

**The effects of centralisation of school governance and funding
on inequalities in education
Lessons from a policy reform in Hungary**

ZOLTÁN HERMANN – ANDRÁS SEMJÉN

KRTK-KTI WP – 2021/38

October, 2021

<https://kti.krtk.hu/wp-content/uploads/2021/10/KRTKKTWP202138.pdf>

KRTK-KTI Working Papers aim to present research findings and stimulate discussion. The views expressed are those of the author(s) and constitute “work in progress”. Citation and use of the working papers should take into account that the paper is preliminary. Materials published in this series may be subject to further publication.

ABSTRACT

In 2013 the responsibility for school governance and funding has been transferred from local governments to a central government agency in Hungary. The key objectives of this reform, as stated by policy makers, was to mitigate interjurisdictional inequalities in education. This paper explores whether the reform had an equalizing effect on education resources on the one hand, and student achievement on the other. First, we estimate elasticities of per-student school expenditures to average income in municipalities. The results reveal a substantial equalization of school resources: before the reform rich municipalities had spent significantly more on education than poor ones, while after the reform no difference in school spending can be detected. Second, we ask whether the equalization of resources had an effect on inequalities in student achievement. Student achievement is measured by test score in grade 6 and grade 8. The results show no equalization in this respect, suggesting that inequalities in school quality were hardly affected by the reform.

JEL codes: I22, I24, H37

Keywords: centralisation, school governance, school finance, public management reform, inequality, student achievement

Zoltán Hermann

Centre for Economic and Regional Studies Education and Labour Economics
Research Unit, 1097 Budapest, Tóth Kálmán street 4, Hungary
and

Corvinus University of Budapest, Institute of Economics, 1093 Budapest, Fővám
square 8, Hungary

e-mail: hermann.zoltan@krtk.hu

András Semjén

Centre for Economic and Regional Studies Education and Labour Economics
Research Unit, 1097 Budapest, Tóth Kálmán street 4, Hungary

e-mail: semjen.andras@krtk.hu

Az oktatásirányítás és -finanszírozás központosításának hatásai az oktatási egyenlőtlenségekre

HERMANN ZOLTÁN – SEMJÉN ANDRÁS

ÖSSZEFOGLALÓ

2013-ban az oktatásirányítás és -finanszírozás korábban e helyi önkormányzatok által ellátott feladatait egy központ kormányzati ügynökségre ruházták át Magyarországon. A reformot kidolgozó oktatáspolitikusok állítása szerint a reform fő célja az önkormányzatok közti oktatási egyenlőtlenségek csökkentése volt. Tanulmányunk azt vizsgálja, mennyire volt sikeres ez a reform az oktatási erőforrások és a tanulói teljesítmények kiegyenlítése terén. Először megbecsültük az egy tanulóra jutó oktatási kiadások az önkormányzati átlagjövedelem szerinti rugalmasságát. Az eredmények jelentős kiegyenlítő hatást tártak fel: míg a reform előtt a gazdagabb önkormányzatok szignifikánsan többet költöttek fajlagosan oktatásra, mint a szegényebb helyhatóságok, addig a reform után eltűntek az önkormányzatok jövedelme szerinti fajlagos kiadási különbségek. Ezek után azt vizsgáltuk, hogy az oktatási erőforrások kiegyenlítése hatással volt-e a tanulói teljesítményekben mutatkozó egyenlőtlenségekre a gazdagabb és szegényebb önkormányzatok között. A tanulói teljesítményeket a 6. és 8. évfolyamos központi teljesítményméréseken elért teszteredményekkel mértük. Az eredmények e tekintetben sajnos nem mutatnak kiegyenlítődést, ami azt sugallja, hogy a reform alig érintette az iskolák közti minőségi különbségeket.

JEL: I22, I24, H37

Kulcsszavak: centralizáció, oktatásirányítás, oktatásfinanszírozás, közigazgatási reform, egyenlőtlenségek, tanulói teljesítmények

The effects of centralisation of school governance and funding on inequalities in education.

Lessons from a policy reform in Hungary¹

Zoltán Hermann – András Semjén

Abstract:

In 2013 the responsibility for school governance and funding has been transferred from local governments to a central government agency in Hungary. The key objectives of this reform, as stated by policy makers, was to mitigate interjurisdictional inequalities in education. This paper explores whether the reform had an equalizing effect on education resources on the one hand, and student achievement on the other. First, we estimate elasticities of per-student school expenditures to average income in municipalities. The results reveal a substantial equalization of school resources: before the reform rich municipalities had spent significantly more on education than poor ones, while after the reform no difference in school spending can be detected. Second, we ask whether the equalization of resources had an effect on inequalities in student achievement. Student achievement is measured by test score in grade 6 and grade 8. The results show no equalization in this respect, suggesting that inequalities in school quality were hardly affected by the reform.

JEL: I22, I24, H37

Keywords: centralisation, school governance, school finance, public management reform, inequality, student achievement

Introduction

In 1990 local governments became responsible for the provision of primary and secondary education in Hungary. Though private (church and non-church) schools are also present, the majority of schools were owned, funded and run by local governments. In 2013 the central government took over public schools from local governments. This reform has changed the funding and governance of schools and reshaped the rules and practice of education governance immediately (see Semjén et al for more details).

One of the declared policy goals of the reform was to improve the large disparities in the distribution of school resources and school quality, related to differences in fiscal capacities of local governments (Semjén et al, 2018). This paper explores whether the reform was successful in (1) the reallocation of resources, and (2) reducing inequalities in student achievement.

We focus on differences in per-pupil spending and test scores between poor and rich municipalities. We estimate the effect of average income of the municipality (where the school is located) on resources and student achievement before and after the reform. The analysis is descriptive, but we rely on an exogenous

¹ The research project on which the present paper is based was made possible by an NKFIH K_17 research grant (contract identification No. K 124867).

variation in resources, created by the reform. Regarding student achievements we assume that any changes in the gap between poor and rich municipalities after the reform are the result of the reallocation of resources. We argue that other elements of the reform, like changes in school governance, curtailing school autonomy, etc. have affected poor and rich municipalities similarly, while they encountered diverse changes in the level of funding relative to their pre-reform expenditures. Our analysis is confined to *general* or *basic* (primary and lower-secondary) *education*, provided in grade 1-8 schools (hereafter *basic schools*) in Hungary.²

Previous research has shown that disparities in school expenditures were substantial in the 1990s and 2000s in Hungary, similar in magnitude to disparities in the US (Varga, 2000, Hermann, 2008). It was also shown, that student achievement was higher in high income and high spending municipalities, even if differences in the individual characteristics of students were taken into account (Hermann, 2010). Much less is known about the effects of the recent reform. Semjén et al (2018) describes the reform, its political background in detail and provide some descriptive statistics on its effect on funding. Lénárd (2021) analysed the effect of the reform on the mean level of student achievement in public schools and found no effect.

Our analysis is closely related to the recent literature in the US on the effects of school funding reforms. These reforms changed intergovernmental grant formulas with the aim of decreasing disparities in spending between poor and rich municipalities and ensuring adequate education in poor communities. An emerging literature uses these reforms to identify the causal effect of school resources (or spending) on student outcomes. The majority of studies has found a positive effect on student achievement that is largest in poor communities or among low scorer students (see e.g. Card and Payne 2002, Candelaria and Shores 2019, and Lafortune et al 2018 using state level variation in school reforms and Guryan 2001, Papke 2008, Roy 2011, and Nguyen-Hoang and Yinger 2014 for results for a single state). Nevertheless, the results are not unequivocal. Clark (2003) found no effect of the Kentucky reform on the test score gap, while Van der Klaauw (2008) found funding reforms supporting compensatory programs in New York City ineffective. Besides test scores, these reforms tend to have a positive impact on educational attainment (Hyman 2017), labour market outcomes (Jackson et al 2016) and intergenerational mobility (Biasi 2019). Overall the results suggest that equalizing funding has a positive effect on mean student outcomes, mainly driven by the decreasing lag of poor students. Note that the results of this literature are at odds with those of the long-established conventional education production function literature, which basically says, as Hanushek (2020, p. 165) puts it, “there is very weak support for the notion that simply providing higher teacher salaries or greater overall spending will lead to improved student performance”.³ In this paper we look at this question in a different institutional context.

² The term *general education* is used for primary and lower secondary education by the World bank in Alonso and Sanchez, 2011 (see Levačić, 2011 or Abu-Ghaida, 2011). The term *basic education* is used for the same type of education amongst others by UNESCO.

³ Hanushek, 2003 reviewed 90 publications that appeared before 1995. These were based on 377 production function estimates. Only 27% of the studies focusing on the effects of financial resources (in most cases per-pupil expenditures) showed a positive and significant effect, while 7% suggested that adding resources would even harm student achievement. As the studies finding strong resource effects are typically of low quality according to Hanushek, even this 27% figure may overstate the true effect of added expenditure,

To explore the effect of the reform on spending and test score disparities we estimate association between average income in the municipality and per-pupil spending on the one hand, and standardized math and reading test scores on the other. We estimate these regressions year by year, and compare the coefficient of income before and after the reform. Our results suggest that the reform had a marked equalization effect regarding per-pupil spending, while the test score gap remained unaffected.

The paper proceeds as follows. The next section describes the 2013 education reform. Section 3 introduces the data, section 4 explains the methods and section 5 presents the results. Section 6 discusses the results and concludes.

Education funding and governance in Hungary before and after the 2013 reform

In Hungary, prior to the 2013 reform, schools were owned and run by municipalities or their associations (local authority associations) and county level local governments. The state budget contributed to the cost of education through a formula funding system based on the number of students studying in public schools in the municipality, and some other variables (Polónyi, 2017).⁴ The system was based on a so-called normative per capita basic contribution and a complex system of add-ons (or complementary normative contributions, see Madaras and Varga, 2014) based on some other variables. So the formula funding system was quite complex from the beginning, and as a consequence of frequent changes its complexity grew further as time passed by. While in 1995 the total number of variables in the formula was 16, a decade later it was already 60 (Varga, 2008). The formula determined the amount of state support for education received by the municipalities/local governments. Municipal or county-level local authorities also could (and were expected to) contribute to the cost of education from their other revenues. Budgetary allocations based on per capita financing covered only an ever diminishing part of school expenditures, and their ratio to realistic per capita costs was the smallest in general (primary and lower secondary education (basic schools), see Velkey, 2019 for details. Madaras and Varga, 2014 also demonstrated that the real value of the so-called normative per-capita basic contribution diminished drastically from 2003 to 2012.⁵

⁴ There was a move in many transition countries towards per capita financing (PCF) of education after the systemic change (Alonso and Sanchez, 2011). While in Western countries (e. g. UK, Netherlands) PCF usually meant some kind of formula funding of schools, based on the number of students enrolled together with some other variables (see Fazekas, 2012 for more details), in some transition countries, including e.g. Poland and Hungary formula funding was used to determine the budgetary allocations to municipalities and/or higher level local governments that own and run the schools. Per capita financing of education in these countries replaced the previous input-based budgeting system that was non-transparent and often led to inefficient use and inequitable allocation of resources.

⁵ The real value of the normative per-capita basic contribution in 2012 amounted only to 56 per cent of the 2003 level.

The first phase of the reform

There has been a strong and rapid centralization process in education administration, school governance and education finance (school funding) in Hungary in the last decade. The cornerstones of this reform were laid during its first phase, in the first years of the decade.⁶

The main characteristics of this reform process were the following:

- Educational institutions (schools) were no longer run by local county governments but by a central mammoth organization, the Klebelsberg Institution Governance Centre (Klebelsberg Intézményfenntartó Központ, abbreviated as KLIK).
- Parallel to the reorganization of public administration through the reinstatement of districts (járás in Hungarian), the work of KLIK was also organized according to school districts. However, school districts became completely independent of the district-level public administration, and they constitute the regional branches of KLIK, an independent government agency. Initially, there were 198 school districts, covering the 175 districts of the country and the 23 districts of Budapest.
- Eight-year basic schools providing elementary and lower secondary education (ISCED 1 and ISCED 2 levels), are generally operated by the local branch of KLIK. Secondary schools including vocational schools, vocational secondary schools and academic secondary schools (called gimnázium in Hungarian) offering non-vocational 'academic' upper secondary education programs are usually operated by the county centre school district in each county.
- County centre school districts had to some extent organize and control the work of the school districts situated in their county. Nevertheless, most of the important decisions had to be approved by the Centre itself; it had to supervise the operation of each of the 198 units. This organizational structure made the work of the Centre extremely difficult.
- Formula funding or per-capita financing of education was abolished and replaced by an input-financing system. (Polónyi, 2019). Current education expenses, including teacher wages, became centrally financed by KLIK, which became the biggest employer in the country. Central budgetary allocations to local governments were cut drastically. Local school districts have not become independent budgetary institutions and do not know their exact "budgets" – the so-called 'soft' budget constraints (Kornai, 1986) of local education were replaced by even less well defined, fuzzy ones.
- The previous salary scale for teachers practically set only the lower salary limits for the different categories of teachers (according to their degrees and length of service). This was replaced by a far more strictly regulated universal salary system based on a national career path model.
- As a general rule, the ownership rights and maintenance duties with regard to school buildings remained in the hands of local governments initially. However, for small communities or for those not willing to cover maintenance costs, the task could be transferred to the central level. If a local government transferred its maintenance duties to the centre, it was supposed to pay a contribution to the costs of maintenance. This system was a permanent source of conflict.
- The rights and powers (including employer rights, the choice of teachers and school personnel, or the autonomy in dealing with everyday management problems, purchase order placements, etc.) of headmasters or principals diminished drastically. Decisions in trivial matters were often referred up to the Centre, which had little information to base a proper decision on. The professional autonomy of schools and teachers diminished considerably. The freedom to use a licensed

⁶ These are the law on National Public Education (Act CXC of 2011); and a law (Act CLXXXVIII of 2012) on the taking over of the control and funding of some education institutions from local government by the state (i.e. the central government).

textbook was severely reduced, and the number of approved textbooks was cut drastically. Officially-approved new textbooks contained serious mistakes and were often considered inferior to those previously used by teachers' associations and unions.

The second phase of the reform⁷

Although some unpublished internal reports criticising the first phase of the reform and the new governance system circulated within the Ministry, no systematic independent appraisal of its results and problems was prepared and made available to the public.

It is difficult to tell whether the various steps of the second phase were already foreseen and pre-planned at the beginning of the centralization, or they became only necessary in order to correct the faults and unwanted consequences of the first phase of the reform. Based on our research interviews, however, we tend to believe that at least some of the later steps were not foreseen at the beginning of the reforms and were meant to correct the pitfalls of the earlier measures in some sort of a “trial and error” process. Although the complete failure of the previous organizational structure was never acknowledged officially, the scope of the changes showed that the government had obviously recognized the failure of the 2013 centralization.

From 2014 on it became increasingly accepted even within the administration that the middle level of education governance has to be strengthened and more tasks have to be delegated to school districts to make the new education governance system work more smoothly. At first a pyramid-like structure was recommended, together with the strengthening of the autonomy of the county centre school districts.

In 2016 a decision was made that the heavily criticized original organizational structure of KLIK has to be radically changed. This change took effect at the beginning of 2017. Here, the focus was on redefining school districts, and revising the problematic original organizational structure of the Centre.

The important features of this phase of the reform are listed below.

- Perhaps the most important feature of this second phase was that the extremely centralized “one centre - 198 school districts” governance system of KLIK was completely redesigned. Each former regional school district was transferred to a newly established (much bigger) one. The (originally 58, now 60) new school districts became the employers of school staff, including the teachers. The new school districts became autonomous budgetary organizations, and got far more autonomy than their smaller predecessors ever had.
- From the beginning of 2017, the nationalization of municipal schools progressed further and the asset management rights were transferred to the state (in practice to the regionally competent school district). Although local government formally remained the owner of school buildings (often constructed and financed from their own resources), practically they lost their ownership rights over the buildings almost entirely. Central budget subsidies to local governments were once again cut substantially, since the task of school building maintenance also became a responsibility of central government.
- A so-called solidarity contribution calculated according to the size of the municipality's local tax revenues was introduced, and is now collected from more affluent local government districts to

⁷ The main legal steps of the second phase were the amendment (Act LXVI of 2015) of the existing Vocational Training Act (Act CLXXXVII of 2011), and of another act on Adult Training (Act LXXVII of 2013,) together with some other related acts. Further, there came the amendment of some acts related to the regulation of education and some other related acts (Act LXXX of 2016), plus finally a decree (Government Decree 134/2016. [VI. 10.]) concerning organizations that perform state tasks in public education as school operators, and the Klebelsberg Centre.

finance school maintenance expenses partially. Many municipalities found this contribution unfair and some of them turned to the courts, initiating litigation.

- The central unit was also renamed and remodelled: the Klebelsberg Center (Klebelsberg Központ or KK) now organizes the work of school districts and provides supervision and professional guidance to them, but the decisions are made by the individual school districts themselves. This change was at the same time a further step in centralization (as the number of school districts was reduced drastically), and a massive decentralization as well, as their responsibilities and degree of autonomy greatly increased. Headmasters and teachers did not, however, regain the level of autonomy they had in the decentralized system.
- Since the task of overseeing vocational training institutions was transferred from the Ministry of Human Resources at first to the Ministry of National Economy, and later to the Ministry of Innovation and Technology, the Centre's former powers in relation to these schools were also transferred to a newly established organization.

Data

The analysis builds on four datasets. School level expenditure data for several components of expenditures are available from 2012 to 2019 (KIRINTGAZD). Note that only a single year belongs to the pre-reform period. Individual level standardized test scores and student family background data come from the National Assessment of Basic Competencies (NABC) dataset. Full cohorts of students are tested in grade 6, 8 and 10 yearly in math and reading literacy. We use grade 6 and 8 data, for the period 2008-2017. School level data on enrolment are available from 2001 to 2018 (KIRSTAT). This dataset provides the number of basic school students, and school level control variables. Finally, average income of municipalities is calculated from data provided by the Central Statistical Office (TSTAR and TEIR).

Schools, as legal entities in Hungary may provide a mix of educational services and thus defining basic schools in the available datasets is far from straightforward. In some cases a school and a kindergarten is part of the same organization, while grade 1-8 education is sometimes accompanied by academic or even vocational secondary education. This diversity complicates our analysis as expenditure data are available for the school as a legal unit, covering all the education services.

We restrict our sample to schools (1) providing grade 1-8 education, (2) not providing upper-secondary education, (3) having no student hostel and (4) where the share of students with special education needs in classes is below 50%. We take into account other cost-related characteristics of schools by controlling for these in our regression models. The results are robust to different definitions of the school sample (i.e. excluding also schools with kindergarten or arts and music education).

School expenditures are measured for calendar years, while the number of students is available for the beginning of the academic year. We assume that the number of students remains unchanged throughout the academic year, and calculate per-student expenditures using a weighted mean of enrolment in the spring and fall semester.

Some schools, as legal entities, incorporate more than one sites, often located in different municipalities. For example, a school in a rural town may have affiliated schools in some surrounding villages. In our analysis of school expenditures we use school sites as units of observation and hereafter refer to these as schools. Per-pupil spending is measured for the organization as a whole, hence we assume that spending is the same for all member schools. However, average income of the municipality may differ within organizations.

In the analysis of test scores we start with the data covering entire grade 6 and 8 student cohorts. We exclude students studying in 6 or 8 years long academic secondary education programs (about 7% of all students), and students with special education needs.

Our key explanatory variable is average income. We measure this as per capita personal income tax base in municipalities in 2012. In our regression estimates we use standardized average income to make the interpretation of results easier.

Though the majority of basic schools are public, there are private schools as well, directly unaffected by the centralization reform. Nevertheless, we do not exclude private schools and their students from our estimation samples for two reasons. First, inequalities in education should be evaluated for the entire student population. Second, the share of private schools, church schools in particular has increased in these years. Due to this the possibly changing patterns of sorting between the public and private sector would make it difficult to interpret the results from a sample restricted for the sample of public schools as the effect of the reform. However, the results are qualitatively similar for the restricted sample.

The number of schools and municipalities in the estimation sample are shown in Table A1 of the Appendix. Descriptive statistics are provided in Table A2 and A3 of the Appendix.

Methods

To explore the effect of the reform on the distribution of school resources we estimate a school expenditure function in two different specifications. The concise specification provides estimates of the effect of income on log per-pupil spending:

$$(1) \log E_{jt} = \alpha + \beta I_{jt} + \theta X_{jt} + \varepsilon_{jt}, \text{ for } t=2012 \dots 2018$$

where E denotes per-pupil spending of school j in year t , I is the average income in municipality of school j in 2012 and X is a vector of school characteristics potentially affecting costs. We use log expenditures as the dependent variable as the distribution of raw per-pupil spending is quite asymmetric. Moreover, the estimated effects are comparable more directly over the years. Average income is standardized by the population weighted mean and standard deviation. Control variables are factors that might be related to both costs and student achievement⁸. These are log school size, capturing economies of scale, the number of school sites, the share of students with special education needs (SEN), the share of kindergarten pupils, and dummy variables denoting arts and music education in the school, ancillary pedagogical services, and schools operating only in the spring or fall semester of year t .

The key coefficient of interest is β . As income is standardized, this can be interpreted approximately as the increment in per-pupil spending in percentage points implied by a 1 standard deviation increase in average income.

⁸ See e.g. Duncombe and Yinger (1999) for the importance of including this kind of cost factors in the analysis of school expenditures.

As a robustness check we also estimate a specification to detect potential nonlinear income effects:

$$(2) \log E_{jt} = \alpha + \sum \beta^k Q_{jt}^k + \theta X_{jt} + \varepsilon_{jt}, \text{ for } t=2012 \dots 2018$$

where Q^k stands for the 1st – 5th population weighted income quintiles of municipalities. The reference category is the 3rd quintile.

We estimate eq 1 and 2 separately for each year, as the expenditure effects of the cost factors might have changed, as well⁹. For example, the additional expenditures related to SEN students or small school size in part reflect the additional costs, but also reflect the level of targeted subsidies.

Eq 1 and 2 is estimated using total basic school enrolment of schools as weights. Standard errors are clustered at the municipality level.

The association of average income and per-pupil spending is important for two reasons. First, different fiscal capacities of local governments, which generated disparities in school spending, are strongly related to average income. Consequently, a successful equalizing policy should eliminate or at least weaken the income - spending association. Second, not all differences in school spending are equally important from a policy perspective. From an equity point of view, the key question is whether poor students receive at least as much school resources as better off students. Since the share of poor students is higher in low income municipalities, the income - spending association also represent the family background – spending association to a certain extent. However, the former is a coarse measure of the latter, depending on the patterns of sorting across municipalities (Card and Payne, 2002). Hence we also look at the association between student family background and school resources directly.

To assess the redistribution of school resources towards poor students we estimate eq 1 and 2 using the share of students with low education mothers in the school as the key right hand side variable instead of average income.

To answer the second research question we look at changes in differences in test scores after the reform. Since the production of student skills is a cumulative process, test scores in a certain year are affected by both current and preceding school and non-school resources. Consequently, if the reform had an effect on the distribution of school resources, the effect of additional resources on test scores can be expected to appear gradually after the reform (REF). For example, test scores in grade 8 in poor schools one year after the reform can hardly change substantially due to increased school resources as the students tested were exposed to the reform (and additional resources) only in a single year, while in the preceding seven years they studied in schools lacking resources. The more time has passed since the reform, the larger the effect on test scores can be.

Ideally we could detect this effect by estimating the pre-reform trend in the association between income and test scores, and testing whether the trend after the reform deviates from the pre-reform trend. However, the relatively short period covered by the available data do not allow to estimate these trends

⁹ Estimating eq 1 and 2 for the pooled sample, including year fixed effects and year-income interactions provides qualitatively similar results.

precisely. Therefore we estimate models similar to eq 1 and 2 for test scores in each year separately, and assess changes in the coefficient of income.

To explore this effect we estimate the following equation:

$$(3) A^{gs}_{ijt} = \alpha + \beta I_{ijt} + \theta Z_{ijt} + \varepsilon_{ijt}, \text{ for } g=6, 8, s=\text{math, reading, } t=2008 \dots 2017$$

where A is math or reading test score in grade 6 or 8 for student i in school j in year t , and Z is a set of individual characteristics. Individual controls are gender, mother's and father's education and the number of books at home, all represented by sets of dummy variables. Missing values are treated as a separate category.

The key coefficient is β , representing the correlation between municipality income and test scores in each year. If the reform had an equalizing effect on student achievement, β s should show a negative trend after the reform, indicating a narrowing test score gap between poor and rich municipalities.

Again, we also estimate a nonlinear variant of eq 3. Similar to eq 2, we substitute income quintiles for the continuous average income variable.

Finally, we look at the evolution of test score differences between poor and rich students before and after the reform. Here we use low level of mother's education as a single indicator of family background.

The test score models are estimated for the 2008-2017 period. Standard errors are clustered at the municipality level.

Results

Per-pupil spending

Figure 1 displays the association of per-pupil spending and average income of the municipality where the school is located for each year in the 2012-2018 period. In 2012, before the reform, spending and income are positively correlated, while after the reform this correlation seems to disappear or even turns to negative.

However, the raw correlation between income and spending at the school level is not very informative. Income related differences in spending are important as far as they represent different opportunities to provide high quality education in poor and rich communities. Per-pupil spending is an inappropriate measure of education quality as the unit cost of schooling of a certain quality vary substantially across schools. Moreover, these cost differences may correlate with average income, as well. For example, per-pupil cost of education is decreasing with school size due to strong economies of scale in schooling. At the same time, most of the small schools are located in villages, where the average income tends to lag behind that in towns.

Figure 2 and Table 1 show estimates of the correlation of income and per-pupil spending taking into account cost differences. Costs are controlled for in a regression model. The dependent variable is log per-pupil spending. Figure 1 displays the estimated coefficients of standardized average income estimated for each year. The results suggest significant income-related differences before the reform. In 2012 a 1 SD difference in income implied about 7% higher per-pupil spending. After the reform these spending disparities have more or less disappeared. The correlation between income and per-pupil operational expenditures has changed immediately when the reform was launched, while it turned to positive again in 2015 and 2016, though at a lower level compared to 2012. Regarding per-pupil expenditures on teaching personnel a more gradual change can be observed in the first two years. From 2015 the correlation is not significant statistically any more. This gradual change is probably due to the fact that changing the number of teachers employed requires reorganizing education and takes longer time.

Table 2 provides similar estimates by income quintiles. The estimated spending gap between the bottom and the top quintile was about 20% in 2012, and generally vanished after the reform.

Figure 3 displays the estimated effect of income on two components of per-pupil expenditures on teaching personnel. The reform seems to have affected both the student-teacher ratio and the average wage of teachers, though not at the same pace. The effect was more immediate in case of the latter and more gradual for the former.

Figure A1 of the Appendix provides estimated coefficients of income for other components of school expenditures.

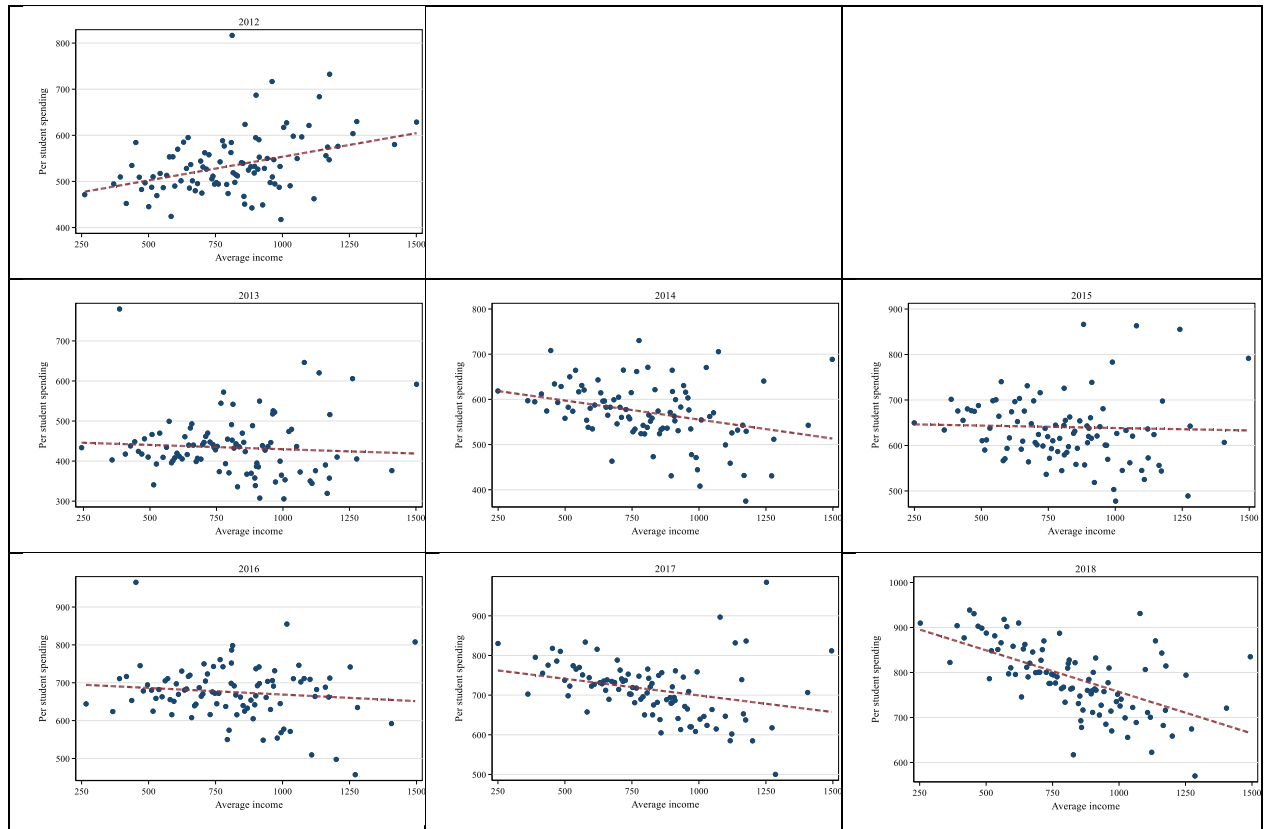
Overall, the results suggest that the centralization reform rearranged the preceding pattern of spending disparities and generated a marked redistribution of school resources towards poor communities.

Though eliminating spending disparities between poor and rich communities can be regarded as a significant improvement on its own right, equality of opportunity in education is advanced only as far as the distribution of school resources spent on poor and rich students becomes less unequal. To explore this we estimated the effect of school composition (the share of students with low level of mother's education in school) on per-pupil spending, controlling for the same cost-related factors as above.

Figure 4 and Table 3 and 4 display the results. The results are in line with those for average income. Before the reform per-pupil spending was on average lower in schools where the share of socially disadvantaged students were higher, while after 2013 there is no correlation between per-pupil spending and school composition.

Figure 5 and 6 show the effect of income and school composition on per-pupil expenditures on teaching personnel separately for towns and villages. Regarding income, a similar reallocation of resources can be seen in the two groups. Regarding school composition it turns out that equalization is driven by changes in villages (and possibly the shrinking spending gap between towns and villages).

Figure 1 Average per-student spending by income percentiles before and after the reform



Note: Means weighted by enrolment. Income percentiles are percentile groups of schools, weighted by enrolment, with respect to average income of the municipality in 2012.

Figure 2 The effect of income on per-pupil spending

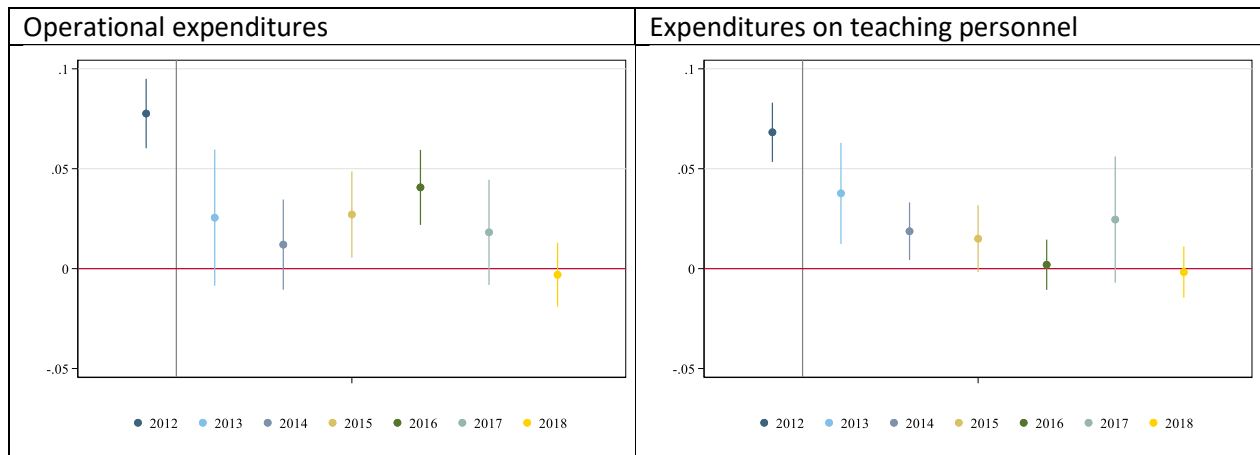
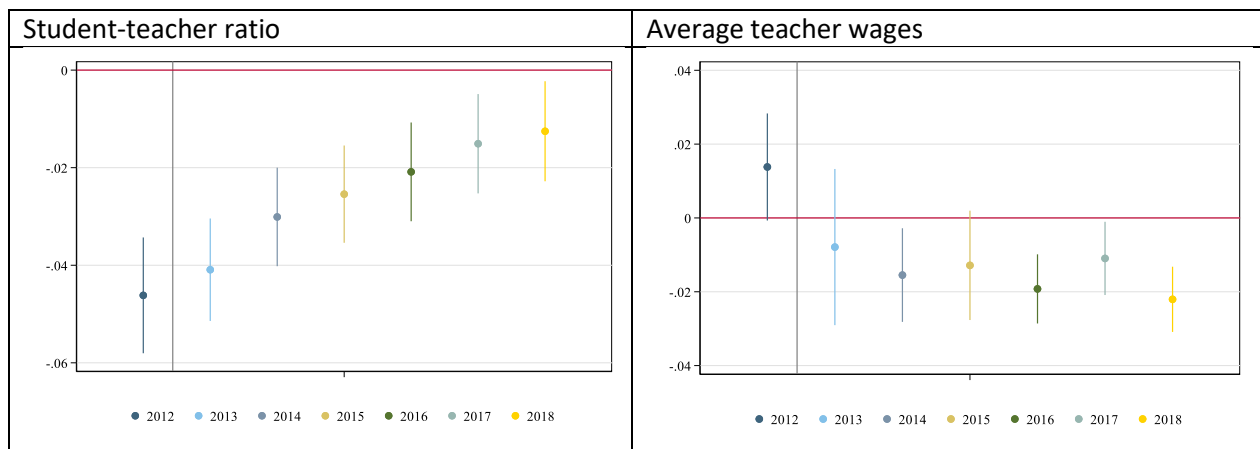


Figure 3 The effect of income on student-teacher ratio and average teacher wages



Note: average teacher wages: teacher wage expenditures per full time equivalent teachers

Figure 4 The effect of the share of students with mothers with low education attainment on per-pupil spending

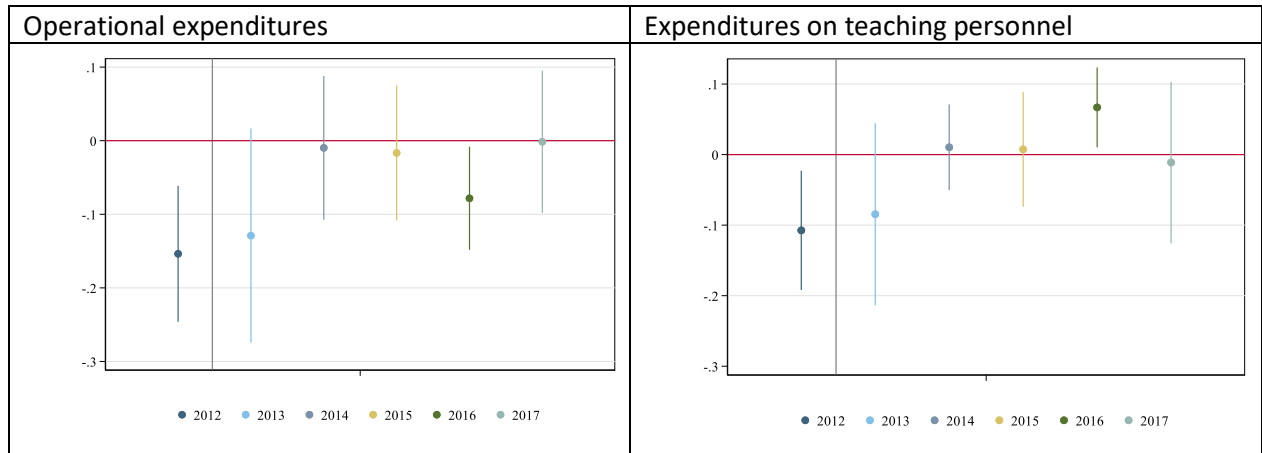


Figure 5 The effect of income on per-pupil expenditures on teaching personnel in towns and villages

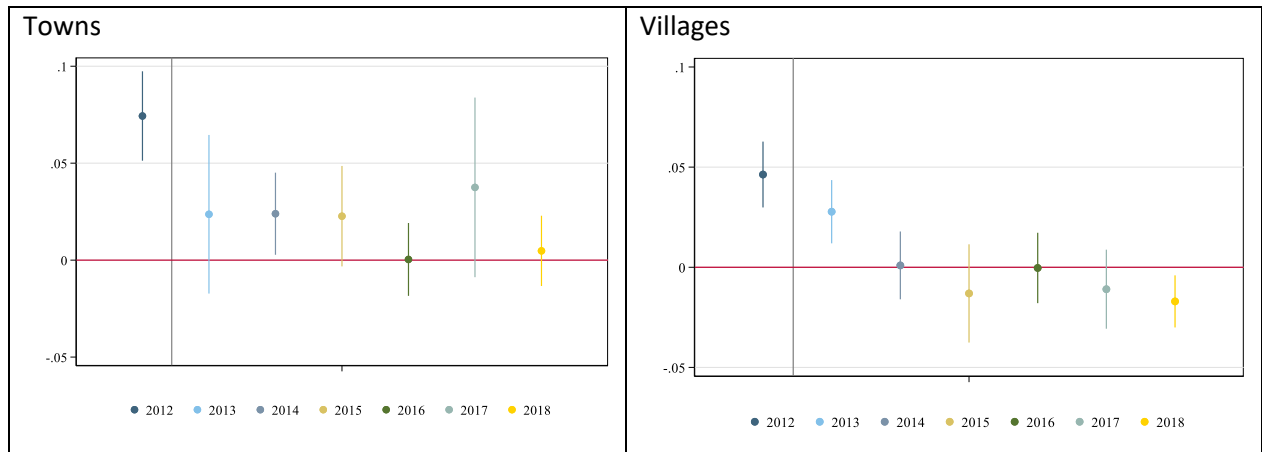
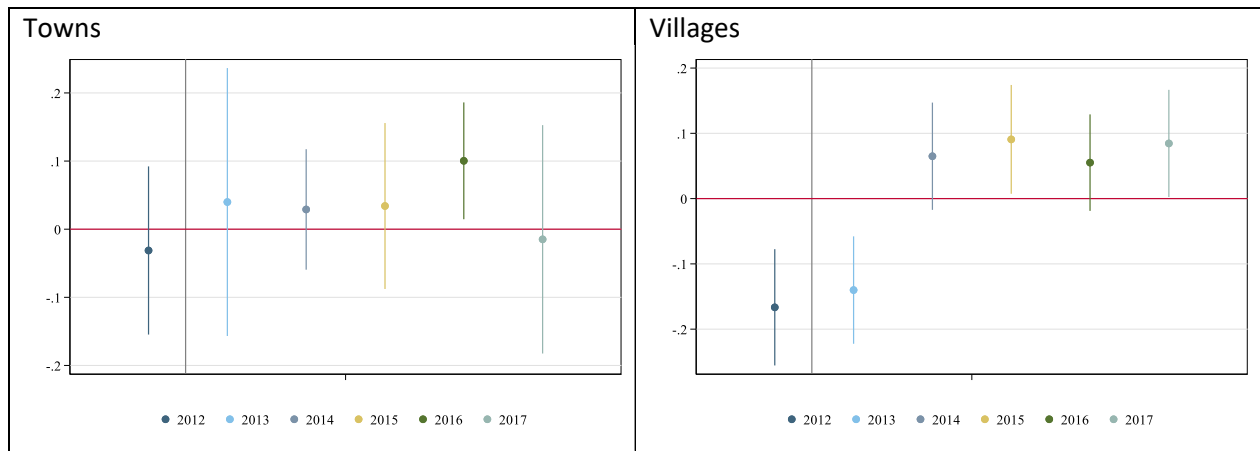


Figure 6 The effect of the share of students with low education mothers on expenditures on teaching personnel in towns and villages

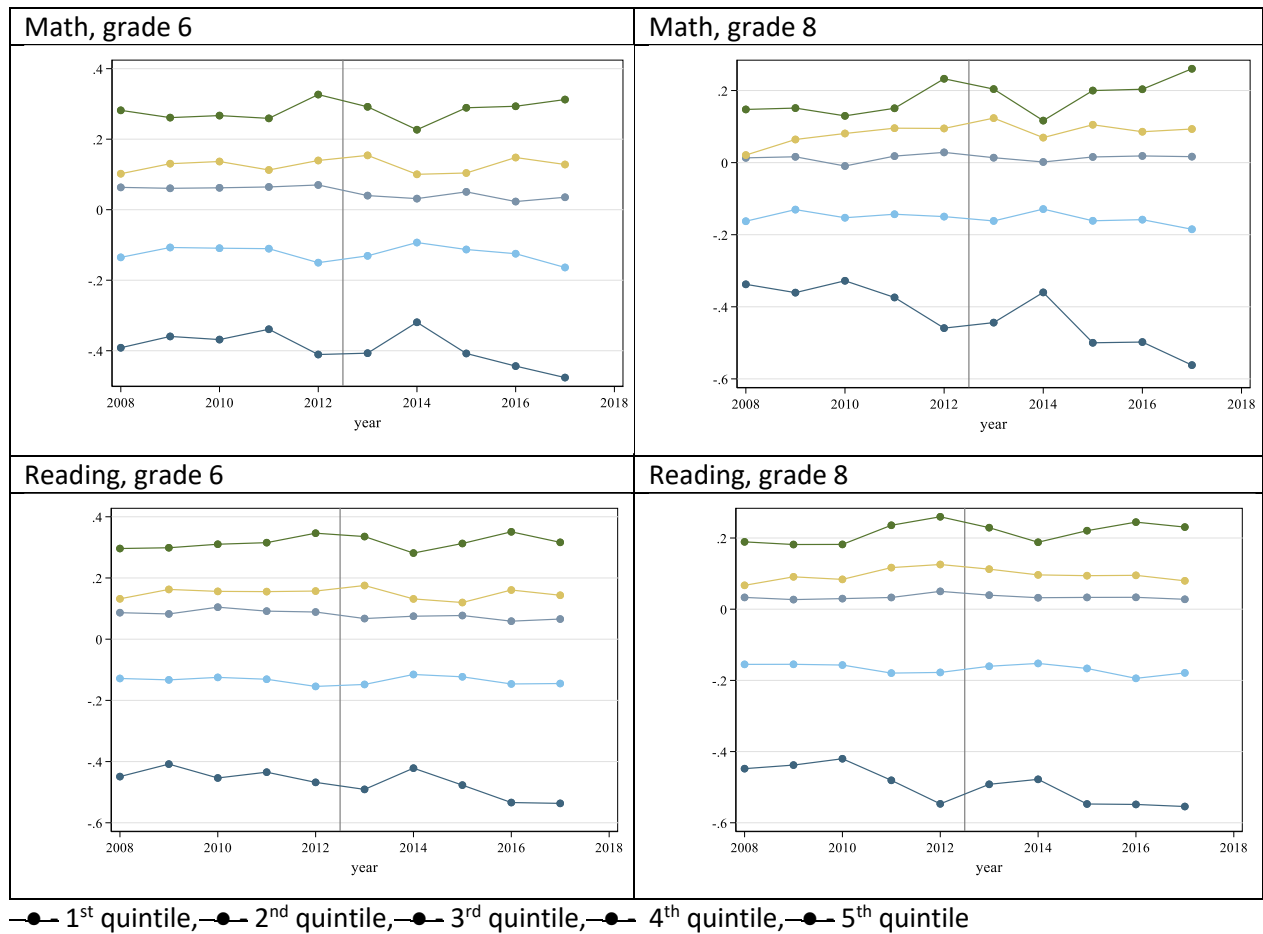


Test scores

Overall, the centralization reform brought a significant equalization in the distribution of school resources. Was it successful in improving equality of opportunity in education? To explore this we look at inequalities of standardized test scores before and after the reform.

Figure 7 displays average test scores for income quintiles of municipalities. In general, there are large differences, the gap between the bottom and top quintile is 0.6-0.8 SD. Moreover, the gap seems to open up in math after 2010.

Figure 7 Average test scores by income quintiles of municipalities



Student achievement depends strongly on student characteristics, including family background. As the social background of students and average income of the municipality are positively correlated, the differences in Figure 7 reflect both the family background effect and the effect of differences in school resources. Moreover, average student characteristics might have changed differently in poor and rich communities over time. In order to separate the effect of the reallocation of school resources we estimate the effect of average income on test scores controlling for some indicators of family background.

Figure 8 and Table 5-7 summarizes the results. Note that we expect a gradually diminishing effect of income on test scores as later student cohorts spend more time in school after the reform. Overall there is no sign of a consistent decrease in the achievement gap after the reform. The gap is smaller than before in 2014, but this is most likely an outlier year, probably due to differences in the test. In general the results suggest that a less unequal distribution of school resources had no effect on social inequalities of achievement. The gap between students with low and higher level of mother's education seems to confirm this result (Figure 9).

Figure 8 The effect of average income on test scores

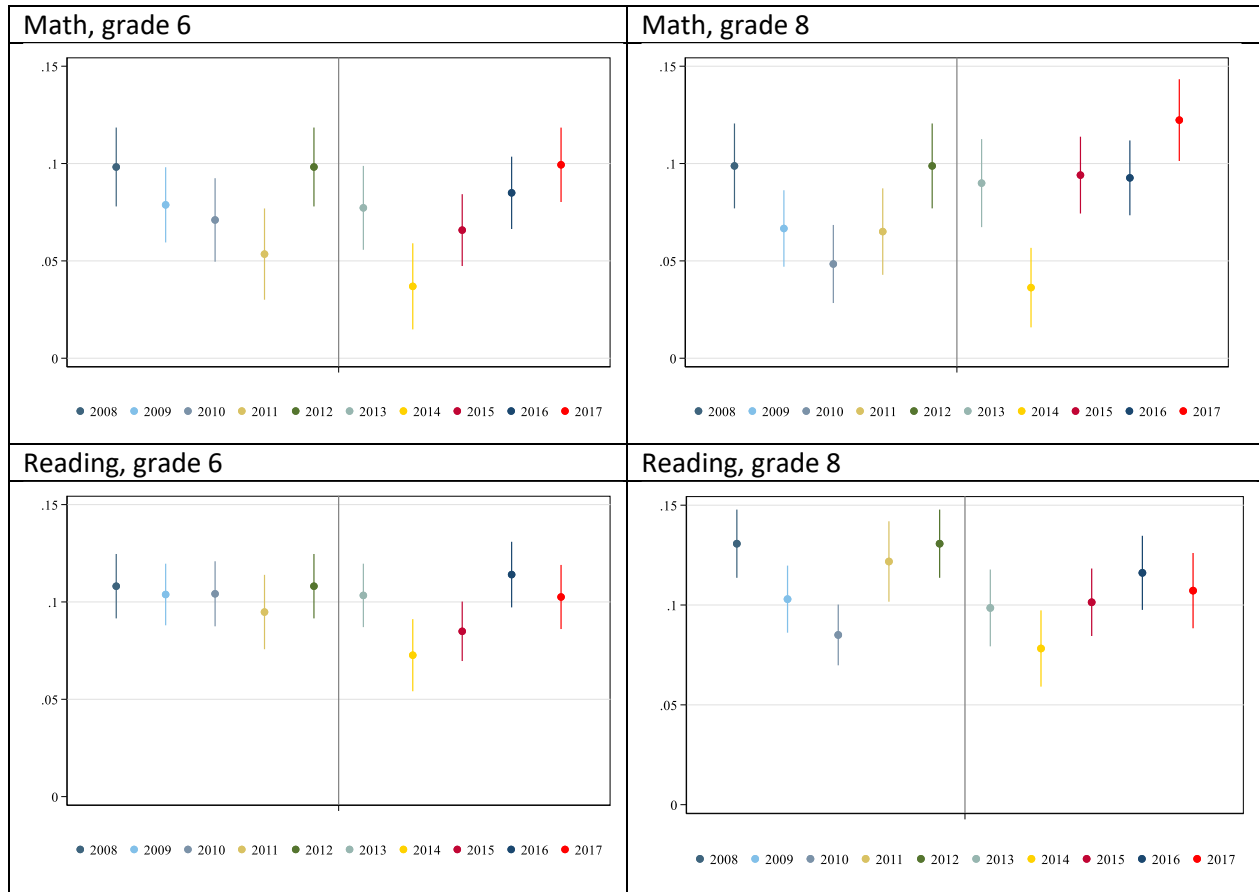
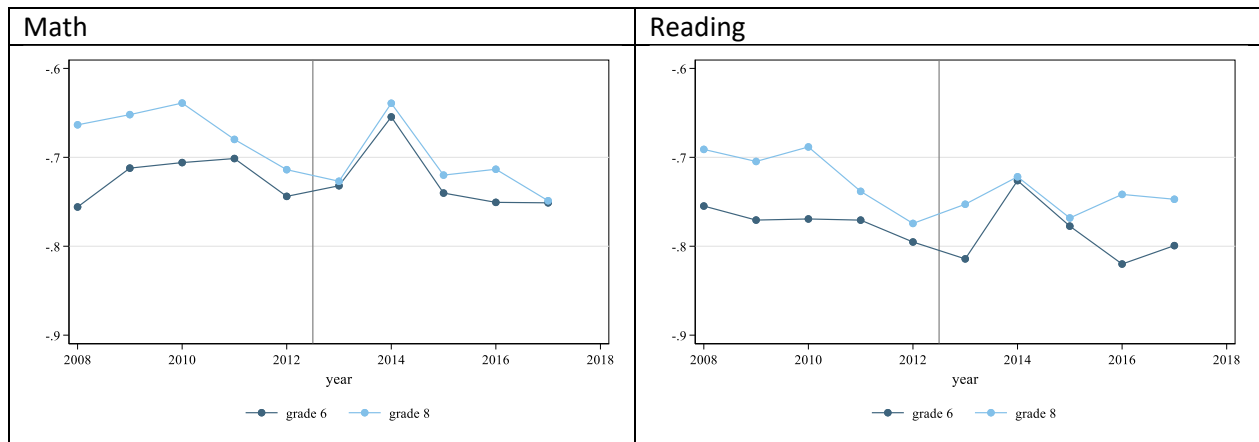


Figure 9 The test score gap between students with low and higher level of mother's education



Note: low education: lower secondary education or below, vocational school; high education: upper secondary or tertiary education

Conclusions and hypotheses for further research

In this paper we analysed the effect of a major policy reform of education governance on interjurisdictional disparities in Hungary. Our results suggest that the reform had a considerable effect on the distribution of school resources. While before the reform rich municipalities spent more than poor ones, the reform eliminated income-related differences in per-pupil spending. At the same time, in spite of the expectations of education administration the equalization of per-pupil school resources has not diminished the achievement gap between schools in rich and poor municipalities, or schools with significant differences in their student mix according to the socio-economic status of parents.

The lack of equalization in student achievement may seem a rather shocking result, especially if one tends to believe that the main motive behind centralization and equalization of per-student resources was to provide underperforming students with a higher quality of education. Moreover, this result is more consistent with the findings of the conventional education production function literature (see e.g. Hanushek, 2020) than the results of a new literature on the effects of equalizing grant reforms in the US (see e.g. Jackson et al 2016).

The question arises, how can we interpret or explain the failure of the equalization of per-pupil resources in reducing the test-score or achievement gap. At this point of our research we can only provide some hypotheses that may be verified or disproved by later research.

Hypothesis 1: additional school resources fail to produce a significant positive effect on achievement due to the lack of incentives, accountability and central guidelines for the school districts on interventions in underperforming schools;

Hypothesis 2: Higher test scores in rich municipalities are not generated by better school resources, but reflect differences in unobserved student characteristics (see e.g. Goldhaber & Brewer, 1997 on the role of unobservables).

Hypothesis 3: It is not so much the higher level of per-pupil resources that is important in reducing the achievement gap, but the (re)allocation of (existing) resources.¹⁰ If more resources are allocated to the instruction of disadvantaged students, this may have a positive effect on student outcomes.

Hypothesis 4: Teacher quality is still unequal and this manifests in the achievement gap between rich and poor municipalities. It is obvious that rich municipalities could employ better teachers before the reform (higher earnings, more attractive places to live, better students). After the reform teacher sorting did not adapt to the redistribution of resources immediately, and schools in rich municipalities can employ better teachers even if salaries are the same, as rich municipalities are more attractive places to live, and tend to have better students.

Hypothesis 5: The equalization of per-pupil spending was only one element of the reform, and it was not the most important one in determining student outcomes. Some other features of the reform (e.g. the loss of autonomy of schools, headteachers and teachers, the reduction of the number of licensed

¹⁰ There is a growing body of literature that suggests this. See e.g. Pan et. al., 2003; James et al., 2011; Cobb-Clark and Jha, 2016; and Neal, 2016.

textbooks, etc.) may have affected schools much more than this, and this may have led to the lack of results in the field of the reduction of the achievement gap.

References

Abu-Ghaida, D. (2011): Per Capita Financing of General Education in Europe and Central Asia: Has It Delivered on Its Promise? An Overview of Six Country Case Studies, In Alonso and Sánchez, 2011.

Alonso, J.D. and Sánchez, A. eds. (2011): Reforming Education Finance in Transition Countries. Six Case Studies in Per Capita Financing Systems. World Bank, Washington DC. 336 p.

Biasi, B (2019) School Finance Equalization Increases Intergenerational Mobility, NBER working paper No. 25600

Candelaria, C. A. and Shores, K. A. (2019): Court-Ordered Finance Reforms in the Adequacy Era: Heterogeneous Causal Effects and Sensitivity, *Education Finance and Policy*, vol. 14(1), pp 31-60.

Card, D. and Payne, A. A. (2002): School finance reform, the distribution of school spending, and the distribution of student test scores, *Journal of Public Economics*, vol: 83, pp. 49-82.

Clark, M. A. (2003) Education Reform, Redistribution, and Student Achievement: Evidence From the Kentucky Education Reform Act https://www.mathematica-mpr.com/-/media/publications/pdfs/education/edreform_wp.pdf.

Cobb-Clark, D. A. and Jha, N. (2016): Educational Achievement and the Allocation of School Resources, *Australian Economic Review* 49(3):251-271

Duncombe, W. D. and J. M. Yinger [1999]: Performance standards and educational cost indexes: you can't have one without the other. H. F. Ladd – R. Chalk – J. S. Hansen (eds.) [1999]: Equity and adequacy in education finance, National Academy Press, Washington.

Goldhaber, D. D. and Brewer, D. J. (1997). Why Don't Schools and Teachers Seem to Matter? Assessing the Impact of Unobservables on Educational Productivity. *The Journal of Human Resources*, 32(3), 505–523. <https://doi.org/10.2307/146181>

Guryan, J. (2001): Does Money Matter? Regression-Discontinuity Estimates from Education Finance Reform in Massachusetts. NBER Working Paper No. 8269

Hanushek, E. A. (2003): The failure of input-based schooling policies, *Economic Journal*, Vol. 113, Issue 485. February, pp. F64-F98

Hanushek, E. A. (2020): Education Production Function, in: Bradley, S. & Green, C. *Economics of education*, 2nd edition, London: Academic Press, pp. 161-170

Hermann Z. [2008]: Iskolai kiadási egyenlőtlenségek, 1992-2005, *Kormányzás, Közpénzügyek, Szabályozás* 3. évf./2. <http://www.kormanyzas.hu/082/2.php>

Hermann Z. [2010]: Az önkormányzatok költségvetési helyzete és a kompetenciamérési eredmények települések közötti különbségei, In: Kolosi T. and Tóth I. Gy. (ed.): Társadalmi Riport 2010, Tárki, Budapest, 2010, 430-450.

Hyman, J. (2017) Does Money Matter in the Long Run? Effects of School Spending on Educational Attainment. *American Economic Journal: Economic Policy*, 9(4):256-280.

Jackson, C. K., Johnson, R. C., and Persico, C. (2016). The Effects of School Spending on Educational and Economic Outcomes: Evidence from School Finance Reforms. *The Quarterly Journal of Economics*, 131(1):157-218.

James, L., Pate, J., Leech, D., Martin, E., Brockmeier, L. and Dees, E. (2011): Resource Allocation Patterns and Student Achievement, *International Journal of Educational Leadership Preparation*, v6 n4 Oct-Dec

Kornai, J. (1986). The Soft Budget Constraint, *Kyklos*, **39** (1): 3-30.

Lafortune, J., Rothstein, J., and Schanzenbach, D. W. (2018): School Finance Reform and the Distribution of Student Achievement. *American Economic Journal: Applied Economics*, 10(2):1-26.

Lénárd Tünde [2021]: A közoktatási centralizáció hatása a diákok teljesítményére Magyarországon, *Közgazdasági szemle*, LXVIII. évf., május (457–489.)

Levačić, R. (2011): Per Capita Financing of General Education in Poland: A Case Study, in Alonso and Sanchez (2011)

Madaras A. and Varga J. (2014): Changes in Education Funding in Hungary, *Acta Univ. Sapientiae, Economics and Business*, 2, 59-74

Neal, J. A. (2016): Examination of Resource Allocation and Student Achievement, Walden Dissertations and Doctoral Studies Collection, ScholarWorks, Walden University

Nguyen-Hoang, P. and Yinger, J. (2014): Education Finance Reform, Local Behavior, and Student Performance in Massachusetts, *Journal of Education Finance*, v39 n4 p297-322

Pan, D., Rudo, Z. & Smith-Hansen, L. (2003): Resource Allocation Does Matter in Improving Student Performance, Southwest Education Development Laboratory (SEDL)

Papke, L. E. (2008) The effects of changes in Michigan's school finance system, *Public Finance Review*, vol: 36, pp. 456-474.

Polónyi I. (2017): Finanszírozási libikóka, *Educatio* 26 (4), pp. 603–624 (DOI: 10.1556/2063.26.2017.4.8)

Roy, J. (2011) Impact of school finance reform on resource equalization and academic performance: Evidence from Michigan, *Education*, vol: 6, pp. 137-167.

Semjén A., Le, M. and Hermann Z. [2018]: The goals and Consequences of the Centralization of Public education in Hungary. *Acta Educationis Generalis*, Vol. 8. no. 3. 9–34. o.

Van der Klaauw, W. (2008) Breaking the link between poverty and low student achievement: An evaluation of Title I, *Journal of Econometrics*, vol: 142, pp. 731-756.

Varga J.[2000]: A közoktatás-finanszírozási rendszer hatása az egyenlőségre, 1990–1997. Közgazdasági Szemle, XLVII. 531–548.

Varga J. (2008): Az iskolaügy intézményrendszere, finanszírozása. In: Zöld könyv a magyar közoktatás megújításáért. (szerk.: Fazekas K., Köllő J., Varga J.) ECOSTAT, Budapest, 235–259. p.

Tables

Table 1 The effect of income on per-pupil spending

	(1) 2012	(2) 2013	(3) 2014	(4) 2015	(5) 2016	(6) 2017	(7) 2018
operational expenditures income	0.0776*** (0.00885)	0.0255 (0.0174)	0.0120 (0.0115)	0.0271** (0.0110)	0.0407*** (0.00957)	0.0182 (0.0134)	-0.00305 (0.00813)
expenditures on teaching personnel income	0.0682*** (0.00756)	0.0377*** (0.0129)	0.0187** (0.00735)	0.0150* (0.00853)	0.00195 (0.00640)	0.0246 (0.0161)	-0.00172 (0.00653)
N	1,567	1,775	1,833	1,847	1,889	1,929	1,952

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the municipality level in parentheses. Dependent variable: log per-pupil operational expenditures and expenditures on teaching personnel. Estimates are weighted by general school enrollment. Income is standardized average income of municipalities in 2012. Control variables: log school size, number of school sites, share of SEN students, share of kindergarten students, arts and music education dummy, other pedagogical services dummy, school observed in the first/second semester only dummies.

Table 2 The effect of income quintiles on per-pupil spending

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	2012	2013	2014	2015	2016	2017	2018
operational expenditures							
1st quintile	-0.132*** (0.0280)	-0.0944** (0.0387)	-0.0260 (0.0282)	-0.0344 (0.0282)	-0.0821*** (0.0255)	-0.00617 (0.0204)	0.0234 (0.0188)
2nd quintile	-0.0758** (0.0296)	-0.0594* (0.0305)	-0.0358 (0.0287)	-0.0410 (0.0299)	-0.0466* (0.0264)	-0.0147 (0.0205)	-0.00693 (0.0189)
4th quintile	0.0105 (0.0391)	-0.0473 (0.0421)	0.00774 (0.0364)	0.0673 (0.0591)	0.0115 (0.0297)	0.00843 (0.0256)	0.00378 (0.0223)
5th quintile	0.112*** (0.0381)	-0.0210 (0.0500)	0.00405 (0.0441)	0.0260 (0.0403)	0.0367 (0.0327)	0.0304 (0.0396)	0.00442 (0.0288)
expenditures on teaching personnel							
1st quintile	-0.108*** (0.0289)	-0.0371 (0.0372)	-0.0179 (0.0199)	0.0112 (0.0360)	-0.0339 (0.0247)	-0.00488 (0.0238)	0.0346 (0.0233)
2nd quintile	-0.0561* (0.0294)	-0.0147 (0.0285)	-0.0304 (0.0203)	0.00692 (0.0351)	-0.0286 (0.0257)	0.00155 (0.0228)	0.0122 (0.0229)
4th quintile	0.0173 (0.0327)	0.0445 (0.0276)	0.0346 (0.0234)	0.0984 (0.0616)	-0.0121 (0.0264)	0.0178 (0.0253)	0.0371 (0.0242)
5th quintile	0.109*** (0.0378)	0.0821** (0.0328)	0.0365 (0.0275)	0.0538 (0.0394)	-0.0211 (0.0264)	0.0583 (0.0475)	0.0247 (0.0277)
N	1,567	1,775	1,833	1,847	1,889	1,929	1,952

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the municipality level in parentheses. Dependent variable: log per-pupil operational expenditures and expenditures on teaching personnel. Estimates are weighted by general school enrollment. Population weighted income quintiles of municipalities in 2012. Control variables: log school size, number of school sites, share of SEN students, share of kindergarten students, arts and music education dummy, other pedagogical services dummy, school observed in the first/second semester only dummies.

Table 3 The effect of the share students with a low level of mother's education on per-pupil spending

	(1)	(2)	(3)	(4)	(5)	(6)
	2012	2013	2014	2015	2016	2017
operational expenditures						
share of low education	-				-	
mothers	0.154***	-0.129*	-0.00975	-0.0166	0.0783**	-0.00152
	(0.0471)	(0.0742)	(0.0498)	(0.0468)	(0.0357)	(0.0492)
expenditures on teaching						
personnel						
share of low education						
mothers	-0.107**	-0.0845	0.0104	0.00737	0.0669**	-0.0112
	(0.0431)	(0.0657)	(0.0309)	(0.0415)	(0.0289)	(0.0583)
N	1,486	1,733	1,784	1,813	1,846	1,875

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the municipality level in parentheses. Dependent variable: log per-pupil operational expenditures and expenditures on teaching personnel. Estimates are weighted by general school enrollment. Control variables: log school size, number of school sites, share of SEN students, share of kindergarten students, arts and music education dummy, other pedagogical services dummy, school observed in the first/second semester only dummies.

Table 4 The effect of quintiles of schools by the share students with a low level of mother's education on per-pupil spending

	(1)	(2)	(3)	(4)	(5)	(6)
	2012	2013	2014	2015	2016	2017
operational expenditures						
1st quintile	0.00911 (0.0353)	0.0617* (0.0370)	0.000895 (0.0337)	-0.00794 (0.0309)	0.00948 (0.0270)	0.0355 (0.0348)
2nd quintile	0.0204 (0.0285)	0.0665** (0.0282)	0.00628 (0.0212)	0.0306 (0.0253)	0.0124 (0.0216)	0.00826 (0.0176)
4th quintile	0.0742*** (0.0238)	-0.0305 (0.0247)	0.0396** (0.0201)	0.0639*** (0.0236)	-0.0350* (0.0203)	-0.00268 (0.0170)
5th quintile	0.0765*** (0.0227)	0.00182 (0.0344)	0.0133 (0.0200)	0.00931 (0.0216)	0.0435** (0.0211)	0.0403*** (0.0148)
expenditures on teaching personnel						
1st quintile	-0.00302 (0.0345)	0.0506** (0.0244)	-0.00986 (0.0209)	-0.0153 (0.0278)	-0.0357* (0.0213)	0.0447 (0.0402)
2nd quintile	0.0169 (0.0262)	0.0498** (0.0195)	0.0170 (0.0167)	0.0285 (0.0216)	-0.0116 (0.0197)	0.00512 (0.0199)
4th quintile	0.0693*** (0.0225)	-0.0227 (0.0190)	0.0353** (0.0157)	-0.0492* (0.0290)	0.00167 (0.0202)	0.00197 (0.0182)
5th quintile	0.0591*** (0.0204)	0.00165 (0.0354)	0.0148 (0.0176)	0.0162 (0.0205)	0.00593 (0.0197)	0.0362** (0.0171)
N	1,486	1,733	1,784	1,813	1,846	1,875

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the municipality level in parentheses. Dependent variable: log per-pupil operational expenditures and expenditures on teaching personnel. Estimates are weighted by general school enrollment. Enrollment weighted quintiles of schools in each year. Control variables: log school size, number of school sites, share of SEN students, share of kindergarten students, arts and music education dummy, other pedagogical services dummy, school observed in the first/second semester only dummies.

Table 5 The effect of income on test scores

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Math										
grade 6										
income	0.0913***	0.0788***	0.0710***	0.0535***	0.0982***	0.0772***	0.0369***	0.0658***	0.0849***	0.0994***
	(0.00817)	(0.00985)	(0.0109)	(0.0119)	(0.0103)	(0.0110)	(0.0113)	(0.00941)	(0.00947)	(0.00974)
N	91,639	84,282	81,733	79,056	77,727	79,226	77,711	77,712	76,180	77,051
grade 8										
income	0.0579***	0.0666***	0.0484***	0.0650***	0.0988***	0.0899***	0.0363***	0.0941***	0.0926***	0.122***
	(0.00901)	(0.0100)	(0.0102)	(0.0113)	(0.0111)	(0.0115)	(0.0104)	(0.0101)	(0.00980)	(0.0107)
N	87,541	83,449	83,723	76,926	73,132	70,335	68,621	70,355	69,258	68,397
Reading										
grade 6										
income	0.117***	0.104***	0.104***	0.0948***	0.108***	0.103***	0.0726***	0.0849***	0.114***	0.103***
	(0.00786)	(0.00807)	(0.00852)	(0.00974)	(0.00843)	(0.00831)	(0.00945)	(0.00779)	(0.00859)	(0.00839)
N	91,639	84,282	81,733	79,056	77,727	79,226	77,711	77,712	76,180	77,051
grade 8										
income	0.109***	0.103***	0.0850***	0.122***	0.131***	0.0985***	0.0782***	0.101***	0.116***	0.107***
	(0.00731)	(0.00856)	(0.00776)	(0.0103)	(0.00871)	(0.00980)	(0.00974)	(0.00862)	(0.00946)	(0.00961)
N	87,541	83,449	83,723	76,926	73,132	70,335	68,621	70,355	69,258	68,397

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the municipality level in parentheses. Dependent variable: test score standardized by year and grade. Income is standardised average income of municipalities in 2012. Control variables: gender, mother's and father's education, the number of books at home. All control variables are coded as a set of dummies.

Table 6 The effect of income quintiles on math test scores

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Math										
grade 6										
1st quintile	-0.158*** (0.0292)	-0.123*** (0.0291)	-0.113*** (0.0334)	-0.0849*** (0.0329)	-0.134*** (0.0280)	-0.0889*** (0.0321)	-0.0269 (0.0345)	-0.0862*** (0.0302)	-0.0929*** (0.0291)	-0.125*** (0.0277)
2nd quintile	-0.0797*** (0.0282)	-0.0429 (0.0302)	-0.0548 (0.0335)	-0.0475 (0.0333)	-0.0788*** (0.0252)	-0.0309 (0.0268)	0.000238 (0.0303)	-0.0170 (0.0274)	-0.0139 (0.0244)	-0.0550** (0.0236)
4th quintile	0.0149 (0.0279)	0.0448 (0.0304)	0.0495 (0.0335)	0.0161 (0.0316)	0.0433 (0.0298)	0.0854*** (0.0313)	0.0440 (0.0297)	0.0252 (0.0299)	0.102*** (0.0257)	0.0636** (0.0279)
5th quintile	0.0929*** (0.0288)	0.0896*** (0.0342)	0.0738* (0.0385)	0.0651* (0.0368)	0.122*** (0.0297)	0.109*** (0.0313)	0.0550* (0.0321)	0.0865*** (0.0265)	0.124*** (0.0274)	0.136*** (0.0268)
N	96,117	88,100	85,197	82,312	80,950	82,198	80,894	81,293	79,983	80,781
grade 8										
1st quintile	-0.106*** (0.0333)	-0.120*** (0.0284)	-0.0537* (0.0310)	-0.101*** (0.0346)	-0.168*** (0.0314)	-0.116*** (0.0323)	-0.0482 (0.0340)	-0.164*** (0.0306)	-0.168*** (0.0277)	-0.231*** (0.0291)
2nd quintile	-0.0722** (0.0310)	-0.0394 (0.0287)	-0.0352 (0.0306)	-0.0451 (0.0340)	-0.0588* (0.0318)	-0.0449 (0.0312)	0.00139 (0.0317)	-0.0419 (0.0272)	-0.0477* (0.0252)	-0.0706*** (0.0267)
4th quintile	-0.0105 (0.0331)	0.0322 (0.0313)	0.0742** (0.0321)	0.0612* (0.0355)	0.0406 (0.0333)	0.0842** (0.0340)	0.0553 (0.0340)	0.0643** (0.0298)	0.0490 (0.0308)	0.0484 (0.0296)
5th quintile	0.0320 (0.0350)	0.0484 (0.0331)	0.0465 (0.0340)	0.0460 (0.0359)	0.0916** (0.0366)	0.0911** (0.0356)	0.0206 (0.0330)	0.0721** (0.0291)	0.0754*** (0.0289)	0.121*** (0.0290)
N	90,619	86,549	86,732	79,984	76,294	73,300	71,681	73,475	72,639	72,038

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the municipality level in parentheses. Dependent variable: test score standardized by year and grade. Population weighted income quintiles of municipalities in 2012. Control variables: gender, mother's and father's education, the number of books at home. All control variables are coded as a set of dummies.

Table 7 The effect of income quintiles on reading test scores

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Reading										
grade 6										
1st quintile	-0.237*** (0.0230)	-0.170*** (0.0256)	-0.209*** (0.0271)	-0.177*** (0.0273)	-0.186*** (0.0219)	-0.158*** (0.0273)	-0.135*** (0.0267)	-0.169*** (0.0251)	-0.187*** (0.0226)	-0.186*** (0.0216)
2nd quintile	-0.0938*** (0.0222)	-0.0772*** (0.0260)	-0.103*** (0.0266)	-0.0810*** (0.0263)	-0.0916*** (0.0206)	-0.0601** (0.0233)	-0.0543** (0.0235)	-0.0519** (0.0233)	-0.0602*** (0.0199)	-0.0571*** (0.0196)
4th quintile	0.0232 (0.0236)	0.0545** (0.0274)	0.0237 (0.0297)	0.0314 (0.0344)	0.0380* (0.0227)	0.0794*** (0.0305)	0.0291 (0.0294)	0.00881 (0.0285)	0.0748*** (0.0235)	0.0484** (0.0244)
5th quintile	0.0918*** (0.0225)	0.0998*** (0.0295)	0.0652** (0.0295)	0.0844*** (0.0299)	0.105*** (0.0226)	0.107*** (0.0279)	0.0617** (0.0285)	0.0708*** (0.0254)	0.130*** (0.0244)	0.101*** (0.0235)
N	96,118	88,097	85,184	82,298	80,994	82,230	80,934	81,330	80,018	80,816
grade 8										
1st quintile	-0.221*** (0.0267)	-0.199*** (0.0266)	-0.157*** (0.0246)	-0.197*** (0.0265)	-0.246*** (0.0269)	-0.168*** (0.0292)	-0.161*** (0.0265)	-0.198*** (0.0283)	-0.218*** (0.0245)	-0.232*** (0.0288)
2nd quintile	-0.0831*** (0.0253)	-0.0729*** (0.0254)	-0.0669*** (0.0241)	-0.0862*** (0.0256)	-0.0976*** (0.0268)	-0.0572** (0.0270)	-0.0404* (0.0225)	-0.0543** (0.0251)	-0.0899*** (0.0221)	-0.0785*** (0.0265)
4th quintile	0.0171 (0.0275)	0.0507* (0.0295)	0.0379 (0.0244)	0.0680** (0.0296)	0.0473 (0.0293)	0.0483 (0.0327)	0.0455* (0.0268)	0.0372 (0.0301)	0.0445 (0.0294)	0.0208 (0.0315)
5th quintile	0.0599** (0.0266)	0.0633** (0.0283)	0.0624** (0.0274)	0.111*** (0.0285)	0.0883*** (0.0300)	0.0881*** (0.0296)	0.0516** (0.0256)	0.0648** (0.0288)	0.0982*** (0.0273)	0.0790*** (0.0277)
N	90,597	86,564	86,728	79,988	76,346	73,338	71,714	73,535	72,687	72,088

Notes: *** p<0.01, ** p<0.05, * p<0.1 Robust standard errors clustered at the municipality level in parentheses. Dependent variable: test score standardized by year and grade. Population weighted income quintiles of municipalities in 2012. Control variables: gender, mother's and father's education, the number of books at home. All control variables are coded as a set of dummies.

Appendix

Table A1 Number of schools and municipalities in the estimation sample, by year

year	spending		test scores grade 6		test scores grade 8	
	schools	municipalities	schools	municipalities	schools	municipalities
2008			2541	1654	2491	1621
2009			2480	1615	2434	1586
2010			2444	1601	2407	1579
2011			2439	1598	2387	1562
2012	2019	1085	2384	1583	2346	1557
2013	2282	1282	2393	1579	2345	1546
2014	2310	1294	2391	1567	2360	1548
2015	2288	1285	2412	1566	2381	1548
2016	2347	1309	2407	1562	2383	1544
2017	2382	1318	2410	1549	2379	1533

Table A2 Descriptive statistics of the estimation sample, spending data

	N	mean	standard deviation
operational expenditures per student, thousand HUF	10847	594.5696	193.6079
teaching expenditures (wage costs of teachers and teaching related personnel) per student, thousand HUF	10847	425.9305	144.6983
average income in the municipality, 2012, standardized	10847	.0633259	1.003023
school size (basic school enrolment)	10847	533.605	461.1795
number of school sites	10847	1.778937	1.133781
share of students with special education needs	10847	.0527269	.0483656
share of kindergarten students	10847	.0262409	.0773023
arts and music education dummy	10847	.2086239	
other pedagogical services dummy	10847	.0553239	
categories of operation of school			
both in spring and fall semester	10847	.9859734	
spring semester only	10847	.0049724	
fall semester only	10847	.0090541	

Note: descriptive statistics weighted by total school enrolment

Table A3 Descriptive statistics of the estimation sample, test score data

	grade 6			grade 8		
	N	mean	standard deviation	N	mean	standard deviation
reading test score, standardized	802502	-.0154673	.984558	751981	-.07334	.9783821
math test score, standardized	802502	-.015597	.9857838	751981	-.0681692	.9771023
average income in the municipality, 2012, standardized	802488	.0408443	1.002354	751966	.0040871	.9747616
female	802331	.4987468		751949	.4997147	
categories of mother's education						
lower secondary or below	802502	.1599012		751981	.1553231	
vocational school	802502	.237172		751981	.2448626	
upper secondary	802502	.2687445		751981	.2688379	
college degree	802502	.1426314		751981	.1249792	
university degree	802502	.0642889		751981	.0470823	
missing	802502	.127262		751981	.1589149	
categories of father's education						
lower secondary or below	802502	.1309542		751981	.1217916	
vocational school	802502	.3643044		751981	.3721105	
upper secondary	802502	.1977291		751981	.1939677	
college degree	802502	.0842901		751981	.0732279	
university degree	802502	.0741842		751981	.0567634	
missing	802502	.1485379		751981	.1821389	
categories of number of books at home						
1	802502	.15227		751981	.1456619	
2	802502	.1311311		751981	.1300006	
3	802502	.203926		751981	.1976273	
4	802502	.138994		751981	.1361803	
5	802502	.1138626		751981	.1069362	
6	802502	.0799662		751981	.0749341	
7	802502	.0595587		751981	.0567661	
missing	802502	.1202913		751981	.1518935	

Figure A1 The effect of income on components of per-pupil spending (excluding teaching personnel costs)

