ONLINE APPENDIX FOR:
City Size and Public Service Access:
Evidence from Brazil and Indonesia

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I. MODELS AND ANALYSIS

We estimate ordinary least squares regressions for each country for two sets of dependent variables: divisible and networked public goods. We transform our measures for divisible public goods (schools, health clinics, doctors) to per capita counts. The dependent variables capturing access to networked public goods (electricity and water access) are measured in percentage terms (i.e., the percent of household access). Our main independent variable of interest is city population, which we include in our main models as a continuous variable. Following convention, we log population size to normalize its distribution.[1] Our main results present conventional standard errors, although our estimates are similar if we cluster our standard errors at the state (or province) level. We include a four types of control variables to rule out theoretically motivated alternative explanations:[2]

- First, we include control variables that help one distinguish between the effect of city size and other aspects of the urbanization process. We control for settlement population density, as well as the population growth rate over the previous ten years. Classic texts in the social sciences (e.g., Huntington, 2006) as well as the urban studies literature (e.g., Ladd, 1992) have identified these two factors as relevant for the provision of public services.

- Second, we also include controls for diversity, as a large body of scholarship suggests that ethnic diversity negatively affectively public goods provision (e.g., Alesina et al., 1999; Habyarimana et al., 2009; Tajima et al., 2018).[3] We operationalize this variable differently in each case, so as to capture the main the most relevant and salient cleavages in each country. In Brazil, we measure racial fractionalization; in Indonesia, we measure religious fractionalization.

- Third, our models also control for the degree of economic development. There is good reason suspect that settlements with wealthier populations will likely have higher levels of local public goods provision due to greater tax revenue. In Brazil and Indonesia, we include control variables that measure the average level of household income per month, and the percent of residents in the city that are literate.

- Fourth, we include political variables. A growing literature in political science has identified partisan alignment, on the one hand, and partisan competition, on the other, as important factors that generate a greater provision of public goods in certain communities (e.g., Cleary, 2007; Rosenzweig, 2015). In Brazil, we include a measure of electoral competition, as measured by party fractionalization in the first round of mayoral voting in the 2009 municipal elections. We also include a measure that captures the partisan alignment of provincial governors and mayors, with the expectation being that such alignment could increase cash transfers. In Indonesia, we include a party fractionalization index, based on the 2009 local council elections (DPRD-II).

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[1] We use an ordinal measure for city size categories in supplemental analyses, which yield similar results.
[2] The variables are broadly consistent across all three cases but include important differences due to both data availability and relevance.
[3] For all measures, we create a Herfindahl index to reflect the degree of "ethnic monopolization."

II. SUPPLMENTAL PUBLIC GOODS ANALYSIS
Table I. Relationship Between City Size and Public Goods, Brazil, Metro Split Sample

	Dependent variable:									
	Community Health Centers		Schools		Doctors		Electricity Access		Water Access	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
City Size (log(population))	-0.049***	-0.058***	-0.192***	-0.103***	-1.552***	-2.068***	0.008	-0.233***	-1.368***	-2.670***
	(0.004)	(0.005)	(0.023)	(0.021)	(0.132)	(0.144)	(0.031)	(0.039)	(0.211)	(0.237)
Growth (%, 2001-2011)	-0.064*	-0.086**	-0.252	-0.288*	4.022***	3.169***	-0.189	-0.603**	-11.352***	-11.036***
	(0.030)	(0.031)	(0.183)	(0.118)	(1.038)	(0.803)	(0.246)	(0.221)	(1.656)	(1.327)
Density (1000/km2)	-0.001	-0.022	0.014	-0.431*	0.172	2.141	0.003	1.567***	-0.098	2.711
	(0.003)	(0.046)	(0.020)	(0.176)	(0.111)	(1.195)	(0.026)	(0.329)	(0.176)	(1.971)
Racial Diversity Index	0.162***	-0.142*	0.897***	0.452*	-9.066***	-11.108***	-0.367	-1.419***	-8.057***	-20.448***
	(0.041)	(0.059)	(0.252)	(0.226)	(1.426)	(1.539)	(0.338)	(0.423)	(2.275)	(2.538)
Average Monthly Income	-0.00002	-0.0002*	-0.0001	-0.002***	0.003***	0.002	0.001**	0.004***	0.008***	0.033***
	(0.00003)	(0.0001)	(0.0002)	(0.0002)	(0.001)	(0.002)	(0.0002)	(0.0005)	(0.002)	(0.003)
Illiteracy Rate	0.006***	0.001	0.035***	0.022***	0.211***	0.086*	-0.046***	-0.034**	-0.655***	-0.528***
	(0.001)	(0.001)	(0.005)	(0.006)	(0.030)	(0.038)	(0.007)	(0.010)	(0.049)	(0.062)
Electoral Competition Index	0.091**	0.005	0.370	-0.094	4.072***	0.617	-0.019	0.569	0.767	3.720
	(0.034)	(0.052)	(0.212)	(0.200)	(1.202)	(1.362)	(0.285)	(0.375)	(1.917)	(2.250)
Partisan Alignment (0/1)	0.011	-0.029*	0.001	-0.087	-0.441	0.354	0.019	0.019	-0.674	-0.176
	(0.010)	(0.013)	(0.063)	(0.049)	(0.356)	(0.337)	(0.084)	(0.092)	(0.567)	(0.554)
Constant	0.593***	1.030***	2.063***	2.642***	24.399***	33.737***	99.763***	100.215***	116.239***	118.025***
	(0.052)	(0.076)	(0.320)	(0.291)	(1.812)	(1.986)	(0.430)	(0.544)	(2.891)	(3.265)
Cluster SE?	No	No	No	No	No	No	No	No	No	No
Metro Area?	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Observations	568	863	568	870	568	861	568	870	568	870

Note: $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p<0.001$

Figure I. Relationship Between City Size and Public Goods, Brazil, Metropolitan Area Subset
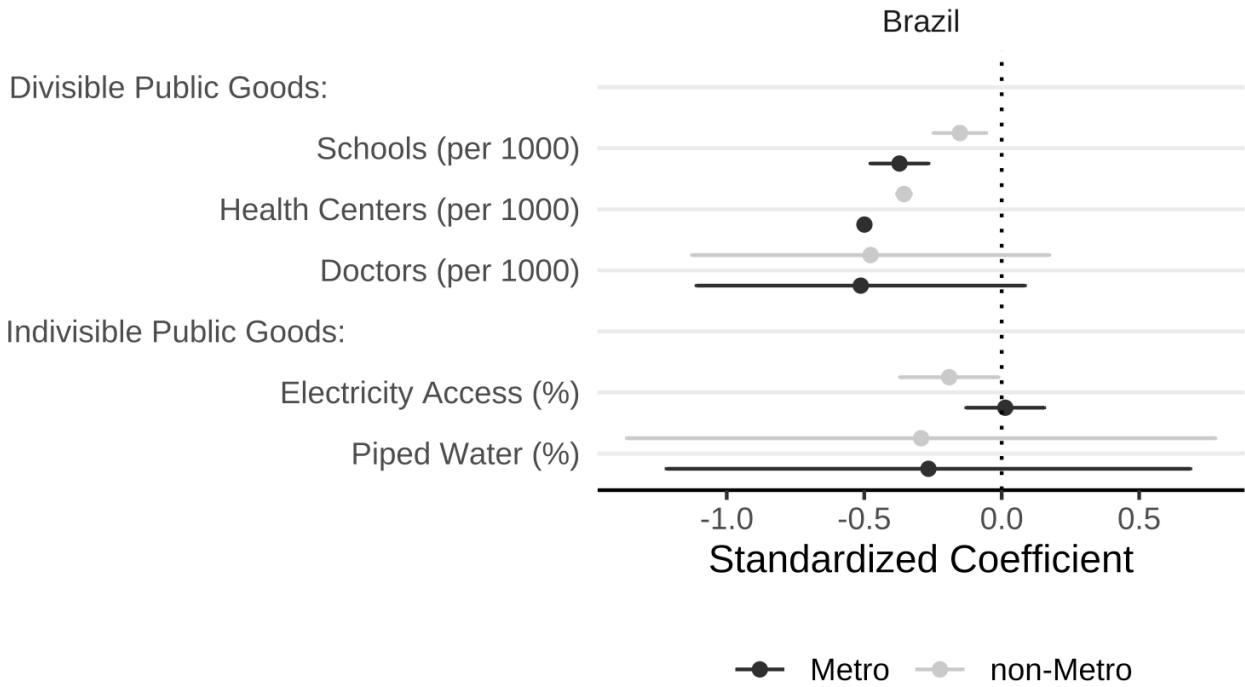
Note: Both panels show the standardized coefficients of the relationship between logged city size and provision of local basic services. Divisible public goods are measured in per capita counts, while indivisible public goods are measured in percentage point access. Data sources can be found in Table 1 of the online appendix.

Table II. Relationship Between City Size and Public Goods, Brazil, Interaction Models

	Doctors	Teachers	Health Centers	Schools	Electricity	Water
Population (logged)	-3.3***	-14.4*	-0.1***	-0.1	-0.0	-0.1***
	(0.9)	(6.6)	(0.0)	(0.1)	(0.0)	(0.0)
Partisan Fractionalization	9.3	-25.3	-0.1	2.5+	0.0	-0.1
	(8.6)	(61.3)	(0.3)	(1.3)	(0.0)	(0.1)
Population X Fractionalization	-1.5	4.3	0.0	-0.5+	-0.0	0.0
	(1.9)	(13.3)	(0.1)	(0.3)	(0.0)	(0.0)
Num.Obs.	1499	1034	1509	1509	1509	1509
R2	0.315	0.124	0.320	0.344	0.241	0.505
Controls	Yes	Yes	Yes	Yes	Yes	Yes

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table III. Relationship Between City Size and Public Goods, Indonesia, Interaction Models

|	Doctors	Teachers	Health Centers	Schools	Electricity	Water
Population (logged)	0.3	-12.1***	-0.1**	-0.6***	0.1	-0.1
	(0.4)	(2.8)	(0.0)	(0.1)	(0.1)	(0.2)
Partisan Fractionalization	29.0+	-246.1*	-0.3	-8.6	3.2	0.9
	(15.4)	(120.3)	(2.1)	(6.2)	(3.5)	(8.2)
Population X Fractionalization	-4.8+	43.8+	0.1	1.6	-0.4	-0.3
	(2.9)	(22.4)	(0.4)	(1.1)	(0.7)	(1.5)
Num.Obs.	74	73	74	74	74	70
R2	0.252	0.598	0.608	0.661	0.285	0.198
Controls	Yes	Yes	Yes	Yes	Yes	Yes

+ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure II. Educational Quality and Municipal Population (Brazil), 2011
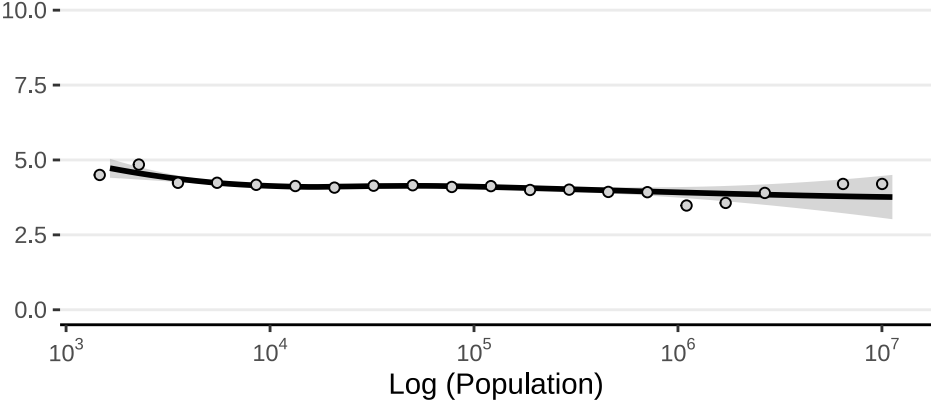
Notes: Basic Education Development Index (IDEB) scores were collected in 2011 by the National Institute for Educational Studies (INEP). Data are drawn from the school census, and from performance averages obtained through standardized examines.

Figure III. Conditional Association Between City Size and Local Public Goods (Indonesia), Budget Controls
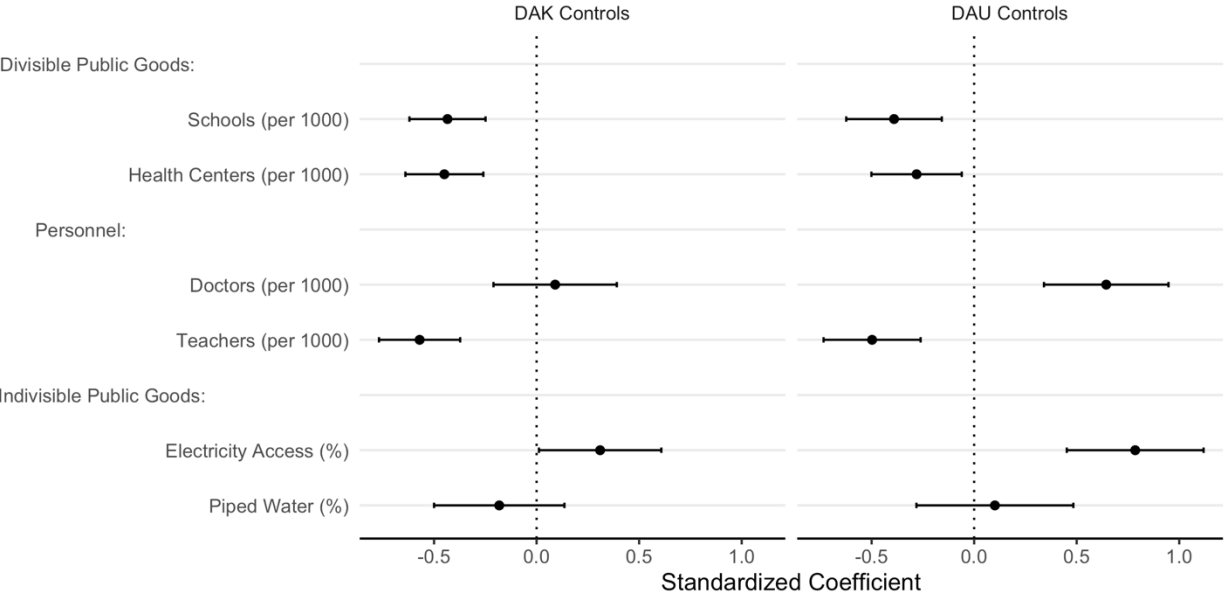
Note: Both panels show the standardized coefficients of the relationship between logged city size and provision of local basic services, with per capita central government transfers used as a control variable. Divisible public goods are measured in per capita counts, while indivisible public goods are measured in percentage point access.

Figure IV. Time Spent Traveling to School by City Size, Indonesia, 2014.

Distance to School (minutes), Indonesian Cities, By Population (logged, 2014)
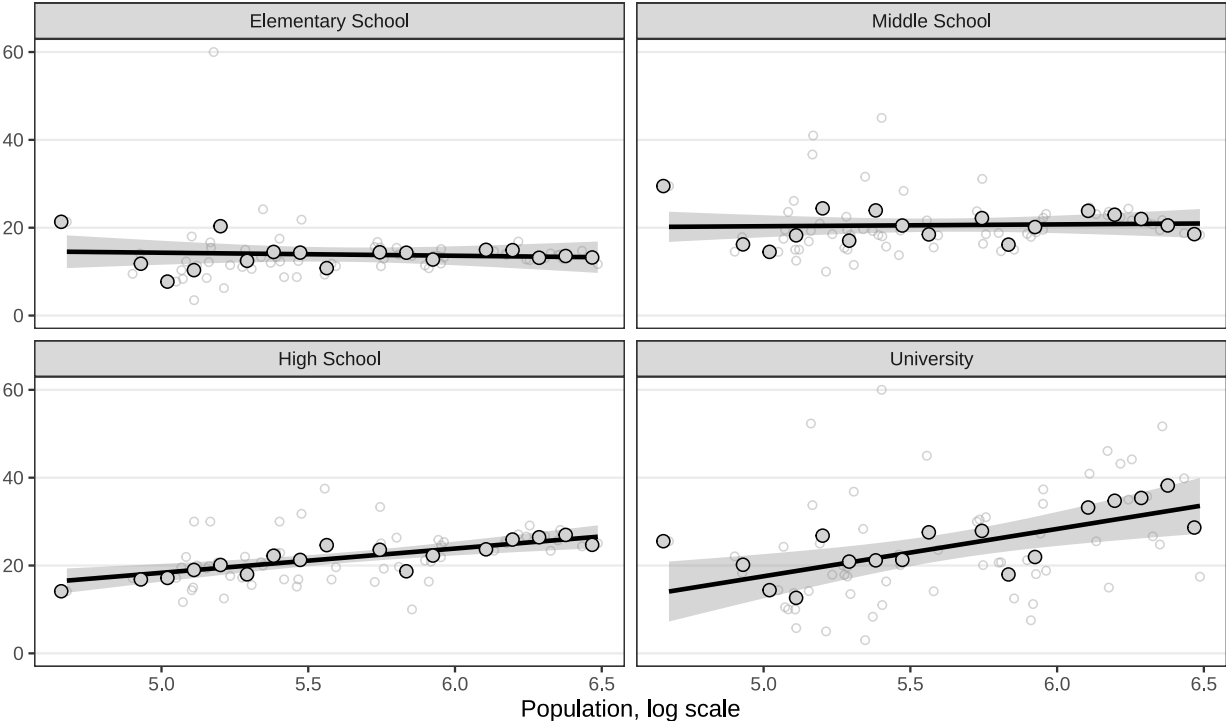
Note: Data from the Indonesian Family Life Survey, conducted in 2014. School-aged respondents were asked how much time they spent travelling to and from school in minutes, on average.

Figure V. Children's Polio Vaccination Rates, Brazil (2019) and Indonesia (2014), by City Size.
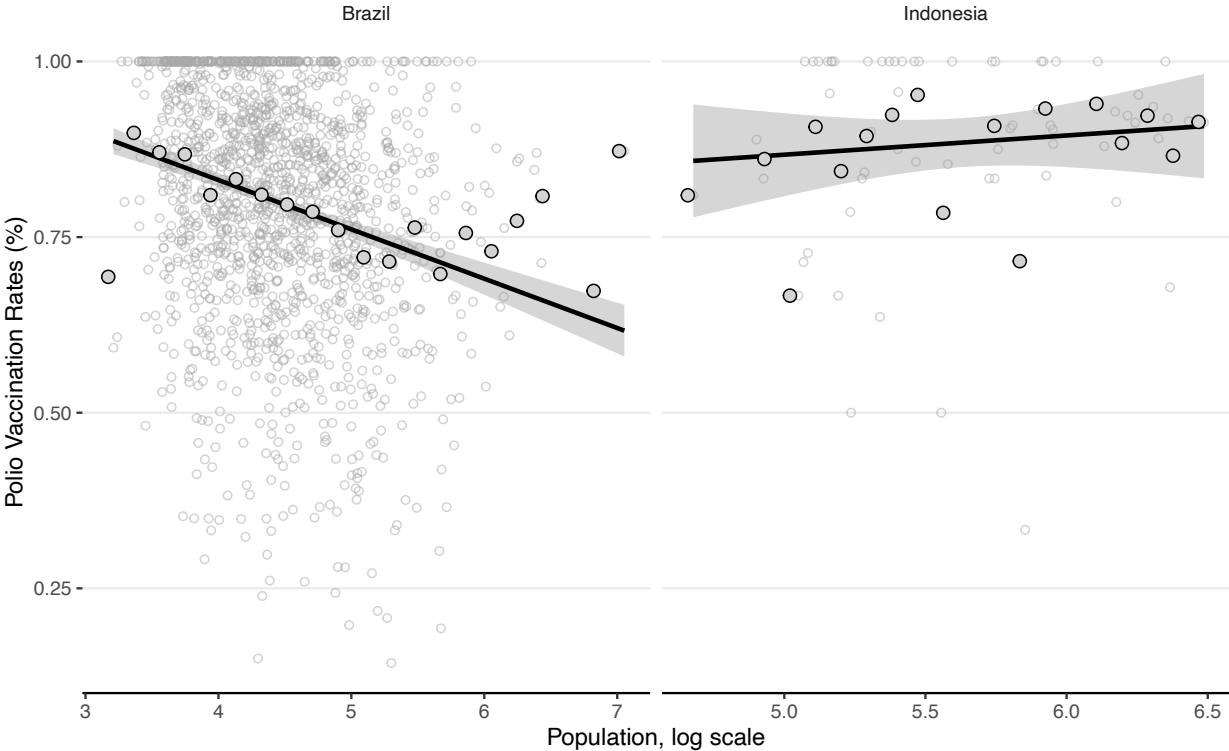

Notes: Brazil data provided by IBGE for children under the age of four in 2019. Indonesia data comes from the Indonesian Family Life Survey for all children under the age of 18 for 2014.

Figure VI. National Exam Scores, Brazil (2019, IDEB) and Indonesia (2015, UN), by City Size.
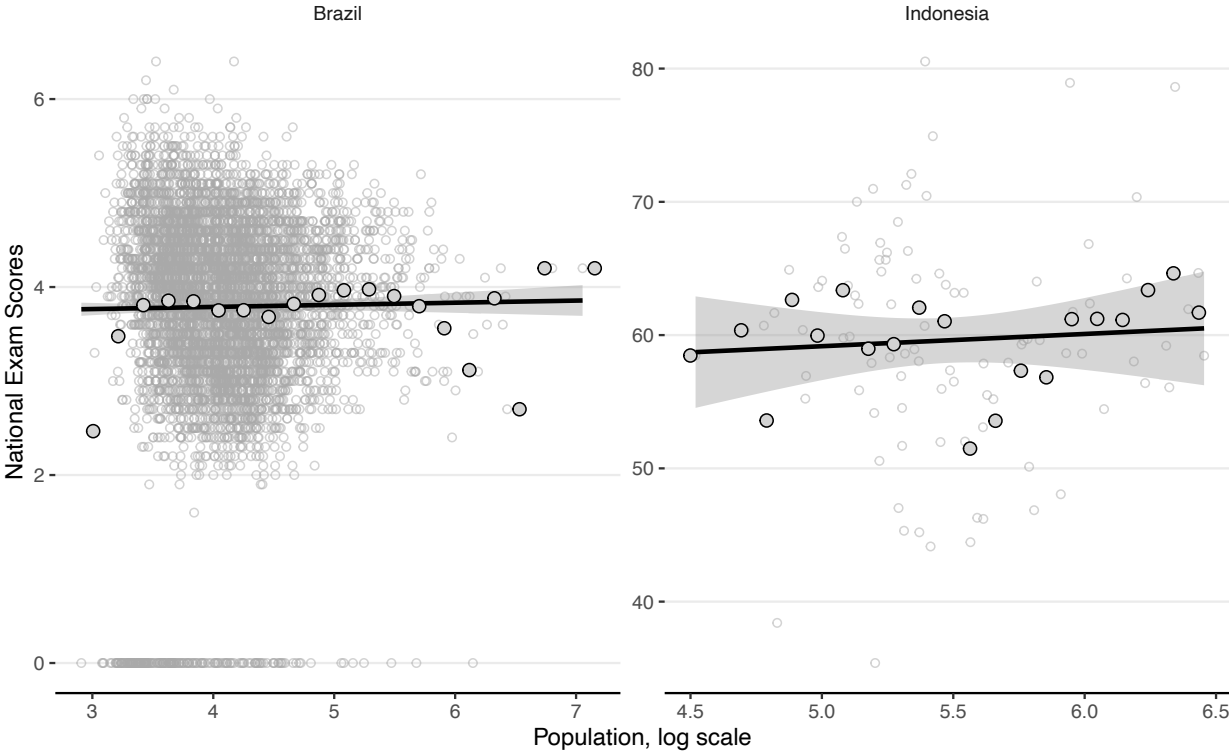
Notes: Brazil data provided by *Censo Escolar*, for all schools reporting IDEB scores. Indonesia data comes from the Ministry of Education reports of average Ujian Nasional (National Exam) scores for 2015.

Figure VII. Public Schools per Capita, by City Size and Type of School, Indonesia.
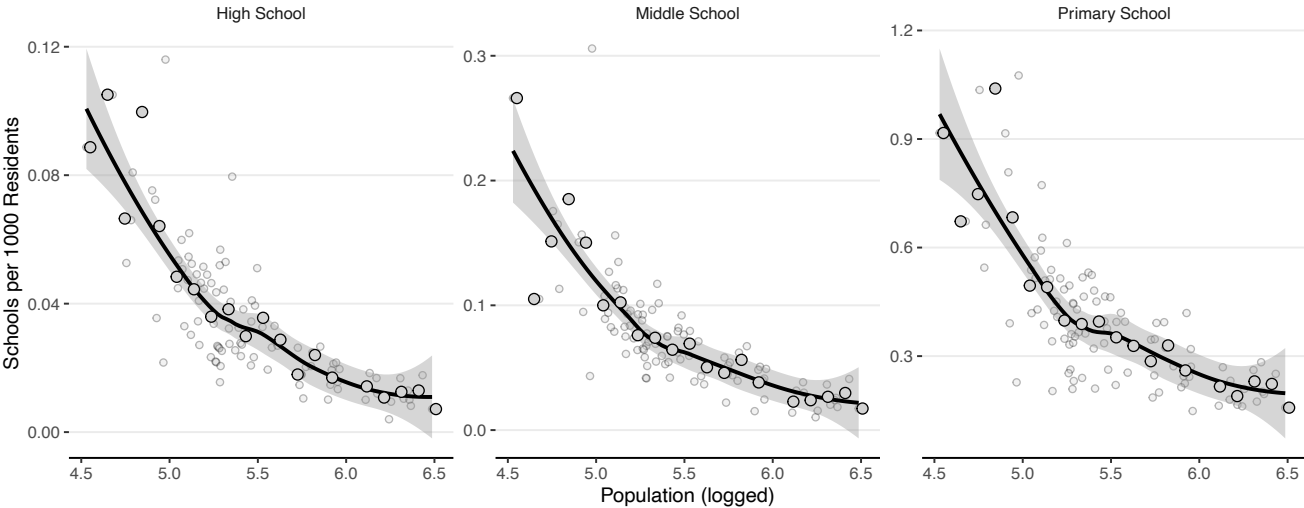
III.   Distance Analysis for Brazilian Case Studies

To assess whether or not residents of Pederneiras needed to travel shorter distances to reach basic health clinics than residents of Sorocaba, we developed a method that drew upon government-provided GPS coordinates for primary health care clinics (UBS and USF). We describe our approach here. Replication code for our analysis will be available through Dataverse, stored with other replication files and data for our paper.

Our first step was to identify the portion of the municipality where individuals lived. Brazilian municipalities typically contain rural as well as urban areas. Given that just a tiny fraction of the population lives in rural areas, we focused our analysis on urbanized portions of the municipality. To do this, we first obtained shape files for each municipality. We then created a separate shape/kml file that traced the border of the "urban extent," or the urbanized area within the municipality, in Google Earth Pro. Both files were loaded into QGIS and exported as shape files, and were imported into R. The urban extent was then superimposed over the municipal boundary. The intersection of the two shapes was then calculated.
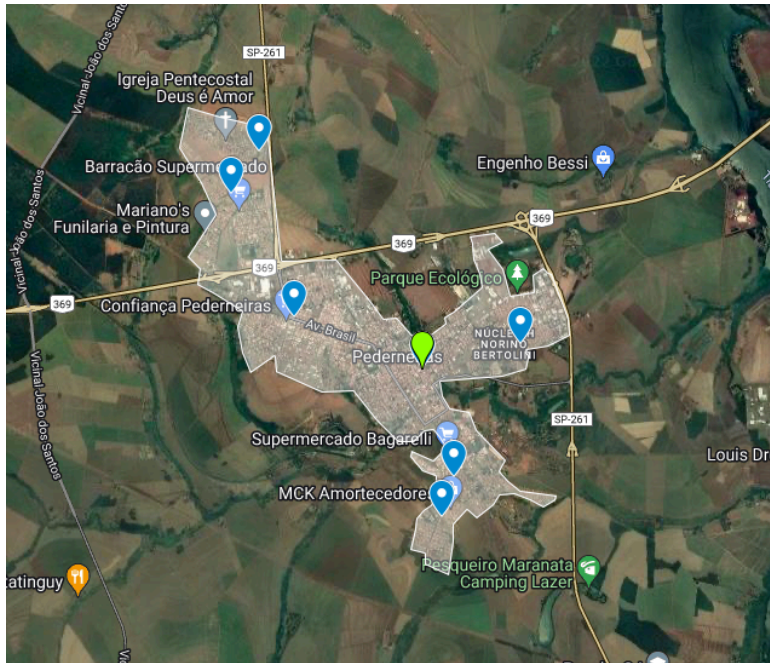

Figure VIII. Urban extent for Pederneiras (area shaded in white, with white boundary)

A grid with cells of varying sizes (0.001 degrees per side in the first iteration, 0.005 degrees per side in the second, 0.01 degrees per side in the third) was then overlaid over the portion of the urbanized area. We then calculated the centroid of each grid cell.

Figure IX. Grid cells of 0.005 degrees (0.239 sq kms) superimposed over the urbanized portion of Pederneiras

We next imported the GPS coordinates for clinics in Brazil based on data from the municipalities (cross-checked with maps), and plotted the clinics in both cities. (We focused on UBS and USF constructed by 2013, for consistency with the broader data analysis on the presence of clinics throughout Brazil. This yielded 11 clinics for Pederneiras and 30 for Sorocaba.)

This provided us with the data needed to calculate the distance between each centroid and each clinic. We then obtained the distance to the closest clinic for each centroid, and calculated the mean and standard deviation. Our results were robust to different grid cell widths across the two locations.

Table IV. Average Distances to Basic Health Clinics by Grid Cell Size

	Grid Cell Width (in degrees)	Mean distance from centroids to closest clinic (km)	Standard deviation (km)
Pederneiras	0.001	0.69	0.33
	0.005	0.75	0.36
	0.01	0.76	0.39
Sorocaba	0.001	1.20	0.80
	0.005	1.26	0.84
	0.01	1.31	0.84

IV. Interview Procedures for Brazilian Case Studies

Sampling Frame:

Our aim was to understand the political influences upon education and health policy at the municipal level. We therefore approached the following individuals in each city: a) the mayor; b) the chair of the city council; c) additional city councilors chairing or serving as members of the health and education commissions in the city council, from a range of different political parties (aim: 2 out of 9 for Pederneiras and 2 out of 20 for Sorocaba); d) the municipal health and education secretaries, and other bureaucrats suggested by interviewees (e.g. planning secretary in Sorocaba); e) members of the city's participatory councils for health and education, if such councils appeared to exist and be active (assessment based on council websites). In the case of the smaller city of Pederneiras, it did not appear that a health or educational council was sufficiently active to warrant pursuing an interview. The names and contact information for the offices of each of these individuals were possible to obtain through city government websites and through phone calls.

Format and Length of Interviews:

Interviews lasted between 1 and 2 hours, and were conducted in-person in interviewee offices. In some cases, press agents observed the interviews (noted in the table). A translator and research assistant, XXXX (a university of Sao Paulo masters student), attended and participated in each of the interviews. In each case, a list of questions had been prepared beforehand. Questions focused on the main sorts of issues voters tended to bring to elected officials, public spending priorities within the city, and the presence and influence of non-state providers of education and health services. Based on responses to these questions, follow-up questions were asked for clarification purposes.

Recording method:

XXX and AUTHOR took detailed notes during the interview, and worked together to type up these notes immediately following the interviews. Inconsistencies were discussed and reconciled during these sessions.

Table V. Interview Methods Table

Interviewee and political party (if relevant)	Status	Source	Saturation	Format + Location	Length	Recording	Transcript
Location 1: Pederneiras							
Mayor (PMDB)	Conducted in person, in presence of press secretary, with translator on 11/20/2018	Sample frame	Yes	Semi-structured, in mayor's office	70 minutes	Concurrent notes & supplementary notes within 4 hours	Yes
Municipal Secretary of Education	Conducted in person, with translator on 11/19/2018	Sample frame	Yes	Semi-structured, in secretary's office	80 minutes	Concurrent notes & supplementary notes within 6 hours	Yes
Municipal Secretary of Health	Conducted in person, with translator on 11/20/2018	Sample frame	Yes	Semi-structured, in secretary's office	90 minutes	Concurrent notes & supplementary notes within 2 hours	Yes
City Council President (PSDB)	Conducted in person, with translator on 11/19/2018, in presence of press secretary	Sample frame	Yes	Semi-structured, in council office	120 minutes	Concurrent notes & supplementary notes within 2 hours	Yes

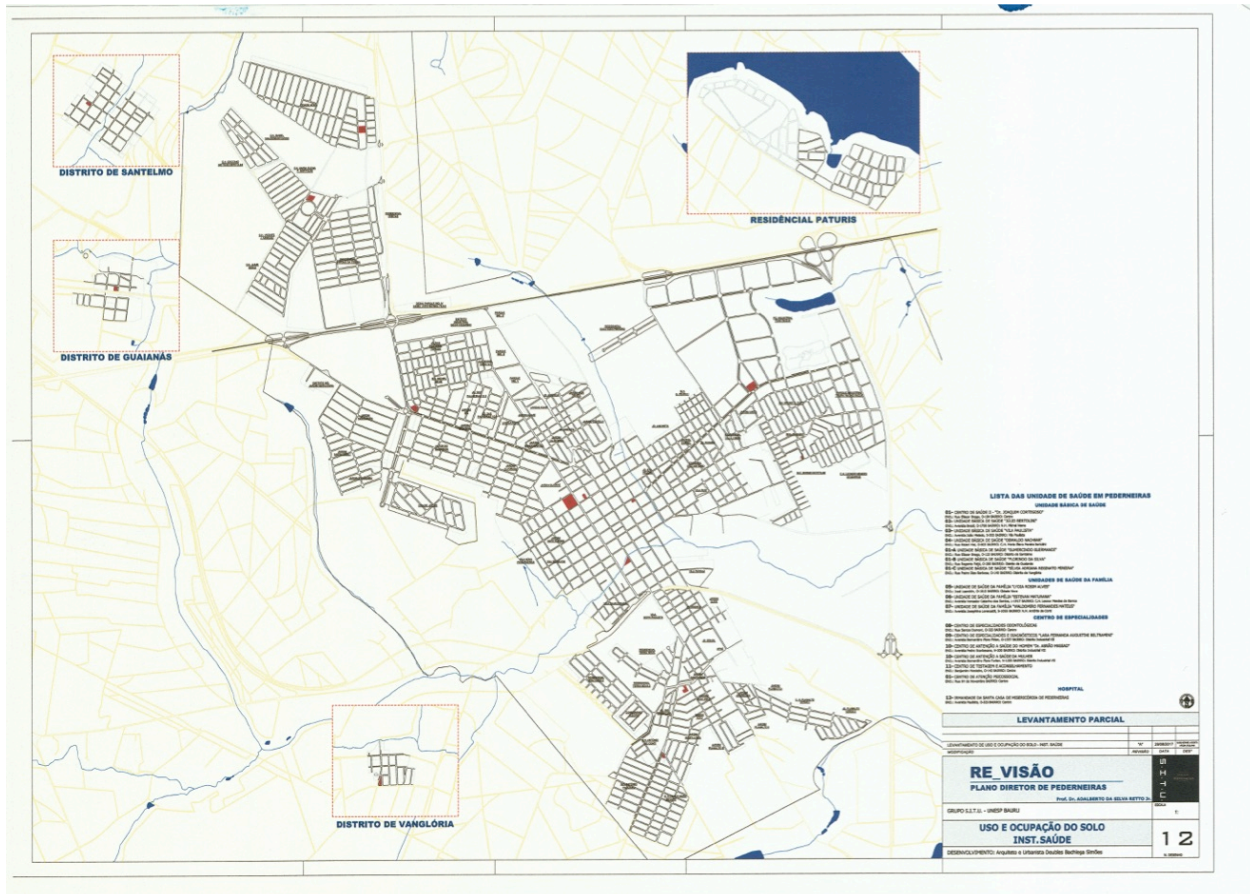| City Councilor (PRP)	Conducted in person, with translator on 11/19/2018, in presence of press secretary	Sample frame *(Recommended by staff assistant for council based on health expertise)*	No	Semi-structured, in council office	90 minutes	Concurrent notes & supplementary notes within 2 hours	Yes
City Councilor (PMDB), Member of Education and Health Commission	Conducted in person, with translator on 11/19/2018, in presence of press secretary	Sample frame	No	Semi-structured, in council office	60 minutes	Concurrent notes & supplementary notes within 2 hours	Yes
City Councilor (PV), President of Health, Education, Culture, Recreation and Tourism Commission	City council assistants recommended interviewing other councilors instead, due to experience with health and education affairs.						
City Councilor (PSB)	City council assistants recommended interviewing other councilors instead, due to experience						

	with health and education affairs.						
Location 2: Sorocaba							
Mayor	Invitation declined due to scheduling conflicts. Suggested meeting with the Secretary of Planning and Projects.	Sample frame	No				
Municipal Secretary of Planning and Projects	Conducted in person, with translator on 11/22/2018. City ombudsman joined the interview partway through the session.	Sample frame	Yes	Semi-structured, in secretary's office	90 minutes	Concurrent notes & supplementary notes within 2 hours	Yes
Municipal Secretary of Education	Conducted in person, in presence of one of education supervisors, with translator on 11/22/2018	Sample frame	Yes	Semi-structured, in secretary's office	90 minutes	Concurrent notes & supplementary notes within 2 hours	Yes

Municipal Secretary of Health	Interview arranged, but took place with Vice-Secretary instead, in presence of one of advisors, + with translator on 11/22/2018	Sample frame	Yes	Semi-structured, in secretary's office	80 minutes	Concurrent notes & supplementary notes within 4 hours	Yes
City Council President (DEM)	Conducted in person, in presence of 5 press officers + staff, with translator on 11/23/2018	Sample frame	Yes	Semi-structured, in council office	60 minutes	Concurrent notes & supplementary notes within 6 hours	Yes
City councilor (PSB, President of Education Commission)	Conducted in person, in presence of one aide, with translator on 11/22/2018	Sample frame	No	Semi-structured, in council lobby	40 minutes	Concurrent notes & supplementary notes within 2 hours	Yes
City councilor (PSB, Member of Health Commission)	Conducted in person, with translator on 11/22/2018	Sample frame	No	Semi-structured, in council office	80 minutes	Concurrent notes & supplementary notes within 8 hours	Yes
City Councilor (PCdoB), President of	Interview arranged, but later cancelled due to						

| Public Health Commission	schedule. Put us in touch with other councilor who served as member of Public Health Commission.						
Members of Participatory Council for Education (President + 2 additional members)	Conducted in person, with translator on 11/23/2018	Sample frame	No	Semi-structured, in participatory council office	90 minutes	Concurrent notes & supplementary notes within 4 hours	Yes

V. Additional Figures for Brazilian Case Studies

Figure X. Map of Municipal Health Clinics in Pederneiras, 2017 (red)

Source: Pederneiras municipal administration

Figure XI. Map of Educational Establishments in Pederneiras, 2017 (yellow)

Source: Pederneiras municipal administration

Figure XII. Centro de Atenção a Saúde da Mulher, Pederneiras (founded 2007)
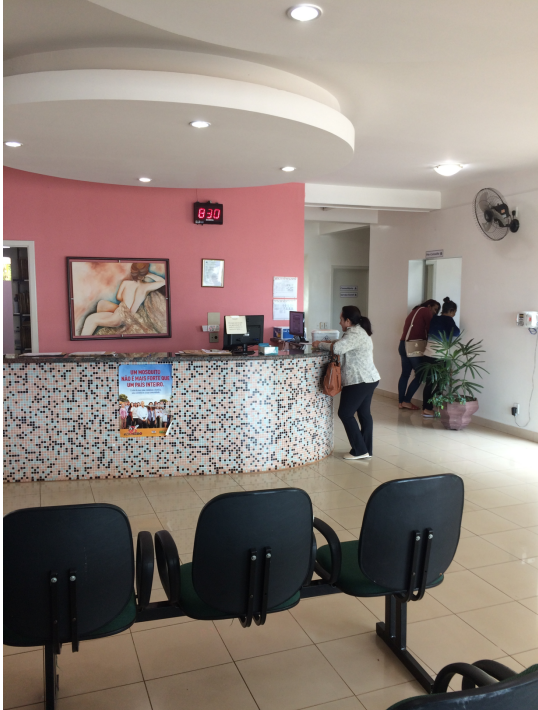
Note: Photo by AUTHOR, Pedeneiras, November 2018

Figure XIII. Sorocaba Clinic in Need of Automation and Repair

Photo by AUTHOR, Sorocaba, November 2018

VI. Works Cited:

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