. Miguel and Kremer (2001) find no evidence that a school-based mass treated with deworming drugs in Kenya improves test scores of the pupils. A paper by Glewwe, Kremer and Moulin (1998) evaluates a program through which a non-profit organization provided textbooks to 25 randomly chosen rural Kenyan primary schools. Similarly, they do not find any differences in average test scores between the program and comparison schools. However, they do find a positive effect on academic achievement for students in the top quintile. Chin (2002) evaluates an educational reform that increased the

amount of teachers as well as introduced a teacher-learning packet in the primary schools in India. Her findings are that the number of teachers per school increased despite large misallocation by the state and local government. Also, the reform had a positive impact on primary school completion and literacy among girls. Banerjee, Cole, Duflo, and Linden (2003) present results from a study of a two-year randomised evaluation of a large-scale remedial education program conducted in India. Their result is very different from other studies of policy reform effects on test scores, in the context that they find the remedial education program to be very effective. Their findings conclude that the program increased learning by 0.15 standard deviations in the first year, and 0.39 in the second year. Further, they find that the gains are largest for children at the bottom of the distribution.

According to the above presentation of studies testing for potential improvements in student performance caused by educational policy programs, relatively few studies find an effect on test scores. One explanation might be that different school programs have different power in the possibility to affect test scores. Thus, some education programs might have a more direct effect on education achievements, while other programs increase the learning environment at the school but its effect on educational achievements is more long-run or perhaps nil. I.e. Banerjee et. al. (2003), studied a program of remedial education, while both studies of Glewwe et. al. (1998, 2000), examined the effect of school programs that increased educational material at the schools. According to the results found in these studies, increasing the number of teacher has a greater impact student performance than increasing school material, such as textbooks. Another potential reason for the different results in the above mentioned studies might be that projects differ in how much the school is engaged, and how much decision right a school has, in the program. Imagine a program that retrieve information from the school on its primary needs and demands and accordingly, engage and empower the school in the program. Such a program could potentially have a stronger effect on test scores since a committed school might generate more out of the resources received compared to a school which is has no saying in the use of the resources. When an empowered school receives i.e. public funds, donated to the school, it might feel responsibility since the school was part of the decision making during the program design.

In similarity to Banerjee et.al, this study finds evidence that provision of public funds in the Ugandan primary schools led to a positive impact on average test score. This paper reports an evaluation of the per-student capitation and its effect on average total test score. The study is

conducted on a district level, and district test score averages are calculated from data sampled on all Grade 7 pupils in Uganda. The study uses a unique natural experiment to identify the treatment and non-treatment districts: a mass information campaign introduced by the government to inform and empower teachers and parents of the monthly disbursements of capitation grant. Reinikka and Svensson´s (2003) evaluation of the information campaign concludes that schools with access to newspaper received approximately 12 percentage point more capitation grant than schools with no access to newspaper. Treatment and control districts used in this study are identified through this fact: districts with high newspaper circulation are considered treatment districts while districts with low newspaper circulation are non-treated districts.

The study uses an unusual evaluation design, in several ways. First, the study is a large-scale study conducted with test score data on all Grade 7 students in Uganda and on newspaper circulation in all districts. By using data on the entire population the potential problem of both attrition and selection bias is reduced. Second, the per-student capitation grant program is a large-scale government program implemented in all schools in Uganda and most likely, this program could be reproduced in other developing country. A similar program was implemented in Tanzania in 2002 and another one in Kenya in 2003, which confirms the ability of reproducing the program. Third, the mass information campaign began operating in 1997, and by looking at the change in test scores between 1996 and 2002 the study allows for persistence in the effect on test scores. Finally, this study shows that a non-earmarked per-student capitation grant disbursed to the schools in Uganda has a positive impact on the PLE average test scores in the districts, given that it reaches the schools. The findings in this paper indicate that students in district that received more capitation grant improved their test scores by 0.42 standard deviations compared to students in districts with less funding.

The remainder of the paper is organized as follows. Section I portray the background of the primary education in Uganda and the reform of the primary education sector. Section II describes the outcome of interest, the identifying strategy, and the data collected. Section III discusses the statistical framework used in the study. Section IV presents the results of the per-student capitation grant on average total test scores in the districts. Results are reported both when newspaper circulation is used as a binary variable as well as a when it is a continuous variable. Section IV concludes.

2 The Educational Reform

The primary educational sector in Uganda has during the last 30 years experienced some rapid changes regarding funding and provision of the service. Beginning in the 1960s Uganda had a relatively well-functioning public service delivery system. As a consequence of the political and military uproar during the 1970s and 1980s, the government of Uganda withdrew from funding and provision of public services. This withdrawal of the governmental support caused the parents to take charge over the primary education, both in regards to financial and management issues. Still, in the beginning of the 1990s, parents were the most important source of income to the school and hence, had a large influence in the decisions taken by the school.

In the beginning of the 1990s the government of Uganda decided to increase their leverage in the primary education sector by introducing a primary educational reform. The government almost doubled its financial contribution to the primary educational sector between 1991 and 1995, in real terms, even though the starting point was low.[4] The central government's increased financial contribution to the primary education sector had three aims. First, the teacher's salaries were to be raised since they had been sustained at extremely low levels since the institutional and economic crises of the 1970s and 1980s. Secondly, instructional material and other non-wage spending at primary schools were to be financed through a capitation grant per student. The capitation grant was a centrally set allocation per student and year, the same for all students in the country, and was intended to go directly to the schools. Third, because of low infrastructure at the schools since the governments' withdrawal from the sector in the 1970s, increased spending on classroom construction was an important part of the school reform.

In 1996 a public expenditure tracking survey (PETS) covering the period 1991-1995, including 250 government primary schools, were conducted in Uganda.[5] The objective of the study was to find out to which extent the public resources intended for the primary education actually were captured at the schools. At the time of the survey, about 8,500 government

[4] See for example Reinikka and Svensson (2004)

[5] A PETS compare budget allocations to actual spending thorough various tiers of government; including central ministries, local governments (districts), and primary schools. For a more extensive description of PETS, other similar surveys, and an overview of ongoing survey work, se Dehn, Reinikka and Svensson (2003) and Reinikka and Svensson (2004)

primary schools were supposed to receive a large proportion of their funding from the central government via local government administrations. The results of the survey were harsh: on average, only 13 percent of the annual capitation grant (per student) from the central government reached the school in 1991-1995. Most schools received negligible small amounts (roughly 70 percent of the schools). Thus, 87 percent either disappeared for private gain or was captured by corrupt local district officials and politicians for purposes unrelated to education (Reinikka and Svensson (2004). In 1995, 80 percent of the grant was still captured on its way to the schools. A possible explanation for the large capture of the funding might be that most schools were not aware of the fact that they were entitled to capitation grants since little information was available to the public. This lack of knowledge of the recipients gave local officials and politicians a possibility to capture a large part of the grant by themselves.

The Government of Uganda's reacted to the survey findings of major leakage of public funds in the primary education sector by two large changes. First, it introduced the UPE, Uganda Primary Education, program which consisted of abolishment of user fees in public primary schools. Free education for all children in Uganda accompanied with an increased per-student caption grant to all children in primary school was intended to decrease the illiteracy rate as well as increase the quality of education in Uganda. Second, the government introduced a large information campaign covering the whole country. The key instrument in the information campaign was publications of the monthly disbursements of grants to the districts in the main newspapers.[6] The purpose of the centrally initiated information campaign was to empower parents and teachers and consequently, promote accountability of the policy reform. In 2002 a repeated PETS was conducted on the primary schools in Uganda to observe the effect of the information campaign, and the results from the repeated survey showed large improvements in the leakage of public funds. According to the survey, capture at the schools had been reduced from 80 percent in 1995 to approximately 20 percent in 2001.[7] Furthermore, the study concluded that the information campaign could explain about two-thirds of the advance in the leakage of public funds.[8]

The positive outcomes of the policy reform in the Ugandan primary education sector during the 1990 are confirmed by simple statistics: in the beginning of the 1990s the ratio of students

[6] New Vision is the largest newspaper in Uganda.
[7] Reinikka and Svensson (2002)
[8] Reinikka and Svensson (2003)

in primary-school-age attending school was roughly 54 percent. Obviously, almost half of the children in school age did not attend primary school. During the 1990s there was a large increase in enrollment in primary school, and the ratio of children in school age attending school in the end of the 1990s increased to 78 percent. Further, the illiteracy rate among the population decreased during the 1990s, from 40 percent in 1995 to 35 percent in 2000.[9] Considering the successful policy reform in the primary educational sector in Uganda in the last half of the 1990s, an interesting enquiry to follow up on is whether the increased public funding at the school level had further positive implications, such as improvements in the performance of the pupils.

3 Outcome of interest

In this study, the outcome of interest is to find out if the increased public funding to the schools in Uganda during the last part of the 1990s resulted in improvements in cognitive skills of the pupils.

The capitation grant disbursed from the centre to the schools was supposed to cover instructional material and other non-wage spending at the primary schools. The schools were entitled to independently decide upon how it was going to spend the funds. Each school was empowered to decide upon which was the most efficient way to use the money in order to increase the learning environment for the students. The large reduction in leakage caused by the mass information campaign increased the income at primary schools, which probably increased teaching material and other resources at the schools and hence, improved the learning environment of the pupils. These enhancements could potentially have led to improved educational achievements, test scores, at the schools. On the other hand, the UPE program with abolished school fees in the public schools and the increased capitation grant could potentially have a negative effect on the students' academic achievements. First, there is the overcrowding effect that could lead to a decrease in average test score of the student. The policy reform consistent of abolishment of user fees in the primary education sector lead to a massive increase in enrolment in all public schools in Uganda. Consequently, more students in the class rooms imply that the available resources have to be shared with more pupils, which potentially could have a negative effect on educational accomplishment. The other

[9] Information derived from the Ugandan Bureau of Statistics.

possible effect is the peer effects. Hence, as a result of the abolishment of user fees and its following massive increase in enrolment there might have been a large increase in enrolment of poor, and low-performing, students who earlier could not afford the school fee. The presence of these additional poor-performing pupils in the classroom may have created a negative learning externality on other pupils, which would lead to a downward bias in the average test scores. Finally, there is also the potential bias because of the substitution effect. Hence, parents' contribution to the primary school is substituted away because of government transfers. This entail that at the same time as there is an income increase at the schools caused by the government per-student capitation grant, there is an income decrease because the parents are contributing less than before. If the government contribution is lower than the previous parent contribution, this might lead to a decreased learning environment and consequently, to lower average test scores among the students. The four above mentioned potential effects of the public sector program; enhanced availability of resources to the students, the overcrowding effect, the peer effect, and the substitution effect, are affecting tests scores in opposite directions and thus, it is interesting to distinguish which effect is the strongest.

4 Identification strategy

The identification strategy in this paper uses the fact that exposure to the program of per-student capitation grant varied by district. Substantial variations existed in program intensity across districts, due to variation in newspaper circulation between districts.

The mass information campaign throughout Uganda is the greatest cause for the large reduction in leakage of capitation grant aimed to the primary schools between 1995 and 2001. In 1995 only 20 percent of the capitation grant was received at the school level versus 80 percent was received in 2001. Schools with and without newspaper showed different success in reducing leakage of grants. In 1995, schools with and without newspaper access were exposed to the same amount of leakage. Between 1995 and 2001, both groups experienced a drop in leakage, but the reduction in leakage was significantly higher for schools with access to newspaper, approximately 12 percentage points higher.[10] Hence, for each dollar capitation grant (per student) disbursed from the central government, schools with access to newspaper

[10] Reinikka and Svensson (2003)

received 12 percent more than schools without newspaper. If more grants received at the schools improved the learning environment by i.e. increased resources, the pupils in schools with access to newspaper should have had better learning possibilities than pupils in schools with no or little access to newspaper.

According to the above described identification strategy, pupils in districts with high newspaper circulation could possibly perform better than pupils in districts with low newspaper circulation. This paper uses the variation in newspaper circulation and hence, the difference in program exposure between the districts, to identify the treatment and control districts. The treatment group is districts with access to the main newspaper. It is assumed that schools in districts with high newspaper circulation will have easy access to newspaper. The control group is schools in districts with no, or very little, access to newspaper. Further, this paper uses a difference-in-difference estimator that controls for systematic variation in test scores both between years and between the treatment and non-treatment districts. The variation in program exposure between the years cannot alone identify the causal effect of the per-student capitation grant. Variation between the treatment and non-treatment districts cannot either identify the casual effect alone, since newspaper circulation is partly endogenous. Thus, only the combination of the two variations is considered as exogenous.

5 Data

A well-performing instrument for measuring cognitive skills of the pupils has to be comparable between the schools and districts in Uganda. One way of measuring cognitive skills of the pupils in Uganda is by looking at the Primary Leaving Exam, which is a standardized test, conducted yearly by all students Grade 7, in all schools in Uganda[11]. The PLE covers Math, English, Science, and Social Studies and give test scores for each of the four subjects as well as an aggregate score. In this study the aggregate score of all subjects is used in the estimations. The PLE is the most important test the pupils in Uganda perform during their primary education since it underlies the primary education final grade and hence, indirectly decides whether the student will be accepted at secondary school. Therefore, PLE test score is a reliable instrument for evaluating the pupils' cognitive skills since one would expect the students to perform their best in this standardized test. This study uses PLE test

[11] Grade 7 is the highest grade in the primary school in Uganda.

score data for all students in Grade 7 in Uganda for the years 1995 and 2002. The individual test score data is used to calculate district averages for the two years. Data on PLE test scores are collected from the Ugandan National Examination Council.

The extensive information campaign mainly consisted of publishing the monthly intergovernmental disbursements of capitation grant in the main newspapers in Uganda. This study uses the largest newspaper in Uganda, New Vision, to estimate newspaper circulation in the districts. New Vision circulation data is received from the New Vision head office and corresponds to their printing order for all districts in the country. An assumption is made that if the district has a large penetration of newspaper, the schools and parents in that district are assumed to have easy access to newspaper. New Vision circulation data are collected for the year 2002 and according to the newspaper officials, the distribution has been stable for the last six years and hence, it can be used for establishing treatment and non-treatment district for both 1996 and 2002.

6 Statistical framework

This study is conducted on district level with data on newspaper circulation in each district, as well as data on district average test scores of all pupils attending the PLE. The effect of the per-student capitation grant is estimated by using a difference-in-difference approach, and by using two different variables for newspaper circulation. First, the effect is estimated by using a binary variable indicating newspaper circulation. Second, the study estimates the effect on student performance by using the variation in the newspaper circulation data and hence, the effect is estimated with a continuous variable on newspaper circulation.

6.1 Estimations with binary district variable

The districts are divided up in treatment and non-treated districts depending on the circulation of New Vision. Districts with high newspaper penetration are considered treated, while districts with lower newspaper circulation are regarded as non-treated (control) districts.

Given the initial condition that in 1996 treatment and control schools were exposed to the same amount of capture of capitation grant, one would expect the pre-period (1996) test

scores in the treatment districts to be similar between those in the control. Additionally, using the fact that the information campaign was non-exclusive and that the treatment districts received approximately 12 percentage points more grant than those in the control, the 2002 test scores are expected to differ between the treatment and the control districts. Noting y_{it} , the average total test score in district i in year t (year 1996 ,the pre-period, or year 2002 the post-period), a first glance of the effects the information campaign has on test scores is provided by comparing test scores between treatment and non-treatment districts in the pre-period and the post-period with the following regression to assess the significance of any differences:

$$y_{it} = \alpha + \beta T_i + \varepsilon_{it} \qquad (1)$$

where T_i is a dummy variable indicating whether district i had high circulation of newspaper and hence, was a treatment districts in year t and, ε_{it} the error term. This regression is run separately for each year. Running this regression for the pre- and post-period provides a first estimate of the program effect on test scores.

Biased estimates from ordinary least square regression (1) might occur as a cause of auto-correlation in test scores and difficulties to control for unobserved time-invariant factors and other omitting variables, influencing the relationships between districts and schools. Therefore, by using differences-in-differences estimates the accuracy of the estimate may increase. Let y_{0i} be the total test score average of district i with no, or very low, newspaper circulation. Similarly, let y_{1i} be the total test score average of district i, which has a high circulation of newspaper. The total average test score of district q in year t is E[y_{0i} | q,t], with no newspaper circulation, and E[y_{1i} | q,t] if it had high newspaper circulation. Let q denote treatment group and q=1 if the district had high newspaper circulation and were more exposed to the program, and q=0 if the district had low newspaper circulation and hence, were less exposed to the capitation grant program. To estimate the effect of capitation grant we observe the total test scores in districts with high newspaper penetration (treatment districts), E[y_{1i} | q=1,2002] and uses the comparison districts to study the counterfactual averaged, E[y_{0i} | q=1,2002], i.e. the test score in the treatment districts if it had not been highly exposed to the capitation grant program (if the treatment districts had not been exposed to less capture than the non-treated districts). The underlying principle for how the difference-in-difference

method identifies a causal effect is by restricting the conditional mean function $E[y_{0i} | q,t]$ in a particular way.[12]

Suppose the total average test score of districts with no access to newspaper would be the sum of a year effect that is common to all districts and district effect that is fixed over time, hence:

$$E[y_{0i} | q,t] = \alpha_t + \beta_c \quad (2)$$

Further, suppose that the total average test score of districts with access to newspaper would be:

$$E[y_{1i} | q,t] = E[y_{0i} | q,t] + \phi \quad (3)$$

Then, differencing total average test score across districts and years would give us the differences-in-differences estimator as follows:

$$\phi = \{ E[y_i | q=1, 2002] - E[y_i | q=0, 2002] \} - \{ E[y_i | q=1, 1996] - E[y_i | q=0, 1996] \} \quad (4)$$

The differences-in-differences estimates tell us whether the difference in test scores between treated and non-treated districts between the years 1996 and 2002 is significant, while controlling for any pre-existing differences between the treatment and the control group.

6.2 Estimations using a continuous variable for newspaper circulation

In this part, estimations of the effect public grant has on student performance is made by using the existing variation in newspaper circulation. Initially, we are conducting a pre- and post-period estimation of the policy reform on test score with an ordinary least square estimation. The following regression is run for both 1996 and 2002 to be able to compare the impact grant has on the average total test score in the districts, y_{it} :

$$y_{it} = \alpha + \beta NV_i + \varepsilon_{it} \quad (5)$$

where NV_i is New Vision circulation in each district which is constant over the years, and ε_{it} the error term.

[12] See Angrist and Krueger (1999) for further explanation.

The following regression is used to estimate the difference in test scores between low and high newspaper circulation districts between the years 1996 and 2002:

$$y_{it} = \alpha + \beta Y96 + \theta Y02 + \gamma NV_i + \lambda (Y02 * NV_i) + \eta_{it} \quad (6)$$

Controlling for the average year effects for 1996 and 2002 and for the average effect of newspaper circulation, the λ coefficient explains the effect newspaper circulation has on test scores in year 2002. Hence, the λ coefficient predicts the treatment effect on test scores.

7. Results

7.1 Descriptive statistics

The Primary Leaving Exam consists of four subject; English, Social Science, Science, and Math. Each of the subjects is graded from 1 to 9, and the total test score on the PLE represents the sum of all test score result in the four subjects. The focus in this paper is on the total test score on the PLE[13]. The scores are presented as raw scores as well as in normalized test scores, with the test scores in the Uganda Primary Leaving Exam ranging from 1 to 36. The Uganda grading system is functioning opposite the grading system in the western countries and hence, the lower score the student has on the PLE the greater achievement and the better grade/division will he or she receive. Instead of grades the Ugandan school system has divisions, ranging from division 1 to division 4, with division 4 being the bottom (lowest) division and 1 being the top (highest) division[14]. Hence, the lower test score the student has on the PLE, the better (lower) division he or she gets. Further, sufficiently high test score will result in a failure for the student. Consequently, the results stated in this paper has to be interpreted such that an improvement in test scores corresponds to a decrease in PLE test scores, which will be indicated by a negative coefficient estimate in the regressions.

According to Table 1, the average total test score across districts does not change dramatically between 1996 and 2002; it stays constant at a score of approximately 25. The Primary

[13] I have also estimated the effect on test scores in the four subjects, math, social science, english and sst, separately, but these results are not reported since they do not contribute to the study. The total average test score provides the best description of the investigated effect.
[14] An average total test score of 25 gives the student a division 3.

Leaving Exam in Uganda is a standardized test and a potential problem when using standardized tests in evaluations is that the standardized test is not advanced enough to create a range of grades and hence, most students scores about the same value. Accordingly, a potential difficulty with using standardized tests could be that they generate very little variation in test scores. However, this is not the case in the Primary Leaving Exam in Uganda and the descriptive statistics in table 1 show that there is a wide range in average district test scores both in 1996 and 2002. The range in test scores for the PLE goes from the worst performing district having average test score around 31, while the average test score in the best performing district is roughly 13 points. The standard deviation is approximately 4.

The average number of students in Grade 7 per district increased from 4366 in 1996 to 6805 in 2002. This corresponds to an average increase in enrolment of the number of students in Grade 7 per district by 56 percent. The massive increase in number of students between 1996 and 2002 is an effect of the school reform, which partly intended to increase the number of students in primary school by reducing the cost of education through abolishment of user fees. Further, between 1996 and 2002 the average ratio of students failing the PLE decreased by 4.5 percent, while the average ratio of absent students on the examination day increased by 130 percent. This increase in average ratio of absent students can potentially be a result of higher enrolment in the primary school of poorer and low-performing students, which do not have the same incentive to take the PLE. On average, roughly 21 percent of the students per district taking the PLE fail the exam. Summary statistics on newspaper circulation is stated in table 2. The average amount of newspaper per school is 6.77 but the variation between districts is large, ranging from 272 newspapers/school to 0.12 newspapers/school. The newspaper circulation has been stable between 1996 and 2002[15]. As can be seen in the first column in table 2, the variation in daily newspaper circulation between districts is high, ranging from one district having 23,200 newspapers per day (this district includes the capital town), while another district have 15 newspapers per day. There are five obvious high newspaper circulation districts that all have a newspaper circulation above 1000 newspapers per day and further, they are all located within the 95 percentile in the newspaper circulation distribution. Most of these districts are urban districts which are not representative in the sample, since they highly differ from the overall average on both newspaper circulation and on test scores. In the later analysis these districts will be excluded as they are large outliers in

[15] According to circulation data from the New Vision in Uganda.

the data sample. According to the third column in table 2, the average newspaper circulation per school in the sub-sample is 1.13 and the district with highest newspaper circulation per school has 3.03 papers while the district with lowest newspaper circulation per school has 0.12 papers.

Table 3a and 3b provides summary statistics for the treatment and control districts for the full sample respectively the sub-sample, used in the analyses when newspaper circulation is transformed to a binary variable. The identification strategy for the treatment and control groups is that the two groups are supposed to be similar pre-treatment. Thus, the cut-off value for the division of the districts into control and treatment districts are chosen such that in the sub-sample, which is the most plausible sample for analysis, the two groups of districts are similar pre-treatment in 1996. Roughly 41 percent of the districts belong to the control group and 59 percent of the districts are considered treatment districts. According to the statistics for the full sample, table 3a, initially there exist a difference in average total test score between the treatment and the control districts of 1.06 points. Hence, in 1996 the pupils in treatment districts are performing slightly better in the PLE than pupils in non-treatment districts. This difference in average test score between the groups is expanded and in 2002 the difference in test score between the treatment and the control district is 3.42 points. In other comparable variables such as average number of students and the average rate of failed and absent student, the treatment and control districts are performing similar before treatment. Further, in the sub-sample, table 3b, the treatment and control districts are similar before treatment. In 1996, the average test score in the districts is approximately 26 for both groups, and the treatment and control districts look similar in other comparable variables as well. The control districts have on average 1.5 percent higher rate of students who fail the PLE. According to table 3b, in 2002 the difference in test scores between the treatment and the control districts are 2.37 point. Hence, the districts are similar before treatment, and after treatment students in control districts are, on average, falling behind with 9.4 percent compared to the treated districts. Another noticeable difference between the treatment and control districts post-treatment is that the average number of students much higher in the treated districts than in the control districts; 7499 students in the treated districts versus 5924 in control districts. Also, in 2002 there is a lower average rate of absenteeism and failure in the treated districts compared to the control districts.

7.3 Attrition and selection bias

The sample attrition in the districts is small, although increasing in 2002. Table 1 show that on average 96 percent of all students in Grade 7 in the districts took the PLE in 1996, while in 2002 the average number of students taking the PLE in the districts had decreased to 91.5 percent. Hence, there was in 4.5 percent increase in attrition between 1996 and 2002. Comparing treatment and control districts in both the full sample and the sub-sample indicates the same pattern; there is an increase in attrition rates between pre- and post-treatment. There are, on average, more students participating in the PLE in 1996 both in the treatment and control districts compared to the average number of students taking the PLE in 2002. In 1996 the average number of students sitting for the PLE is the same in the treatment and the control group. However, in 2002 there are, on average, 4.1 percent more students taking the PLE in the treatment districts than in the control districts.

Even though there are some attrition in the sample it is not extensive, and there are plausible explanations for this fact. First, the PLE is the final examination in the primary school and it provides all students with a final grade, which affirm whether the student has graduated (passed) primary school or not. Second, to be able to apply to secondary school the students need the PLE grade. Third, the schools are aware of the test date well in advance, which makes it probable that the students is informed about the examination day and therefore will be present at the examination day. Thus, the importance of the standardized test for all students in all districts assures that the attrition rate is minimized. Theoretically, for the same reasons there should not be any large differences in attrition rates between treatment and control districts. Hence, students in all districts should have the same incentive to take the PLE and to graduate from primary school. However, the data indicates that there are higher average attrition rate in the control districts in 2002 compared to the treatment districts. According to Angrist (1995), if the there are different types of students (low- and high-performers) absent in the treatment and control group on the examination day, the estimated treatment effect could potentially be biased. One potential problem could be that because of additional funding disbursed to schools through the education program students that would otherwise drop out of school are now able to stay in school longer. The prevalence of marginal students is expected to be higher in the treatment districts since the treatment group receives more grants than control schools during the six years. Also, in the data we see that the attrition rate is lower in the treatment districts than in the control districts which

potentially could be explained by marginal students staying longer in school and are more motivated to participate in the PLE. The prevalence of increased marginal students would result in a lower average test score in the treatment groups in 2002 and hence, cause a potential downward bias in the estimates. Another possible scenario is that the absent pupils in the non-treated districts in the PLE exam in 2002 were the low-performers, which would increase the average test score in the control group and potentially biase the estimated treatment effect downwards.

Problem with selection bias would occur if parents with children in control schools moved their children to a treatment school because they realized that their children would have an increased learning environment in the treatment school. There is one potential reason why in this study the problem of selection bias is reduced. The study is conducted on district levels, which imply that if the parent wanted to move their child it must have moved the child to another district. This would only have been possible for parents living close to the district borders and hence, the majority of the parents did not have this option since it would have been too far to travel for the pupil. Also, since this study is conducted on a district level there is a small probability that the parents were aware of which districts were treated and which were not.

However, it is possible that parents send their children to relatives in treated districts so that the children are able to go to more funded schools there. In table 3a and 3b there are indications that the schools in treated districts on average have a higher increase in students between 1996 and 2002 compared to schools in control districts. If this is caused by parents sending their children to treated schools instead of to control schools there might be a problem of selection bias in the estimates. The sign of the bias depends on whether the students sent to schools in treated districts are low- or high performers. If high-performing students are sent from the control districts to the treated districts between 1996 and 2002, there will potentially be an upward bias in the estimates.

7.3 Effects of policy program on tests cores

7.3.1 Binary variables indicating newspaper circulation

Table 4 present the estimates of the effect of the primary education reform and more specifically, the capitation grant, as differences between the test scores in the treatment and control districts in the pre- and post-period. The third row in table 4, "access-no-access difference", reports results from estimating equation 1 on total average test score with robust standard errors, for 1996 and 2002[16]. According to Regression (1), in both years the difference in average total test scores between the treatment and control districts is negative.[17] In the full sample regression (specification (1)), in 1996 schools in treatment districts scored 0.15 standard deviation (1.05 points) lower test score that schools in the control districts. The difference in average total test score between the districts in 1996 is not significant. In 2002, when the mass information campaign had been in operation for 6 years, schools in treatment districts performed better than schools in control districts. The estimate enters highly significant and states that in districts where schools had access to newspaper the student performed, on average, 0.46 standard deviations (3.41 points) better in the PLE compared to districts where schools had no access to newspaper. This implies an average improvement in the PLE by 13.4 percent of the average student in Uganda in 2002. The difference in test score is sufficiently high to make it possible for the average student to upgrade one division in the total grade[18]. Excluding districts with considerable high newspaper circulation that considered influential outliers as discussed above, creates a representative sub sample from which the results are reported in Regression (2) in table 4.[19] The estimates from this sub sample indicate a very small difference in average test score between the treatment and the control districts in 1996, and the effect is insignificant. The insignificant and minor effect in the sub sample between the two groups, suggests that there were no large or systematic difference in student performance between the treatment and control district prior to the implementation of the mass information campaign. In 2002, the results indicate a high and

[16] Changes of test scores in standard deviations are recorded in the fourth row of table 4.
[17] As described above, the lower test scores the higher division (grade) and therefore, a negative difference between the treatment and the control group is a desired result in the regressions.
[18] The average student would upgrade from division 3 to division 2 on the division scale from 1 through 4.
[19] Influential observations are those that, according to various criteria, appear to have a large influence on the parameter estimates. In accordance with earlier discussion I have deleted districts which have considerable high newspaper circulation compared to the average district. According to Belsley, Kuh, and Welsch (1980), observations influencing the regression coefficient with more than 2/sqrt (n) standard deviations deserve attention. In my sample those observations show up as large outliers, and are deleted in both years.

well significant effect of capitation grant on test score. According to Regression (2), pupils in treatment districts performed on average 0.44 standard deviations (2.48 points) better than pupils in control districts, and this effect is significant at 1 percentage level. Students in districts where schools had access to newspaper and consequently received more capitation grant, scored on average 10 percent higher in the PLE than students in schools located in districts that did not have access to newspaper. These differences in test score between students in treated and non-treated districts are large, by the standard of most in the education literature[20].

One problem with identifying the causal effect with these pre- and post comparison between the treatment and the control group is that it is difficult to control for unobserved time-varying factors that might have influenced the performance of the students in the different districts. One possible missing variable is income, which exclusion might cause an omitted variable bias in the estimate of the treatment effects. Increased income inequality between the treatment and the control districts between 1996 and 2002, could potentially influence the test score of the pupils in the districts. In Regression (3) in Table 4 we are controlling for income in both years to study any changes in the treatment effect. Obviously, the result in the sub sample regression is robust to controlling for income per capita, and the difference in test scores between treated and non-treated districts in 2002, is 0.45 standard deviations. Income per capita is not significant in the regression.

The difference-in-difference specification is an alternative approach to investigate the causal effect between capitation grant and test scores. The difference-in-difference approach (equation 4) allows us to control for unobserved time-invariant factors that might affect the treatment effect and hence, the method can be used to improve the precision in the estimates. The third column for each specification in Table 4 displays the difference-in-difference estimates. For each specification in Table 4, the first column presents the average total test scores, by districts, in 1996, the second column reports test scores in 2002, and the third column presents the difference between the years. The first row show the average test score and robust standard errors for districts with access to newspaper, and the second row show the matching results for districts without access to newspaper. The third row presents the difference between the treatment and the control districts, and the fourth row reports the

[20] Duflo,

differences in normalized test scores. According to results reported above in the full sample regression in 2002, the average difference in test scores between students in treatment districts and students in control districts is 0.46 standard deviations, and the difference is highly significant. Notable, the change in test scores is largest in the control group, which has an increase, and hence a decline in improvement, in test scores of 0.24 standard deviations between 1996 and 2002. Test scores in the treatment group stays relatively constant during the period 1996 to 2002; the results show a non-significant decrease in average test score of 0.10. The difference-in-difference estimate is a decrease of 0.31 standard deviations, and the estimate is significant at over 95 percent confidence. Students in districts with access to newspaper and who therefore, studied in schools that were exposed to less leakage of capitation grant did, on average, improve their test score by 0.31 standard deviations compared to students in districts with no access to newspaper. However, the full sample contains large outliers and therefore, the more interesting results is attained from the more representative sub sample in specification (2) in Table 4. Similar results is found in the sub sample hence, that the large change in average test score between the treatment and control districts between 1996 and 2002 is caused by the control group falling behind. The difference in average test score between 1996 and 2002 in the treatment group is an in-significant improvement of 0.10 standard deviations, while the control group shows a significant reduction in improvement of 0.31 standard deviations. The difference-in-difference estimate indicates that students in the treated districts improved their average test scores by 0.39 standard deviations (2.26 points), and the result is significant with over 95 percent confidence.

The key identifying assumptions in the difference-in-difference equation is that the interaction term would have been zero in the absence of different program exposure between the districts. Thus, if students in treatment districts on average scored 0.39 standard deviations better then students in control districts in the pre-period, the 0.39 standard deviations difference between the districts should have been constant through the years in absence of different program exposure. Clearly, the evolvement of average total test scores could have differed between the districts regardless of the per-student capitation grant program. Regression (1) and (2) in Table 5a shows the estimates from the regression version of the difference-in-difference version. Table 5b shows the same result in normalized test scores. Results from a robustness test of the difference-in-difference estimates are depicted in Regression (3). In this regression, I am controlling for the mean income per capita in the district, since difference in income per capita between districts could potentially be a factor violating the key identifying assumption

in the difference-in-difference estimation.[21] The estimates in Regression (3) show that the estimate is robust to controlling for income. Thus, the difference between 2002 and 1996 and between the average total test score in treatment districts and the average test score in non-treated districts is 0.39 standard deviations, and the difference is significant at 5 percentage level. The estimate for mean income per capita is significant but the coefficient is zero and hence, income has no effect on the difference in average test score between the treated and non-treated districts.

7.3.2 Continuous values on newspaper circulation

Possible critique against using a binary variable as indicator for newspaper circulation in this paper is the actual non-existence of clear control districts with no newspaper circulation. In the above analysis districts with very low newspaper circulation relative to the number of schools in the district, are assessed to control districts. Using the variation in newspaper circulation per district could possibly establish a more precise and accurate estimate of the relationship between capitation grants and test score. Table 6 and 7 depicts the results from regressions conducted with newspaper circulation as a continuous variable. Table 6 provides a first estimate of the effect of the capitation grant on test scores, with a pre- and post evaluation between the years 1996 and 2002, using newspaper circulation (with continuous values) as the independent variable. The estimations are based on equation 5 and the reported estimate is changes in average total test score by district for 1996 and 2002, with robust standard errors in parenthesis. Results on normalized test scores are reported in the second row. In both years, newspaper circulation has a negative, and significant, effect on average total test scores in the districts. In the full sample estimation the change in test score between districts with high newspaper circulation and districts with low newspaper circulation as a result of the program, reported both as raw and normalized scores, is 0.45 standard deviations in both 1996 and 2002. The effect is significant at 1 percentage level in both years. In the more representative sub sample (Regression (2)) when observations with large influence on the regression coefficient are left out, the estimated effect between the years changes. In the sub sample, the effect of capitation grant on test score in 1996 is approximately zero, and insignificant, while the effect in 2002 is significant and large. In the sub sample in 2002, students in districts with high newspaper circulation score, on average, 0.36 standard

[21] Income per capita in is estimated by mean expenditure level per capita in the districts, and the variable is constructed from the 1995/1996 and 2001/2001 Uganda National Household Survey.

deviations lower than students in districts with low newspaper circulation. The result is robust for controlling for income per capita. Hence, in Regression (3), the pre- and post evaluations when controlling for income in the sub sample in, gives a non-significant zero result in 1996, while in 2002 the effect of capitation grant on test scores is stronger than without control and significant on 1 percentage level. When controlling for income in the regression, students in districts with high distribution of newspaper and accordingly, more exposed to the capitation grant program scores on average 0.40 standard deviations lower than students in districts with low newspaper circulation.

Table 7, depicts the regression version of the difference-in-difference specification using a continuous variable for newspaper circulation (equation 6). Identification assumption for this regression is that in absence of the mass information campaign and hence, in absence of difference between districts in capitation grant program exposure, test scores would have been equal in districts with low and high newspaper circulation. In the full sample regression, specification (1), the average effect of newspaper on test score is significant and -0.04 standard deviations (-0.03 points). In 2002, students in districts with high newspaper circulation scored 0.04 standard deviations lower than districts with low newspaper circulation, when controlling for newspaper circulation and year effects. This effect is significant with 99 percent confidence. Using the more plausible sub sample after eliminating observations that has large effect on the regression coefficients the results show that there is a considerable effect on average test score between 1996 and 2002 and between districts with high and low newspaper circulation, and the effect is significant at the 5 percent level. The average, general effect of newspaper circulation on test score is nil and insignificant, while the difference between 2002 and 1996 between districts with high newspaper circulation and districts with low newspaper circulation, is an improvement, decrease, in average test score by 0.42 standard deviations.

Furthermore, in Regression (3) in Table 7, I am testing for violations in the identification assumption by controlling for income per capita in the sub sample. The result on average total test scores in the districts is robust to income, and income show up as insignificant in the regression. The robustness check suggests that it is not the difference in income per capita between the districts that are driving the results presented above. Thus, in absence of different program exposure between the districts the average total test scores would most probably be similar in the treatment and the control districts between 1996 and 2002. Therefore,

considering the robustness check, I am more confident in proposing the conclusion that the per-student capitation grant program had a significantly positive effect on test scores in Uganda.

8 Conclusion

The comprehensive primary education reform in the 1990s was an attempt by the Government of Uganda to recover the primary education sector from a long period in a poor financial situation. This paper is the first attempt to examine the impact of the reform on educational achievements. The government increased its financial contribution to the primary education sector and the key element of the program was a per-student capitation grant, which was distributed to the schools directly. This study is estimating the effect of the grant program on the test scores in the Primary Leaving Exam, a standardized test conducted by all pupils in grade seven. A difference-in-difference approach is used to compare test scores in 1996, the pre-period, with the post-period, 2002 and the results suggests that the per-student capitation grant program had a large and positive effect on the average total test score in the standardized test. Students in district with a high exposure to the program scored, on average, 0.42 standard deviations better than students in districts that were less exposed to the program. This suggests that pupils in districts that received more capitation grant scored approximately 6 percent better in the Primary Leaving Exam compared to students in the control districts. The study evaluates the impact by using a difference-in-difference method and by using both a binary variable on the variable indicating program exposure as well as a continuous variable. The results are significant and large, both when estimating the effect using the binary variable and when using continuous variable. However, the effect is slightly stronger, and highly significant, when using the continuous variable for program exposure. The program was implemented in all districts in Uganda and is to this date, functioning well. The improvements in average test score in the treatment districts suggests that the per-student capitation grant program might help Uganda in reducing its still quite high illiteracy rate. Considering that the result in this paper is reliable and correct, it suggests that per-student capitation grant program probably would be a functioning and efficient primary sector program in other developing countries as well.

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Table1. Summary statistics by districts

	Mean	Median	St.dev	Max	Min	Obs
1996						
Average total score	25.29	25.44	3.91	30.51	12.45	59
Primary schools	176	162	96.50	546	14	53
Total students	4366	3779	3404	15446	75	53
Students failed (%)	22.2	19.5	13.1	47	0.4	59
Student absent (%)	3.7	3.2	2.2	13.3	0.6	59
Mean income per household (ug.shs)	10019	9461	2927	26069	6261	53
2002						
Average total score	25.39	26.02	3.70	31.03	13.51	59
Primary schools	175	162	96	546	14	53
Total students	6805	5059	5246	21298	212	59
Students failed (%)	21.0	20.0	13.0	47.0	0.3	59
Student absent (%)	8.5	8.2	3.9	23.8	1.9	59
Mean income per household (ug.shs)	10932	10556	3617	27602	5272	53

Table2. Summary statistics by districts, on newspaper circulation data (New Vision)

	Newspaper circulation	Newspaper/ school
Mean	689	6.77
Median	140	0.89
St.dev	3083	37.3
Max	23200	272
Min	15	0.12
Obs	56	53

Table3a. Summary statistics on treatment and control districts *(full sample)*

	Mean	Median	St.dev	Max	Min	Obs
1996						
Control districts						
Average test score	25.99	25.53	2.36	30.01	21.54	20
Primary schools	164	148	84	412	65	20
Students	4449	2960	4308	15446	822	10
Student absent (%)	3.7	4.0	1.3	6.0	1.8	20
Student failed (%)	25.4	24.4	13.3	46.6	8.5	20
Treatment districts						
Average test score	24.93	25.44	3.79	30.51	12.44	39
Primary schools	183	191	103	546	14	33
Students	4341	4001	3166	11977	75	34
Student absent (%)	3.8	3.1	2.5	13.3	0.6	39
Student failed (%)	21.2	19.0	13.1	47.0	0.4	39
2002						
Control districts						
Average test score	27.65	28.06	2.4	31.0	22.8	20
Primary schools	164	148	84	412	65	20
Students	5924	4942	3660	14345	1871	20
Student absent (%)	11.0	10.9	4.5	23.8	3.4	20
Student failed (%)	27.9	28.6	12.2	44.6	3.6	20
Treatment districts						
Average test score	24.23	24.72	3.75	30.2	13.5	39
Primary schools	183	191	103	546	14	33
Students	7256	5650	5890	21298	212	39
Student absent (%)	7.2	7.2	2.9	15.3	1.9	39
Student failed (%)	17.5	15.6	12.1	47.0	0.3	39

Table3b. Summary statistics on treatment and control districts *(sub sample)*

	Mean	Median	St.dev	Max	Min	Obs
1996						
Control districts						
Average test score	25.99	25.53	2.36	30.01	21.54	20
Primary schools	164	148	84	412	65	20
Students	4449	2960	4308	15446	822	10
Student absent (%)	3.7	4.0	1.3	6.0	1.8	20
Student failed (%)	25.4	24.4	13.3	46.6	8.5	20
Treatment districts						
Average test score	25.86	25.91	2.65	30.51	20.53	29
Primary schools	190	192	106	546	14	29
Students	4517	4266	2939	11216	142	27
Student absent (%)	3.6	3.1	1.8	9.9	0.7	29
Student failed (%)	23.9	21.0	12.7	47.0	0.2	29
2002						
Control districts						
Average test score	27.65	28.06	2.4	31.0	22.8	20
Primary schools	164	148	84	412	65	20
Students	5924	4942	3660	14345	1871	20
Student absent (%)	11.0	10.9	4.5	23.8	3.4	20
Student failed (%)	27.9	28.6	12.2	44.6	3.6	20
Treatment districts						
Average test score	25.28	25.53	2.36	30.0	21.54	29
Primary schools	190	192	106	546	14	29
Students	7499	6618	5114	19897	212	29
Student absent (%)	7.5	7.5	3.0	15.3	1.9	29
Student failed (%)	20.1	18.9	12.3	47.0	0.3	29

Table 4. Difference-in-difference estimates of the effect of newspaper circulation on test scores

Specification	(1)			(2)			(3)		
Group / Year	1996	2002	2002-1996 difference	1996	2002	2002-1996 difference	1996	2002	2002-1996 difference
High access to newspaper	24.93*** (0.61)	24.24*** (0.60)	-0.66 (0.73)	25.76*** (0.50)	25.17*** (0.51)	-0.59 (0.71)	24.58*** (1.32)	23.89*** (1.53)	-0.69 (0.73)
Low access to newspaper	25.99*** (0.52)	27.65*** (0.53)	1.66** (0.75)	25.99*** (0.52)	27.65*** (0.53)	1.66** (0.75)	24.77*** (1.36)	26.33*** (1.49)	1.56** (0.78)
High access- low access difference	-1.05 (0.80)	-3.41*** (0.80)	-2.36** (1.13)	-0.23 (0.73)	-2.48*** (0.80)	-2.26** (1.04)	-0.19 (0.76)	-2.44*** (0.71)	-2.25** (1.04)
Normalized high access low access difference	-0.15 (0.11)	-0.46*** (0.10)	-0.31** (0.15)	-0.04 (0.14)	-0.44*** (0.13)	-0.39** (0.18)	-0.03 (0.14)	-0.45*** (0.13)	-0.39** (0.18)
Observations	118	118	118	96	96	96	96	96	96
Controls	No	No	No	No	No	No	Yes	Yes	Yes

a. District average test scores (in points) in the PLE.
b. Robust standard errors in parenthesis.
c. District mean income per capita is used as control variable
d. Specification: (1) Full sample regression, (2) Sub sample regression, (3) sub sample regression with control
e. *** [**] (*) denote significance at the 1 [5] (10) percent levels

Table 5a. Regression version of the difference-in-difference estimates (in test score)

Specification	(1)	(2)	(3)
1996	25.99***	25.99***	24.77***
	(0.52)	(0.52)	(1.36)
2002	27.65***	27.65***	26.33***
	(0.53)	(0.53)	(1.49)
Newspaper	-1.05	-0.23	-0.19
	(0.80)	(0.73)	(0.76)
Newspaper in 2002	-2.36**	-2.26**	-2.25**
	(1.13)	(1.04)	(1.04)
R^2	0.99	0.99	0.99
Observations	118	96	96
Controls	No	No	Yes

a. Dependent variable is district average test score.
b. Robust standard errors in parenthesis.
c. Specification: (1) Full sample regression, (2) Sub sample regression, (3) sub sample regression with control
d. District mean income per capita is used as control variable
e. *** [**] (*) denote significance at the 1 [5] (10) percent levels

Table 5b. Regression version of the difference-in-difference estimates (normalized test scores)

Specification	(1)	(2)	(3)
1996	3.69***	4.91***	4.68***
	(0.07)	(0.10)	(0.26)
2002	3.92***	5.22***	4.97***
	(0.08)	(0.10)	(0.28)
Newspaper	-0.14	-0.04	-0.03
	(0.11)	(0.13)	(0.14)
Newspaper in 2002	-0.31**	-0.39**	-0.39**
	(0.15)	(0.18)	(0.18)
R^2	0.99	0.99	0.99
Observations	118	96	96
Controls	No	No	Yes

f. Dependent variable is district average test score.
g. Robust standard errors in parenthesis.
h. Specification: (1) Full sample regression, (2) Sub sample regression, (3) sub sample regression with control
i. District mean income per capita is used as control variable
j. *** [**] (*) denote significance at the 1 [5] (10) percent levels

Table 6. Pre- and post-evaluation when using a continuous variable for newspaper circulation

Specification	(1)		(2)		(3)	
	1996	2002	1996	2002	1996	2002
Newspaper Circulation/School	-0.034*** (0.002)	-0.04*** (0.002)	0.06 (0.41)	-1.32*** (0.38)	0.10 (0.38)	-1.40*** (0.33)
Normalized newsp. Circulation/School	-0.45*** (0.02)	-0.44*** (0.03)	0.02 (0.14)	-0.36*** (0.11)	0.03 (0.12)	-0.40*** (0.09)
R^2	0.21	0.20	0.00	0.14	0.10	0.33
Observations	53	53	48	48	48	48
Control	No	No	No	No	Yes	Yes

a. Dependent variable is district average test score.
b. Robust standard errors in parenthesis.
c. Specification: (1) Full sample regression, (2) Sub sample regression, (3) sub sample regression with control
d. District mean income per capita is used as control variable
e. *** [**] (*) denote significance at the 1 [5] (10) percent levels

Table 7. Differenced estimates of the effect of newspaper circulation on test scores using continuous values on newspaper circulation

Specification	(1)	(2)	(3)
Test scores			
1996	25.81***	25.79***	24.25***
	(0.38)	(0.62)	(1.56)
2002	26.13***	27.70***	26.04***
	(0.41)	(0.69)	(1.77)
Newspaper / school	-0.03***	0.06	0.43
	(0.002)	(0.41)	(0.43)
(Newspaper/school)*2002	-0.004	-1.38**	-1.39**
	(0.0026)	(0.56)	(0.56)
Normalized test scores			
1996	4.31***	4.87***	4.58***
	(0.06)	(0.12)	(0.29)
2002	4.37***	5.22***	4.92***
	(0.07)	(0.13)	(0.33)
Newspaper / school	-0.42***	0.02	0.01
	(0.02)	(0.13)	(0.12)
(Newspaper/school)*2002	-0.04***	-0.42**	-0.42**
	(0.023)	(0.17)	(0.17)
R^2	0.98	0.98	0.99
Observations	106	96	96
Control	No	No	Yes

a. Dependent variable is district average test score.
b. Robust standard errors in parenthesis.
c. District mean income per capita is used as control variable
d. Specification: (1) Full sample regression, (2) Sub sample regression, (3) sub sample regression with control
e. *** [**] (*) denote significance at the 1 [5] (10) percent levels