The effect of publicly provided health insurance on academic performance in Mexico

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Abstract

In this paper we study the causal effect of a large expansion of publicly provided health insurance on children's academic performance using the case of Mexico. In general, access to free health insurance could improve education outcomes directly by making household members healthier or indirectly by raising the amount of resources available for education expenses. Using a panel of municipalities from 2007 to 2009, we find that the expansion of the Mexican public health insurance program, Seguro Popular, had a positive, statistically significant effect on standardized test scores of primary school children.

Keywords: Health insurance, Public health, Seguro Popular, Mexico, Education, Test scores.

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1. Introduction

Access to free health insurance could have a positive effect on education, which in turn is a relevant determinant of growth and economic development. The most direct channel through which access to publicly provided health insurance could improve education is through better health. Healthier parents and children could lead to higher school enrollment and attendance and to an increase in effective study time. Indeed, evidence from various countries has shown that better health leads to improved education outcomes (see Miguel (2005) for a review). Some important studies in this area include Glewwe et al. (2001) who, using a longitudinal data set for the Philippines, found that better nutrition caused children to enroll in school earlier and improved their performance. Alderman et al. (2001), for the case of Pakistan, argue that better health and nutrition have a positive impact on school enrollment. Using an experimental approach based on randomized treatments for worm infections in Kenya, Miguel and Kremer (2004) find that better health increased school attendance, although not academic performance. Similarly, Todd and Winters (2011), using the randomization structure of the conditional cash transfers program in Mexico, Oportunidades, argue that interventions on early health and nutrition have a positive effect on school enrollment. Moreover, using a fixed effects strategy, Lavy, Ebenstein, and Roth (2012) show that exposure to air pollution is associated with declines in standardized test scores in Israeli high schools.

Access to free-of-charge publicly provided health insurance can also improve educational outcomes by increasing the amount of resources available for education expenses. Indeed, health insurance could reduce both out-of-pocket and catastrophic health expenditures by the household. This implies that families could reallocate resources previously devoted to solve health problems into education. Furthermore, health insurance could help households to cope better with health shocks without interfering with their decisions regarding education. The alleviation of budget constraints could avoid the need to take children out of school and send them to work in order to reduce expenses and increase income.[2] The introduction of free health insurance could also reduce precautionary savings and therefore release additional resources for the household. Gruber and Yelowitz (1999) show that this was actually one of the consequences of the expansion of Medicaid in the United States. Several studies have shown that low levels of investment in education could be the consequence of low income levels together with liquidity constraints. See for example World

[2] In a related area of study, Alcaraz, Chiquiar, and Salcedo (2012) for Mexico and Yang (2008) for Philippines, have shown that additional household income through remittances could lead to higher school attendance and lower child labor.

Bank (2006) and De Ferranti et al. (2003) for developing countries and Johnson (2011) and Carneiro and Heckman (2002) for the case of developed countries. In a literature review on this topic, Lochner and Monge-Naranjo (2012) argue that exogenous increases in family income lead to improvements in early child development. A reduction on uncertainty regarding future income could also play a role in improving education outcomes when access to health insurance is provided. Indeed, according to Flug et al. (1998), factors that could hamper investment in education could be aggravated in the presence of income volatility. Additionally, these authors find that volatility, income inequality, and credit constraints reduce investment in education in developing countries.

In this paper we study the effect of a large expansion of the coverage of a publicly provided health insurance program on children's academic performance, using the case of Mexico. In 2002, the Mexican government introduced Seguro Popular (SP), a health insurance program for households not covered by social security, estimated to be around half of the population. SP provides health services and medicines practically free of charge. To test whether the expansion of SP had an effect on children's academic performance, we use a panel of municipalities from 2007 to 2009. We focus on the effect on ENLACE standardized test scores for primary school children, and our measure of the expansion of coverage is the proportion of the population in the municipality covered by SP. To address possible endogeneity problems associated to omitted variables we use a fixed effects model. Furthermore, we believe we do not face the reverse causality problem that studies in the health and education literature could have to sort given the nature of the variables we focus on. In fact, it is difficult to think of some mechanism through which test scores affect SP coverage. To control for possible changes over time within municipalities that could affect both health coverage and academic performance, we include in our estimations the amount of public transfers for the poverty reduction program Oportunidades, which has both a health and an education component. Additionally, we control for per capita state GDP. Our findings suggest an important and statistically significant effect of having a higher SP coverage on children's test scores.

The rest of the paper is organized as follows. Section 2 briefly describes the introduction and expansion of Seguro Popular in Mexico. Section 3 presents the data used for the analysis and reports some descriptive statistics. Section 4 focuses on the identification strategy and the results. Section 5 concludes.

2. Expansion of the public health insurance system

The public health system in Mexico is divided in two sectors. One of them provides health services to the population covered by social security institutions managed by the government (mainly IMSS and ISSSTE).[3] Access to these institutions is obtained through a formally registered employer and once workers are covered, their families can be beneficiaries as well. Part of the services are financed with payroll taxes, although the Federal Government provides an important part of the resources as well. In this sector, health provision is bundled with other services such as child care and pensions. Households not covered by social security institutions, which comprise around half of the population, receive health services from the state governments. In this case, services are funded by general taxes. There was an important gap in terms of resources allocated to health care between these two sectors, and SP was introduced in 2002 as a means to close such gap and to improve health services in the latter sector (Barros, 2008). The main eligibility criterion to enroll in SP is precisely not to be covered by a social security institution.

In principle there is a fee schedule for registering to SP that depends on household income, where families in the four poorest income deciles do not have to pay. In practice, very few households are actually required to pay, and the program can be considered essentially free.[4] Registered beneficiaries of SP are entitled to receive health services and full treatment for the diseases listed in the official SP catalog, all of which should be provided free of charge. Enrollees are guaranteed a package of 275 interventions classified into six groups: public health, emergencies, general family health services and specialty services, general surgery, hospitalization, and dentistry. SP is partly financed by the federal government and partly by state governments. The latter are responsible for the provision of all services and material. For a detailed description see Levy (2008), Barros (2008), and Bosch and Campos-Vázquez (2010).

The expansion of SP can be used to test the effects that the introduction of a free publicly provided health insurance can have on education outcomes. SP could affect academic performance through improved health and through an income effect channel. With respect to the first channel, there is some evidence suggesting that SP did have an impact on health levels. In particular, according to Sosa-Rubí et al. (2009a and 2009b), SP has had a significantly positive effect on the

[3] IMSS stands for Instituto Mexicano del Seguro Social and ISSSTE stands for Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado. These are the two main social security institutions in Mexico.

[4] Levy (2008) argues that it is unlikely that SP fees can be enforced and estimates that in 2006 fees represented only 0.8% of the program's budget.

access of poor women to obstetric care, an important predictor of maternal and infant health, and has improved both access to health services and biological health outcomes among adults with diabetes. Furthermore, Barros (2008) and King et al. (2009) found that SP has a positive effect on self-perceived health. However, some studies have not been able to identify a statistically significant effect of SP on objective health measures (Barros, 2008 and Knox, 2008). Evidence seems more compelling with respect to the income channel. Several studies have found that SP actually reduces out-of-pocket health expenditure (Galárraga et al., 2010 and Barros, 2008), and different papers have found that SP reduces catastrophic health expenditure (Galárraga et al., 2010; Gakidou et al., 2006; Knaul et al., 2006; Barros, 2008; and King et al., 2009). Although it seems reasonable that SP reduces uncertainty given the insurance component, we are not aware of papers formally documenting that this is the case.[5]

Given the large segment of the population that SP intends to cover, the program was implemented gradually across the country and full coverage is expected to be achieved by 2013 (Levy, 2008). The most recent data shows that SP has enrolled 52.7 million beneficiaries (Sistema de Protección Social en Salud, 2012). Some authors like Barros (2008) and Bosch and Campos-Vázquez (2010) have argued that political factors could have influenced the rollout schedule of the program. This has played in favor of different identification strategies in various studies. In our paper, although the use of a longitudinal dataset and of a fixed effects specification can account for possible endogeneity issues, the exogenous variation in SP could be an additional factor supporting the results.

3. Data and descriptive statistics

We construct a panel of municipalities with annual data from 2007 to 2009 with information on SP coverage measured by the proportion of the population registered in SP, and academic performance measured by the results in standardized tests. We include additional variables that serve as controls in the regression framework, as will be described below. Our main sources of information were the Ministry of Education, the Ministry of Health, and Mexico's National Statistics Institute INEGI (Instituto Nacional de Estadística y Geografía). We restricted the analysis

[5] An important branch of the SP literature has focused on whether this program could induce informality (workers with access to social security institutions moving to jobs without such access), as suggested by Levy (2008). No strong evidence has been found in this direction (Barros, 2008; Bosch and Campos-Vázquez, 2010; Azuara et al., 2010).

to this time period due to data availability. However, as will be seen below, there is considerable variation in SP coverage in the period, as the program was in an expansion phase throughout the country.

More precisely, our indicator of yearly SP coverage by municipality was constructed as the number of persons enrolled in SP relative to total population in the municipality. Data on the number persons enrolled in SP at the end of each year comes from the SP National Registry and was provided to us by the Ministry of Health. Estimations on yearly population size at the municipality level were obtained from the Ministry of Health webpage. These estimates, in turn, are based on projections by the National Population Council (CONAPO).[6] A possible concern with this measure of SP coverage is that it may be correlated with some characteristics of the municipality such as the percentage of the population with access to social security institutions, which could in turn be linked to the municipality's wealth, health status, or to the quality of its education system. However, in the estimates below we include municipality fixed effects, which address this concern under the assumption that the proportion of the population eligible for SP (without access to social security) is constant in time. This is reasonable considering the nature of the variable and the three years time span of this study.[7]

The academic performance variable we use is the score in the yearly national standardized test ENLACE (Evaluación Nacional de Logro Académico en Centros Escolares). Since 2006, primary school students from third to sixth grade take the test, which consists mainly of math and Spanish language questions, but may also include questions on other subjects, all related to topics in the official curricula. The staff that conducts the test is unrelated to the school where it is taking place. Junior high school students are also tested, but we focus only on results at the primary level. As with all standardized tests, the main advantage is that the results are directly comparable across schools all over the country. The Ministry of Education has made an effort to make results publicly available.[8] We obtained from this institution's webpage a database with the average score in ENLACE exam at the school level for all primary schools in the country. We then constructed

[6] Although the SP coverage variable should lie between 0 and 1, some values in the original dataset were greater than 1. This is theoretically not possible, as coverage is defined as the proportion of the population enrolled in SP. However, because information for SP enrollment and population come from different sources, discrepancies may occur. This was the case for less than 0.6% of the observations, which as a consequence of this were excluded from the dataset. The results do not change significantly if we instead keep these observations.

[7] As mentioned before, there is no evidence that SP has itself caused a shift in the proportion of households with and without access to social security.

[8] Results for the ENLACE tests are available from 2006, the first year of implementation of the test. However, we do not include this information in our sample because we understand that the standardization process in 2006 was different from the one used for other years.

average scores at the municipality level taking into account only those scores that according to the Ministry of Education satisfied a certain standard of quality, or were "representative" at the school level.[9] This mean score at the municipality level is our outcome of interest in the estimation of the effect of SP on academic performance.[10] Our fixed effects model should account for differences across time in the exam, such as possible changes in the difficulty of the questions or the implementation process.

Our regression framework includes two main control variables. The purpose is to control for factors that could have changed over time and could have affected both academic performance and health provision differently across municipalities. The first variable is the per capita amount spent by the government on Oportunidades transfers at the municipality level. As is well known (see Levy and Rodríguez, 2005), Oportunidades is a poverty reduction conditional cash transfer program that has important education and health components, as families receive transfers for sending their children to school and visiting health clinics. Data on the total amount of money spent on this program at the municipality level was downloaded from INEGI's National States and Municipalities Information System (SIMBAD), which at the moment does not provide information for years after 2009. Using total population data from the Ministry of Health as before and the consumer price index, we constructed per capita Oportunidades transfers in constant pesos. The second control variable we include is per capita state real GDP. We obtained state real GDP from SIMBAD and total population from the Ministry of Health as before.

We balanced the panel database so that our sample only includes municipalities for which we have information on both SP coverage and ENLACE score for the three years of our study.[11] Our sample therefore consists of 1,906 municipalities (77% of the total) with data for the 3 years, resulting in 5,718 observations.

[9] The exam is not considered representative if the school has less than eight students, if the percentage of students that sit the test is lower than 80% of the total enrollment in the school, or if the percentage of "suspicious tests" is greater than 30%. For robustness we also performed exercises including all schools, and we find qualitatively similar results although smaller in magnitude.

[10] Merging the information on standardized tests with the rest of the relevant variables at the municipality level was not straightforward, as the databases from the Ministry of Education webpage did not include the official INEGI identification code for the municipalities. Therefore, we first merged the ENLACE database with INEGI's catalog using the name of the municipality. With this procedure we were able to match between 80 and 90% of municipalities. For the unmatched ones, we used the school identification code to match the ENLACE database to a list of schools that contained both the school identification code and the municipality code. We also obtained such list of schools from the Ministry of Education. We were able to identify the municipality for around 99% of schools in the ENLACE database.

[11] This led us to exclude the municipalities of the state of Michoacan from the study due to the lack of data on ENLACE scores in this state for 2007. This exclusion represents 4.6% of the municipalities in the country.

Figure 1 presents kernel density estimates of the SP coverage variable. There is important variation between municipalities in each of the three years that constitute our database. Moreover, the distribution has shifted to the right over time, suggesting that coverage has increased across municipalities, which is important for our identification strategy. Indeed, as Table 1 shows, average coverage was 33% in 2007, 41% in 2008, and 46% in 2009. Additionally, the table indicates that although most of the variation in our data is explained by differences between municipalities, within variation is also relevant.

Figure 2 shows kernel density estimates for the average scores in the ENLACE standardized test. Note that there is variation across municipalities and that the distributions changed in the period too. As Table 1 reports, the mean scores for 2007, 2008, and 2009 are 475, 482, and 485, respectively. Additionally, there is important variation both between and within municipalities.

4. Estimation of the effects of SP on children's academic performance

We estimate a fixed-effects regression with ENLACE test scores as dependent variable and SP coverage as the main independent variable. The regression takes the following form:

$$score_{it} = \alpha + \beta^{SP} SP_{it} + \gamma_1 X_{st} + \gamma_2 W_{it} + \pi_i + \tau_{st}\, state_s \cdot year_t + u_{it},$$

where SP_{it} is the SP coverage variable in municipality i at time t; π_i are municipality fixed effects; $state_s$ and $year_t$ are state and year dummies respectively, so that by considering the interaction in the regression, we include state-specific time fixed effects to control for possible changes over time that could affect all municipalities in the same state in a similar fashion[12]; X_{st} is the control variable at the state level, GDP per capita; W_{it} is the control at the municipality level, per capita public expenditure in Oportunidades transfers; and u_{it} is the error.

Municipality fixed effects allow us to control for observable and unobservable characteristics at the municipality level that do not change over time and could simultaneously affect education and SP enrollment levels. This addresses possible endogeneity problems related to constant-in-time unobservables. However, the concern regarding possible factors that could be changing over time differentially across municipalities that could affect both SP expansion and test

[12] For example, the recent economic crisis could have affected children's academic performance, and this could have taken place differentially across states depending on the way the crisis affected the region.

scores remains. To address this possibility to some extent, we include the two control variables, which vary in time and could have a simultaneous effect on the health system and on student's performance.

An additional concern in the health and education literature is reverse causality. However, given the nature of our dependent variable and our main independent variable, we do not believe this is a threat in this setting. Indeed, there is no plausible reason to think that changes in ENLACE test scores at the primary school level could affect SP coverage in the short run. That is, it is unlikely that the government decided to provide more SP in places where students were getting higher grades, or that more people decided to enroll because children in the municipality were performing better.

Table 2 presents the main results. Column 1 includes only municipality fixed effects, together with state-specific time fixed effects, and no other controls. The coefficient indicates a positive and statistically significant effect of SP coverage on test scores. The coefficient maintains a similar value and significance level as we include additional controls. In particular, Column 2 adds GDP per capita, Column 3 includes Oportunidades transfers, and Column 4 the full set of controls. As expected, both controls have a positive effect on academic performance. In all cases standard errors are clustered at the municipality level.

Table 3 puts our findings in perspective by giving some points of reference to understand whether the increase in the mean score associated to higher SP coverage is economically relevant. The coefficient in Column 4 of Table 2, our main specification, takes a value of 16.9, which means that if a municipality goes from having no persons registered in SP to having everyone enrolled, the test score average would increase by 16.9 points. However, the exercises presented take into account that SP is targeted to the population not covered by social security, and therefore not every person in the municipality is expected to be enrolled. A more reasonable range would be to go from no coverage to 46 percent of the population enrolled, for example, which was the mean SP coverage across municipalities in 2009.

Table 3 assumes precisely an increase in SP coverage from 0 to 46 percent, which would imply an increase of 7.8 points in the average score, according to the reported coefficient. The first row proposes as point of reference the gap in average test scores between the state with the best performance and the one with the worst, where the average test score in a state corresponds to the average across municipalities. In 2007, the difference between Mexico City, the region with the highest average score, and Chiapas, the state with the lowest average score was 117.7 points, which

implies that the simulated expansion in SP of 46 percentage points corresponds to 6.6 percent of the gap. The second row considers the gap between the score of the state in the 90th percentile of test scores across states and that in the 10th percentile, which is equal to 44.9 points. An increase in SP coverage of 46 percentage points would be associated to a raise in test scores equal to 17.3 percent of this gap. The last row proposes as point of reference the standard deviation of average scores across municipalities in 2007 (36.2 points). The estimated effect of an equally large SP expansion corresponds to 21.5 percent of such standard deviation. According to the World Economic Forum (2009), a measure that increases test scores in 10 percent of the standard deviation may be considered successful. We therefore believe that the effects we find are sizable, although in interpreting the results, one should remember that it may have taken a municipality around seven years to go from no coverage to 46 percent. On the other hand, it is important to also bear in mind that we are estimating the effects of a program that did not target academic performance directly.

As robustness checks we conducted additional exercises to consider other forms of time fixed effects. In particular, we substituted the state-specific time fixed effects with simple time fixed effects, state-specific trends, and a combination of both. Results are presented in Table 4. Only in the case of simple time fixed effects the results turn out not to be statistically significant, although the coefficient is positive and would point to a relatively important effect.[13]

5. Conclusion

The evidence presented in this paper suggests that the introduction of Seguro Popular, a program to provide public health insurance essentially free of charge in Mexico, had a positive and statistically significant effect on academic performance of children in primary school. We use a panel of municipalities to show that the expansion of SP coverage increased average test scores. This effect could be attributed to improved health or to an income effect, due to, for example, lower expenditures in health. Given the reduced form of our estimates, we are not able to identify the channels through which higher SP coverage could be improving children's academic performance. The identification of these channels is left for future work. Given the strong evidence showing that the introduction of SP has led to savings in health expenditures, it is likely that households are allocating part of those resources to education expenditures, thus helping their children to achieve higher test scores. Nonetheless, the importance of the channels associated to improved health and

[13] An additional robustness check consisted of weighting the observations by the 2007 population. In this case the estimations lose precision, as they are smaller in magnitude.

diminished uncertainty regarding future income resulting from increased health insurance coverage cannot be ruled out.

We find remarkable that SP has improved academic performance of Mexican children when its main goal is to provide better health services. The evidence indicating that the program has ameliorated education outcomes as an indirect effect suggests that there are additional channels through which it may translate into higher long term incomes and economic development.

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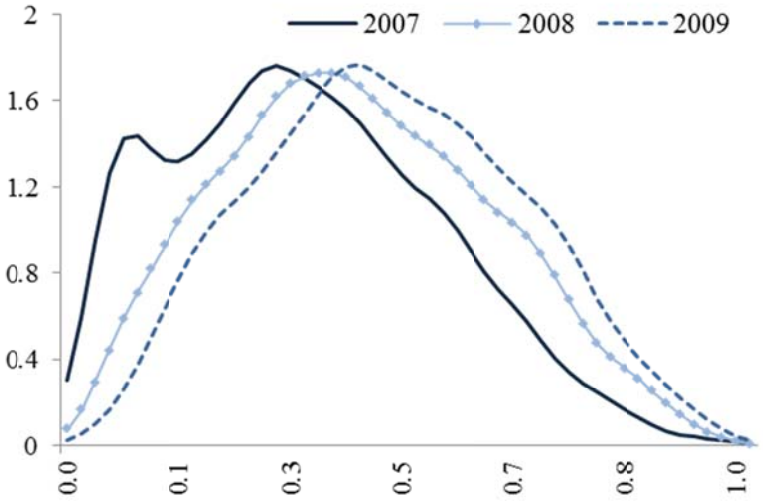
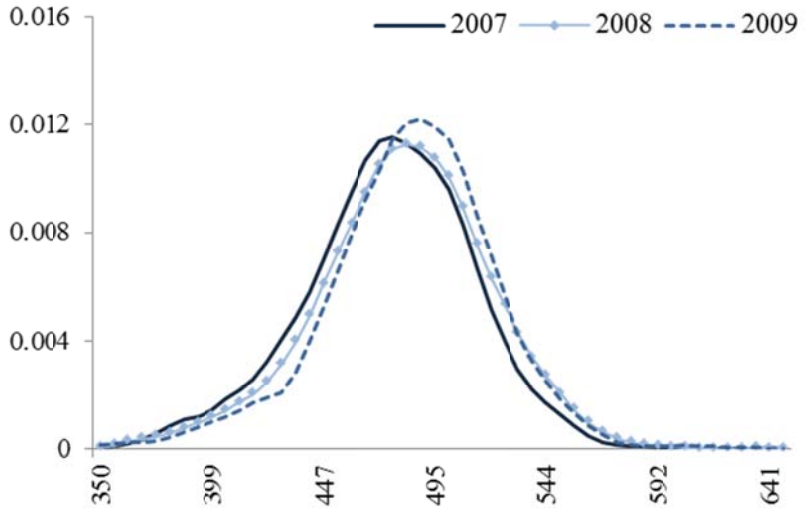
7. Figures and Tables

Figure 1
Distribution of SP coverage across municipalities
Gaussian Kernel Density



Note: Units of observations are municipalities. SP coverage is defined as the proportion of the population in the municipality enrolled in SP. Own calculations based on information from the Ministry of Health.

Figure 2
Distribution of average ENLACE test scores across municipalities
Gaussian Kernel Density



Note: Units of observations are municipalities. Own calculations based on information from the Ministry of Education.

Table 1
Summary statistics 2007-2009

Variable	Overall Mean	Annual information Year	Mean	S.D.	Standard deviation		Observations
SP coverage (proportion of population enrolled in SP)	0.404	2007	0.333	0.210	overall	0.216	N = 5718
		2008	0.415	0.211	between	0.202	n = 1906
		2009	0.465	0.207	within	0.078	T = 3
Score in ENLACE standardized test	480.57	2007	475.3	36.3	overall	37.0	N = 5718
		2008	481.8	37.5	between	34.3	n = 1906
		2009	484.6	36.6	within	13.9	T = 3
Per capita resources spent on Oportunidades transfers (thousands of	0.831	2007	0.749	0.441	overall	0.513	N = 5574
		2008	0.851	0.509	between	0.475	n = 1906
		2009	0.891	0.569	within	0.207	T-bar = 2.9
GDP per capita (thousands of 2003 pesos)	62.28	2007	63.46	36.86	overall	34.96	N = 5718
		2008	63.82	35.84	between	34.82	n = 1906
		2009	59.57	31.84	within	3.18	T = 3

Note: Municipalities are the units of observation. N corresponds to the total number of observations (including all periods and municipalities), n corresponds to total number of municipalities, T corresponds to the number of waves (and T-bar to the average number of waves).

Table 2
Fixed effects estimation results

Dependent variable: ENLACE test scores

	(1)	(2)	(3)	(4)
SP coverage	16.70***	16.70***	16.89***	16.89***
	(6.017)	(6.017)	(6.039)	(6.039)
GDP per capita		0.393***		0.392***
		(0.0901)		(0.0898)
Oportunidades			2.092*	2.092*
			(1.072)	(1.072)
Constant	469.7***	444.8***	467.3***	443.2***
	(2.014)	(6.112)	(2.177)	(5.991)
R-squared	0.167	0.167	0.165	0.165
Observations	5,718	5,718	5,574	5,574
Number of municipalities	1,906	1,906	1,906	1,906
Municipality fixed efects	✓	✓	✓	✓
State-specific time fixed effects	✓	✓	✓	✓

*** p<0.01, ** p<0.05, * p<0.1
Clustered standard errors in parenthesis.
Note: Seguro Popular (SP) coverage is defined as the proportion of the population in the municipality enrolled in SP.

Table 3
Interpreting the size of the main fixed effect results

	Assumption: Increase in SP coverage from 0% to 46%		
	Reference (number of points)	Estimated effect on test scores with a coefficient of 16.9 (points)	Percentage increase
	(a)	(b)=0.46*16.9	(c)=(b)/(a)
Tests scores gap between the state with highest average score and the state with lowest average score in 2007	117.7	7.8	6.6%
Test scores gap between the state in the 90th test scores percentile and the state in the 10th percentile in 2007	44.9	7.8	17.3%
One standard deviation in 2007	36.2	7.8	21.5%

Note: This table presents the interpretation of a coefficient of 16.9 of a fixed effects regression of test scores on SP coverage using a panel of municipalities. It shows the effect of an increase of 46 percentage points in SP coverage relative to three measures in 2007. The first row shows the size of the effect with respect to the test scores gap (difference) between the state with the highest average score (across municipalities) and the state wth the lowest average score (across municipalities). The second row shows the effect as a percentage of the gap between the state in the 90th test scores percentile and the state in the 10th percentile (across municipalities). The third row shows the effect as a percentage of one standard deviation of the scores (across municipalities).

Table 4
Additional fixed effects estimations

Dependent variable: ENLACE test scores

	(1)	(2)	(3)	(4)	(5)
SP coverage	35.49***	6.327	17.41***	17.53***	16.89***
	(3.706)	(5.292)	(5.819)	(5.844)	(6.039)
GDP per capita	-0.00337	0.409***	0.660***	0.726***	0.392***
	(0.0622)	(0.0729)	(0.135)	(0.204)	(0.0898)
Oportunidades	4.039***	1.801*	1.820*	1.840*	2.092*
	(1.393)	(1.016)	(1.001)	(1.007)	(1.072)
Constant	462.2***	446.0***	-8,759***	-8,976***	443.2***
	(4.587)	(4.872)	(1,131)	(1,286)	(5.991)
R-squared	0.051	0.084	0.147	0.148	0.165
Observations	5,574	5,574	5,574	5,574	5,574
Number of municipalities	1,906	1,906	1,906	1,906	1,906
Municipality fixed efects	✓	✓	✓	✓	✓
Time fixed effects	×	✓	×	✓	×
State-specific trend	×	×	✓	✓	×
State-specific time fixed effects	×	×	×	×	✓

*** p<0.01, ** p<0.05, * p<0.1
Clustered standard errors in parenthesis.
Note: Seguro Popular (SP) coverage is defined as the proportion of the population in the municipality enrolled in SP.