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WORKING PAPER SERIES

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Working Paper n. 326

August 2006

IGIER – Università Bocconi, Via Salasco 5, 20136 Milano –Italy
http://www.igier.uni-bocconi.it

Does Money Matter for Student Performance? Evidence from a Grant Program in Uganda*

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First version: December 2004
This version: August 2006

Abstract

In response to extensive corruption in the education sector, the Government of Uganda began to publish newspaper ads on the timing and amount of funds disbursed to the districts. The intent of the campaign was to boost schools' and parents' ability to monitor the local officials in charge of disbursing funds to the schools. The mass information campaign was successful. But since newspaper penetration varies greatly across districts, the exposure to information about the program, and thus funding, differ across districts. I use this variation in program exposure between districts to evaluate whether public funds have an effect on student performance. The results show that money matters: On average, students in districts highly exposed to the information campaign, and hence to the grant program, scored 0.40 standard deviations better in the Primary Leaving Exam (PLE) than students in districts less exposed to information. The results are robust to controlling for a broad range of confounding factors.

Keywords: Primary education; Capitation grant; Test scores; Uganda
JEL-classification: O12, I28, I22

*I am grateful for comments and suggestions by David Card, Edward Miguel, Jakob Svensson and seminar and conference participants at University of California, Berkeley, Cornell University, EEA Congress 2004 (Madrid), IIES (Stockholm), NEUDC 2004 (Montréal) and Nordic Conference in Development Economics (Gothenburg). I wish to thank the Uganda National Examination Board and the Ministry of Education and Sports for sharing their data with me and Frances Nsonzi for assistance during data collection. Thanks also to Christina Lönnblad for editorial assistance. Financial support from Jan Wallander's and Tom Hedelius' Research Foundation is gratefully acknowledged.

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1 Introduction

An educated population is a key determinant of economic growth and development, but what policies should governments in developing countries pursue in order to promote and enhance education? Understanding which school policies are most effective in terms of improving the quality and quantity of schooling has long been a concern for development economists and policymakers. The importance of this issue has been reemphasized in recent years because of the Millennium Development Goals and their call for universal primary school enrollment by 2015.

The ideal approach when studying the impact of school policies on students' outcomes is to generate or find random variation in school characteristics and relate that variation to outcomes across schools. This can be done either by allocating educational programs randomly across schools or by exploiting exogenous natural variations and applying appropriate statistical modeling strategies. In recent years, a number of studies have assessed the impact of specific school (input) programs using such approaches.[1] These studies are seminal contributions in estimating the causal effect of specific school inputs on student outcomes. However, the studies analyze programs exclusively assigned to certain observational units and therefore, their external validity has been questioned.[2] This paper, on the contrary, assesses the impact of a large, and fairly common, education program: a capitation grant to cover primary schools' non-wage expenditures.

To estimate the causal effect of the grant program, I exploit an unusual policy experiment: a newspaper campaign introduced by the Government of Uganda in the late 1990s in response to extensive corruption in the educational sector. The main objective of the information campaign was to provide information on the grant program, including the timing and amount of funds disbursed to the districts, so as to boost schools' and parents' ability to monitor the local officials in charge of disbursing funds

[1] Examples are Miguel and Kremer (2004), Banerjee et al. (2005), Glewwe, Kremer and Moulin (2002), and Glewwe et al. (2004).

[2] See Ravallion (2005) for a critical review on methods used for ex-post counterfactual analysis of programs exclusively assigned to individuals, households or locations.

to the schools. The mass information campaign was successful and a public expenditure tracking survey (PETS) in 2002 showed that more funds were received at the primary schools and, on average, leakage had been reduced by 57.9 percentage points since 1995.[3] Further, schools with high exposure to the newspaper campaign, i.e. more informed schools, experienced a significantly larger reduction in local capture of funds than those with low exposure. Since newspaper penetration varies greatly across districts, the exposure to information about the grant program, and thus funding, differ across districts. I exploit this variation in program intensity across districts to identify treatment and non-treatment districts and evaluate the effect of the grant on students' academic achievements through a difference-in-differences approach, i.e. on average test scores in standardized tests. Specifically, I compare students in districts with high and low newspaper penetration before and after the newspaper campaign. Students should perform better on the test after the information campaign; i.e. when leakage has been reduced. But the difference should be larger for students in districts with high newspaper circulation and thus with more funding, than for students in districts with low newspaper circulation.

This study finds strong evidence that money matters. I find that the non-earmarked grant had a positive impact on the academic performance of the average student. On average, students in districts highly exposed to the information campaign, and hence to the grant program, scored 0.40 standard deviations better on the Primary Leaving Exam (PLE) than students in districts less exposed to information. This corresponds to an improvement of roughly 11% in the test scores of the average student in Uganda. The result is robust to controlling for a broad range of confounding factors, including income.

The remainder of the paper is organized as follows. Section II gives an overview of earlier literature and describes the major reforms in the primary education sector in Uganda in the late 1990s. Section III presents the identifying strategy and a conceptual discussion on the expected effects of the program. Section IV discusses the

[3] Reinikka and Svensson, 2005a.

data. Section V presents the estimated impact of the capitation grant on student performance. Section VI concludes.

2 Background

2.1 Previous Literature

Education in developing countries has been the subject of tremendous scholarly interest and research.[4] Still, many would argue that, until recently, the literature has provided few reliable insights into what governments in developing countries should prioritize to raise educational attainment. This lack of knowledge does not reflect a lack of interest in the economic profession but, as argued in Glewwe (2002), the fact that most of the contributions suffer from methodological shortcomings. In recent years, however, new methods, in particular evaluations based on quasi- or randomized experiments, have provided more credible evidence on which interventions work, and which do not. In the recent literature, three types of policy interventions have been analyzed: (i) reducing the cost of schooling; (ii) rewarding students for doing well on tests; and (iii) improving the quality of education. These three areas are discussed below.

Duflo's (2001) study on Indonesia analyzes the effect of reduced cost of schooling on outcomes. The paper evaluates the effect of a rapid school expansion program in Indonesia on education and wages The results suggest that the construction of primary schools led to an increase in education and earnings. Children aged 2 to 6 at the beginning of the program received 0.12 to 0.19 more years of education for each new school constructed per 1,000 children and this increase translated into an increase in wages of 1.5 to 2.7 percent. Another example is Vermeersch and Kremer's (2004) study on the effects of subsidized school meals on school participation and educational achievement in Kenya. They found school participation to be 30 percent greater in the 25 pre-schools where free breakfast was introduced than in the 25 comparison schools.

[4] See Glewwe and Kremer (2005) and Asim Ijaz Khwaja (2005) for an overview of evaluations of educational programs.

The program had no effect on test scores except for schools where the teacher was relatively well trained prior to the program. Schultz (2004) estimates the impact of a cash grant to mothers conditional on their children's school attendance and participation in preventative health measures, the PROGRESA program in Mexico. He finds an average 3.4 percent increase in enrollment for all students in all grades.

The second strand of the literature studies the effect of rewarding students for good performance. Kremer, Miguel, and Thornton (2004) used a randomized experiment approach to estimate the impact of a merit-based scholarship program for girls in rural Kenya. The scholarship was awarded to girls in two districts in Western Kenya who scored in the top 15 percent on tests administered by the Kenyan government. One portion of the scholarship was paid directly to the school for school fees, the other portion to the family for school supplies and uniforms. They find that girls eligible for the scholarship had significantly higher school attendance rates as well as showed gains of 0.2-0.3 standard deviations in test scores in one of the two districts studied. Angrist et al. (2002) evaluate a Colombian program providing vouchers to pupils from poor neighborhoods. The vouchers were awarded by lottery and partially covered the cost of private secondary school for students who maintained satisfactory academic progress. They find that lottery winners were 10 percent more likely to finish 8^{th} grade and scored significantly higher on standardized tests as compared to their classmates who did not win the lottery.

A number of studies focus on the impact of school quality and school inputs on student performance. Glewwe et al. (2004) analyze the effect of flip charts on test scores in rural Kenyan schools. The study of 178 schools, randomly divided into treatment and control groups, provides no evidence of increased test scores as a result of the flip charts. Glewwe, Kremer and Moulin (2002) evaluate a program that provided textbooks to 25 randomly chosen rural Kenyan primary schools. No differences in average test scores between program and comparison schools are found in this case either. However, they do find a positive effect on academic achievement for students in the top quintile. Banerjee et al. (2005) conducted a randomized evaluation of a two-

year remedial education program in India. This program hired young women from the community to teach basic literacy and numeracy skills to children who reached grades 3 and 4 without mastering some basic competencies. On average, the program increased the test scores by 0.14 standard deviations in the first year and 0.28 in the second year. The gains were largest for children at the bottom of the distribution. Similarly, Chin (2005) evaluates a reform in India which aimed at providing all one-teacher primary schools with a second teacher. She finds that the program increased the primary school completion rate by 4 percentage points for girls and 2 percentage points for boys. The reform had the greatest impact on children from the poorer half of the population. Banerjee et al. (2005) conducted a randomized evaluation of a computer-assisted learning program in India. The program provided each child in the fourth grade with 2 hours of shared computer time per week, in which students played educational games reinforcing mathematical concepts. They found the program to be quite effective, with average increases in mathematics scores of 0.36 standard deviations in the first year and 0.51 standard deviations in the second year. The program was equally effective across student ability levels. Finally, Miguel and Kremer (2004) evaluate a Kenyan project where a school-based mass treatment with deworming drugs was randomly phased into schools. They find increased student participation (fewer absences and reduced dropout rates) but no significant effect on students' test scores.

According to the above review of various educational programs and the impact on students' average test score, the evidence is inconclusive and deserves further study.

2.2 The Primary Education Sector in Uganda

The primary education sector in Uganda experienced two large reforms in the late 1990s. First, in 1997, as a response to a manifesto commitment made during the presidential election campaign, the Government of Uganda introduced free primary education (Universal Primary Education, UPE). The reform resulted in an universal abolishment of school fees in public primary schools.

The second reform, also introduced in 1997, was a newspaper campaign by the

Government of Uganda to reduce the capture of public funds in the education sector by providing schools (parents) with information to monitor local officials' handling of a large education grant program. The program in question was a capitation grant to cover instructional material and other non-wage expenditures at the school level. The grant was a centrally set annual allocation per student, the same for all students in the country and intended to go directly to the schools.[5] In 1996, a public expenditure tracking survey (PETS) was implemented to gauge the extent to which the public grant was captured at the school level. The results of the PETS were harsh: the average school only received around 20% of the central government spending on the program in 1995. Most schools received negligible small amounts (roughly 70 percent of the schools) and most of the public funds were captured by corrupt local district officials and politicians for purposes unrelated to education (Reinikka and Svensson, 2004).

In response to this extensive corruption in the education sector, the Government of Uganda introduced the mass information (or newspaper) campaign in 1997. The main component of the information campaign was publications in the national newspapers on the monthly transfers of capitation grants to schools. The aim of this bottom-up approach was to boost schools' and parents' ability to monitor the local officials in charge of disbursing funds to the schools and hence, to strengthen accountability in the primary education sector. To assess the impact of the information campaign on the capture of public funds, a repeat PETS was carried out in 2002. The repeat PETS revealed that the newspaper campaign was successful and thus, more funds were received at the primary schools. Leakage at the average school had been reduced from approximately 80 percent in 1995 to less than 20 percent in 2001 (Reinikka and Svensson, 2005a). Schools that were more extensively exposed to the newspaper campaign, i.e. more informed schools, experienced a significantly larger reduction in local capture of funds. More specifically, schools with a one standard deviation increase

[5] The grant formula prescribed that students in higher grades received a larger grant than students in lower grades. That is, in 1995, each student in grades P1 to P3 was entitled to UGX 2,500 per year, while students in P4 to P7 were entitled to UGX 4,000. The grant doubled in 2001 but has maintained its real value in U.S. dollar terms (Reinikka and Svensson, 2005a).

in information about the grant program had a 1.1 standard deviation increase in grants reaching the schools (corresponding to a 44.2 percentage point increase in funding reaching the schools between 1995 and 2001).[6]

3 Identification Strategy

3.1 Sources of Variation

The date of birth and the district of schooling jointly determine an individual's exposure to the grant program. The benefits of the capitation grant were limited for children who had finished primary school in 1997, when the information campaign was introduced, since the leakage of the public grant was extensive in the period prior to 1997. A child in primary school after 1997 was more exposed to the grant program since the leakage reduced dramatically in the years following the introduction of the information campaign. The second source of variation is due to the substantial variation in program intensity across districts due to the variation in newspaper circulation between districts. Schools that were more extensively exposed to the newspaper campaign, i.e. more informed schools, experienced a significantly larger reduction in the local capture of funds after the campaign had started. Since newspaper penetration varies greatly across districts, the exposure to information about the capitation grant program, and thus funding, differ across districts. I use this variation in program exposure between districts to identify treatment and non-treatment districts.

Schools in districts with high newspaper circulation which experienced a larger reduction in local capture of funds constitute the treatment group and schools in districts with nil or very low access to newspapers constitute the control group. I estimate the reduced form effect of the grant on students' average test scores by comparing test

[6] In the IV approach, information is the aggregate test score on questions posed to head teachers about the formula used for deriving the capitation grant and knowledge about the timing of releases of funds by the central government. The instrument used is distance to the nearest newspaper outlet, which has a strong negative effect on head teachers' knowledge about the grant program. For more information, see Reinikka and Svensson (2005a).

scores of students in districts with high newspaper circulation to those of students in districts with low newspaper circulation, between the years 1996 and 2002.

Students should perform better on the test after the information campaign; i.e., when leakage has been reduced. But the difference should be larger for students in districts with high newspaper circulation and thus, in districts with more funding, than for students in districts with low newspaper circulation. Variation in program exposure between the years cannot alone identify the causal effect of the grant. Since newspaper circulation is partly endogenous, variation between the treatment and non-treatment districts cannot identify the casual effect alone either. Thus, only the combination of the two variations is considered as exogenous.

3.2 Statistical Framework

This paper uses a reduced form approach to establish the effect of the capitation grant on student performance. Variation in newspaper circulation per district is used as an instrument for exposure. The paper uses two different variables for newspaper penetration. First, newspaper circulation is treated as a binary variable and districts are divided into treatment and control districts.[7] Second, newspaper circulation is used as a continuous variable where I am taking advantage of the natural variation in newspaper circulation across districts.

A first glance at the effect of the information campaign on test scores is provided by OLS regressions which compare test scores of students in treatment and non-treatment districts in the pre- and post-period (1996 and 2002):

$$y_{it} = \alpha + \beta T_i + \varepsilon_{it} \tag{1}$$

$$y_{it} = \alpha + \beta NV_i + \varepsilon_{it}. \tag{2}$$

[7] When using newspaper circulation as a binary variable, the cut off value in newspaper circulation determining whether a district is a treatment or a control district is chosen such that the treatment and control districts have similar pre-treatment characteristics. To this end, students in treatment and control districts have similar test scores and other district school characteristics before treatment.

y_{it} is the average test score in district i in year t and in regression (1), newspaper circulation is a binary variable where T_i is a dummy variable indicating whether district i was a high newspaper circulation district and ε_{it} is the error term. In regression (2), newspaper circulation is a continuous variable, NV_i is newspaper penetration in district i, and ε_{it} is the error term.[8]

Biased estimates from the ordinary least square regressions (1) and (2) might occur because of unobserved time-invariant factors. Therefore, I am estimating a difference-in-differences model controlling for all systematic differences between treatment and control districts. The difference-in-differences specification compares the change (before and after the newspaper campaign started) in average test scores for students in the treatment group with the change in the control group.

Let y_{0i} be the average test score of students in district i with no, or low, newspaper circulation. Similarly, let y_{1i} be the average test score in district i, which is a district with high newspaper circulation. The average test score of district q in year t is $E[y_{0i}|q,t]$ if it is a district with no, or low, newspaper circulation, and $E[y_{1i}|q,t]$ if it is a district with high newspaper circulation. Let q denote treatment. $q = 1$ if the district had high newspaper circulation and thus, was more exposed to the capitation grant program, and $q = 0$ if the district had low newspaper circulation and hence, was less exposed to the program. To estimate the effect of the capitation grant program on test scores, I observe the average test score in districts with high newspaper penetration (treatment districts), $E[y_{1i}|q = 1, 2002]$ and use comparison districts to study the counterfactual average, $E[y_{0i}|q = 1, 2002]$, i.e. the test score in the treatment districts if it had not been highly exposed to the capitation grant program (if it was a district with low newspaper circulation). The underlying principle for how the difference-in-differences method identifies a causal effect is by restricting the conditional mean function $E[y_{0i}|q,t]$ in a particular way.[9]

Suppose that the average test score in districts with low access to newspaper would be the sum of a year effect common to all districts and a district effect that is fixed

[8] Newspaper circulation across districts has been stable during the period 1996 to 2002.

[9] See Angrist and Krueger (1999) for further explanations.

over time, hence:

$$E\left[y_{0i}|q,t\right] = \alpha_t + \beta_c. \tag{3}$$

Further, suppose that the average test score in districts with high newspaper penetration would be the sum of the average test score in districts with low access to newspapers plus a treatment effect:

$$E\left[y_{it}|q,t\right] = E\left[y_{0i}|q,t\right] + \phi. \tag{4}$$

Then, differencing the average test score across districts and years gives me the difference-in-differences estimator as follows:

$$\phi = \left\{E\left[y_i|q=1,2002\right] - E\left[y_i|q=0,2002\right]\right\} - \left\{E\left[y_i|q=1,1996\right] - E\left[y_i|q=0,1996\right]\right\}. \tag{5}$$

The difference-in-differences estimate gives me the estimated difference in test scores between the treated and non-treated districts between the years 1996 and 2002, while controlling for pre-existing differences between the treatment and the control group.

Similarly, when using newspaper circulation as a continuous variable, the following regression is estimated:

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

Controlling for the average year effects for 1996 and 2002 and for the average effect of newspaper circulation, the λ coefficient determines the effect of newspaper circulation on test scores in 2002. The λ coefficient is the difference-in-differences estimate when using newspaper circulation as a continuous variable.

The difference-in-differences estimate can be interpreted as the causal effect of the capitation grant program under the assumption that, in the absence of the newspaper

campaign, the change in average test scores would not have been systematically different in low and high newspaper circulation districts. The identification assumption is crucial and should not be taken for granted: the pattern of test scores could vary systematically across districts. If the change in test scores were positively correlated with the initial levels, this pattern would be observed in the data even if the grant program had no effect. One way of testing the identification assumption is to look at the difference in the trend in test scores of students in treatment and control districts before the information campaign. Before 1997, the trend in test scores between cohorts of students in primary schools should not be systematically related to newspaper penetration in the districts. This control experiment is presented in Table 8. I compare test scores of students in 1993 and test scores of students in 1996 between treatment and control districts. The result provides evidence that the difference-in-differences estimates are not driven by inappropriate identification assumptions. In the control experiment, the difference-in-differences effect is insignificantly different from 0 and hence, I cannot reject the hypothesis that there was no difference between test scores of students in treatment and control districts in the period before the information campaign, i.e. in the years 1993-1996.

Figure 1 depicts the trend of test scores for students in treatment and control districts during the period 1993-2002. Similarly to the regression results from the control experiment, the graph shows no significant difference in test scores of students in treatment and control districts prior to the information campaign (1997), but a significant and large effect once the campaign had started.

One concern with the difference-in-differences methodology, equations (5) and (6), is that newspaper access is partly endogenous. Specifically, there may be unobserved district characteristics correlated with both newspaper access and student performance. While this is a valid concern, note that the control experiment presented in Table 8 suggests that average test scores in low and high newspaper circulation districts did not systematically differ prior to the newspaper campaign. Thus, there are reasons to believe that in reality, this may not be a serious concern.

In a predominantly rural country like Uganda which lacks an adequate transport infrastructure, access to newspapers is mainly determined by logistical factors outside the control of the districts. Newspaper access is essentially determined by three factors: infrastructure, historical political preferences in the districts, and the languages in which the newspaper is printed. First, infrastructure and, more specifically, the roads determine where newspapers can be logistically distributed. If districts with good infrastructure and hence, with high newspaper circulation, also encompass some other characteristics positively correlated with test scores, this might be a concern. However, to the extent that infrastructure is correlated with income, part of this omitted variable problem is controlled for since I am controlling income in the regressions. Second, availability of infrastructure (roads) changes slowly over time and the control experiment does not suggest that differences in 1995 were correlated with schooling outcomes. The second factor affecting newspaper access is the political background of the main national newspaper and the fact that historically (and to some extent today), it was a political newspaper mainly read by supporters of the incumbent. If the pattern of newspaper readership is persistent, historically "politically connected" districts will have higher newspaper circulation. This might be a concern if these districts have also received more investments and resources and therefore, have higher average test scores. In reality, this may be less of a problem since the three different incumbents during the last four decades originate from different regions in the country.[10] Finally, the languages in which the national newspaper are printed also determine where the newspaper is circulated. To the extent that the printing languages of the newspaper are orthogonal to student performance (as suggested by the control experiment), this source of variation can be explored to estimate causal effects.

Although logistical factors determining a district's access to newspapers may influence its average test scores, this would most probably work against finding an effect in the data. For example, if districts with high newspaper circulation are populated

[10] Ida Amin, the incumbent in the 1970s, originated from the Northwest region, the government from the 1980s, Obote, came from the Central and Northeast region of Uganda and today's government, Free Movement, is from the Southwest part of the country.

by households that, on average, have higher income, more human capital and higher ability, and these districts also have higher test scores, independent of the newspaper campaign and the capitation grant, $E[y_{1i}|q = 1, 2002]$ and $E[y_{1i}|q = 1, 1996]$ would both increase but given diminishing returns to education, the catch-up effect, or the fact that there is a roof on test scores, the difference between them would fall. Thus, the existence of fixed district-specific effects that are positively correlated with both newspaper circulation and student performance would result in a downward bias in the estimate of interest.

3.3 Conceptual Discussion

The primary education sector in Uganda experienced two large reforms in the late 1990s. First, school-fees were abolished in all public schools and second, the Government of Uganda introduced a newspaper campaign that reduced the local capture of public funds at primary schools. Considering the two reforms, the expected aggregate effect on test scores is not obvious. The increased funding at the schools and the abolishment of school fees could possibly have opposite effects on student performance and the joint effect of the two concurrent reforms is unclear.

The newspaper campaign resulted in increased funding to primary schools and thus, increased teaching material and other non-wage resources at the schools which could have a positive effect on student performance. On the other hand, the abolishment of user fees in primary education led to a massive increase in enrollment in public schools. The enrollment of grade 7 students, for example, increased by 112 percent between 1996 and 2002 (see Table 1). This implies that resources had to be shared among more students, and this overcrowding effect could have a negative effect on the students' test scores. If the abolishment of school fees led to an increase in the enrollment of poor and low-performing students who could previously not afford the school fee, average test scores are expected to decrease. Further, an increase in the enrollment of poor and low-performing students may also have created negative learning externalities on other pupils and this peer effect could also have a negative effect on the average test

scores.

Another potential negative bias is attributed to the substitution effect and the fact that parents' earlier contribution to primary schools is now substituted away by government transfers. If the government's capitation grant is less than the parents' previous contribution, less resources are available at the schools which may have a negative effect on average test scores. However, there are reasons to believe that this problem is minor, since the main analysis in this paper is focused on rural (poor) districts where parents' contributions are small.

The estimated treatment effect could potentially be biased if different types of students (low- and high-performers) are absent in the treatment and control group on the examination day. Tables 3a and 3b reveal that the absenteeism rate is lower in the treatment districts than in the control districts after the mass information campaign. If the additional funding received at schools in treatment districts allowed marginal students to stay in school longer, I would have a downward bias in the treatment effect. Similarly, if the absent pupils in the non-treated districts in 2002 were low-performing students, I would have a downward bias in the estimate, since the difference between test scores in the treatment and the control group would be less than if no attrition was prevalent.

Finally, another potential problem in evaluating the impact of increased grants to the schools on student performance is sorting. That is, it may be the case that test scores in aggregate do not improve, but that students sort into schools in districts with more resources. The sign of the selection bias depends on which type of students change schools. Thus, if high-performing students sort from schools in control districts into schools in treated districts, I would have an upward bias in the estimates. While problematic, in reality there are reasons to believe that this problem is not so severe. First, I am using district averages in my analysis which minimized the problem of sorting since switching between a control school and a treatment school would require moving to another district. Second, the focal analysis exclusively consists of rural districts and the pool of potential students served by schools in rural districts does

not typically have much choice with respect to primary school. Further, the problem of sorting is conditional on the fact that families in the control districts observe the funding of schools in treatment districts and thus, that they are aware that schools in treatment districts received more grants.

4 Data

This paper uses and merges data from three different sources. Test score data have been collected from the Uganda National Examination Board. Obviously, a useful measure of students' cognitive skills must be comparable between all schools and districts. Primary Leaving Exams (PLE) fulfill this requirement as these standardized tests are taken each year by all Grade 7 students in Uganda. The PLE provides test scores separately for Math, English, Science and Social Studies as well as an aggregate score. This paper will primarily focus on the aggregate test score for the years 1996 and 2002. One advantage of using PLE as a measure of cognitive skills is that passing the test is a requirement for acceptance into secondary school, so students have strong incentives to do their very best. A possible disadvantage is that average PLE scores may not display a great deal of variation across districts. Test score data are available at the individual level for all students in Uganda and are used to calculate district averages for the relevant years.

The mass information campaign launched by the Government of Uganda consisted of monthly publications in the national newspapers on the intergovernmental disbursements of capitation grants to districts.[11] I am using the main newspaper in Uganda, *The New Vision,* to measure newspaper access in the districts. Data on newspaper printing orders (including local language editions) for all districts in Uganda in 2002 have been collected from *The New Vision* head office. According to newspaper offi-

[11] The newspapers used for the information campaign were *The New Vision* (and its local language editions) and *The Monitor*. Data on printing orders from *The Monitor* are not available but according to The Monitor's head office, its pattern of newspaper circulation across the country is similar to that of The *New Vision*.

cials, the distribution of newspapers across districts has been stable during the period 1996 to 2002, which allows me to use the 2002 circulation data to establish treatment and non-treatment districts for both 1996 and 2002.

Primary school data on the number of students, teachers and schools per district for the relevant years have been collected from the Ministry of Education and Sports (MOES) in Uganda. Data on mean consumption level per household have been collected from the 1995/1996 and 2000/2001 Uganda National Household Survey at the Uganda Bureau of Statistics. The mean consumption level across districts is used as a measure of income.

4.1 Descriptive Statistics

Summary statistics on the PLE data are presented in Table 1. The PLE test score ranges from 0 to 32 and the average test score in the district is approximately 10 in 1996 and 2002. There are large variations in both years, however, with students in the worst performing district scoring around 5 and students in the best performing district scoring roughly 4 times higher. On average, 23 percent of all students who take the PLE fail.

The average number of Grade 7 students in the districts more than doubled (112%) between 1996 and 2002, which is probably an effect of the abolished school fees in 1997. Despite the massive increase in enrollment, the average number of Grade 7 students per school only increased by 2.7 students during the period. This is due to improved infrastructure during the period and, on average, 110 new schools per district were built between 1996 and 2002. The number of teachers per school increased from 2.1 in 1996 to 15.3 in 2002.

The average number of newspapers per school in the districts is 6.77, varying from 273 newspapers per school (in Kampala) to 0.12 newspapers per school (in Pader).

There are five obvious high newspaper circulation districts in Uganda and they are located in the 95 percentile of the distribution of newspaper circulation. These are urban districts highly deviating from the overall average in both newspaper circulation

and test scores. Therefore, the main analysis in this paper focuses on the rural districts where information and grants matter most. In the sample of rural districts, there are, on average, 1.13 newspapers per school.

Tables 3a and 3b present summary statistics on the PLE data for the treatment and control group, respectively, when newspaper circulation is a binary variable. 40 percent of the districts belong to the control group and 60 to the treatment group. In Table 3b, which shows summary statistics for the sample of rural districts, students in the treatment and control districts score approximately 10 in 1996 and the two groups are similar in other variables as well. This is in accordance with the identification strategy that assumes the treatment and the control group to be similar before treatment. In 2002, the difference in average test scores between students in treatment districts and control districts is 2.4 points. Hence, students in the treatment and control districts have similar average test scores before treatment, while after treatment the performance of students in control districts is, on average, falling behind by 24 percent as compared to students in the treated districts. In 2002, there is a lower average rate of absenteeism and failure in the treated districts as compared to the control districts.

Sample attrition is small but differing between the treatment and control districts. According to Table 3b, the average number of students sitting for the PLE in 1996 is the same in the treatment and the control group, while in 2002, there are, on average, 3.8 percent less students taking the PLE in the control districts than in the treatment districts. A plausible explanation for the higher attrition rate in the control districts after the information campaign could be that students in the control districts are less motivated to take the test, since the schools have less funding and thus, less resources to motivate the students.

5 Effects of the Capitation Grant Program

I start by presenting the results of the approach using newspaper circulation as a binary variable when establishing the effect of the capitation grant (newspaper campaign) on student performance. That is, the districts are divided into clear treatment and control districts and I exploit the difference between them. However, this approach can be criticized since pure treatment and control districts do not exist in reality. The second approach avoids this shortcoming of dividing the districts into treatment and control districts. Here, newspaper circulation is used as a continuous variable and I exploit the natural variation in newspaper access between districts when estimating the relationship between grants and student performance.

5.1 Newspaper Circulation as a Binary Variable

Table 4 reports the results of estimating the effect of the capitation grant on student performance when newspaper circulation is a binary variable. For each specification, the first column reports test scores in 1996, the second column reports test scores in 2002, and the third column reports the difference between them. The rows give averages (and robust standard errors) for the treatment group, the control group and the differences between them.

A first glance at the effect of the capitation grant program on test scores is provided by studying the results from regression (1), i.e. the differences in average test scores between the treatment and control districts in 1996 and 2002. In specification (1) in Table 4, i.e. the full sample, students in treatment districts scored on average 0.11 standard deviations (0.66 points) higher on the PLE as compared to students in control districts in 1996, but the effect is insignificant. In 2002, students in districts with high access to newspapers scored, on average, 0.46 standard deviations (2.85 points) higher on the PLE as compared to students in districts with low access to newspapers and the difference is significant at the 1 percent level. Specifications (2)-(4) in Table 4 focus on the rural districts where information and grants matter most. Specification (2) shows

there to be a nil and insignificant difference in the average test score between students in the treatment and control districts in 1996. This evidence suggests that there were no large systematic differences in student performance between the treatment and control districts prior to the implementation of the mass information campaign. However, in 2002, the estimate indicates that the grant program had a positive and significant effect on student performance. Students in districts with high access to newspapers and hence, in districts where the schools received a larger amount of capitation grant, scored on average 0.46 standard deviations (2.48 points) better on the test than students in districts with low access to newspapers and the effect is significant at the 1 percent level.

Tables 5a and 5b display the regression version of the difference-in-differences estimates. The double differences approach, regression (5), controls for unobserved time-invariant factors that might be correlated both with newspaper circulation and student performance. In specification (1), i.e. the full sample, the difference-in-differences estimate is 0.34 standard deviations and is significant at the 5 percent level. When focusing on the sample of rural districts, Specification (2), the difference-in-differences estimate is 0.39 standard deviations (2.26 points) and significant at the 5 percent level. Thus, students in districts with high newspaper circulation and accordingly in schools with more funding scored 0.39 standard deviations higher than students in districts with low newspaper circulation. According to Table 4, the large difference in average test scores between students in the treatment and control districts and between 1996 and 2002 is caused by students in the control group who are falling behind. The change in average test score in the treatment group between 1996 and 2002 is an insignificant improvement of 0.11 standard deviations, while the test scores of students in the control group decreased by 0.31 standard deviations during the period, a decrease which is significant at the 5 percent level.

This finding could be explained by the massive increase in enrollment of marginal students in both types of districts in combination with the districts' differential success in reducing the leakage of public funds. The increase in the enrollment of marginal

students in combination with insufficient funding caused test scores to fall in the control districts during the period. Schools in the treatment districts received more funding and therefore, students in treatment districts were able to maintain the average test scores at a constant level during the period, despite the increase in poor and low-performing students.

The identifying assumption in the difference-in-differences model is that in absence of the information (newspaper) campaign, the increase in average test scores would not have differed systematically in low and high newspaper circulation districts. Clearly, the evolvement of average test scores could have differed between the districts regardless of the grant program if the districts differed in other dimensions, for example in income. Results from robustness tests are depicted in specifications (3) and (4) in Tables 4, 5a and 5b. In specification (3), I am controlling for mean income per capita in the district. Increased income inequality between the treatment and the control districts between 1996 and 2002 could potentially influence the test scores of the pupils in the districts. According to specification (3), the difference-in-differences estimate remains unchanged when adding income. The coefficient on mean income per capita is 0.18 standard deviations and insignificant and hence, district income has no significant effect on the difference in average test score between districts with high and low newspaper circulation.

Further robustness tests are depicted in specification (4) in Table 5, where I am controlling for the number of Grade 7 students per school, the number of teachers per school and district income. The results are robust to controlling for these additional variables.[12] According to the difference-in-differences estimate, students in districts with high newspaper circulation score 0.33 standard deviations better in the PLE as compared to students in districts with low newspaper circulation, an effect is significant at the 7 percent level.

[12]It is important to remember that the number of students per school is endogeneous in this regression.

5.2 Newspaper Circulation as a Continuous Variable

Possible critique against using newspaper circulation as a binary variable is that in reality, pure control districts with no newspaper access do not exist. Therefore, an alternative approach is to use the natural variation in newspaper circulation between districts when estimating the relationship between capitation grants and test scores. Table 6 depicts the results from regression (2), when newspaper circulation is a continuous variable, and estimates the effect of the per-student capitation grant program on test scores between 1996 and 2002. In specification (1), the full sample regression, students in districts with high newspaper circulation score 0.45 standard deviations better on the PLE as compared to students in districts with low newspaper circulation in both 1996 and 2002 and the effect is significant at the 1 percent level. However, in the sample of rural districts, specification (2), the estimated effect of the capitation grant program on test scores in 1996 is nil and insignificant while in 2002, students in districts with high newspaper circulation and hence, in districts that receive more grants, on average score 0.38 standard deviations better on the PLE than students in districts with low newspaper circulation. According to specification (3), the result is robust for controlling for income per capita, the number of Grade 7 students per school and the number of teachers per school and the estimate increases to 0.47 standard deviations. The coefficient on income per capita in the district is 0.35 standard deviations and is significant at the 5 percent level. The coefficients on the number of students per school is -0.13 standard deviations and the coefficient on the number of teachers per school is 0.19 standard deviations. Both estimates are insignificant.

Table 7 depicts the regression version of the difference-in-differences regression (6) when newspaper circulation is a continuous independent variable. In Specification (1), the full sample regression, an increase in newspapers at the schools by one standard deviation increases average test scores in the district by 0.03 standard deviations, and the effect is significant at the 1 percent level. In 2002, when controlling for the average effect of newspaper circulation and year effects, students in districts with high newspaper circulation scored 0.04 standard deviations better on the exam than students in

districts with low newspaper circulation and the effect is significant at the 1 percent level. In this sample of urban, high test score and high funding districts, the results show that the newspaper campaign does not really make a difference. However, when looking at rural districts, Specification (2), the results show that capitation grant has a significant effect on average test scores. The average effect of newspaper circulation on test score is nil and insignificant in both years, while the difference in student performance between 2002 and 1996 and between students in districts with high newspaper circulation and districts with low newspaper circulation is 0.42 standard deviations and significant at the 1 percent level.

In specifications (3) and (4) in Table 7, I am testing for violations in the identification assumption by controlling for possible time-varying omitted variables. The result is robust when controlling for income per capita in the district, and the number of students and teachers per school. In specification (4), the average effect of newspaper circulation on test scores is nil and insignificant while in 2002, students in districts with high newspaper circulation score 0.40 standard deviations (1.34 points) better on the primary leaving exam than students in districts that were less exposed to the program. This effect is significant at the 5 percent level.[13] This corresponds to an improvement of roughly 11% in the test scores of the average pupil in Uganda.

[13]Complementary evidence to the findings in this paper is provided by Reinikka and Svensson, 2005b, where they use an IV approach to estimate the effect of the newspaper campaign on school enrollment and student performance. Distance to the nearest newspaper outlet is used as an instrument for exposure to the information campaign. They use a random sample of schools from 18 districts in Uganda and find that the newspaper campaign and hence, reduced capture, had a large and positive effect on school enrollment. A one standard deviation increase in grants received at the schools is found to have resulted in a 0.66 standard deviation increase in enrollment. When using the IV-approach to estimate the effect of the grants on test scores, the estimate enters with a positive sign but it is imprecisely estimated. However, when running a regression on distance to a newspaper outlet and controlling for time and district fixed effects, they find that being closer to a newspaper outlet after the newspaper campaign started significantly increased spending to the school which, in turn, had a large positive impact on school performance.

6 Conclusion

Does money matter for student performance in the primary education sector? In this paper, I show that an untied public grant provided to schools had a large and positive effect on students' academic performance. This is illustrated by using data from an unusual policy experiment: a mass information (or newspaper) campaign introduced by the Government of Uganda in the mid 1990s in response to extensive corruption in the education sector. The main objective of the campaign was to provide information on a large education grant program, so as to boost schools' and parents' ability to monitor the local officials in charge of disbursing funds to the schools. The program was a capitation grant program to cover the non-wage expenditures of primary schools. The major tool in the information campaign was newspaper ads. Evidently, the mass information campaign was successful and more funds, the so-called capitation grant, were received at the primary schools. But since newspaper penetration varies greatly across districts, the exposure to information about the grant program and thus funding, also differed across districts. In this paper, I use this variation in program exposure between districts to identify treatment and non-treatment districts and evaluate if public funds have an effect on student performance. The result shows that money matters! On average, students in districts highly exposed to the information campaign and hence to the grant program, scored 0.40 standard deviations better in the Primary Leaving Exam (PLE) than students in districts less exposed to information. This corresponds to an improvement of roughly 11% in the test scores of the average student in Uganda. My results are robust to controlling for a broad range of confounding factors, including income.

The effect found in this paper is rather large, especially in comparison to previous studies evaluating educational sector programs in developing countries and their effect on average test scores. There are two explanations for the large magnitudes found in this paper: the distinct design of the capitation grant program and the compounding effect. First, the grant program has a unique design and differs from other educational sector programs implemented in developing countries, which usually focus on

specific school inputs. In the grant program in Uganda, schools were free to spend their grants on whatever non-wage items they needed, be it textbooks, school meals, school uniforms, or flipcharts (or even to boost wages since funds generated by the schools themselves are fungible). Thus, each school could, independent of other schools and districts, spend the grant on the items most necessary for this particular school. Second, I am estimating the compounded effect over a few years, i.e. 6 years. I am evaluating the effect on test scores when the information campaign had been running for 6 years and hence, the schools had received additional funding for 6 years.

The capitation grant program is a large-scale government program implemented in all schools in Uganda and it is also a fairly standard education program in other developing countries. Similar programs have been implemented in, for example, Tanzania, Kenya and Cambodia. The rapid replication of the program in other countries emphasizes the importance of evaluating the qualitative effects and the effectiveness of the program. The results found in this paper clearly show that the capitation grant program has a large and positive effect on the pupils' academic performance.

In this paper, I show that when institutions are in place to ensure that funds reach the schools (in this particular case, a newspaper campaign reduced the local capture of public funds by boosting schools' and parents' ability to monitor local officials' handling of the grant program) untied grants do have a substantial impact on students' performance. This suggests that more efforts should be devoted to ensuring that already existing resources reach the end-producers. In other words, experimentations and evaluations of new tools to enhance accountability and strengthen governance should be an integral part in the research agenda on improving social service outcomes.

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Table 1. Descriptive statistics on Primary Leaving Exam test score data by district.

	Mean	Median	St.dev	Max	Min	Obs
1996						
Test scores	10.4	10.6	2.8	19.4	5.5	53
Primary schools	154	130	95.1	493	13	53
P7 students	3465	2711	2621	11977	142	53
P7 students per school	24.2	18.8	22.7	171	10.1	53
Students failed (%)	23.4	20.2	12.7	47	2.3	53
Teachers per school	2.1	1.1	2.8	16.3	0.04	53
Students absent (%)	3.6	3.2	1.7	9.9	0.7	53
Mean income per household (UGX)	10019	9461	2927	26069	6261	53
2002						
Test scores	10.1	10.0	3.2	19.9	4.97	53
Primary schools	264	219	177	809	18	53
P7 students	7355	5679	5241	21298	212	53
P7 students per school	26.9	26.6	8.5	45.8	9.3	53
Students failed (%)	22.5	22.6	12.6	47.0	0.3	53
Teachers per school	15.3	9.8	19.3	89	0.2	53
Students absent (%)	8.7	8.2	4.0	23.8	1.9	53
Mean income per household (UGX)	10932	10556	3617	27602	5273	53

Table 2. Descriptive statistics on newspaper circulation by district.

	Newspaper circulation	Newspapers per school
Mean	727	6.77
Median	145	0.89
St.dev	3166	37.3
Max	23200	273
Min	15	0.12
Obs	53	53

Table 3a. Descriptive statistics on Primary Leaving Exam test score data by treatment and control districts *(full sample)*.

	Mean	Median	St.dev	Max	Min	Obs
1996						
Control districts						
Test scores	10.0	10.5	2.4	14.5	6.0	20
Primary schools	135	118	78	393	64	20
P7 students	2513	2061	1668	6683	822	20
P7 students per school	18.5	16.4	7.1	37.9	11.0	20
Students absent (%)	3.7	4.0	1.3	6.0	1.8	20
Students failed (%)	25.4	24.2	13.3	46.6	8.5	20
Teachers per school	1.9	1.2	1.6	6.2	0.4	20
Mean income per household (UGX)	9756	9875	1953	13326	7056	20
Treatment districts						
Test scores	10.7	10.6	3.1	19.4	5.5	33
Primary schools	165	170	103	493	13	33
P7 students	4041	3202	2932	11977	142	33
P7 students per school	27.6	20	27.9	171	10	33
Students absent (%)	3.6	3.1	1.8	9.9	0.7	33
Students failed (%)	22.8	19.5	12.7	47.0	2.3	33
Teachers per school	2.3	1.1	3.4	16.3	0.1	33
Mean income per household (UGX)	10178	9407	3404	26068	6260	33
2002						
Control districts						
Test scores	8.4	7.9	2.4	13.2	4.9	20
Primary schools	219	200	90	473	107	20
P7 students	5924	4942	3660	14345	1871	20
P7 students per school	25.9	25.1	8.9	45	11.9	20
Students absent (%)	11.0	10.9	4.5	23.8	3.4	20
Students failed (%)	27.9	28.6	12.2	44.6	3.6	20
Teachers per school	13.1	12.3	9.1	34.9	1.6	20
Mean income per household (UGX)	10509	10377	2077	15986	7404	20
Treatment districts						
Test scores	11.2	10.9	3.2	19.9	5.8	33
Primary schools	291	225	210	809	18	33
P7 students	8221	6692	5885	21298	212	33
P7 students per school	27.6	27.8	8.3	44.5	9.3	33
Students absent (%)	7.3	7.2	2.9	15.3	1.9	33
Students failed (%)	19.3	18.9	11.9	47.0	0.3	33
Teachers per school	16.6	7.6	23.5	89.2	0.2	33
Mean income per household (UGX)	11188	10555	4303	27602	5273	33

Table 3b. Descriptive statistics on Primary Leaving Exam test score data by treatment and control districts *(sub sample)*.

	Mean	Median	St.dev	Max	Min	Obs
1996						
Control districts						
Test score	10.0	10.5	2.4	14.5	5.9	20
Primary schools	135	118	78	393	64	20
P7 students	2513	2060	1668	6683	822	20
P7 students per school	18.5	16.4	7.1	37.9	10.9	20
Students absent (%)	3.7	4.0	1.3	6.0	1.8	20
Students failed (%)	25.4	24.2	13.3	46.6	8.5	20
Teachers per school	1.9	1.2	1.6	6.2	0.4	20
Mean income per household (UGX)	9756	9876	1953	13326	7056	20
Treatment districts						
Test scores	10.2	10.2	2.6	15.5	5.5	28
Primary schools	165	171	103	493	13	28
P7 students	3546	2955	2349	8814	142	28
P7 students per school	22.1	19.1	10.0	61.1	10.1	28
Students absent (%)	3.6	3.1	1.8	9.9	0.7	28
Students failed (%)	23.3	20.0	12.6	47.0	0.2	28
Teachers per school	2.5	1.1	3.6	16.3	0.3	28
Mean income per household (UGX)	9455	9251	1817	12044	6261	28
2002						
Control districts						
Test scores	8.4	7.9	2.4	13.2	5.0	20
Primary schools	218	200	90	473	107	20
P7 students	5924	4942	3660	14345	1871	20
P7 students per school	25.6	25.1	8.9	45	11.9	20
Students absent (%)	11.0	10.9	4.5	23.8	3.4	20
Students failed (%)	27.9	28.6	12.2	44.6	3.6	20
Teachers per school	13.0	12.3	9.1	35.0	1.6	20
Mean income per household (UGX)	10509	10377	2077	15986	7404	20
Treatment districts						
Test scores	10.8	10.7	2.7	17.6	5.8	28
Primary schools	271	225	195	809	18	28
P7 students	7199	6291	4942	19897	212	28
P7 students per school	26.0	26.6	7.5	40.1	9.3	28
Students absent (%)	7.2	7.4	2.6	11.6	1.9	28
Students failed (%)	19.3	18.9	11.9	47.0	0.3	28
Teachers per school	18.7	8.7	24.9	89.2	1.9	28
Mean income per household (UGX)	10174	9669	2631	17279	5273	28

Table 4. The effect of newspaper circulation on test scores for discrete values of newspaper circulation.

Specification	(1)			(2)			(3)			(4)		
Period	1996	2002	2002-1996 difference	1996	2002	2002-1996 difference	1996	2002	2002-1996 difference	1996	2002	2002-1996 difference
High access to newspaper	10.67*** (0.54)	11.20*** (0.56)	0.52 (0.77)	10.23*** (0.50)	10.83*** (0.51)	0.60 (0.71)	11.42*** (1.32)	12.11*** (1.53)	0.69 (0.73)	13.56*** (1.86)	14.50*** (2.19)	0.95 (0.78)
Low access to newspaper	10.01*** (0.52)	8.35*** (0.53)	-1.66*** (0.75)	10.01*** (0.53)	8.35*** (0.53)	-1.66** (0.75)	11.23*** (1.36)	9.66*** (1.49)	-1.56** (0.78)	13.08*** (1.67)	12.09*** (2.16)	-0.99 (0.97)
High access - low access difference	0.66 (0.75)	2.85*** (0.77)	2.18*** (1.07)	0.23 (0.73)	2.48*** (0.74)	2.26** (1.04)	0.19 (0.76)	2.44*** (0.71)	2.25** (1.04)	0.48 (0.83)	2.41*** (0.68)	1.94* (1.07)
Normalized high access - low access difference	0.11 (0.13)	0.46*** (0.12)	0.34*** (0.17)	0.04 (0.14)	0.46*** (0.14)	0.39** (0.18)	0.03 (0.14)	0.45*** (0.13)	0.39** (0.18)	0.09 (0.18)	0.45*** (0.13)	0.33* (0.18)
Observations	106	106	106	96	96	96	96	96	96	96	96	96
Controls	No	No	No	No	No	No	Income	Income	Income	Income P7 students per school Teachers per school		

a. Robust standard errors in parenthesis.

b. Income per capita, number of teachers and grade 7 students per school and district are included as controls.

c. Specification: (1) All districts, (2) Rural districts, (3) and (4) Rural districts with controls.

d. *** [**] (*) denote significance at the 1**,** [5] and (10) percent level.

Table 5a. Difference-in-differences estimates of the effects of newspaper circulation on test scores (in points).

	Specification			
	(1)	(2)	(3)	(4)
1996	10.01***	10.01***	11.23***	13.08***
	(0.53)	(0.53)	(1.36)	(1.66)
2002	8.35***	8.35***	9.67***	12.09***
	(0.53)	(0.53)	(1.49)	(2.16)
Newspaper	0.66	0.23	0.19	0.48
	(0.75)	(0.73)	(0.76)	(0.83)
Newspaper in 2002	2.18**	2.26**	2.25**	1.94*
	(1.07)	(1.04)	(1.04)	(1.07)
R^2	0.93	0.94	0.94	0.95
Observations	106	96	96	96
Controls	No	No	Income	Income
				P7 students per school
				Teachers per school

a. Robust standard errors in parenthesis.
b. Income per capita, number of teachers and grade 7 students per school and district are included as controls.
c. Specification: (1) All districts, (2) Rural districts, (3) and (4) Rural districts with controls.
d. *** [**] (*) denote significance at the 1**,** [5] and (10) percent level.

Table 5b. Difference-in-differences estimates of the effects of newspaper circulation on test scores (in beta coefficients).

	Specification			
	(1)	(2)	(3)	(4)
1996	1.67***	1.89***	2.11***	2.46***
	(0.09)	(0.10)	(0.26)	(0.31)
2002	1.40***	1.58***	1.83***	2.28***
	(0.09)	(0.10)	(0.28)	(0.41)
Newspaper	0.11	0.04	0.03	0.09
	(0.12)	(0.13)	(0.14)	(0.15)
Newspaper in 2002	0.34**	0.39**	0.39**	0.33*
	(0.17)	(0.18)	(0.18)	(0.18)
R^2	0.93	0.94	0.94	0.95
Observations	106	96	96	96
Controls	No	No	Income	Income
				P7 students per school
				Teachers per school

a. Robust standard errors in parenthesis.
b. Income per capita, number of teachers and grade 7 students per school and district are included as controls.
c. Specification: (1) All districts, (2) Rural districts, (3) and (4) Rural districts with controls.
d. *** [**] (*) denote significance at the 1**,** [5] and (10) percent level.

Table 6. The effect of newspaper circulation on test scores before and after the newspaper campaign for continuous values of newspaper circulation.

Specification	(1)		(2)		(3)		(4)	
Year	1996	2002	1996	2002	1996	2002	1996	2002
Newspaper per school	0.034***	0.04***	-0.06	1.32***	-0.10	1.40***	0.04	1.66***
	(0.002)	(0.002)	(0.41)	(0.38)	(0.38)	(0.33)	(0.42)	(0.30)
Newspaper per school (Normalized)	0.45***	0.45***	-0.02	0.38***	-0.03	0.40***	0.01	0.47***
	(0.02)	(0.03)	(0.13)	(0.11)	(0.12)	(0.09)	(0.13)	(0.08)
R^2	0.21	0.20	0.00	0.14	0.10	0.33	0.13	0.55
Observations	53	53	48	48	48	48	48	48
Controls	No	No	No	No	Income		Income	
							P7 students per school	
							Teachers/sch	

a. Robust standard errors in parenthesis.
b. Income per capita, number of teachers and grade 7 students per school and district are included as controls.
c. Specification: (1) All districts, (2) Rural districts, (3) and (4) Rural districts with controls.
d. *** [**] (*) denote significance at the 1**,** [5] and (10) percent level.

Table 7. Difference-in-differences estimates of the effects of newspaper circulation on test scores for continuous values on newspaper circulation .

Dependent variable	Test scores			
Specification	(1)	(2)	(3)	(4)
1996	10.19***	10.21***	11.75***	13.67***
	(0.36)	(0.62)	(1.56)	(1.88)
2002	9.86***	8.30***	9.96***	12.18***
	(0.41)	(0.68)	(1.77)	(2.38)
Newspaper per school	0.03***	-0.06	-0.04	0.17
	(0.002)	(0.41)	(0.43)	(0.49)
(Newspaper per school)*2002	0.004	1.38**	1.39**	1.34**
	(0.0026)	(0.56)	(0.56)	(0.59)
Normalized test scores				
1996	1.70***	1.93***	2.22***	2.58***
	(0.06)	(0.11)	(0.29)	(0.35)
2002	1.65***	1.56***	1.88***	2.30***
	(0.07)	(0.13)	(0.33)	(0.44)
Newspaper per school	0.42***	-0.02	-0.01	0.05
	(0.02)	(0.12)	(0.13)	(0.14)
(Newspaper per school)*2002	0.04	0.42**	0.42**	0.40**
	(0.023)	(0.17)	(0.17)	(0.17)
R^2	0.94	0.94	0.94	0.95
Observations	106	96	96	96
Control	No	No		Income
				P7 students per school
				Teachers perschool

a. Robust standard errors in parenthesis.

b. Income per capita, number of teachers and grade 7 students per school and district are included as controls.

c. Specification: (1) All districts, (2) Rural districts, (3) and (4) Rural districts with controls.

d. *** [**] (*) denote significance at the 1**,** [5] and (10) percent level.

Table 8. *Control Experiment:* The effect of newspaper circulation on test scores before 1997.

Dependent variable	Test scores		
Period	1993	1996	1996-1993 difference
High access to newspaper	10.46***	10.23***	0.23
	(0.60)	(0.53)	(0.78)
Low access to newspaper	9.43***	10.01***	0.58
	(0.89)	(0.53)	(1.04)
High access - low access difference	1.03	0.22	-0.81
	(1.07)	(0.73)	(1.30)
Normalized high access - low access difference	0.19	0.04	-0.14
	(0.20)	(0.14)	(0.23)
Observations	81	81	81
Controls	No	No	No

a. Robust standard errors in parenthesis.
b. *** [**] (*) denote significance at the 1**,** [5] and (10) percent level.

Figure 1. Average test scores in high and low newspaper circulation districts plotted over time (1993-2002).