The allocation of regional education funding and politics in Peru between 2007-2016

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Summary

We examine the allocation of the regional education budget over two Peruvian government periods (2006-2011 and 2011-2016). The latter period coincides with the start of a range of educational reforms and a substantial increase in the education budget. We estimate the extent to which the budget can be considered "needs-based", with the residual representing more discretionary "excess" spending.

We find that over the period, the allocation of funding to regions became more needs-based; it was directed more towards regions that lagged behind in terms of school infrastructure, and which employed more teachers per pupil population. Nevertheless, a fairly significant proportion of the variation in regional funding remains unexplained. The share of indigenous population or the general level of wealth of the region are only weakly associated with more excess funding. Transfers of tax income from natural resource related activities to regions can be linked to excess funding, suggesting that these tax receipts have the potential to benefit educational funding in a meaningful matter in resource rich regions. Finally, changes in excess funding correlate with changes in political representation, measured as the share of the region's districts that have a member of congress. This can increase the influence of these districts and thus the region in budget negotiations.

A separate regression analysis on the influence of political alignment and representation also suggests that representation matters. The share of a region's districts that have a member of congress is positively associated with increased infrastructure funding and a reduced wage bill, and consequently with the opening of new schools, and a reduction in the number of teachers per pupil. On the other hand, we don't find a clear association between other political variables and budget items and resources. We also do not find that regions that obtained more funding than expected, managed to translate this funding into larger improvements in learning.

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1 Introduction

In the 2010s, Peru started a period of educational reform with significant increases in funding. This enabled a significant improvement in the levels of learning, which were lagging behind in many parts of the country. This study focuses on the determinants of budget resources for in the period prior and during the reforms in 2007-16, and whether the allocation of the budget was more rational or less discretionary over the reform period.

We examine the allocation of the regional education budget over two Peruvian government periods (2006-2011 and 2011-2016), which coincide with the administrations of Alan Garcia (2006-2011) and Ollanta Humala (2011-2016). We analyze the extent to which the funding of education has been either needs based or discretionary over this time period and whether political favoritism has played a role. For the latter, we study whether political alignment of regions with the central government, and the distribution of members of congress have affected the allocation of resources. We focus on the regional education budget, for a number of reasons. For this purpose, we use several sources of data, on the budget at different administrative levels, school census data and household survey data.

In principle, Peru operates a decentralized budget model in the case of education, whereby the responsibility for educational infrastructure and equipment lies with the regional government, although problems with delegation of responsibility have been reported (Alcázar y Valdivia, 2011). In practice, these budgets are largely funded by the central government, but managed in a devolved fashion by the regions, who are responsible for delivering basic education. Previous studies in Peru analyzing the education budget have focused for instance on aggregate level indicators, such as economic growth, the size of the state and the share of education in the aggregate budget, concluding that between 2000 to 2012, the growth in the education budget was largely driven by economic growth (Nopo, 2018).

There is significant empirical literature analyzing the role of political alignment in the budget process. Theoretically, the relevance of political alignment of a constituency in the receipt of grants was formalized by Cox and McCubbins (1986). For a review of the theoretical and empirical literature, see for instance Golden and Min (2013). Peru has a weak party system, where politicians operate outside the party system and coalitions of politicians join forces for the duration of an electoral cycle (Levitsky, 2018). Therefore, it could be the case that the traditional models of distributive politics do not apply similarly to the Peruvian case. However, a few studies find that political support can play a role in funding allocation. Schady (2000) finds evidence of political alignment playing a role in increased allocation of resources to provinces, whereas Segura-Ubiergo (2007) and Letelier and Neyra (2013) find the opposite.

In this study, we study the extent to which the allocation of the education budget is needs based and produce an estimate of “excess funding”, which is a positive or negative deviation from the expected funding, beyond what is justified by average infrastructure and staffing needs. There could be several explanations for such deviations. For example, income from the taxation of natural resources/extractive industries is transferred by the State based on specific formula to regions where the income originates from. The regional governments receive 25% of the payments and 20% of these payments need to be used for public universities. This benefits certain regions rather disproportionately. This is a legal requirement and by law, the regional governments are supposed to use these income transfers for public investment projects, including education spending. On the other hand, discrepancies in funding can also be due to

details in educational production that is deemed important by bureaucrats, but are not easily visible to researchers in the data on schools and teachers.

However, we also investigate whether excess funding is related to 1) a conscious policy effort to target traditionally more disadvantaged regions, on the basis of lower incomes or a larger indigenous population and 2) political influence and lobbying, which we measure with political alignment of the regions with the nationally dominant political forces, or political representation, namely members of congress lobbying for the politician's region or district.

Regarding point 1), during the second political period, under President Ollanta Humala (2011-2016), who comes from a region with a larger indigenous population, the Ministry of Development and Social Inclusion was created, and the government prioritized intervention in regions with high levels of poverty and low social development indicators. Indicators of human development improved significantly over the period studied, but there is significant and continued variation. The regions lagging most behind had Human Development Index values of 0.21-0.29 to 0.34-0.43, with Huancavelica and Ayacucho as the bottom performers. The most developed regions had values of 0.42-0.49 to 0.61-0.72 with Lima and Arequipa having the highest levels (UNDP, 2019).

We conduct a further analysis to study how political factors may affect funding. Variation in the political situation derives from both national and regional elections, which may change members of congress and redefine the relationship between regions and the central government. The indicators we construct are as follows: (1) Region's leading party in the regional elections is the same as the leading party in the national elections. (2) Share of region's district where the leading local candidate is from the same party as the leading party in the national elections. (3) Whether the region's leading party is represented in the congress. (4) Share of regions districts that have a member of congress originating from that district. (5) The number of region's members of congress that serve in the budget commission. The number of members of congress is 130 and while it is fixed at regional level, regions with larger populations have more members of congress. Since members of congress are elected from the entire region, the elected members may represent a limited number of districts, such as the main city, or alternatively they might come from a more dispersed set of districts.

The paper is organized as follows. Section 2 describes the political system and the allocation of the education budget in Peru. In Section 3, we conduct a statistical analysis of the association between the regional education budget and existing school resources, socio-economic variables, as well income transfers to natural rich resources. Section 4 focuses of the role of political factors in influencing the regional budget allocation. Section 5 concludes.

2 Political background and education budget

2.1 Political background

According to Article 110 of the Peruvian Constitution, the President of the Republic is the head of State and personifies the Nation. The President and representatives of the parliament are elected every 5 years in general elections. The parliament consist of 130 members of congress, who are elected for a period of five years, and the parliament is the only regulatory body of the executive power. The elections of the 25 regional governors and provincial and local mayors must take place every 4 years.

At the subnational level, it is recognized that “Regional governments have political, economic and administrative autonomy in matters within their competence. They coordinate with the municipalities without interfering with their functions and powers.” (Article 191). At this level, the authorities have the power to approve its internal organization and its budget, as well as to regulate and grant authorizations, licenses and rights over the services for which they are responsible, and to promote and regulate activities in different areas, including education.

The education sector is characterized by the co-existence of different processes for appointing authorities, at the national (Ministry of Education), regional (Regional Directorates of Education) and local (Management Units) levels. Regional Directors of Education, who are responsible for conducting the educational service in their regions, following the guidelines of the Ministry of Education, are appointed by the Regional Governors, who are the highest political authority of their respective regions. The technical teams are selected through the same modalities at the central level (administrative service contracts and service orders).

At the local level, education is managed by Local Educational Management Units (UGEL), the number of which is above 200 nationwide. The Teacher Reform Law of 2012 introduced entrance and promotion exams for managerial positions at the level of educational institutions and UGELs. The Ministry of Education indicates the vacant managerial positions and administers a Single National Test, which is one of the stages of the selection process.

2.2 Education Budget Allocation

The budget formulation cycle in Peru is annual and involves different stages. The first of these is carried out by the executive power, in which each budgetary unit formulates a proposal for its budget, subject to a maximum amount previously defined by the Ministry of Economy and Finance (MEF). After that, the unit presents its proposal to the MEF, and in the case that it exceeds the original maximum amount, the request for "additional demand for resources" is submitted. Once each budget is defined by the MEF, it is approved by the Council of Ministers and sent with the signature of the President of the Republic to the Congress of the Republic. This occurs, in accordance with the provisions of the Political Constitution of Peru, before August 30 of each year.

In the education sector, the budget negotiations and plans are carried out at the three levels of government (national, regional and local), and both the Ministry of Education and the Regional Governments, and even the Municipalities program resources linked to the sector. However, as part of its leading role in educational policy, the Ministry of Education coordinates the process and administers the total budget, from which funds are later transferred to Regional Governments. Depending on the strategic relevance of educational infrastructure projects specifically, these may be administered by the Ministry of Education, since 2015 through the National Educational Infrastructure Program (PRONIED), or by the Regional Governments, through the Regional Directorates of Education, or by the Local Governments.

After the budget project is submitted to the Congress of the Republic, it is reviewed by the Budget Commission, made up of a group of Members of congress from different political parties. After that, the Budget Commission formulates the final draft of the Budget Law for its subsequent approval. This last process must occur before November 30 of each year.

A particularity of this last stage is that, despite the fact that the legislature lacks a spending initiative by law, the budget law includes an annex for investment projects that can be financed

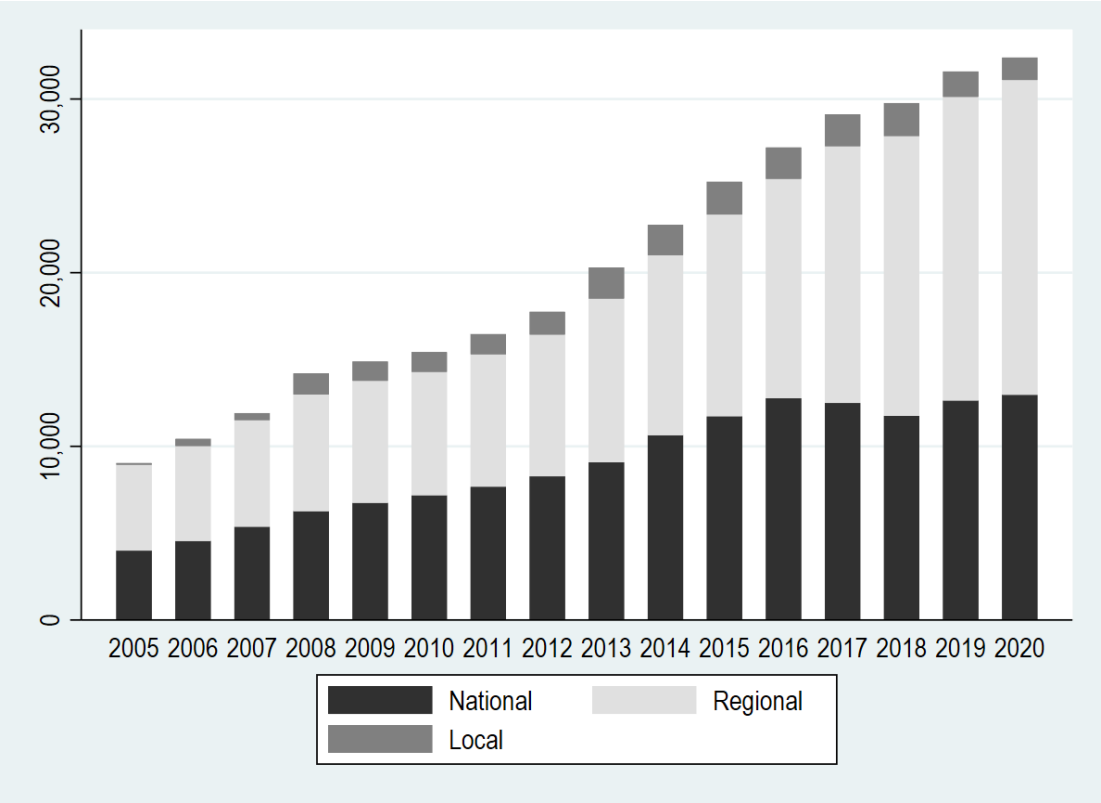
during the year. It is precisely in this section that the members of congress, in charge of approving the final draft budget, have the possibility of proposing the inclusion of projects, often linked to the regions they represent. This can be a means of financing projects that the members of congress view as important for achieving popularity among voters. Thus, these projects can deviate from objective goals and criteria, such as the closing of an infrastructure gap. They are a result of internal negotiations and the distribution of political power within Congress.

2.3 Developments in the education budget

In the forthcoming analysis, we rely on budget level data from the Ministry of Economy and Finance between the years 2007 and 2019, sourced from the Portal de transparencia del Ministerio de Economía y Finanzas (MEF). We focus on the regional budget.

As can be seen from Figure 1, the total education budget rose significantly from 2011 onwards, in a concerted effort to reform the education system and improve educational performance at several levels.

Figure 1 Total budget allocated to education in 2005-2020, millions of Soles



Source: Authors' calculations based on data from the Portal de Transparencia del Ministerio de Economía y Finanzas (Ministry of Economy and Finance).

In our analysis, we use both the total regional education budget as well as a sub-set, which consist of items that we have classified as intended for primary education. The initial justification for the latter was that in the analysis in Section 3, we relate the budget to resources at the level of primary schools, based on the annual school level census data for 2007-16 (Censo Escolar). The share of items classified as intended for primary schools ended up being quite high, possibly because in some instances it has been impossible to separate primary funding from funding intended for other levels. In 2007, at the starting point of our data, according to our classification, primary expenditure accounted for 86% of the regional budget and only 16% of the national budget, given that regions are largely in charge of basic education with the exception of Lima. Similarly, at the end (2019), the basic education budget was 70% of the regional and 8% of the national budget.

Given that our classification of primary education items covers the majority of the budget and there are some inconsistencies in this classification between 2009-2011, we have decided to conduct the majority of the analysis with the total regional education budget. However, since we only have a breakdown of budget items for our classification of the primary school budget and not the total budget, in a few instances we utilize these different primary school budget items as outcomes of interest.

3 What determines allocation of regional funding for education?

In principle, the simplest way to allocate money would be to fund all regions in proportion to the number of pupils, for example with 2000 soles per primary pupil. While such an allocation would be equal and transparent, it would not take into consideration that some regions are severely behind in terms of the quality of school infrastructure or might have a more challenging geography that requires more funds per student.

For this analysis, in addition to the budget data, we use school census data for 2007-16 (Censo Escolar). This is an annual school level census data set and includes information of school resources and teachers among other things. Our current data set only covers all primary schools in Peru, with more than 5 pupils. We recognize that the regional education budget extends beyond primary schooling, but we believe that it is reasonable to assume that the magnitude of the primary education sector is indicative of the size and development of the other levels of education funded from the regional budget.

Our sample of schools covers both schools where the language of instruction is Spanish, and bi-lingual schools. The choice of years has been guided by the availability of cross-sectional pupil level test score data (Evaluación Censal de Estudiantes) that we have linked to the school census data. Among other things, the school census data include school level aggregates on resources, teachers, pupils and location, but do not contain information on household or parental characteristics. Information on population and household characteristics were obtained from the Encuesta Nacional de Hogares (ENAHO), which is representative at the regional (departemento) level.

Given that large regional gaps exist, not only in learning outcomes, but also in school infrastructure, pupil-teacher ratios, and prevalence of small single-teacher schools, any aims to narrow the regional disparities should aim to disperse more funds to the regions that are lagging behind in resources. We could therefore hypothesize that the funds allocated the different regions could be expected to follow a function of the following resources:

(1) The existing school infrastructure – The poorer the average infrastructure, the more money per pupil should be spent.
➔ Negative relationship expected

(2) The number of teachers per pupils – Teachers' salaries are the biggest cost item in education, so it would be expected that the more there are teachers per pupils, the more costs there are. But the alternative is theoretically possible: if a region is understaffed, low teacher numbers might predict higher spending as authorities aim to close the gap.
➔ Positive or possibly negative relationship expected

(3) The number of schools per pupils – The average school size is smaller in more remote areas, representing a more demanding infrastructure needs per pupil. The larger the relative number of schools, the more funding would be justified. Alternatively, a deficient school network could be considered to justify more resources to close the gap.
➔ Positive or possibly negative relationship expected

It is also likely that such resource gaps are correlated with numerous social indicators such as incomes, rurality and ethnicity. We'll examine these simple determinants of theeducation budget allocation for the years 2007-2016, given that we have school census data for the years 2007-2016. Summary statistics for the data used are presented in Table 1. The average funding per primary level pupil is about 5000 Soles, but it should be noted that this also includes funds going to levels of education. As such, the 5000 soles should not be taken as a face value of the cost of education in the primary education in Peru. The summary statistics also include the so called 'canon' payments, which represent extra income due to tax receipts from mining. This income is concentrated to some regions and is known to have been used for social purposes such as education.

Table 1 Summary statistics of funding and its potential determinants across regions, 2007-16

	Obs.	Mean	S.D.	Min	Max
Year	240	2011.5	2.9	2007	2016
Funding per pupil (Regional)	240	5063	2446	1431	16858
'Canon' payments per capita*	240	144	148	0	830
Basic 5 Infrastructure	240	3.82	0.64	2.03	4.84
Teachers per 100 pupils	240	5.04	0.83	3.66	7.43
Schools per 1000 pupils	240	7.91	2.98	1.85	14.95
Share in urban schools	240	0.71	0.19	0.30	1.00
Avg. expenditure per capita	240	314	113	83	591
Share indigenous	240	0.23	0.23	0	0.78
Obs: 240 (24 regions, 10 years)					

Notes: Pupils here refers to the total number of primary school pupils, based on the School census. * The canon payments refer to tax income from the use of natural resources, which is allocated by law to resource rich regions. 'Basic 5 infrastructure' is a sum of five indicator items, which are summed and averaged over schools, weighted by pupils: Water, Electricity, Toilet, Sewage and Internet. Sources: Avg. household expenditure per capita (monthly) and

Share indigenous are from ENAHO, funding per primary pupil from MEF, the rest from Censo Escolar. Lima is excluded due to being funded from the national, and not regional budget.

In Table 2, we show the results of two simple alternative models for the determination of educational funding allocation across regions. In the first column, we focus only on socioeconomic or regional characteristics, to see whether funding favored areas that could be considered more disadvantaged on the basis of these indicators, namely whether funding is more targeted towards rural and poorer areas and those with a larger share of indigenous population over 2007-16. In the second column, we focus on the 'needs based' determinants of funding, as detailed above. Since resource needs and social factors are highly correlated, including both sets of variables would reduce the precision of estimates.

Table 2 Testing for social vs resource determinants of regional funding allocation across 24 regions, 2007-16

	[1]		[2]	
	Funding per pupil		Funding per pupil	
	Coef.	T-stat.	Coef.	T-stat.
Share in urban schools	5,117.9**	[4.2]		
Avg. expenditure per capita	0.3	[0.1]		
Share indigenous	3,321.3**	[6.1]		
Basic 5 Infrastructure			-536.9	[-1.4]
Teachers per 100 pupils			2,147.0**	[11.3]
Schools per 1000 pupils			-361.6**	[-5.4]
Year 2008	584.6	[1.1]	526.1	[1.2]
Year 2009	1,015.1+	[1.9]	607.2	[1.4]
Year 2010	524.5	[1.0]	349.5	[0.8]
Year 2011	861.6	[1.6]	340.3	[0.7]
Year 2012	1,355.2*	[2.5]	904.2+	[1.8]
Year 2013	1,918.3**	[3.5]	1,052.4*	[2.2]
Year 2014	2,500.3**	[4.5]	1,540.0**	[3.1]
Year 2015	3,017.0**	[5.4]	2,666.0**	[4.6]
Year 2016	3,735.5**	[6.6]	3,142.1**	[5.7]
Constant	-1,019.1	[-1.7]	-1,954.6+	[-1.7]
Observations	240		240	
R-squared	0.5		0.7	

Notes: '+': $p < .1$, '*': $p < .05$, '**': $p < .01$. Lima is excluded from the analysis since Lima's schools are funded from the national, not regional budget.

The year effects in the first column show how quickly the average funding per pupil increases compared to the base year, 2007. In an average region, by 2016, funding is over 3700 Soles higher per pupil, than in 2007. Of the social indicators included, the share of indigenous people turns out to be highly statistically significant; a 10 percentage point increase in the share of indigenous people, increases funding by 332 Soles per pupil. One should note that this is not due to bilingual education, as only a small fraction of indigenous people opt for bilingual schooling. This rather just shows that the thrust of the funding for education has favored regions

with indigenous populations. The share of urban pupils is also significantly associated with funding; 10% higher share of urban pupils comes with 512 Soles more per pupil. This could be due to higher costs of education per pupil in urban areas.

The second column explains funding per pupil as the function of the three resource items listed above. Two of them turn out to be statistically significant. The infrastructure score varies between 2.03 and 4.84 in the data and it measures how many of the following infrastructure items the average pupils have access to: Water, Electricity, Toilet, Sewage and Internet. This variable does not predict funding in the full sample, suggesting that resources have not been allocated more to regions with weaker infrastructure. The next explanatory variable 'Teachers per 100 pupils' is highly significant and positive. The more there are teachers per pupil, the more funding per pupil is being allocated. In the data, 'Teachers per 100 pupils' varies from 3.66 to 7.43, which is a wide range and reflects the fact that regions with small rural schools typically employ more teachers per pupil population.

The final item, 'Schools per 1000 pupils' is also statistically significant. The range for this variable in the sample is 1.85 – 14.95, again reflecting partly the fact that schools are larger in more urban regions. The justification for the inclusion of this variable is that each school comes with some fixed running costs, so running more schools per pupil population could incur additional costs per pupil. On the other hand, some regions may be short of schools, compared to others and should thus be invested in. The latter explanation appears to dominate the result, since the funding favors regions with fewer schools per pupil. The resource-based explanation is more powerful than the social indicators in column 1, since the R-squared statistics is higher.

Table 2 does not reveal how the allocation of funding has changed over time. In Table 3, we estimate the determinants of funding separately for each year. Firstly, it needs to be pointed out that these annual regressions have just 24 observations each, and thus the statistical degrees of freedom are limited. The educational reforms gathered pace from 2013 onwards. There are some clear patterns, showing that the basis of funding allocation changed over the years. In the top panel (A), we estimate funding annually using the social determinants, and in Panel B, the resource-based determinants.

Firstly, looking at Panel A, we find that the share of urban pupils and average household expenditure are not consistently associated with funding, whereas the share of indigenous population becomes larger and more significant as the years pass. This implies that funding increasingly began to favor regions with larger indigenous populations.

Panel B shows that in earlier years, funds were not significantly associated with infrastructure, but this changes over time; the estimated coefficient for infrastructure becomes more negative and occasionally significant at the 5% level by 2015. This suggests that funding has systematically started to favor areas with weaker school infrastructure. For Teachers per pupils, the positive coefficient becomes larger from 2013 onwards. Finally, schools per pupils is initially not a significant predictor of funds, but from the year 2013 onwards, there is a significant tendency to favor areas with a more sparse school network. Overall, the results of Panel B suggest that funding has become more 'needs-based' over time, at least in a sense that the statistical pattern of funding allocation matches the assumed needs better.

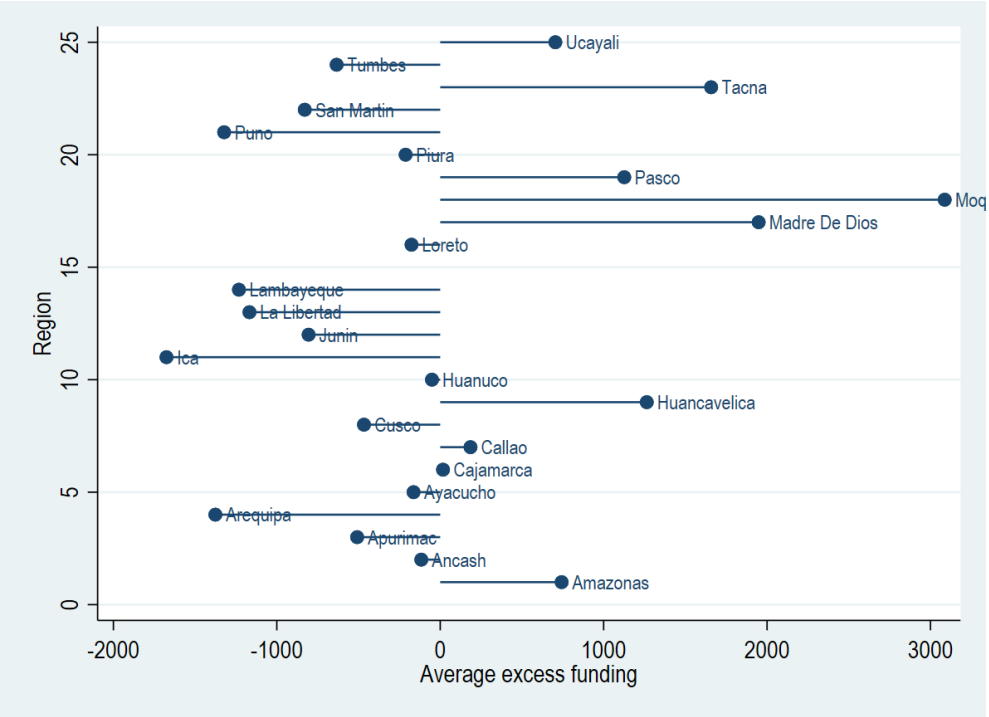
Table 3 Simple determinants of regional funding allocation across 24 regions, separately annually for years 2007-16

Dependent: Regional funding per pupil										
Panel A: Social determinants										
	% Urban		Expenditure p.c.		% Indigenous		Constant		Obs.	R2
	Coef.	T-stat	Coef.	T-stat	Coef.	T-stat	Coef.	T-stat		
2007	1,468.5	[0.4]	8.3	[0.8]	1,851.9	[1.3]	-63.8	[-0.1]	24	0.3
2008	6,182.4	[1.4]	-2.1	[-0.2]	2,480.6	[1.3]	-324.0	[-0.2]	24	0.3
2009	4,730.2	[1.0]	5.7	[0.5]	2,747.5	[1.2]	-1,053.0	[-0.6]	24	0.3
2010	4,264.1	[1.2]	2.4	[0.3]	3,259.1*	[2.1]	-471.3	[-0.4]	24	0.4
2011	-148.3	[-0.0]	6.0	[0.7]	1,958.8	[1.1]	2,211.8	[1.3]	24	0.1
2012	3,468.1	[1.0]	6.6	[1.1]	2,677.6	[1.6]	-419.4	[-0.3]	24	0.4
2013	6,613.1+	[1.8]	-0.7	[-0.1]	3,456.3+	[2.1]	125.4	[0.1]	24	0.3
2014	6,961.0	[1.7]	-4.3	[-0.6]	4,197.8*	[2.6]	1,591.7	[0.9]	24	0.4
2015	6,239.1	[1.2]	-2.7	[-0.4]	6,099.1**	[3.8]	1,588.7	[0.7]	24	0.5
2016	6,993.8	[0.8]	-2.8	[-0.3]	5,945.8*	[2.4]	1,824.0	[0.4]	24	0.3
Panel B: Resource determinants										
	Infrastructure		Teachers /100 pup		Schools /1000 pup		Constant		Obs.	R2
	Coef.	T-stat	Coef.	T-stat	Coef.	T-stat	Coef.	T-stat		
2007	896.0	[1.5]	1,322.5**	[3.3]	-20.3	[-0.2]	-5,273.5*	[-2.6]	24	0.7
2008	846.5	[0.7]	1,801.2*	[2.5]	-36.5	[-0.2]	-7,120.8+	[-2.0]	24	0.6
2009	1,125.0	[0.7]	1,730.6*	[2.1]	-138.7	[-0.5]	-7,048.0	[-1.2]	24	0.5
2010	631.7	[0.5]	1,629.5*	[2.4]	-103.4	[-0.5]	-5,427.1	[-1.3]	24	0.6
2011	1,254.2	[0.9]	1,299.3*	[2.1]	50.8	[0.2]	-7,445.3	[-1.4]	24	0.5
2012	-461.5	[-0.3]	1,781.2*	[2.4]	-409.0	[-1.5]	984.3	[0.2]	24	0.5
2013	-2,106.6	[-1.6]	2,698.8**	[4.3]	-688.4**	[-3.1]	4,953.5	[1.1]	24	0.6
2014	-1,756.0	[-1.7]	2,616.8**	[5.0]	-595.9**	[-3.2]	3,796.6	[1.0]	24	0.6
2015	-2,781.2*	[-2.3]	3,045.3**	[6.0]	-619.0**	[-3.7]	7,784.5+	[1.7]	24	0.7
2016	-3,520.3	[-1.6]	3,120.8**	[5.1]	-830.4**	[-2.9]	12,443.7	[1.2]	24	0.6

It is of interest to see which regions experience larger deviations from the predicted amount of funding based on infrastructure needs (Table 2, column 2), representing either excess or shortage of funds. To this end, we obtained the residuals from the model in Table 2, column 2, and averaged them over the years. This shows that the regions that received most 'excess' or 'discretionary' funding were Madre de Dios and Moquegua, obtaining about 2000-3000 more Soles annually per primary pupil, than predicted by the three existing school resources. Ica on the other hand, appears to be the most 'underfunded' region (Figure 2).

In Figure 3 we associate these excess funding amounts with the average household expenditure per person (left-hand image) and the share of indigenous population (right-hand image) in the region. Overall, there is only a weak relationship, and thus only weak evidence to suggest that poorer or more indigenous areas would receive more funding than justified by the basic school indicators. One outlier is the region of Huancavelica, where the majority of the population is indigenous, and which has a large value for estimated excess funding.

Figure 2 Average excess educational funding by region over 2007-2016



Notes: Positive values for the "average excess funding" indicate more funding than explained by needs based models.

Figure 3 Excess regional funding across regions over 2007-16, correlated with socioeconomic factors.

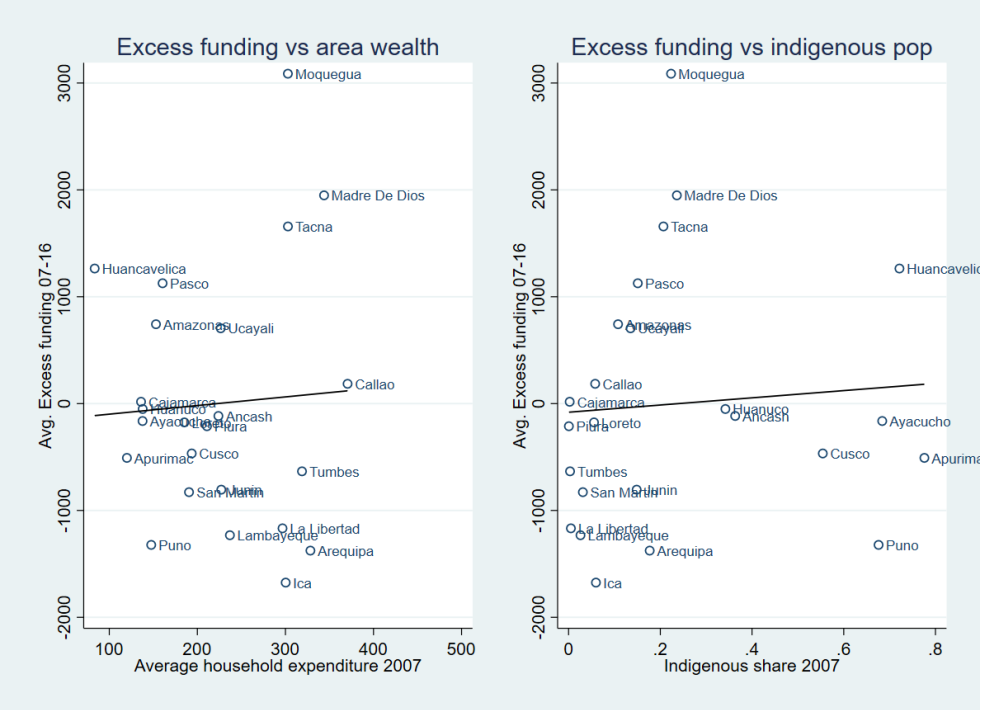
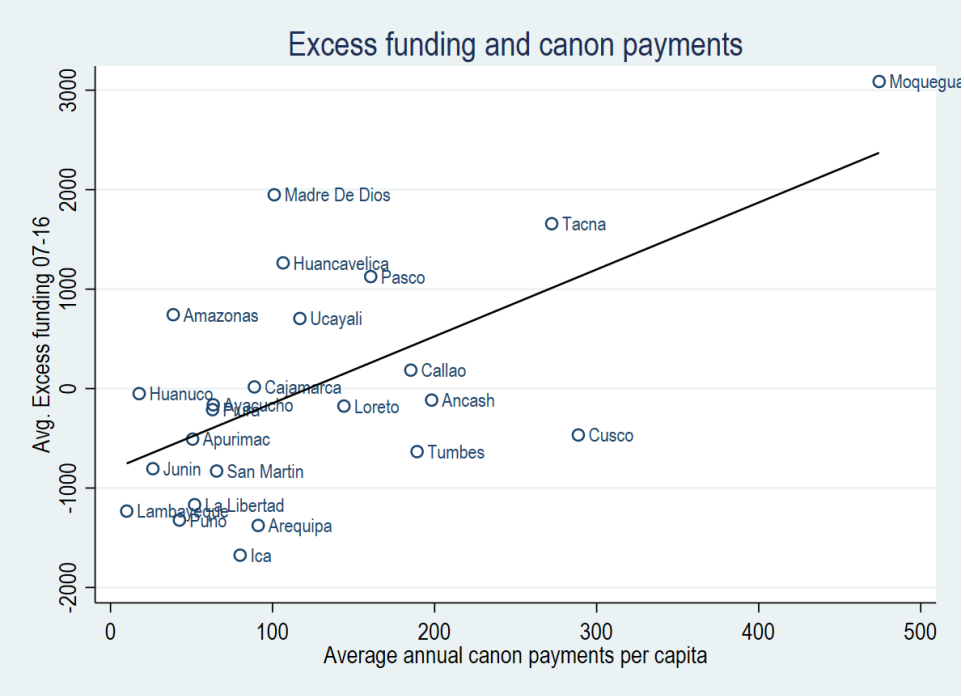


Figure 4 relates the estimated average excess funding to total per capita natural resource tax transfers for the regional government. This income is transferred by law from the state to the regional and local governments. There are five canons: the mining canon (exploitation of mineral, metallic and non-metallic resources), the hydroenergy canon (use of water resources in the generation of electrical energy), gas canon (exploitation of natural gas and condensates), the Fishing Canon (exploitation of hydrobiological resources) and the Forest Canon (rights to use forest products). [1] The figure suggests a positive relationship and could help explain to an extent the large excess funding to Moquegua and Tacna, but not necessarily that in Madre de Dios.

Figure 4 Excess regional funding across regions over 2007-16, correlated Regional canon payments per capita



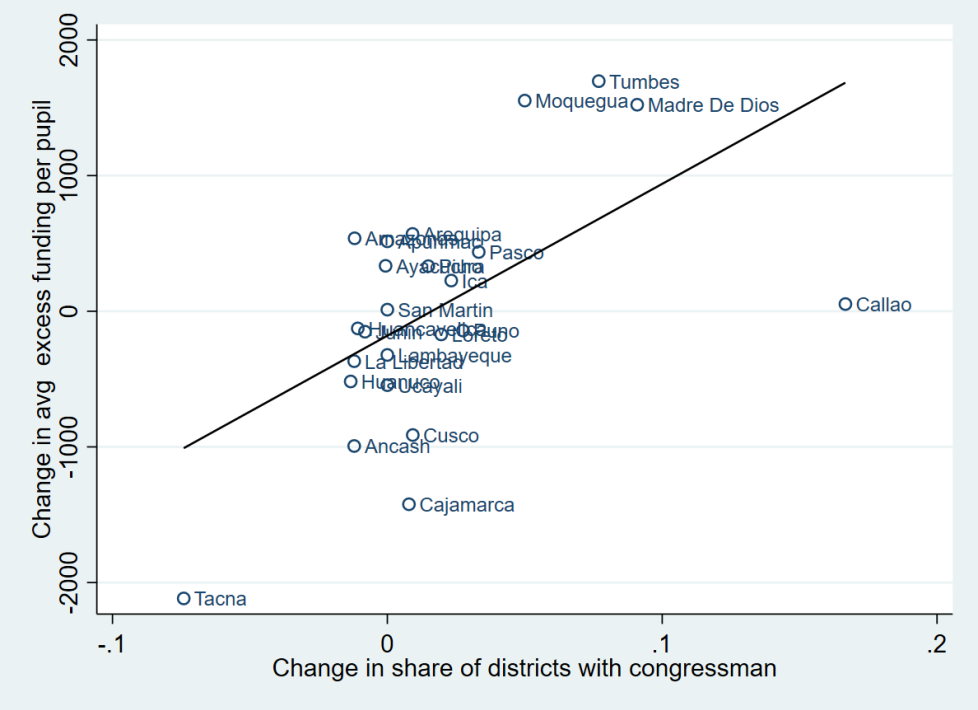
A further alternative to explaining large excess funding in a few regions could be political factors, or an influential regional governor. It should be noted that between 2011 and 2014, Martin Vizcarra, who later became the President of Peru, was elected Regional President (now governor) of Moquegua. During his period, he prioritized educational initiatives in his region and negotiated with the Central State /National Level in order to obtain more educational resource. (Paulino, G.E.**).**

In Figure 5, we relate changes in excess funding to the change in the share of districts within a regions with members of congress. The variable provides one indication of political representation. We will return to this variable and political analysis in more detail in the next

[1] https://www.mef.gob.pe/es/?option=com_content&language=es-ES&Itemid=100959&lang=es-ES&view=article&id=454

Section, but the figure shows a positive relationship, suggesting that some of the excess funding to Moquegua and Madre de Dios could have political motives.

Figure 5 Excess funding and change in in the share of districts with a member of congress



Notes: Panel data based on 24 regions and years 2007-16. 'Change in average excess funding per pupil' is computed by averaging the residual from model (2) in Table 2 for pre and post-2011 governments and computing the change.

4 Political influences on the regional education budget

In this section, we construct a number of variables describing the political status of regions over 2007-16. We then associate these political variables with the annual budget items for education in the regional budget. Since public schools in Lima are funded from the national rather than regional budget, Lima has been excluded from the analysis.

We have constructed a total of five political variables, which represent political alignment and representation. They are as follows: (1) Region's leading party in the regional elections is the same as the leading party in the national elections. This is binary variable that takes a value of zero or one for each region and year. Changes in the variable derive from regional or national elections. (2) Share of region's district where the leading local candidate is from the same party as the leading party in the national elections. This measure varies continuously between 0 and 1. These two variables measure whether some regions might be favorably treated by the main national party forming the government. (3) Whether the region's leading party is represented in the congress. This is a binary variable indicating whether the region's leading party has any members in the congress (as per the latest national election). (4) Share of regions districts that have a member of congress originating from that district. Since the electoral areas for members of congress are the regions, the number of members of congress per region are fixed. However, the distribution of members of congress within the region is not fixed. With more dispersion

of members of congress, a larger share of the districts may by empowered to pursue local interests via their member of congress. (5) The number of region's members of congress that serve in the budget commission. For this we count the so called 'main' and 'fixed' members, but not the ones in 'reserve' role. These members of congress are better connected than average in terms of budget influence. The political variables (3)-(5) aim to measure political representation of regions and their areas via the congress. We hypothesize that more representation could lead to more discretionary spending.

Table 4 below provides summary statistics for the annual budget data for education and political variables between 2007-16 the 24 regions, excluding Lima. We additionally have a breakdown of the budget for different categories, which are Infrastructure, Inputs, Wages, Educational programs, and Teacher training. Due to inconsistencies, we have excluded the data for years 2009-2011 for this categorization.

Table 4 Summary statistics of budget items and political variables 2007-2016, 24 regions, Soles

	Obs.	Mean	S.D.	Min	Max
Regional education budget per pupil	240	5063	2446	1430.8	16858
Region's leading party aligned to gov	240	0.038	0.190	0	1
Share of region's districts aligned to gov	240	0.058	0.075	0	0.25
Region's leading party represented in congress	240	0.067	0.250	0	1
Share of region's districts that have a member of congress	240	0.055	0.0826	0	0.5
Number of members of congress in budget commission	240	0.488	0.7202	0	3
Regional primary budget per pupil	168	4094	1809	1538.1	12008
Infrastructure budget per pupil	168	1163	1115	22.983	6536
Inputs budget per pupil	168	26	33	0	228
Wages budget per pupil	168	2650	952	1157.5	6063
Educ. programs budget per pupil	168	142	199	0	846
Teacher training budget per pupil	168	114	153	0	850

Notes: data excludes Lima, which is not funded via regional budget. For school budget, and the specific budget categories, years 2009-2011 are excluded due to data inconsistency.

We estimate a set of simple panel data fixed effects models in which the total funding and each budget category is regressed against a single political indicator of interest, with controls for year and region:

$$(1)\ \text{Budget}_{rt} = \alpha \text{Pol}_{rt} + \theta_r + \lambda_t + \varepsilon_{rt}$$

In the equation, the Budget_{rt} varies by region (r) and year (t) and can be either total education budget, or Infrastructure, Inputs, Wages, Educational Programs, or Teacher training. Wages and Infrastructure are the largest items, while the others are marginal, as shown by the summary statistics. The budget items are explained with region fixed effects (θ_r) and year effects (λ_t), and finally the political variable (Pol_{rt}), which is defined by year and region. The main parameter of interest is α, which is the one presented in the results tables.

The variation in the political variables derives from elections. The first two political variables that describe political alignment of the region with the national government, changes with each national or local election. The variables describing the congressional representation on the other hand, change only with the national elections in 2011. It should therefore be kept in mind, that with 24 regions and one electoral change, the statistical inference based on congressional representation is based on a fairly small amount of variation.

The results for the total regional education budget are presented in Table 5. Only one political result clearly stands out, the same that was depicted in Figure 5; funding appears to grow in regions which elect their members of congress from a wider selection of districts. There is also a weakly positive relationship (at 10% significance level) with funding and having the region's leading party aligned with the leading party in the country, and a similar weak relationship with having the region's leading party represented in the congress.

Table 5 Political determinants of regional education budget, 2007-16

Dependent: Funding per pupil	(1)	(2)	(3)	(4)	(5)
Region's leading party aligned with gov	749.3+ [1.7]				
Share of region's districts aligned to gov		-126.0 [-0.1]			
Region's leading party represented in congress			655.9+ [1.7]		
Share of region's districts that have a member of congress				6,101.6* [2.3]	
# of members of congress in budget commission					-87.7 [-0.8]
Year effects	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	240	240	240	240	240
R-squared	0.9	0.9	0.9	0.9	0.9

Notes: data excludes Lima, which is not funded via regional budget.

In Table 6 we use our self-calculated primary education budget categories. The disadvantage of this data is that we have less years, 2007-8 and 2012-2016, as we weren't able to carry out the categorization for the intermediate years 2009-2011 due to changes in definitions and data. For the available years however, we have computed budget items for five categories: Infrastructure, Inputs, Wages, Educational programs and teacher training. The summary statistics were provided in Table 4. The estimations in Table 6 measure the effects of the political variables to these specific budget items.

Table 6 Political determinants of regional primary education budget items, 2007-16

	(1) Infrast.	(2) Inputs	(3) Wages	(4) Programs	(5) Training
Region's leading party aligned to gov	191.6	18.7	148.6	17.5	47.9
	[0.5]	[1.2]	[0.6]	[0.3]	[0.9]
R-squared	0.8	0.5	0.8	0.9	0.7
Share of region's districts aligned to gov	-1,885.6	-126.8+	-537.5	-305.8	-131.9
	[-1.2]	[-1.9]	[-0.5]	[-1.4]	[-0.6]
R-squared	0.8	0.5	0.8	0.9	0.7
Region's leading party represented in congress	236.0	4.9	140.7	33.4	35.9
	[0.8]	[0.4]	[0.6]	[0.8]	[0.8]
R-squared	0.8	0.5	0.8	0.9	0.7
Share of region's districts that have a member of congress	10,751.9**	-137.9	-3,909.8*	267.1	-234.4
	[5.2]	[-1.4]	[-2.4]	[0.8]	[-0.7]
R-squared	0.8	0.5	0.8	0.9	0.7
# of members of congress in budget commission	-92.8	0.1	-8.5	-26.3*	-11.1
	[-1.1]	[0.0]	[-0.1]	[-2.2]	[-0.9]
R-squared	0.8	0.5	0.8	0.9	0.7
Year effects	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	168	168	168	168	168

Notes: data excludes Lima, which is not funded via regional budget. Years 2009-11 are excluded due to data inconsistency.

The results in Table 6 show that in the majority of cases, there are no significant relationships between the political variables and funding. However, one result stands out. The share of the region's districts that have a member of congress appears to be strongly positively associated with increased infrastructure funding and a reduced wage bill. The overall effect of the two items is still positive. Is this a large effect? On average only 6% of regions' districts have a member of congress, with a S.D. of 9%. So, if a region moves one standard deviation up, from 6% to 15%, the annual infrastructure funding would increase by about 10750*0.09 = 967 Soles per pupil, and wage bill would reduce by about 3900*0.09 = 351 Soles per pupil. The total budget would thus change about 600 Soles per pupil per year. This is not a large effect in the sense that it would explain the overall discrepancies in regional funding seen in Figure 2, but it is not trivial either.

Since the results in Table 6 are based on our self-coded budget data, a small number of observations, and only a single change of congress over the period 2007-2016, one should exercise caution with the interpretation. A natural way to test the robustness of the findings is to estimate the same models for actual school resources observed in the schools, and check whether they support the finding. The results are shown in Table 7. We test for the effect of political variables on four primary school resource indicators: new public primary schools (per 1000 pupils), discontinued schools (per 1000 pupils), the average school infrastructure, and the number of teachers per 100 pupils.

Table 7 Political determinants of key school inputs

	(1) New schools	(2) Closed schools	(3) Basic 5 infrastructure	(4) Teachers per 100 pup.
Region's leading party aligned to gov	-0.2	0.3	-0.1	0.3*
	[-1.3]	[1.4]	[-0.6]	[2.0]
R-squared	0.7	0.7	0.9	0.9
Share of region's districts aligned to gov	-0.1	0.4	0.3	0.4
	[-0.2]	[0.4]	[0.8]	[0.6]
R-squared	0.7	0.7	0.9	0.9
Region's leading party represented in congress	-0.1	0.1	-0.1	0.1
	[-1.1]	[0.4]	[-0.8]	[0.5]
R-squared	0.7	0.7	0.9	0.9
Share of region's districts that have a member of congress	1.4+	-4.1**	-1.6**	-4.0**
	[1.8]	[-3.3]	[-3.1]	[-4.3]
R-squared	0.7	0.7	0.9	0.9
# of members of congress in budget commission	0.0	-0.0	-0.0	-0.0
	[0.1]	[-0.3]	[-0.2]	[-0.8]
R-squared	0.7	0.7	0.9	0.9
Year effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Observations	216	216	240	240

Notes: New schools is calculated for years 2008 onwards and closed schools for until 2015 and therefore have fewer observations.

Interestingly, the models based on school resources appear to mostly support the findings obtained regarding the funding flows. Most relationships are not significant, but the Share of region's districts that have a member of congress stands out as generally having significant effects on resources. It is associated with an increase in the number of new schools and reduction in the number of closed schools, supporting the earlier findings on increased infrastructure spending. The reduction in spending on wages on the other hand is supported by a reduced numbers of teachers per pupil in column 4. However, there is also a negative effect on the average school infrastructure in column (3). This might be possible if the new infrastructure spending has been directed into new schools at the expense of upgrading of the existing ones.

The result with this particular political variable is intriguing, since we should remember that the number of members of congress per region stays fixed as they are supposed to represent the whole region. This variable thus measures how the members of congress are *dispersed* around the region. It is generally common that members of congress tend to come from larger cities and this tends to concentrate the members of congress to fewer districts. If a district has a number of successful candidates from more rural locations or smaller towns, the share of districts with a member of congress can increase. This can have consequences for the political

haggling of school resources, if the members of congress from smaller districts emphasize factors such as building of schools. Our results would support this interpretation.

The ultimate goal of the funding and the school network is learning. As the final piece of analysis, we estimate panel data models to test whether the 'excess funding' identified in the study might have consequences for learning. In Table 8, columns 1-2 show estimates of simple pooled OLS models, where the annual excess funding explains the normalized sum of combined reading and mathematics scores for second grade pupils. The scores are available annually between 2007-16.

Column 1 includes no control variables, apart from year dummies, while column 2 controls for the basic infrastructure, school and teacher inputs. These models do indeed suggest that larger excess funding would be associated with better learning. The estimated coefficients suggest that 1000 Soles more per pupil would be associated with 0.07 standard deviations better learning. However, the problem with these estimations is that unobserved regional characteristics could be driving this result. For example, population and geography across the regions are not comparable. In columns 3-4 we include regional fixed effects, and by doing that, control for all region-specific fixed characteristics. After this adjustment, additional funding, or changes in funding no longer lead to changes in learning outcomes.

Table 8 Excess funding and learning

	Learning z-score			
	[1]	[2]	[3]	[4]
Excess funding (S)	0.00007*	0.00007**	-0.00002	-0.00002
	[2.21805]	[3.25934]	[-1.21915]	[-1.25325]
Basic 5 Infrastructure		1.05701**		-0.23485*
		[8.01568]		[-2.59634]
Teachers per 100 pupils		0.03255		0.23293**
		[0.49933]		[3.93049]
Schools per 1000 pupils		0.01584		-0.22829**
		[0.68869]		[-5.61478]
Year Effects	Yes	Yes	Yes	Yes
Region Fixed Effects	No	No	Yes	Yes
Observations	240	240	240	240
R-squared	0.52239	0.78171	0.95355	0.96038

Notes: Panel data based on 24 regions and years 2007-16. 'Excess funding' is the residual from model (2) in Table 2.

A cautious interpretation of these results is that the large improvements in Peruvian education have been systemic, taking place across regions, irrespective of the existing regional variations in funding. This is not necessarily a controversial result, because numerous studies have found that many school resources may not have a large impact on pupil learning.

5 Conclusions

A key aim of public school systems is to provide equality of opportunity to citizens irrespective of their background. Regional inequalities are one dimension in which this equality of opportunity may or may not materialize.

Over the examined period, developments in Peru have been positive. Learning outcomes have improved with broad-based educational reforms. In this study, we examined regional inequalities in educational budgets.

We propose a simple model to 'predict' the regions' educational funding as a function of the quality of the existing school infrastructure, numbers of schools and teachers. We have approximated the level of school resources with data on primary school resources. We find that these variables successfully explain a large share of the regional education budgets, and that over time, these factors are more consistently associated with funding. This suggests that the regional funding of education has become more needs based over time. The reason for this is likely to be found from the educational initiatives started during governments of 2006-11 and 2011-16, which at least partly put emphasis on improving rural education.

However, there is also role for discretion in the budget, which we suggest is partly due to natural resource rich areas receiving more funds ('canon' payments), a deliberate effort to target traditionally more disadvantaged areas, in particular by a President who comes from such an area and political lobbying.

We run a number of tests to examine whether the political configuration between regions and the central government, and the representation of regions in the congress affect funding for education. Generally, we find relatively little to report, which should be interpret as a positive sign, indicating that educational funding is mostly under centralized bureaucratic rather than under discretionary political control. This could also be explained by the fact that Peru has a weak part system, and traditional models of distributive politics may not hold. However, we do find that the dispersion of members of congress within regions is associated with funding flows. This implies that if the region's members of congress originate from a broader set of districts, the overall budget for education is significantly larger, favoring infrastructure spending as opposed to teacher salaries. Due to the shortness of the political time-series, this result is speculative, but may point to influence of individual members of congress on infrastructure initiatives across regions. There is also a connection between our estimated increased 'excess' funding' in a region and an increase in the share of districts in a region with a member of congress, which might explain larger funding to regions such as Madre de Dios and Moquegua.

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