The Role of Intergovernmental Fiscal Transfers in Improving Education Outcomes

Annex

Friday, June 25, 2021

EDU

Introduction

This annex contains additional information and results from the publication:

Al-Samarrai, Samer, and Blane Lewis, eds. 2021. The Role of Intergovernmental Fiscal Transfers in Improving Education Outcomes. International Development in Focus. Washington, DC: World Bank. doi:10.1596/978-1-4648-1693-2.

The annexes are ordered by the chapters in the aforementioned publication. Not all chapters have annexes.

Chapter 3

Alternative Empirical Approaches

Lewis and Smoke (2017) and Lewis (2017) illustrate how Dynamic Panel Data (DPD) models can be used to estimate the effect of intergovernmental transfers on education spending and education spending impact on education outcomes, respectively. A positive aspect of DPD models is that they can be used to estimate causal effects when some of the explanatory variables of concern are endogenous, by instrumenting those variables with their lagged values. The down-side is that the models are quite data intensive and somewhat complicated to estimate. Such models may also be quite sensitive to small changes in specification. Roodman (2007) provides an introduction to DPD models (both difference and systems GMM types) and their implemented in Stata.

If such models cannot be employed, due to data deficiencies, for example, then it may be sufficient to estimate the desired impacts by using simple fixed effects/OLS methods.

Consider the following two equations.

$$S_{it} = \alpha + \beta_1 T_{it} + \beta_2 X_{it} + \eta_i + \gamma_t + \varepsilon_{it} \quad (1)$$

$$O_{it} = \alpha + \beta_3 S_{it} + \beta_4 X_{it} + \eta_i + \gamma_t + \varepsilon_{it} \quad (2)$$

In the above specifications, i and t are local governments and time, respectively; S is (log) per capita education spending; T represents (log) intergovernmental transfers per capita; O indicates education outputs, variously defined; X is a set of exogenous control variables; η and γ are unit and time fixed effects, respectively; ε is the error term; and α, β_1, β_2 β_3, and β_4 are the parameters to be estimated.

The above equations can be estimated using standard fixed effects techniques. If data are only available for a single time period, then the models can be estimated without fixed effects (η and γ) by OLS.

If transfers and/or spending are endogenous, however, then the fixed effects/OLS estimation of relevant parameters will be biased. The extent of the bias cannot be determined a priori and will vary case by case. Sometimes the bias will be severe, rendering the estimates implausible; sometimes the bias may be acceptable, generating coefficient estimates with appropriate signs and reasonable magnitudes. Note that

the lagged dependent variable may also be included on the right-hand side of the equation. The lagged dependent variable would also be endogenous, and its endogeneity must also be accommodated.

References

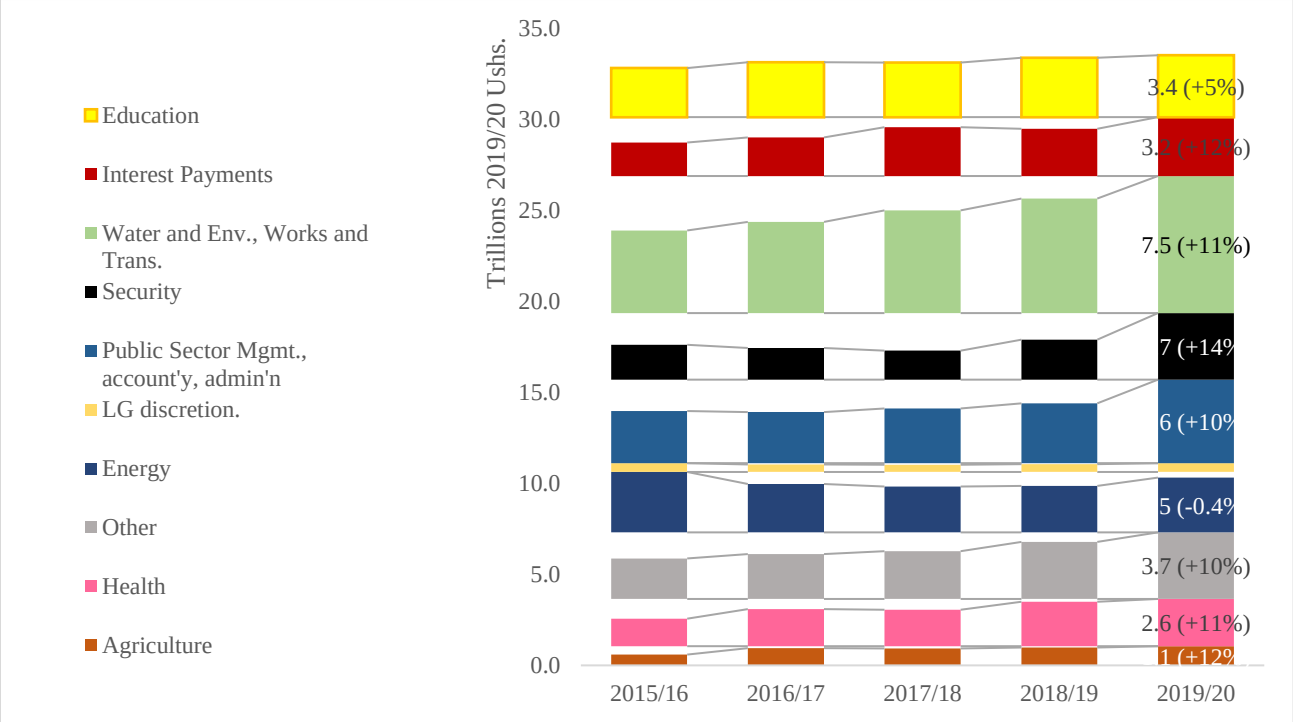
Lewis, B. (2017). Local government spending and service delivery in Indonesia: the perverse effects of substantial fiscal resources, *Regional Studies*, vol. 51, no. 11, pp. 1695-1707.

Lewis, B. and Smoke, P. (2017). Intergovernmental fiscal transfers and local incentives and responses: the case of Indonesia, *Fiscal Studies,* vol. 38, no. 1, pp. 111–139

Roodman, D. (2007). How to do xtabond2: An introduction to difference and system GMM in Stata. *Stata Journal*, 9(1), 86–136.

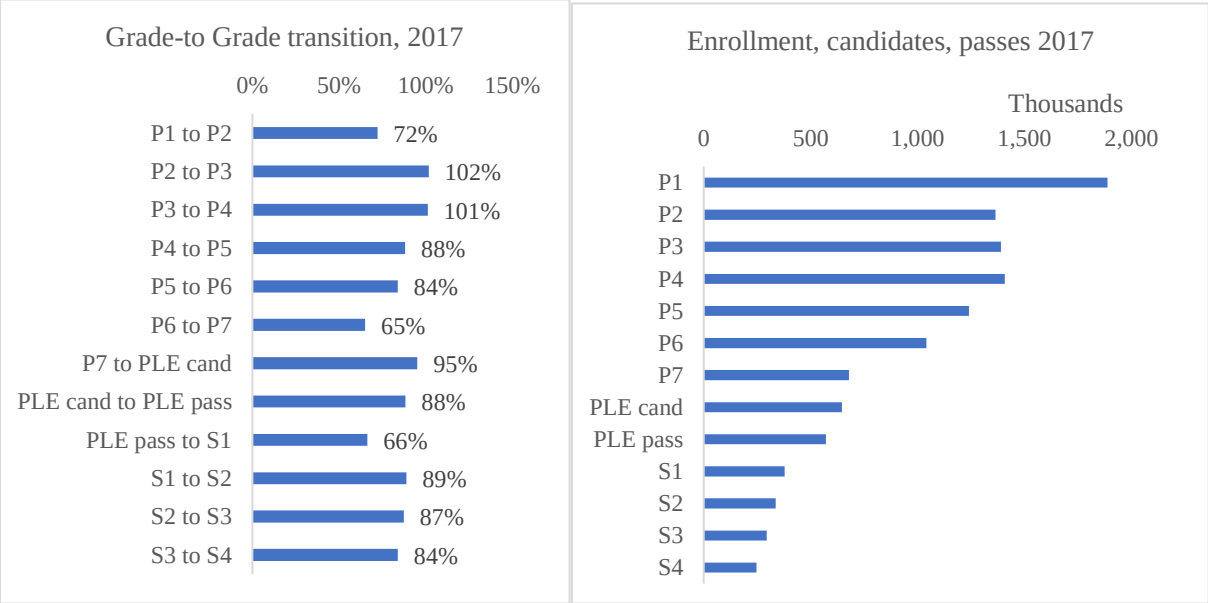
Chapter 5: Uganda Case Study

Annex Figure 5.1: Budget by Sector, 2019/20 Ushs trillion



Note: the percentage indicates the percentage change in the budgeted amount since 2015/16.

Annex Figure 5.2: Grade Transition, 2017-on-2016 Data



Source: World Bank.

Annex Table 5.3: Main Transfer Mechanisms, including Local Government Performance Assessment-linked Development Grants[1]

Grant class	**Conditional grants**	**Unconditional grants**	**Subventions**	**Performance portion of conditional development grants**
Type	Specific to education *Wage, non-wage recurrent (which includes capitation grants), and development*	General purpose grants *Wage, non-wage recurrent and development*	Specific to education *Non-wage recurrent and development*	Specific to education *Development*
Objectives	Sector financing is at increasingly adequate and equitable levels according to transparent allocation criteria.	Discretionary financing for any LG-mandated sector. *Very little of the value of these grants is spent on education.*	Usually project-specific, often a channel for donor financing.	Increases the efficiency LG grants, rewards and recognizes better-performing local governments and yields information on LG performance.
Determining the pool of funds	MoFPED decides the annual budget in accordance with the National Development Plans and other policies including the IGFT reform plan and the UgIFT performance-based, disbursement-linked indicators.			
Allocation of pool[a2]	*Wage:* based on civil service posts. The UgIFT P4R from 2021/22 incentivizes the government to allocate staff to furthest-behind LGs. *Non-wage recurrent:* primary and secondary are 100% based on formula. Post-secondary is ad hoc. Variables=Enrollment, land area, inverse PLE performance, population in hard-to-reach areas, inverse UCE performance.	*Wage:* based on establishment. *Non-wage recurrent:* 100% based on formula. Variables= Population, poverty, land area, fixed per LG allocation, distance from capital city, number of lower LGs. *Conditional Development:*	Ad hoc, although some donors in other sectors have used formula-based allocations to determine each LG's share of resources.	Score is assessed by Office of the Prime Minister according to the annual manual for all LGs except 22 urban LGs, which are covered by a World Bank-funded Program for Results (see MoFPED, 2020a). The score is squared, and multiplied by the "base formula." which is the normal formula for conditional development grants.

[1] Development is equivalent to capital expenditure.
[2] See otims.go.ug for full details.

Grant class	**Conditional grants**	**Unconditional grants**	**Subventions**	**Performance portion of conditional development grants**
	Conditional Development: 30% based on formula (of which half is determined by performance score), 70% based on a list of Lower LGs without secondary schools. Formula variables= Fixed per LG, island, land area, inverse gross enrollment, inverse PLE performance, inverse UCE performance, population of primary and secondary school-going age, population, population in hard-to-reach areas. *Transitional development:* ad hoc.	100% based on formula (of which half is determined by performance score). Variables= historically conflict-affected areas, poverty headcount, population headcount, fixed per LG allocation, number of lower LGs. *Transitional development:* ad hoc		
Incentives	*Non-wage recurrent grants*. Increase reported primary and secondary government enrollment (main incentive) Present more candidates for PLE and UCE (minor incentive) *Development* Lobby for school to be included in secondary construction program. Perform well on LG performance assessment, see column 4.	*Development* perform well on LG performance assessment, see column 4.		See details of the performance assessment at MoFPED (2020[a]).
Who is incentivized?	LGs Schools	LGs	LGs	LGs

Grant class	**Conditional grants**	**Unconditional grants**	**Subventions**	**Performance portion of conditional development grants**
Use of resources	Non-wage recurrent: capitation grants, fuel, running costs Development: construction, maintenance, oversight costs thereof. See guidelines for other restrictions and guidance on use.[b/]			
Supporting systems	(1) MoFPED/MoES enrolment reporting and verification (2) UBoS and UNEB for other statistics which are used for formula, (3) LGs and accountant general to ensure minimum capitation grants are paid.	(1) UBoS to provide statistics. (2) MoFPED and Accountant General to ensure minimum grant levels are paid.	Depends on the donor or program	(1) OPM performance assessment, quality assurance processes, (2) IGFT reporting and coordination multiagency structures. (3) Ministry of Local Government develops [check] Performance Improvement Plans to assist low-scoring LGs.
Impact	Provides virtually all financing for primary, secondary and much of post-secondary education.	Provides virtually no financing for education.	Provides donor project-specific funds and in-kind resources	Under revision to ensure focus on service delivery bottlenecks.
Issues/policy directions	(1) Spending inequality remains, but has been reduced in some cases. (2) Spending level is low but has been increased markedly in recent years. (3) Enrollment is not verified. (4) Children of school-going age are underweighted in formulas. (5) Secondary construction monies lack LG autonomy.	(1) Spending inequality remains in the development grants due to different LG categories based on historical area-based targeting. (2) Spending level is low. (3) The fixed allocation share is high. (4) There is little support for education from these grants.	(1) These are not transparent, not formula allocated, and not predictably allocated in line with budgeting processes and in coordination with other resource flows at the LG level. (2) In other sectors, these are less equitably allocated than government grants. See ACODE-U (2020), Williamson (2010), and Long (2020).	(1) Performance-based incentive comes with some technical support for low scoring LGs, (2) transparency in criteria raises engagement and trust (3) assessment needs refinement to target learning-focused LG behaviors (already underway for fourth assessment round) (4) LGs can be assessed in some cases on factors that central government controls.

Notes: Ad hoc is used synonymously with incremental. a/ See otims.go.ug for full details. b/ 2019/20 education guidelines: https://budget.go.ug/sites/default/files/Education%20sector%20May%202019%20LG%20guidelines%20%28clean%29.pdf Discretionary and unconditional grant guidelines: https://budget.go.ug/sites/default/files/13%20Unconditional%20and%20Administration%20FY%2018-19%20Grant%20and%20Budget%20Guidelines_0%20%281%29.docx and https://budget.go.ug/sites/default/files/00%20Discretionary%20Dev%27t%20Equalisaton%20FY%2018-19%20Grant%20and%20Budget%20Guidelines.pdf.

Annex Table 5.4: Education Formulae Variables and Variable Shares for the Formula Component, Development Formula

Development formula shares, 'basic formula' [a/] – LG performance assessment awards are multiplied. In 2019/20, formula was applied after having allocated 70% for new secondary school construction.						
Variable	**2015/16 proposal**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**Justification**
School- going population	20%	60%	60%	64%	30%	Proxy for the number of children who should be in school and the corresponding need for education infrastructure.
Number of children of school-going age per classroom	39%					Measures how far behind an LG is lagging behind in terms of education infrastructure.
Urban population		0%	0%	0%	5%	Ensures that municipal LGs' allocations better reflect their population.
Inverse gross enrollment		0%	0%	0%	30%	For increased targeting to fund maintenance etc. in districts where net enrollment is lower.
Performance Index	15% [b/]	12%	12%	12%	10%	Those local governments with lower proficiency in English and Math on the PLE and UCE will receive additional resources, which will help to equalize key education performance outcomes
Population in hard-to-reach, hard-to-stay Areas	4%	4%	4%	2%	3%	Mountainous, islands, rivers, etc., have peculiar terrain that increases the costs of providing services. The formula provides greater allocations to these areas.
Land area	4%	4%	4%	2%	2.5%	Land area can impact the cost of providing education, especially in sparsely populated areas with a large land size such as Karamoja region. The formula therefore makes allowance for this.
Islands		0%	0%	0%	0.5%	For the additional costs incurred by island LGs.
Fixed Allocation	20%	20%	20%	20%	19%	Ensure that there is a minimum development grant allocation for each LG.

Notes: The following variables are multiplied by school-going age: Islands, Land area, Inverse Gross Enrollment, performance index. a/ Columns 3 to 6 are from Long 2020 ibid. Column 1 is from MoFPED/ODI 2016 (shared by the World Bank). Column 2 is from the Budget Estimates Book. b/ This was supposed in 2015/16 to incorporate NAPE scores, but in practice a weighted average of PLE and UCE scores was used. They correlate closely.

Annex Table 5.5: Education Formulae Variables and Variable Shares for the Formula Component, Non-wage recurrent (including capitation grants to schools)

Non-wage recurrent formula shares. Formula is applied (2016/17 onwards) after having awarded the capitation grants, and per-LG and per-school inspection minimums, which account for most of the value of the grant. This differs from the original draft policy. Skills development capitation grants are ad hoc. Formulas were phased-in 'hold harmless' so that LGs did not lose out in nominal terms.						
Variable	**2015/16 proposal**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**Justification**
Enrollment count	-	75%	75%	90%	90%	The actual number of children in school, a key driver of operational costs.
School-age population	88%	15%	15%	0%	0%	Proxy for the number of children who should be in school.
Performance index	8% primary, 6% Sec	6%	6%	6%	6%	Those local governments with lower proficiency rates in English and Math will receive additional resources, which will help to equalize key education performance outcomes
Population in hard-to-reach, hard-to-stay areas	2%	2%	2%	2%	2%	Mountainous, islands, rivers, etc., have peculiar terrain which increases the cost of providing services. The formula provides greater allocations to these areas.
Land area	2%	2%	2%	2%	2%	Land area can impact the cost of providing education, especially in sparsely populated areas with a large land size such as Karamoja region. The formula therefore makes allowance for this.

Notes: a/ Columns 3 to 5 are from Long, C. 2020 ibid. Column 1 is from MoFPED/ODI, 2016 (shared by the World Bank). Columns 2 to 5 are in Volume II of the Budget Estimates Books on budget.go.ug.

Summary of Regression Results

The table below shows associations between various measures of learning, and environmental and policy variables. LGs including municipalities are used as the unit of analysis, as the available data are limited.

Annex Table 5.6: Summary of simple regression results

Independent variables ->	Poverty rate	Financing per enrollee (during year of exam. or assessment)	2015 Uwezo repetition rate, in school, aged 6-14	2015 Uwezo out of school share, primary school-aged child	2015 Uwezo private school share of primary school-aged child	Pupil classroom ratio (govt)	N
Learning assessment or examination							
PLE 2019 Division 1	-***	(1)			+*	-***	111
Uwezo 2015 P3-P7 competence	-***		-*	+*		-**	
NAPE P3 Literacy	-***		-***	+**	+*	-***	111

NAPE P3 Numeracy	-***		-***	+**	+*	-***	111
NAPE P6 Literacy	-**	+*		+***		-***	111
NAPE P6 Numeracy	-**	+*		+**	-**	-***	111
With lag							
Uwezo 2015 (lag Uwezo 2011)	-*	(1)					79
NAPE 2018 literacy, P6 (lag NAPE 2015 literacy, P6)	-***	+*		+***		-**	111
NAPE 2018 numeracy, P6 (lag NAPE 2015 numeracy, P6)	-**	+*		+**	-*	-**	111
NAPE 2018 English, P3 (lag NAPE 2015 English, P3)	-***		-***	+*		-***	111
NAPE 2018 numeracy, P3 (lag NAPE 2015 numeracy, P3)	-***		-***	+*		-***	111

Notes: * 90%; **95%; ***99% confidence intervals. 1/ financing is significant and positive in all specifications excepting those with the repetition rate, out of school share, and private school share; these may act as channels through which more financing is associated with better outcomes. STR is very closely associated with per-enrolee financing. 2/ NAPE variables are % proficient in each LG.

The indicative analysis below adapts Lewis (2016). LG education spending is almost entirely determined by the transfers from central government, so we do not report spending as a dependent variable.

Separate regressions for different grants were performed, given the very different structures and allocation policies as described in the main section of this chapter and the previous table.

In summary, real wage grants per capita are significantly positively associated with gross enrollment rates per capita in fixed effects and DPD specifications, but we did not see coefficient stability to the same extent as similar country studies have found, except for wages. The model is not a basis to infer causation. Since GER is persistently above 100%, higher GER may indicate exaggeration or higher rates of grade repetition.

Our specifications controlled for lagged variables and endogeneity in the case of the dynamic panel data (DPD) model, and the idiosyncrasies of each LG in the case of the fixed effects model.

Given that much of the available data are not time-invariant, it is not useful in the fixed effects (FE) (and DPD) specification. The panel is not balanced, because of the creation of 42 LGs since 2013. Fewer years are available for some specifications.

Robust estimators are used throughout. The results of the dynamic panel and fixed effects models are presented in Annex Table 5.7 below.

Annex Table 5.7: Regression Results

Grant (real per capita, 2013-19)	**Dependent variable**	**Specification**	**Co-efficient on same-year financing**, 95% CI	**Controls**	**N**
Non-wage recurrent (all)	GER (primary)	Fixed effects (FE)	0.21 0.13,0.30	Lagged financing (1 lag), lagged GER (1), year, year dummies	262
	GER (primary)	DPD	0.38 0.26,0.50	Lagged financing (1), lagged GER (1)	595
Development (all)	GER (primary)	FE	*0.014* *-0.004, 0.326* Not significant.	Lagged financing (1), lagged GER (1), year, year dummies	262
	GER (primary)	DPD	0.21 0.18-0.25	Lagged financing (1), lagged GER (1)	595
Wage (all)	GER (primary)	FE	0.45 0.27,0.63	Lagged financing (1), lagged GER (1), year, year dummies	262
	GER (primary)	DPD	0.45 0.35-0.54	Lagged financing (1), lagged GER (1)	595
Wage (primary)	GER (primary)	FE	0.66 .48,.85	Lagged financing (1), lagged GER (1), year, year dummies	884
		DPD	0.90 0.78 , 1.01	Lagged financing (up to 6), lagged GER (up to 6), year, year dummies	884
Non-wage recurrent (primary)	GER (primary)	FE	0.75 0.62, 0.87	Lagged financing (up to 6), lagged GER (up to 6), year, year dummies	884
		DPD	0.42 0.38,0.47	Lagged financing (1), lagged GER (1), year, year dummies	884

The above data are in logarithms except for dummies and time trends. GER is expressed in percentage points (16 percent =16) before being transformed into logarithms.

The Arellano Bond test returns null for the small-T samples in the general grants – the first three entries in the far left column of the table, and the lags of financing are negative and significant. For the primary education grants only, tests appear to reject the null hypothesis of unaddressed autocorrelation.

Spending is expressed as real (inflation adjusted), per school-aged child. Time-invariant controls[3] have been removed from the DPD specifications as they were not significant in the specification. Fixed effects modelling does not require time-invariant controls (it assigns a time-invariant "fixed effect" to each LG).

[3] Controls in OLS (not reported) are: two lags of GER, distance from Kampala, 2015 Uwezo repetition share, 2015 Uwezo government share, whether the LG experienced a split in the observed period, the number of lower LGs, and urbanity at the lower LG level.

Chapter 6: Indonesia Case Study

Allocation Procedures for the General-Purpose Grant (DAU)

The procedure for allocating the general-purpose grant (DAU) starts by dividing the total pool of finance into two separate pools, one for the so-called basic allocation and the other for fiscal gap distributions. The relative size of the two pools is determined annually by the Ministry of Finance. As noted in the text, in recent years the basic allocation has amounted to around 45 percent of the total, with the remainder going to fiscal gap allocations. Specifically:

$$PDAU = PDAUBA + PDAUFG \tag{1}$$

where PDAU is the total pool of finance and PDAUBA and PDAUFG are the pools of finance for the basic allocation and fiscal gap component, respectively.

The DAU allocation comprises separate basic and fiscal gap elements:

$$DAU_i = DAUBA_i + DAUFG_i \tag{2}$$

where subscript i represents an individual district or province, DAU is the total allocation, and DAUBA and DAUFG are the basic allocation and fiscal gap components, respectively.

The basic allocation is determined by:

$$DAUBA_i = PDAUBA \cdot \left(\frac{PERSONNEL_i}{\sum_i PERSONNEL_i} \right) \tag{3}$$

where PERSONNEL represents district personnel expenditure.

The fiscal gap allocation is derived by two sets of relations. The first establishes that the fiscal gap allocation is a function of the pool of finance and a subnational government's share of the total fiscal gap.

$$DAUFG_i = PDAUFG \cdot \left(\frac{FG_i}{\sum_i FG_i} \right) \tag{4}$$

where FG is the fiscal gap.

The second relationship defines the fiscal gap itself. Specifically:

$$FG_i = AVGEXP \cdot \left(\sum_{hi} \frac{\alpha_h \cdot PROXY_{hi}}{AVGPROXY_h} \right) - \left(\beta_1 \cdot OSR_i + \beta_2 \cdot STAX_i + \beta_3 \cdot SNRR_i \right) \quad (5)$$

where AVGEXP is average total district expenditure, PROXY represents a set of h local government expenditure needs proxies, AVGPROXY is the average value of the specific expenditure needs proxy across all local governments, and α is the particular proxy's weight (where the sum of all weights is one). Recent expenditure needs proxies include population, area, a cost index, a human development index (HDI), and per capita gross regional domestic product (GRDP). The first (multiplicative) term on the right-hand side of equation (5) is meant to serve as an indication of a local government's fiscal needs.

The second term represents the fiscal capacity of the subnational government. OSR is own-source revenue, and STAX and SNRR represent shared tax and shared natural resource revenues, respectively. In some years, the Ministry of Finance has set the various $\beta_i < 1$, implying that less than the full amount of these revenues has been used in estimating fiscal capacity. Note that the DAK specific purpose grants (along with other transfer revenue) are excluded from the formula's estimation of fiscal capacity as well.

The allocation formula suggests that negative grants are possible, but in practice these have not been allowed. Furthermore, from 2001 to 2008, allocations were restricted by the imposition of a hold harmless condition, which required that a subnational government's allocation in one year could not be smaller than it was the previous year (in nominal terms).

The allocation procedures use the most recently available data. Fiscal data are taken from provincial and district budgets that have been independently audited by the Supreme Audit Agency (BPK), and socioeconomic data are provided by the Central Bureau of Statistics (BPS).

Impact of Intergovernmental Transfers on District Spending

In order to examine the effects of intergovernmental transfers on district spending, the following relation is posited.

$$S_{it} = \alpha + \beta_1 T_{it} + \beta_2 X_{it} + \eta_i + \gamma_t + \varepsilon_{it} \quad (6)$$

where the subscripts i and t represent district and year respectively, S is district spending (total and on education) per capita, T is transfer revenues per capita (total and by instrument), X comprises exogenous control variables (population, poverty, household electricity access, and GRDP per capita), η are district fixed effects, and γ indicates year fixed effects.

Three different methods were used to estimate the above equation: (i) OLS on the pooled data, where η=0 and T is assumed exogenous; (ii) fixed effects, as above, where T is taken as exogenous; and (iii) dynamic panel data (DPD) techniques, as above, where T is taken to be endogenous.

Systems DPD is used.[4] In Annex Table 6.1 and Annex Table 6.3, total transfer revenue is taken to be endogenous. In this case, the second and third lags of transfers and the second and third lags of differenced transfers serve as the instruments for endogenous transfers. In Annex Table 6.2 and Annex Table 6.4, DAU (general-purpose grant) and DAK (specific-purpose grant) are taken as endogenous while other transfers are assumed to be exogenous. The second and third lags of DAU and DAK and the second and third lags of differenced DAU and DAK serve as the instruments for endogenous DAU and DAK, respectively. The instruments are "collapsed" to reduce their number.

Annex Tables 6.1 through 6.4 present the regression results. Note that the usual diagnostic statistics are not reported in these tables or in those that follow. However, in all regressions reported here, the Arellano-Bond tests suggest that the null hypothesis of no second-degree autocorrelation cannot be rejected, and the Hansen's tests for overidentifying restrictions imply that the null hypothesis that instruments are exogenous cannot be rejected. In addition, tests for instrument strength demonstrate that instruments are sufficiently strong in all cases.

The pertinent results are discussed in the text.

[4] See Roodman (2009) for an introduction to DPD models.

Annex Table 6.1: Explaining Log Total District Spending Per Capita, 2010-2016 (Total Transfers)

	OLS			Fixed Effects			Dynamic Panel Data Model		
Independent Variables	Coef.	SE		Coef.	SE		Coef.	SE	
Log of total transfers per capita	0.924	0.017	***	0.847	0.025	***	0.849	0.052	***
Exogenous controls	yes			yes			yes		
District fixed effects	no			yes			yes		
Time fixed effects	yes			yes			yes		
Number of observations	2,863			2,863			2,863		
Number of cross section units	518			518			518		
Number of instruments	--			--			14		

Note: All fiscal and economic variables are measured in constant 2010 terms. Standard errors are cluster robust. ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Exogenous controls include log of population, poverty rate, household access to electricity, and log of GRDP per capita. OLS and fixed effects models assume that all explanatory variables are exogenous. The dynamic panel data model assumes that total transfers are endogenous. The second and third lagged values of endogenous variables (in differences and levels) serve as instruments for endogenous transfers.

Annex Table 6.2: Explaining Log Total District Spending Per Capita, 2010-2016 (Individual Transfers)

	OLS			Fixed Effects			Dynamic Panel Data Model		
Independent Variables	Coef.	SE		Coef.	SE		Coef.	SE	
Log general purpose grants per capita	0.425	0.028	***	0.484	0.045	***	0.460	0.036	***
Log specific purpose grants per capita	0.014	0.009		0.041	0.008	***	-0.027	0.031	
Log other grants per capita	0.335	0.011	***	0.248	0.013	***	0.310	0.011	***
Exogenous controls	yes			yes			yes		
District fixed effects	no			yes			yes		
Time fixed effects	yes			yes			yes		
Number of observations	2,863			2,863			2,863		
Number of cross section units	518			518			518		
Number of instruments	--			--			16		

Note: All fiscal and economic variables are measured in constant 2010 terms. Standard errors are cluster robust. ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Exogenous controls include log of population, poverty rate, household access to electricity, and log of GRDP per capita. OLS and fixed effects models assume that all explanatory variables are exogenous. The dynamic panel data model assumes that DAU and DAK transfers are endogenous. The second and third lagged values of endogenous variables (in differences and levels) serve as instruments for endogenous DAU and DAK.

Annex Table 6.3: Explaining Log District Education Spending Per Capita, 2010-2016 (Total Transfers)

	OLS			Fixed Effects			Dynamic Panel Data Model		
Independent Variables	Coef.	SE		Coef.	SE		Coef.	SE	
Log of total transfers per capita	0.616	0.055	***	0.342	0.102	***	0.466	0.350	**
Exogenous controls	yes			yes			yes		
District fixed effects	no			yes			yes		
Time fixed effects	yes			yes			yes		
Number of observations	2,863			2,863			2,863		
Number of cross section units	518			518			518		
Number of instruments	--			--			16		

Note: All fiscal and economic variables are measured in constant 2010 terms. Standard errors are cluster robust. ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Exogenous controls include the log of population, poverty rate, household access to electricity, and log of GRDP per capita. OLS and fixed effects models that assume all explanatory variables are exogenous. The dynamic panel data model assumes that total transfers are endogenous. The second and third lagged values of endogenous variables (in differences and levels) serve as instruments for endogenous transfers.

Annex Table 6.4: Explaining Log District Education Spending Per Capita, 2010-2016 (Individual Transfers)

	OLS			Fixed Effects			Dynamic Panel Data Model		
Independent Variables	Coef.	SE		Coef.	SE		Coef.	SE	
Log general purpose grants per capita	0.435	0.066	***	0.400	0.133	***	0.485	0.135	***
Log specific purpose grants per capita	0.026	0.026		0.158	0.033	***	-0.037	0.127	
Log other grants per capita	0.155	0.030	***	-0.018	0.045		0.113	0.037	***
Exogenous controls	yes			yes			yes		
District fixed effects	no			yes			yes		
Time fixed effects	yes			yes			yes		
Number of observations	2,863			2,863			2,863		
Number of cross section units	518			518			518		
Number of instruments	--			--			16		

Note: All fiscal and economic variables are measured in constant 2010 terms. Standard errors are cluster robust. ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Exogenous controls include log of population, poverty rate, household access to electricity, and log of GRDP per capita. OLS and fixed effects models assume that all explanatory variables are exogenous. The dynamic panel data model assumes that DAU and DAK transfers are endogenous. The second and third lagged values of endogenous variables (in differences and levels) serve as instruments for endogenous DAU and DAK.

Impact of District Spending on Education Outcomes

In order to investigate the impact of district spending on education outcomes, the following relation is postulated.

$$O_{it} = \alpha + \beta_3 O_{it-1} + \beta_4 S_{it} + \beta_5 X_{it} + \eta_i + \gamma_t + \varepsilon_{it} \quad (7)$$

where i and t are districts and year, O indicates education outcomes (either enrollments or test scores), S is spending (both total spending per capita and education budget shares), X comprises the same exogenous control variables as used before (population, poverty, household electricity access, and GRDP per capita), η is district fixed effects; and γ is year fixed effects. Enrollments are the average enrollments for junior and senior secondary school. Test scores are average UN (*ujian nasional*) scores for junior secondary school and vocational school. (The UN scores for senior secondary school are unreliable.)

Again, three different methods are used to estimate the above equation: (i) OLS on the pooled data, where $\eta=0$, $\beta_3=0$, and S is assumed to be exogenous; (ii) fixed effects, as above, where $\beta_3=0$ and S is taken as exogenous; and (iii) dynamic panel data (DPD), as above, where S is endogenous.

Systems DPD is used, as before. In Annex Tables 6.5 and 6.6, the lagged dependent variable is predetermined, and total district spending and the education budget share are taken to be endogenous. The first and second lags of the lagged dependent variable and the first and second lags of the differenced lagged dependent variable are used as instruments for the predetermined lagged dependent variable. The second, third, and fourth lags of district spending and education budget shares and the second, third, and fourth lags of differenced district spending and education budget shares are the instruments for spending and budget shares, respectively. Instruments are collapsed to limit their number.

The relevant results are discussed in the text.

Annex Table 6.5: Explaining Changes in District School Enrollment Rates, 2010-2016

	OLS			Fixed Effects			Dynamic Panel Data Model		
Independent Variables	Coef.	SE		Coef.	SE		Coef.	SE	
Lagged enrollment	--	--		--	--		-0.778	0.412	*
Log total spending per capita	-0.597	0.279	**	-1.209	0.754		2.876	1.221	**
Education budget share	-0.002	0.008		0.008	0.010		0.103	0.051	**
Exogenous controls	yes			yes			yes		
District fixed effects	no			yes			yes		
Time fixed effects	yes			yes			yes		
Number of observations	2,486			2,486			2,486		
Number of cross section units	519			519			519		
Number of instruments	--			--			21		

Note: Enrollment rates are the average of junior and senior secondary enrollments. All fiscal variables are measured in constant 2010 terms. Standard errors are cluster robust. ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Exogenous controls include log of population, poverty rate, household access to electricity, and log of GRDP per capita. OLS and fixed effects models assume that all explanatory variables are exogenous. Dynamic panel data model assumes that lagged enrollment, total district spending, and education budget shares are endogenous. The first and second lags of lagged

enrollment (in differences and levels) are the instruments for lagged enrollment, and the second, third, and fourth lagged values of district spending and education budget shares (in differences and levels) serve as instruments for those endogenous variables.

Annex Table 6.6: Explaining Changes in District Test Scores, 2010-2016

	OLS		Fixed Effects		Dynamic Panel Data Model		
Independent Variables	Coef.	SE	Coef.	SE	Coef.	SE	
Lagged test score	--	--	--	--	-0.387	0.057	***
Log total spending per capita	0.546	0.994	0.355	1.107	6.193	2.610	**
Education budget share	-0.003	0.017	0.017	0.013	0.038	0.056	
Exogenous controls	yes		yes		yes		
District fixed effects	no		yes		yes		
Time fixed effects	yes		yes		yes		
Number of observations	2,418		2,418		2,418		
Number of cross section units	509		509		509		
Number of instruments	--		--		18		

Note: Test scores are averages junior secondary and vocational school scores. All fiscal variables are measured in constant 2010 terms. Standard errors are cluster robust. ***, **, and * indicate statistical significance at the 0.01, 0.05, and 0.10 levels, respectively. Exogenous controls include log of population, poverty rate, household access to electricity, and log of GRDP per capita. OLS and fixed effects models assume that all explanatory variables are exogenous. The dynamic panel data model assumes that lagged test scores and district total spending and education budget shares are endogenous. The first and second lags of lagged test scores (in differences and levels) are the instruments for lagged enrollment, and the second, third, and fourth lagged values of district spending and education budget shares (in differences and levels) serve as instruments for those endogenous variables.

Revising the DAU Allocation Formula

A simple way to revise the DAU allocation formulation presented above follows:

$$DAU_i = \frac{\sum_i Exp_i}{\sum_i Pop_i} Pop_i \left(\sum_{hi} \frac{\alpha_h PROXY_{hi}}{AVGPROXY_h} \right) - \left(\beta_1 \hat{OSR}_i + \beta_2 STAX_i + \beta_3 SNRR_i \right) \quad (1)$$

where Exp_i is total district expenditure and $\hat{OSR}_i$ is districts' potential own-source revenues:

$$\hat{OSR}_i = \frac{\sum_i OSR_i}{\sum_i GRDP_i} GRDP_i$$

All other variables are defined above, but in this case the PROXY variables only include poverty, area, the cost index, and the human development index. Population is already included in the denominator of the suggested formulation and so it would be inappropriate to include it in the index and it does not make sense to include GRDP as a fiscal needs factor, so it has been dropped as well. In addition, the basic allocation has been expunged.

Of course, more sophisticated (and complicated) approaches are available. The formulation here is just meant to provide an indication of how the DAU allocation formula could be easily amended to eliminate possible perverse incentives and to make distributions more equitable in per capita terms.

Chapter 7: Colombia Case Study

Annex Table 7.1: Formulas Used to Distribute Provision of Service Resources

Year	Distribution Formula
2002-2003	Transition Period Transfers=Real costs of the previous year
2004	$T_i = \frac{1}{m_i} * (teachers_{level<11} + principals + administrative\ staff + dispersion)$ Where: $i = Certified\ Territorial\ Entity; T = Tranfer;\ m = students\ in\ t-1$
2005–2007	$\frac{S}{A_i} = Basic\ Allocation + \%\ Typology$ Where: $Basic\ Allocation = \frac{Teachers\ Payroll}{Students} + \%\ administrative\ cost;\ \ i = Territorial\ Entity;$ $\frac{S}{A} = per\ student\ allocation$ $Typology = f\left(dispersion = \left(\frac{km^2}{Habitants}\right); rurality = \left(\frac{Rural\ Population}{Total\ Population}\right); \left(\frac{Students\ in\ Secondary\ and\ High\ School}{Total\ Students}\right)\right)$ Cluster analysis is then used to split certified territorial entities into four groups.
2008	Costs of the provision of the service + 6% for administrative staff
2009	Costs of the provision of the service + 10% for administrative staff and administrative costs
2010	Costs of the provision of the service + 12.5% for administrative staff and costs
2011-2014	Principal component analysis is used to build an index for each of the following dimensions: 1. Socioeconomic and institutional characteristics of the certified territorial entity: local development index, poverty index, fiscal performance index, and rurality 2. Characteristics of service provision and vulnerability: number of students per teacher, provision to rural population, provision to displaced population, provision to victims of the armed conflict, provision to native population, and provision to Afro population 3. Characteristics of educational development: net basic enrollment (primary + secondary) + net high school enrollment The three indices are used to put the CTEs into eight groups according to the Ward statistical method.
2015-2016	Total transfer is the sum of two values: OLS Mode for costs: $Provision\ Index_i = c + \beta_1 Rural\_Enrollment_i + \beta_2 Minorities\_Enrollment_i + \beta_3 Teachers\ High\ Payroll\ Scale_i + \beta_4 Poverty\ Index_i + u_i$ Quality incentive: $Quality\ Index_i = -(0.2 Average\ Position\ Saber\ 11_i) +$ $(0.1\%\ of\ students\ with\ high\ achievement\ on\ Saber\ 3,5\&9_i) - (0.05\ dropout_i) - (0.05\ Repetition_i) +$ $(0.1\ Survival\ rate_i) - (0.2\ \lvert Actual\ Teacher\ Student\ Ratio - Expected\ teacher\ Student\ Ratio\rvert_i)$ - $(0.15\Delta Saber 11t-1, t-2) + (0.1\Delta\%\ of\ students\ with\ high\ achievement\ on\ Saber 3,5\&9t-2, t-3) -$ $(0.05\Delta Dropout\ t-2, t-3)$ Note: In 2016, dispersion instead of poverty was used in the OLS model.
2017-2019	Cost projections are based on the existing payroll

Source: National Planning Department. (2002). (2003). (2004). (2005). (2006). (2007). (2008). (2009). (2010). (2011a). (2011b). (2012). (2013). (2014a). (2014b). (2015a). (2015b). (2016a). (2016b). (2017a). (2017b). (2018a). (2018b). (2018c). (2019a). (2019b)

Annex Table 7.2: Formulas Used to Distribute Quality Resources

Year	Distribution Formula
2002	Transition Period
2003	40%=historic index and 60%=based on the Index of Unsatisfied Basic Needs
2004-2010	$M_i = m_i \left[\frac{UBN_i}{UBN_N} + 1\right]$

	Where: $i = Municipality;\ M_i = Transfer;\ m_i = students\ in\ t-1;\ UBN_i = Local\ Index\ of\ Unsatisfied\ Basic\ Needs;\ UBN_N = National\ Index\ of\ Unsatisfied\ Basic\ Needs$
2011-2014	1. 50% is distributed according to enrollment: $$Student\ Transfer_i = Transfer\frac{Students_i * \left\{\left(\frac{UBN_i}{UBN}\right)+1\right\}}{\sum\left[Students_i * \left\{\left(\frac{UBN_i}{UBN}\right)+1\right\}\right]}$$ 2. 10% is distributed according to the number of schools: $$School\ transfer_i = School\ Transfer\frac{Schools_i * \left\{\left(\frac{UBN_i}{UBN}\right)+1\right\}}{\sum\left[Schools_i * \left\{\left(\frac{UBN_i}{UBN}\right)+1\right\}\right]}$$ Where: $i = Municipality;\ M_i = Transfer;\ m_i = students\ in\ t-1;\ UBN_i = Local\ Index\ of\ Unsatisfied\ Basic\ Needs;\ UBN_N = National\ index\ of\ Unsatisfied\ Basic\ Needs$ 3. 30% according to performance: $$Performance_i = \frac{[(0.6 * MatDQ1_i) + (0.7 * MatDQ2_i) + (0.8 * MatDQ3_i) + (0.9 * MatDQ4_i) + (1 * MatDQ5_i)] * \left\{\left(\frac{UBN_i}{UBN}\right)+1\right\}}{\sum\left[[(0.6 * MatDQ1_i) + (0.7 * MatDQ2_i) + (0.8 * MatDQ3_i) + (0.9 * MatDQ4_i) + (1 * MatDQ5_i)] * \left\{\left(\frac{UBN_i}{UBN}\right)+1\right\}\right]}$$ Where MatDQ=quintiles of performance in dropouts, repetition, and Saber test 4. 10% according to improvement $$Improvement_i = \frac{[(0.2 * MatMQ1_i) + (0.4 * MatMQ2_i) + (0.6 * MatMQ3_i) + (0.8 * MatMQ4_i) + (1 * MatMQ5_i)] * \left\{\left(\frac{UBN_i}{UBN}\right)+1\right\}}{\sum\left[[(0.2 * MatMQ1_i) + (0.4 * MatMQ2_i) + (0.6 * MatMQ3_i) + (0.8 * MatMQ4_i) + (1 * MatMQ5_i)] * \left\{\left(\frac{UBN_i}{UBN}\right)+1\right\}\right]}$$ Where MatDQ=quintiles of improvement in dropouts, repetition, and Saber test
2015	$$Transfer_i = \frac{UBN_i * Provision\ Index_i * Performance\ Index_i}{10.000}$$ Where: $Provision\ Index_i = 0.5 * Numer\ of\ Schools + 0.5 * Rural\ Enrollment$ $Performance\ Index_i = -(0.15 Average\ Position\ Saber\ 11_i) +$ $(0.05\%\ of\ students\ with\ high\ achievement\ on\ Saber\ 3,5\&9_i) - (0.05 dropouts_i) - (0.05 Repetition_i) +$ $(0.1 Survival\ rate_i) - (0.2|Actual\ Student\ Teacher\ Ratio - Expected\ Student\ Teacher\ Ratio|_i)$ - $(0.2\Delta Saber 11t-1, t-2)$ + $(0.15\Delta\%\ of\ students\ with\ high\ achievement\ on\ Saber 3,5\&9t-2, t-3) - (0.05\Delta dropoutsst-2, t-3)$
2016-2019	Step 1: -Performance index: factor analysis is used for the repetition rate, the survival rate from 9th to 11th grade, the dropout rate, and the percentage of students between positions 1 and 400 on the Saber 11 test. -Improvement index: factor analysis is used for the difference in the number of students that fail a grade, the difference in the survival rate from 9th to 11th grade, the difference in the dropout rate, and the difference in percentage of students between positions 1 and 400 on the Saber 11 test. Step 2: Cluster analysis is then used to put municipalities into seven groups. Step 3: Equity Index: $\frac{UBN_i}{UBN_N}$ Step 4: 0.3*Performance Index + 0.5 Improvement Index + 0.2* Equity Index

Source: National Planning Department. (2002). (2003). (2004). (2005). (2006). (2007). (2008). (2009). (2010). (2011a). (2011b). (2012). (2013). (2014a). (2014b). (2015a). (2015b). (2016a). (2016b). (2017a). (2017b). (2018a). (2018b). (2018c). (2019a). (2019b)

Annex Table 7.3: Formulas Used to Distribute Gratuity Resources

Year	Distribution Formula
2013-2014	Per student cost of: id, report cards, equipment maintenance, prints, certificates, and others
2015-2019	$Per\ student\ transfer_i = \frac{Rurality\ Index_i * Performance\ Index_i}{100}$ Where: $Rurality\ Index_i = \%\ of\ students\ in\ rural\ areas$ $Performance\ Index_i = -(0.1 Average\ Position\ on\ Saber\ 11_i) +$ $(0.1\ \%\ of\ students\ with\ high\ achievement\ on\ Saber\ 3,5\&9_i) - (0.05 dropout_i) - (0.05 repetition_i) +$ $(0.1 Survival\ rate_i) - (0.15 \lvert Actual\ Student\ Teacher\ Ratio - Expected\ Student\ Teacher\ Ratio \rvert_i)$ - $(0.15 \Delta Saber 11 t-1, t-2)$ + $(0.15 \Delta\%\ Students\ with\ High\ Achievement\ on\ Saber\ 3,5\&9 t-2, t-3) -$ $(0.05 \Delta Desertion t-2, t-3) + (0.1\% High\ School\ Students_i)$

Source: National Planning Department. (2013). (2014a). (2014b). (2015a). (2015b). (2016a). (2016b). (2017a). (2017b). (2018a). (2018b). (2018c). (2019a). (2019b)

Regression results

The models were estimated using administrative data from the national and sub-national governments from the National Planning Department and the national government´s Open Data Web Page as follows:

i) Data on sub-national expenditure and on fiscal transfers from the national government to states and municipalities was taken from the Unique Territorial Form (FUT) at the National Planning Department.[i] For both variables, 2017 constant prices were used. Given that the models were estimated at the municipal level, transfers to and spending by the states was incorporated by dividing it among the municipalities according to their populations.

ii) Data on education outcomes, teachers, and enrollment were taken from the Open Data website.[ii] In order to estimate the impact of total expenditure on learning outcomes, the percentage of children above unsatisfactory grades in math and reading in grades 3, 5, and 9 was added into a single variable.

iii) Data regarding local characteristics (such as municipal value added, municipal prenatal controls, population, rurality, poverty index, mortality, water coverage, and displaced population) was taken from Terridata, the online platform of the National Planning Department.[iii]

The dynamic panel data (DPD) model was estimated using a System Generalized Method of Moments estimator (system GMM). In order to avoid over-instrumentation, instruments were collapsed for all specifications. Fiscal transfers, total expenditure, and education outcomes were treated as the only endogenous variables. Year dummies were included in all models even though their results are not incorporated in the tables below.

Finally, for the DPD models used to estimate the impact of total expenditure on education outcomes the null hypothesis of the Arellano Bond – AR(2) test was rejected, meaning that there was second order autocorrelation. Given this result and the fact that second lags could not be used as valid instruments, only deeper lags (third and beyond) were used as instruments in the specifications for all three education outcomes.

Annex Table 7.4: Fiscal Transfers on Total Expenditure

	Ln of Per Capita Total Expenditure					
	OLS		Fe		DPD	
	Coef.	t	Coef.	t	Coef.	t
Ln of Per Capita Total Expenditure (t-1)	0,6531668***	43,28	-0,0541123	-1,54	0,433954***	3,92
Ln of Per Capita National Transfers	0,2556249***	17,19	0,2281262***	3,72	0,7998274***	3,57
Ln of Population	-0,109068***	-13,79	-1,185435***	-4,74	-0,1184543***	-3,38
Ln Value Added	0,0735142***	10,03	0,0558153***	2,87	0,1021636***	4,01
Mortality	-0,0098294***	-5,65	0,0000461	0,01	-0,0261444**	-2,67
Water Coverage	-0,0000738	-0,85	-0,0001114	-0,80	0,0000476	0,41
Internet Coverage	0,0067671***	7,21	0,0057751	0,97	0,0061338	1,44
Rurality	0,0085542**	2,54			-0,0086076	-0,56
Poverty Index	-0,0009972***	-3,42			-0,0055301**	-2,63
Number of Observations	5242		5242		5242	
Number of Groups			1096		1096	
Number of Instruments					18	
R-squared	0,8109		0,2283			
Wald Statistic/F-Statistic	F(13, 5228)=986,48 Pr>F=0,000		F(11, 32)=91,65 Pr>F=0,000		F(15, 32)=302,72 Pr>F=0,000	
Abond Test – AR(1)					z=-7,24 Pr>z=0,000	
Abond Test – AR(2)					z=1,58 Pr>z=0,114	
Hansen Test					Chi(2)=2,75 Pr>chi2=0,253	

Annex Table 7.5: Total Expenditure on Increasing Education Access

	Net Total Enrollment					
	OLS		Fe		DPD	
	Coef.	t	Coef.	t	Coef.	z
Net Total Enrollment (t-1)	1,012863***	196,76	0,4390742***	9,43	1,011355	43,73
Ln of Per Capita Total Expenditure	1,326306***	6,35	-0,1145145	-0,27	5,877762	2,70
Ln of Total Population	0,4206454***	2,94	-8,517309**	-2,29	2,190015	2,46
Ln of Municipal Value Added	-0,078969	-0,68	-0,6735837*	-1,90	-0,9523965	-1,68
Rural Teachers	0,2004358	-0,58	2,64671	1,56	1,014045	1,67
Mortality under 1 year	0,0079038	1,05	0,0056203	0,62	-0,0172093	-1,02
Water Coverage	0,0010673	-0,47	0,0017676	0,53	0,0019038	0,78
Displaced Population	0,00000845	0,05	0,0002639**	2,08	-0,0000226	0,15
CTE	-0,6221256**	-2,32			-3,123263	-2,19
Poverty Index	-0,0074096	1,40			0,0066839	-0,50
Rurality	-0,099646	-1,07			-0,3478107	-1,40

Number of Observations	5186	5186	5186
Number of Groups		1088	1088
Number of Instruments			19
R-squared	0,9634	0,3741	
Wald Statistic/F Statistic	F(15, 5170)=5818,60 Pr>F=0,000	F(12, 1987)=. Pr>F=.	Wald chi2(17) = 673520,51 Pr>F=0,000
Abond Test – AR(1)			z= -5,33 Pr>z=0,000
Abond Test – AR(2)			z= 3,51 Pr>z=0,000
Abond Test – AR(3)			z= -1,03 Pr>z=0,303
Hansen Test			Chi(2)=1,72 Pr>chi2=0,189

Annex Table 7.6: Total Expenditure on Improving Reading Results

	Percentage of Children in grades 3, 5 & 9 that had insufficient scores in reading					
	OLS		**Fe**		**DPD**	
	Coef.	**t**	**Coef.**	**t**	**Coef.**	**t**
Insufficient Reading (t-1)	-0,7442651***	-61,04	-0,0504962**	-2,21	-0,7084338***	-5,82
Ln of per-capita Total Expenditure	0,1742293	0,22	-4,31737***	-2,60	5,682704	0,93
Ln of Public Enrollment	-1,608015***	-2,95	7,237776	1,61	-0,9597614	-0,52
Ln Municipal Value Added	0,6154466	1,47	2,32376	1,62	0,4038417	0,42
Prenatal Controls	1,334119***	4,10	1,05966	1,46	2,37953**	2,37
Minorities Enrollment/Total Enrollment	-3,987472**	-2,38	26,95006*	1,89	-3,21142	-1,00
Mortality under 1 year	-0,1247323***	-3,50	-0,1441042***	-3,50	-0,1253349**	-2,56
Displaced Population	-0,0004002*	-1,78	-0,0007656**	-2,39	-0,000538	-1,58
Ln Teachers with Graduate Degree	0,8486343***	3,75	0,4867234	1,29	0,9629324*	1,81
CTE	2,708227***	3,28			1,201391	0,57
Poverty Index	-0,1178591***	-5,47			-0,1394361	-1,00
Rurality	1,479624***	4,43			1,383466	1,45
Number of observations	4534		4534		4534	
Number of Groups			1047		1047	
Number of Instruments					21	
R-squared	0,8353		0,0032			
F Statistic	F(16, 4517)=930,86 Pr>F=0,000		F(13, 1046)=. Pr>F=.		F(18, 94)=18469,88 Pr>F=0,000	
Abond Test – AR(1)					z= -7,52 Pr>z=0,000	
Abond Test – AR(2)					z= 3,66 Pr>z=0,000	
Abond Test – AR(3)					z= -0,06 Pr>z=0,949	
Hansen Test					Chi(2)=3,52 Pr>chi2=0,172	

Annex Table 7.7: Total Expenditure on Improving Mathematics Results

	Percentage of Children in grades 3, 5 & 9 that had insufficient scores in Mathematics					
	OLS		Fe		DPD	
	Coef.	t	Coef.	T	Coef.	t
Insufficient Mathematics (t-1)	0,7678583***	69,09	0,0245192	0,99	0,6331355***	4,40
Ln of per-capita Total Expenditure	1,814117*	1,95	-3,01828	-1,56	13,0501	1,02
Ln Public Enrollment	-2,20121***	-3,31	4,772328	0,91	-0,3434228	-0,10
Ln Municipal Value Added	0,4887888	0,99	1,510374	0,83	-1,013236	-0,51
Prenatal Controls	1,419939***	3,63	1,201043	1,41	3,302537*	1,76
Minorities Enrollment/Total Enrollment	-7,154418***	-3,78	12,52049	0,86	-12,20824**	-2,11
Mortality under 1 year	-0,0890773**	-2,05	-0,0974657**	-1,99	-0,1560701*	-1,91
Displaced Population	-0,0000701	-0,31	0,000000196	0,00	0,0001672	0,40
Ln Teachers with Graduate Degree	1,015896***	3,83	0,4112422	0,96	1,505967*	1,84
CTE	3,036898***	3,12			0,610014	0,13
Poverty Index	-0,1512268***	-5,61			-0,2767083*	-1,70
Rurality	1,57042***	3,84			2,02841	1,33
Number of observations	4533		4533		4533	
Number of Groups			1048		1048	
Number of Instruments					20	
R-squared	0,8240		0,0021			
F Statistic	F(16, 4516)=1122,09 Pr>F=0,000		F(13, 1046)=. Pr>F=.		F(18, 94)=361,24 Pr>F=0,000	
Abond Test – AR(1)					z= -6,41 Pr>z=0,000	
Abond Test – AR(2)					z= 3,56 Pr>z=0,000	
Abond Test – AR(3)					z= -0,58 Pr>z=0,560	
Hansen Test					Chi(2)=1,48 Pr>chi2=0,224	

Methodology Used to Calculate the Impact of Negotiated Agreements between Teachers and the National Government

Negotiations between the national government and the Teacher´s Union FECODE resulted in two main agreements:

a. A progressive 12-percentage point real increase in the salary of all teachers negotiated in 2015 (1 percent in 2014 paid in 2015, 1 percent in 2015, 2 percent in 2016, 2 percent in 2017, 3 percent in 2018, and 3 percent in 2019)

b. The adoption of a new methodology to evaluate teachers for promotion, which changed the yearly percentage of teachers who were promoted from around 20 percent in 2015 to around 80 percent in 2016 (each promotion represents around a 28 percent increase in the perceived salary).

For both agreements, the following data from the National Ministry of Education were used.

Data

Annex Table 7.8: Distribution of Teachers across Pay Scales, 2016

Classroom Teachers											
Old Statute 2277				New Statute 1278							
Scale	Teachers	Scale	Teachers	Scale	Teachers	Scale	Teachers	Scale	Teachers	Scale	Teachers
1	984	8	3.795	1A	17518	2D	582	2CM	404	3BM	1177
2	494	9	922	1B	1674	2AE	17341	2DM	75	3CM	696
3	95	10	2.862	1C	330	2BE	6850	2AD	3	3DM	323
4	1.023	11	2.812	1D	47	2CE	2113	2BD	3	3AD	18
5	285	12	9.528	2A	70387	2DE	438	2CD	0	3BD	7
6	1.041	13	23.935	2B	11427	2AM	2269	2DD	0	3CD	6
7	671	14	101.590	2C	3100	2BM	1315	3AM	2014	3DD	3
Total		150.037		Total				140.118			
Others (Ethnic Teachers, etc)				3.812							
TOTAL CLASSROOM TEACHERS: 293.968											
Principals and School Coordinators											
Old Statute 2277				New Statute 1278							
Scale	Teachers	Scale	Teachers	Scale	Teachers	Scale	Teachers	Scale	Teachers	Scale	Teachers
1	12	8	131	1A	88	2D	47	2CM	56	3BM	220
2	9	9	23	1B	17	2AE	909	2DM	12	3CM	146
3	2	10	131	1C	3	2BE	1822	2AD	0	3DM	68
4	17	11	126	1D	1	2CE	767	2BD	0	3AD	3
5	6	12	613	2A	964	2DE	219	2CD	0	3BD	4
6	22	13	1978	2B	489	2AM	177	2DD	0	3CD	1
7	15	14	12528	2C	166	2BM	103	3AM	248	3DD	3
Total		15.612		Total				6.533			
Others (Ethnic Teachers, etc)				95							
TOTAL Principals and School Coordinators TEACHERS: 22.240											

Source: National Ministry of Education

Annex Table 7.9: Pay Scales, 2015, 2016, and 2017 (US dollars)

2015											
Old Statute 2277				New Statute 1278							
Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary
1	207	8	407	1A	350	2D	803	2CM	773	3BM	872
2	230	9	451	1B	446	2AE	479	2DM	923	3CM	1.079
3	258	10	494	1C	575	2BE	611	2AD	572	3DM	1.250
4	267	11	564	1D	713	2CE	757	2BD	748	3AD	977
5	313	12	671	2A	440	2DE	896	2CD	873	3BD	1.147
6	331	13	743	2B	575	2AM	506	2DD	1.044	3CD	1.449
7	371	14	846	2C	672	2BM	662	3AM	737	3DD	1.663

2016											
Old Statute 2277				New Statute 1278							
Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary
1	226	8	443	1A	381	2D	874	2CM	841	3BM	950
2	250	9	491	1B	485	2AE	521	2DM	1.005	3CM	1.174
3	280	10	538	1C	626	2BE	665	2AD	623	3DM	1.361
4	291	11	614	1D	776	2CE	824	2BD	814	3AD	1.064
5	308	12	730	2A	479	2DE	976	2CD	951	3BD	1.249
6	360	13	808	2B	626	2AM	551	2DD	1.136	3CD	1.577
7	403	14	920	2C	731	2BM	720	3AM	802	3DD	1.810

2017											
Old Statute 2277				New Statute 1278							
Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary	Scale	Monthly Salary
1	305	8	483	1A	415	2D	952	2CM	916	3BM	1.034
2	316	9	535	1B	528	2AE	567	2DM	1.094	3CM	1.279
3	336	10	585	1C	681	2BE	725	2AD	678	3DM	1.482
4	349	11	668	1D	845	2CE	898	2BD	886	3AD	1.158

5	371	12	795	2A	522	2DE	1.062	2CD	1.035	3BD	1.360
6	393	13	880	2B	682	2AM	600	2DD	1.237	3CD	1.717
7	439	14	1.002	2C	796	2BM	784	3AM	873	3DD	1.971

Source: National Ministry of Education

Annex Table 7.10: Benefits in Addition to Basic Salary, 2015

Old Statute 2277				New Statute 1278							
Scale	Benefits in addition to basic salary	Scale	Benefits in addition to basic salary	Scale	Benefits in addition to basic salary	Scale	Benefits in addition to basic salary	Scale	Benefits in addition to basic salary	Scale	Benefits in addition to basic salary
1	40,60%	8	29,01%	1A	35,26%	2D	20,84%	2CM	26,29%	3BM	21,03%
2	39,75%	9	25,26%	1B	27,78%	2AE	23,88%	2DM	28,65%	3CM	20,38%
3	38,72%	10	24,32%	1C	23,29%	2BE	23,28%	2AD	24,21%	3DM	20,57%
4	39,14%	11	23,18%	1D	24,93%	2CE	22,36%	2BD	19,66%	3AD	17,35%
5	37,97%	12	22,40%	2A	26,04%	2DE	22,04%	2CD	No Information	3BD	22,82%
6	37,03%	13	22,69%	2B	22,06%	2AM	25,04%	2DD	No Information	3CD	26,96%
7	35,64%	14	22,80%	2C	21,65%	2BM	25,49%	3AM	19,99%	3DD	24,67%
Others (Ethnic Teachers, etc)				35,46%							

Source: National Ministry of Education

The percentages corresponding to benefits in addition to basic salary were calculated based on the amount that a teacher should receive according to the pay scales presented in Table A3.1 and the actual amount received and reported by the Ministry of Education. The percentage difference between the two amounts correspond to the numbers presented above.

12 percentage point real increase

In 2015 (the year in which the agreement was reached), teachers were being paid a total amount of US$3,496,818,543.78 and US$2,766,111,516.27 of basic salary.[iv] Given that the agreement stated that the increase would be introduced gradually (1 percent, in 2014, 1 percent in 2015, 2 percent in 2016, 2 percent in 2017, 3 percent in 2018, and 3 percent in 2019), the following numbers were obtained by applying those percentages to the total amounts paid the year before.

Table 7.11: Total Salaries Paid Using the Previous Year as a Base for the Agreed Increases

	Total Salary		Basic Salary	
2013	$	3.427.917.403,96	$	2.711.608.191,62

2014 – 1% increase	$	3.462.196.578,00	$	2.738.724.273,53
2015 – 1% increase	$	3.496.818.543,78	$	2.766.111.516,27
2016 – 2% increase	$	3.566.754.914,66	$	2.821.433.746,59
2017 – 2% increase	$	3.638.090.012,95	$	2.877.862.421,53
2018 – 3% increase	$	3.747.232.713,34	$	2.964.198.294,17
2019 – 3% increase	$	3.859.649.694,74	$	3.053.124.243,00

Source: National Ministry of Education

The difference between total amounts paid between years were then added together to get the impact of the agreement on costs if the base year for the increase was the previous year.

However, when the 12 percent real increase was applied taking the year 2015 as base year (and then distributed across years), the following numbers were obtained.

Annex Table 7.12: Total Salaries Paid Taking 2015 as the Base Year

	Basic Salary		Salary plus benefits=Total amount received	
Base year = 2013	US$	325.392.983	US$	411.350.088

Source: National Ministry of Education

Promotions

According to the available information, the following are the number of teachers who passed the new evaluation for promotion in 2016 and the pay scales for which they were applying.

Annex Table 7.13: Number of Teachers Applying for Promotion and Their Pay Scales

		Aimed Promotion		
		2BE	**3AM**	**3BM**
Initial Paying Scale	**2AE**	26.282	3.499	
	3AM			507

Source: National Ministry of Education

Even though there is no available information regarding the exact number of teachers who passed the new evaluation for promotion for each pay scale, the percentage of all teachers who passed is 71 percent, which, when applied to each pay scale individually, gives the following:

Annex Table 7.14: Number of Teachers Who Passed the New Evaluation for Promotion by Pay Scale

	Aimed Promotion	2BE	3AM	3BM
Initial Pay Scale	2AE	18.660	2.482	
	3AM			360

Source: National Ministry of Education

Taking the salaries established in the pay scales shown before, the following are the total amounts paid:

Annex Table 7.15: Total Amounts Paid without Promotions (US$)

Without Promotion		Basic Salary	Benefits	Total Salary
Initial Pay Scale	2AE	143.900.301	23,87%	178.249.303
	3AM	3.772.634	19,98%	4.526.407

Source: National Ministry of Education

Annex Table 7.16: Total Amounts Paid with Promotions (US$)

	Aimed Promotion	2BE Basic Salary	2BE Total Salary	3AM Basic Salary	3AM Total Salary	3BM Basic Salary	3BM Total Salary
Initial Pay Scale	2AE	162.255.074	200.011.830	26.031.177	31.232.206		
	3AM					4.466.946	5.406.345

The difference between both amounts consists of the costs of the new promotion evaluation for one year (given that a promotion is a permanent state, the total impact on costs would have to be calculated dynamically and for all of the years that the teachers will be providing their services).

Chapter 8: Brazil Case Study

Annex Table 8.1: FUNDEB Weights, 2019

Educational level	Weights
Full-time Crèche (public)	1.30
Full-time Crèche (*conveniada*)	1.10
Full-time Pre-school	1.30
Part-time Crèche (public)	1.15
Part-time Crèche (*conveniada*)	0.80
Part-time Pre-school	1.05
Primary education (urban)	1.00
Primary education (rural)	1.15
Lower secondary education (urban)	1.10
Lower secondary education (rural)	1.20
Full-time Lower secondary education	1.30
Upper secondary education (urban)	1.25
Upper secondary education (rural)	1.30
Full-time upper secondary education	1.30
Upper secondary education integrated with vocational education	1.30
Gifted education	1.20
Indigenous education	1.20
Youth and adulthood education	0.80
Youth and adulthood education integrated with vocational education	1.20

Source: Ministry of Education (December, 1st 2018) Resolution nº 1.

Regression Analysis

To study the relationship between educational transfers and educational spending, we estimated the following regression:

$$S_{it} = \alpha + \beta_1 T_{it} + \beta_2 X_{it} + \eta_i + \gamma_t + \varepsilon_{it},$$

where S is the log of educational spending per capita of municipality *i* in year *t*, T_{it} are transfer revenues per capita, X_{it} are the exogenous control variables (population, GDP per capita and value-added from agriculture and industry), η_i are municipality fixed effects and γ_t are time fixed effects.

We build a panel dataset with information from the 5570 Brazilian municipalities from 2012 to 2017. Information on the educational spending by municipality comes the National Treasury (STN), while detailed information on transfer and revenues comes from the *Sistema de Informações sobre Orçamentos Públicos em Educação* (SIOPE). Educational transfers are a sum of FUNDEB and FNDE transfers, but results are robust to both the inclusion of Salary Education and for the exclusion of FNDE transfers. General transfers are the sum of transfers from the federal government (FPM, IOF, ITR and IPI) and transfers from the state government (ICMS and IPVA) to municipalities. Municipality controls come from the Institute of Applied Economic Research (IPEA-Data).

Three different methods are used to estimate the above equation: (i) OLS with the pooled data, in which municipality fixed effects are omitted; (ii) a fixed effects model, in which we compare outcomes within municipalities across time and (iii) a dynamic panel data (DPD) model, in which, additionally, lags of transfers are used as instruments for its contemporaneous values.

Results are shown in Table 5 and discussed in the main text. Note that, although not reported, the Arellano-Bond tests for the DPD model suggests that the null hypothesis of no second-degree autocorrelation cannot be rejected. Moreover, the Hansen's tests for overidentifying restrictions imply that the null hypothesis that instruments are exogenous cannot be rejected. Finally, tests for instrument strength demonstrate that instruments are sufficiently strong.

Then, to investigate the impact of municipality spending on educational outcomes, we estimate the following regression:

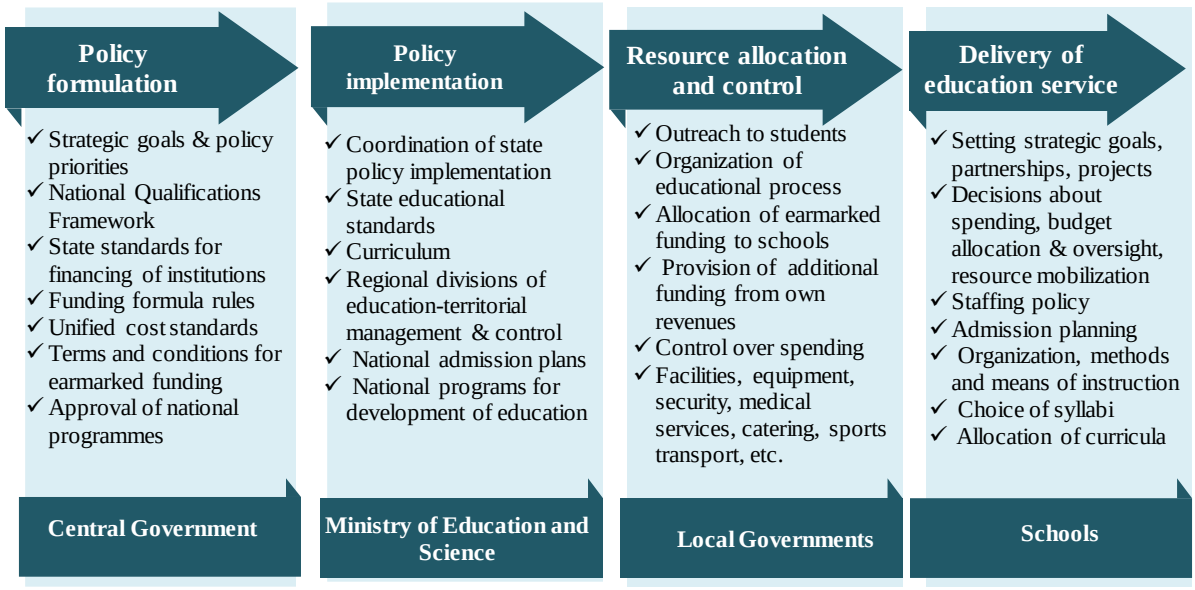
$$IDEB_{it} = \alpha + \beta_3 IDEB_{it-2} + \beta_4 S_{it-1} + \beta_5 X_{it} + \eta_i + \gamma_t + \varepsilon_{it},$$

where the dependent variable is IDEB test scores from years 2011, 2013, 2015 and 2017 and comes from the National Institute for Educational Studies and Research (INEP). The independent variables include the lagged IDEB score of the municipality, lagged variables for educational spending and municipality controls. Again, the above equation is estimated using OLS, fixed effects and a DPD framework. Results are presented in Table 6 and discussed in the text.

Chapter 9: Bulgaria Case Study

Responsibilities for Education Service Delivery and Budget Expenditures Categorization

Annex Figure 9.1. Distribution of Responsibilities for Education Service Delivery



Annex Table 9.1. Categorization of Budget Expenditures in Bulgaria

Categorization of expenditures	Level 1	Additional levels
Administrative classification	Central	Ministries and agencies. State universities and higher education institutions (autonomous budgets). Extrabudgetary accounts and funds at the central government level. Defense-related spending units.
	Local	28 provinces (*oblasti)* and 265 municipalities.
Functional classification	1.General public services 2. Defense and security 3. Education 4. Healthcare 5. Social security, social support, and caretaking	Level 2: Group Level 3: Activities (e.g. kindergartens, comprehensive schools, vocational schools, hostels, canteens, extracurricular activities, etc.)

	6. Construction, public works, utilities, and environment issues 7. Recreation, resorts, culture, and religious activities 8. Economic activities and services 9. Expenditures not classified elsewhere	
Economic classification	Wages and salaries, social security contributions, health insurance contributions, maintenance, paid taxes, interest expenses, capital repair, acquisition of assets, etc.	Level 2: Sub-paragraphs
Source of Financing classification	State budget Municipal budget (delegated and local spending) EU funds & international programs	Level 2: Sub-activities/accounts

Source: National Unified Budget Classification and World Bank BOOST database.

Explaining Local Spendindg and Local Education Spending

The regression models used in this analysis are designed to estimate the impact of total transfer revenues per capita on sub-national total local spending per capita and education spending per student. The data used in the model are for the period 2014 to 2018, with annual data covering all 265 observations (the number of municipalities in Bulgaria). All fiscal and economic variables are measured in constant 2014 terms. The factor variable is total transfers per capita in the municipal budget and is calculated using the revenue side of the World Bank's BOOST database for Bulgaria. Specifically, calculations are based on data classified under code 31-00 "Received transfers (subsidies/payments) from Central Budget (net) of Uniform Budget Classification for each municipality." Control variables include the type of municipality (underdeveloped rural area or not), the population, the number of the students in primary and secondary schools, and the unemployment rate. The model is:

$$S_{it} = \beta_0 + \beta_1 T_{it} + \beta_2 X_{it} + \gamma_t + \varepsilon_{it}$$

where

S_{it} – Log of total spending (Log of total per capita or education per student) per capita in municipality *i* for year *t*

T_{it} – Log of total transfer revenues per capita in municipal budged of municipality *i* for year *t*

X_{it} – comprises exogenous control variables (type of municipality, log of population, log of number of the students, unemployment rate) in municipality *i* for year *t*

γ_t – time fixed effects.

Annex Table 9.2: Impact of Total Transfers on Sub-national Spending

Parameter	Estimate	Std. Error	df	T	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	2,370122	,140543	1106,356	16,864	,000	2,094361	2,645883
underdeveloped rural area= no	,043521	,008262	1068,870	5,268	,000	,027309	,059732
underdeveloped rural area= yes	0[b]	0					
year =1	,094201	,012153	564,928	7,751	,000	,070330	,118072
year =2	,164928	,015375	500,496	10,727	,000	,134721	,195136
year =3	-,043031	,010173	629,816	-4,230	,000	-,063007	-,023055
year =4	-,023790	,008873	530,594	-2,681	,008	-,041220	-,006359
year =5 baseline	0[b]	0					
Log of Total transfers per capita	,449696	,034229	1118,406	13,138	,000	,382536	,516856
unemployment rate	-,001771	,000328	1156,076	-5,402	,000	-,002414	-,001128
population_log	-,180572	,031769	1033,161	-5,684	,000	-,242911	-,118233

students_log	,047953	,025699	1022,497	1,866	,062	-,002475	,098382

Notes: a. Dependent Variable: Log of total spending per capita in constant 2014 terms. b. This parameter is set to zero because it is redundant.

Annex Table 9.3: Impact of Total Transfers on Sub-national Spending on Education

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	2,903844	,076094	1273,939	38,161	,000	2,754561	3,053128
underdeveloped rural area= no	,000701	,004478	1260,664	,157	,876	-,008084	,009486
underdeveloped rural area= yes	0[b]	0					
year =1	-,123861	,006573	625,595	-18,844	,000	-,136769	-,110953
year =2	-,128043	,006532	715,687	-19,601	,000	-,140868	-,115218
year =3	-,106097	,006205	624,920	-17,099	,000	-,118281	-,093912
year =4	-,036081	,005591	520,296	-6,454	,000	-,047065	-,025098
year =5 baseline	0[b]	0					
Log of Total transfers per capita	,152925	,018431	1252,883	8,297	,000	,116766	,189083
population_log	,276125	,017458	1245,579	15,817	,000	,241875	,310375
students_log	-,329695	,014139	1236,648	-23,318	,000	-,357435	-,301955
unemployment rate	,000544	,000168	1194,682	3,232	,001	,000214	,000875

Notes: a. Dependent Variable: Log of Total spending on education per student. b. This parameter is set to zero because it is redundant.

In order to explain the impact of transfers on sub-national spending per student, the regression model is detailed with four-factor variables related to the following transfers: 31-11 "Total supplementary subsidy for state mandated activities," which consists of the main resources used to provide basic education services; 31-12 "General equalization subsidy;" 31-13 "Targeted transfers for capital expenditures," which provides funding for capital spending; and 31-18 "Other targeted transfers," which includes transfers from the national programs for the development of education, among other things. The transport-related transfer category (31-28 "Other targeted subsidies") are not included because of their specific nature and limited relevance.

The model is:

$$S_{it} = \beta_0 + \beta_1 T_{1it} + \beta_2 T_{2it} + \beta_3 T_{3it} + \beta_4 T_{4it} + \beta_5 X_{it} + \gamma_t + \varepsilon_{it}$$

where

S_{it} - Total spending on education per student in municipality *i* for year *t*

T_{1it} – Transfer 31-11 in municipal budged in municipality *i* for year *t*

T_{2it} – Transfer 31-12 in municipal budged in municipality *i* for year *t*

T_{3it} – Transfer 31-13 in municipal budged in municipality *i* for year *t*

T_{4it} – Transfer 31-18 in municipal budged in municipality *i* for year *t*

X_{it} - comprises exogenous control variables (type of municipality, log of population, log of number of the students, unemployment rate) in municipality *i* for year *t*

γ_t – time fixed effects.

Annex Table 9.4. Impact of different transfers on sub-national total education spending per student

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Intercept	351,02	329,14	1235,33	1,07	0,29	-294,72	996,76
underdeveloped rural area= no	33,04	34,92	1213,91	0,95	0,34	-35,46	101,55
underdeveloped rural area= yes	0[b]	0,00					
year =1	-669,74	61,05	721,50	-10,97	0,00	-789,60	-549,88
year =2	-761,32	54,72	594,91	-13,91	0,00	-868,80	-653,85
year =3	-653,93	55,22	585,34	-11,84	0,00	-762,38	-545,48
year =4	-269,60	49,18	450,22	-5,48	0,00	-366,26	-172,94
year =5 baseline	0[b]	0,00					
T 31-11	1,53	0,15	1176,83	10,03	0,00	1,23	1,82
T 31-12	1,13	0,53	1214,30	2,13	0,03	0,09	2,17
T 31-13	0,22	0,15	533,56	1,47	0,14	-0,07	0,51
T 31-18	0,14	0,17	760,73	0,80	0,42	-0,20	0,47
population_log	2429,01	143,27	1197,00	16,95	0,00	2147,92	2710,11
students_log	-2681,38	117,39	1185,27	-22,84	0,00	-2911,70	-2451,07
unemployment rate	2,88	1,31	1124,50	2,20	0,03	0,31	5,44

Notes: a. Dependent Variable: Total spending on education per student. b. This parameter is set to zero because it is redundant

Explaining Local Spending and Education Outcomes

We constructed another municipality-level model in order to estimate the relation between local spending and average test scores on the Bulgarian language external evaluation exam after grade 7 (which is obligatory for all students). All of the data are for 2018. The factor variables are the student/teacher ratio, the average class size, and the share of education spending in the total municipal budget. We also controlled for the following variables:

- type of municipality (underdeveloped rural area or not)
- the population
- the poverty rate among people aged between 0 and 17 years old
- the share of students with parents with low educational attainment (basic education or less)
- total spending per capita.

The model is:

$$R_i = \beta_0 + \beta_1 ST_i + \beta_2 CS_i + \beta_3 SE_i + \beta_4 X_i + \varepsilon_i$$

where

R_i – Average number of points in the Bulgarian language test in municipality *i*
ST_i – Students/ teachers ratio in municipality *i*
CS_i – Average class size in municipality *i*
SE_i – Share of education spending in total municipal budget in municipality *i*

X_{it} - comprises exogenous control variables (type of municipality, log of population, poverty rate, the share of students with parents with low educational attainment, and total spending per capita in thousand BGN) in municipality *i.*

Annex Table 9.4. Impact of transfers on education outcomes

Dependent Variable: *Average test scores in the Bulgarian language*

Parameter	coefficient	Std. Error	Sig.
Intercept	64.249	17.110	.000
Students/teachers ratio	-.360	.258	.164
Average class size	.178	.195	.361
Share of educational spending	-.056	.060	.352
Underdeveloped rural area = no	1.378	1.169	.240
Underdeveloped rural area= yes baseline			
Poverty rate 0-17	-.263	.044	.000
Share of students with parents with low educational attainment	-.210	.030	.000
Total spending per capita (thousand BGN)	-6.739	4.533	.138
Population (logarithm)	4.650	1.432	.001

Spending on Education by Different Levels of Government

Annex Table 9.5: Spending on Education by Different Levels of Government (share of total government spending and share of GDP)

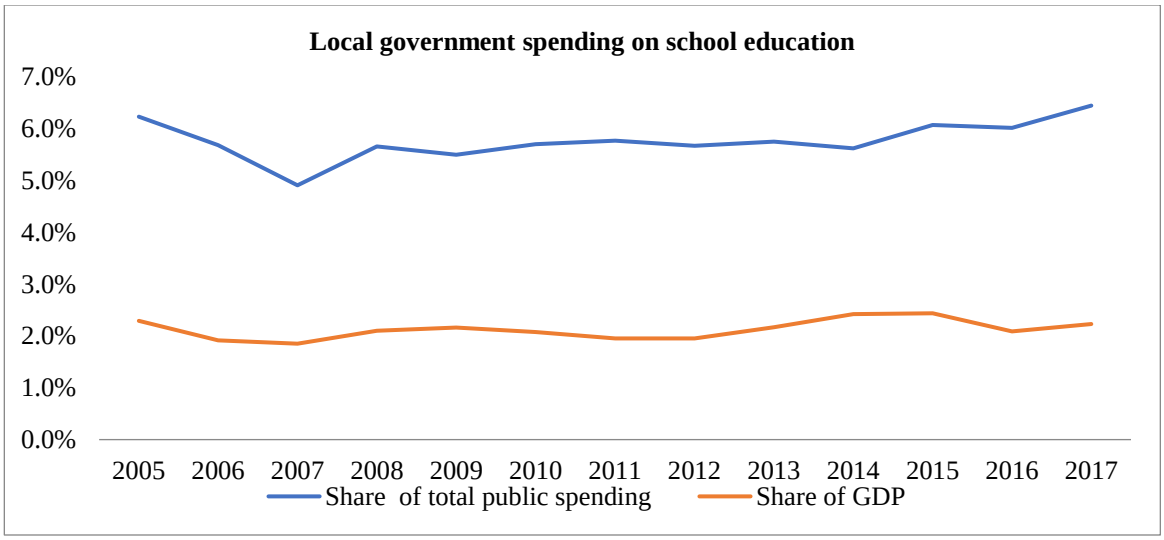
	2005		2008		2015		2017	
	Central Govt	Local Govt	Central Govt	Local Govt	Central Govt	Local Govt	Central Govt	Local Govt
Spending on all education as share of total public spending	4.7%	6.5%	4.7%	6.0%	3.6%	6.4%	3.5%	6.8%
Spending on school education as share of total public spending	0.2%	6.2%	1.5%	5.7%	1.1%	6.1%	0.9%	6.5%
Spending on education as share of GDP	1.7%	2.4%	1.7%	2.2%	1.4%	2.6%	1.2%	2.4%
Spending on school education as share of GDP	0.1%	2.3%	0.5%	2.1%	0.4%	2.4%	0.3%	2.2%

Source: Eurostat COFOG database and NSI

Notes: *including pre-primary, primary, lower secondary and upper secondary education.

As major providers of pre-primary, primary, and secondary education, municipalities distribute the largest shares of total public spending. Since the introduction of the formula-based funding model in 2007, the level of government expenditures for school education has remained relatively stable, both as a share of total public expenditure and as a share of GDP. The slightly upward trend in recent years can partially accounted for by the transfer of some educational services from the central to the local level (for example, the provision of vocational education in municipal general schools and the transfer of ownership of some vocational schools to municipalities), the introduction of integrated schools, and increased access to EU funding for modernizing the infrastructure of municipal schools.

Annex Figure 9.2: Education Decentralization and Stability of Local Spending for Schooling



Source: Eurostat COFOG database and NSI
Notes: * Including pre-primary, primary, lower secondary and upper secondary education.

Individual schools are permitted to use other sources of funding in addition to the public funds (own revenue), but there are no comprehensive system-level data that would show the extent to which they do so. Public schools are not allowed to charge fees for the provision of basic education services subsidized by the state budget, or for the use of the facilities or taking exams, but they are entitled to generate own revenue from the implementation of different projects as well as from rents, donations, sponsorships, and contributions from business. They can also charge fees for providing extra-curricular courses as well as for providing post-compulsory upper-secondary education to students from other countries. The financial reports of individual schools reveal that, for some schools, especially those situated in more rural areas, rent from the school's own land is an important source of additional financial support.

ANNEX TABLE 10.1: ARE TRANSFERS REDISTRIBUTIVE? PROVINCES AND COUNTIES

	Panel A. Central-to-provincial transfers								
	Dependent variable: transfer per capita in each province								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	2005	2005	2005	2007	2007	2007	2017	2017	2017
GDP per capita	-0.011	-0.001	0.005	-0.027*	-0.013	-0.002	-0.083**	-0.051	-0.012
	(0.013)	(0.042)	(0.005)	(0.014)	(0.043)	(0.006)	(0.033)	(0.077)	(0.010)
Relative fiscal capacity per capita		-0.073	0.030		-0.088	0.105***		-0.175	0.060
		(0.278)	(0.031)		(0.247)	(0.034)		(0.377)	(0.048)
(Fiscal expenditure -fiscal revenue) per capita			1.060***			1.079***			1.044***
			(0.023)			(0.028)			(0.026)
ln(population)	-1,021.264***	-1,031.895***	-47.331*	-1,477.050***	-1,498.204***	-19.680	-6,614.332***	-6,821.297***	574.306**
	(154.347)	(162.127)	(27.649)	(218.130)	(229.458)	(49.346)	(1,058.864)	(1,162.270)	(234.106)
# Obs	31	31	31	31	31	31	31	31	31
R-squared	0.611	0.612	0.995	0.635	0.636	0.994	0.627	0.630	0.994

	Panel B. transfers to counties							
	Dependent variable: transfer per capita				Dependent variable: general transfer per capita			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	1999	1999	2007	2007	1999	1999	2007	2007
GDP per capita	0.003	-0.003	-0.175***	-0.037	-0.009***	0.017***	-0.197***	-0.012

	(0.024)	(0.028)	(0.026)	(0.039)	(0.003)	(0.004)	(0.022)	(0.033)
Relative fiscal capacity per capita		1.110*		-2.076***		-0.872***		-2.834***
		(0.580)		(0.496)		(0.081)		(0.414)
(Fiscal expenditure -fiscal revenue) per capita		12.104***		9.108***		0.847***		6.955***
		(0.630)		(0.372)		(0.088)		(0.310)
ln(population)	1,334.669***	2,996.253***	16,922.605***	26,233.129***	27.200	88.269***	11,018.935***	17,991.780***
	(145.212)	(164.071)	(478.653)	(576.152)	(19.804)	(22.943)	(394.966)	(480.396)
Province fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# Obs	2,695	2,693	2,035	2,034	2,695	2,693	2,027	2,026
R-squared	0.280	0.368	0.762	0.820	0.420	0.465	0.712	0.778

Sources: Ministry of Finance and the Fiscal Statistics for Prefectures, Municipalities, and Counties.
Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Relative fiscal capacity per capita is defined as the difference between fiscal revenue per capita in that region (province or county) and the nationwide average fiscal revenue per capita. The definition follows Fu and Shen (2012).

[i] https://sisfut.dnp.gov.co/app/descargas/visor-excel

[ii] www.datos.gov.co
[iii] Terridata.dnp.gov.co
[iv] Numbers in 2017 constant prices using as price deflector for 2015=0.8856668.