AN EVALUATION OF THE 1997 FISCAL DECENTRALIZATION REFORM IN MEXICO: THE CASE OF THE HEALTH SECTOR

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This paper studies the impact of the health decentralization of funds and responsibilities that took place in Mexico in 1997 on state level health outcomes. It renders two main results. First, the magnitude of transfers from the federal government to states failed to take into account state-specific needs; instead, transfers were mainly determined by the pre-reform health expenditures of the federal government in each state. Second, decentralization did not boost the advances in health outcomes already achieved under the centralized health sector regime. We conclude by discussing potential reasons for the results found in this paper.

1 Introduction

Fiscal decentralization has been part of the reform agenda in many developing countries for the last two decades. Theoretically, state and local fiscal autonomy is founded on the idea that public policy decisions by lower tiers of governments would bring about more efficient outcomes in the provision of public goods (Oates, 1972). It is argued that sub-national governments are better able to identify the needs and preferences of citizens. Under fiscal decentralization, taxpayers are closer to authorities, allowing them to better demand transparency, accountability, and efficiency in the use of public resources. As a result, decentralization is expected to generate economic growth and improvements in the welfare of the population.[1] Having these positive effects in mind, Mexico undertook a profound reform in the 1990s to modify the expenditure responsibilities of the federation and state governments. The main aim of the reform was to transfer financial resources and responsibilities to state and local governments for the provision of specific public goods. By 1998, five earmarked funds were created (one for basic education, one for health services, one for social infrastructure, one for municipal strengthening, and one for multiple destinations);[2] these were financed through federal transfers to sub-national governments.[3]

This paper focuses on one of these earmarked funds: the Health Services Fund[4] (FASSA, for its acronym in Spanish). Particularly, we analyze the consequences that such fund had over the health of the population according to specific health outcomes. We present results for infant mortality rate at the state level, a broadly used health indicator; but our results are robust to the use of other health indicators. The reform entitled the states to organize, control, coordinate, evaluate, and monitor the supply of health services, facilities and medical attention for the non-insured

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[1] However, the outcomes of fiscal federalism may be the opposite if political economy considerations are included in the analysis (Prud'homme, 2004 and Weingast, 2009).

[2] In 1999 two more funds were added: one for public safety and the other one for technological and adult education.

[3] It is important to address that the reform focused on changing the expenditures assignments between states and federation but it did not modify tax collection responsibilities among tiers of governments. Federal government is still responsible for collecting more than 90 per cent of the public revenue of the country, but after unconditional and earmarked federal transfers, sub-national governments spend around 50 per cent of the public expenditure in Mexico.

[4] In Spanish, Fondo de Aportaciones para Servicios de Salud (FASSA).

population[5] in the following areas: maternity care; visual and hearing health; nutrition; epidemiology; among others. In this context, FASSA's aim was to endow states with resources to meet the new health responsibilities that came with the decentralization of the sector. Decentralization meant that the medical attention of the non-insured (and therefore more vulnerable) population would now become the responsibility of state health authorities. Likewise, states were responsible for the administration of state hospitals for primary health care that used to be operated by the federal Ministry of Health (MofH hereafter) before the reform. One particular feature of the decentralization reform is that during the first years of its implementation, the amount of funds received by the states from FASSA was similar to what the federal MofH used to spend for non-insured population, via Ramo12, in each state before the reform took place. Another interesting feature is that the allocation of FASSA among states did not respond to the particular health needs of each state. These two facts, besides being clearly surprising, allow us to identify the impact on health indicators when health budget is spent by state governments rather than by the federal one.

We explore whether the decentralization of health provision in Mexico can account for the improvements of state level health indicators experienced in the last twenty years. First, we discuss whether the institutional arrangement of health decentralization is appropriate to maximize the impact of each peso spent. For instance, the Law of Fiscal Coordination determines a formula that specifies the factors used to calculate the share of FASSA assigned to each state, but does not present the weights given to each factor. Even more importantly, the factors determining what every state receives do not include health needs or rewards to those states that are spending efficiently. In order to address these issues, we present regressions that analyze the determinants of FASSA. Surprisingly, we find that the money spent by the federal government in each state in 1997, that is, the year before the reform was implemented, is the strongest predictor of what each state receives from the FASSA in any given year. We also found that health outcome variables, like infant mortality rate and deaths by infectious and parasitic diseases, do not show stable or significant coefficients. Medical resources are, in general, statistically insignificant, contrary to what the formula of FASSA stipulates. Population is the variable that more consistently shows a negative sign. We also perform similar regressions to look at the determinants of the non-insured health expenditure made by the federal government (Ramo12) before the reform. The results are very similar to the FASSA regressions and we conclude that the most important determinant driving health expenditure is the expenditure made in prior to decentralization.

The second part of our empirical strategy studies whether transferring health resources from the federal government to states has an effect on the infant mortality rate. For this purpose, we rely on different empirical exercises. We first compare FASSA to the federal budget on health, *i.e.*, Ramo12, by estimating the effect each budget had over the infant mortality rate for the years after the reform and for the years before the reform, respectively. This allows us to make a comparison between how state governments performed between 1998 and 2003 relative to how the federal government did between 1993 and 1997. The former exercise is an important comparison because the decentralization reform consisted in transfers of resources and responsibilities from the federal to state governments. We find no significant difference between the efficiency of Ramo12 and that of FASSA. Perhaps one reason we do not find a significant effect is that some states did very well whereas others underperformed, neutralizing the gains when averaging across states. Thus, in our second set of estimates, we test whether states that received more FASSA resources observed better health outcomes than those that received less resources when comparing the years after the reform with the years before the reform. Again, we find no significant difference between the high FASSA group relative to the low FASSA group. In another set of estimations that do not use infant

5 The non-insured is the fraction of the population that is not covered by an insurance mechanism; however they can access health care services at less than full-cost prices in Ministry of Health and state health facilities (OECD, 2005, pp. 29-30).

mortality rate but fetal death rate[6] and that take as control group that fraction of the population that is insured, we find that the fetal death rate among the non-insured population did not have a significant change after 1997 when compared to the fetal death rate in the insured population. However if we compare the expenditure efficiency (as measured by the effect of health expenditure on the infant mortality rate) for the non-insured with that of the insured population, we find that the former became more efficient after the decentralization reform. Thus, excluding the last specification, the evidence suggests that the decentralization of the health sector did not have an effect on the well-being of the population.

This paper has four main contributions. The first two are empirical ones. In the first place, this is the first work studying the effects of decentralizing the health sector in Mexico as well as the determinants of the distribution of health funds across states. Second, to the best of our knowledge, this paper is the only one that compares the efficiency in the provision of health services between the federal and state governments in two different federalist settings: centralized and decentralized. The other two contributions are related to the methodology. First, our identification strategy allows us to overcome some problems of endogeneity between decentralization and health outcomes, an issue seldom discussed in the literature. Finally, our measure of health decentralization is the actual health expenditure made by the state governments (from federal transfers), which, we consider, is a cleaner way to analyze efficiency issues relative to previous literature as we will discuss below.

The results of the present work may give important lessons about the conditions under which fiscal decentralization maximizes its impact on people's welfare. We argue that successful decentralization may be related to some necessary conditions: revenue collection decentralization, the strengthening of transparency and accountability of state governments, and improving institutional checks and balances.

The structure of the paper is as follows. Next section reviews previous literature related to health decentralization. The third section discusses briefly some characteristics of the health system in Mexico and the evolution of the main health indicators in the last two decades. The fourth section presents a description of the process of health decentralization and an analysis of how FASSA is allocated between states. The fifth part describes our empirical strategy followed by the analysis of the effects of decentralization on the infant mortality and fetal death rates. Finally, the paper concludes by discussing some lessons and plausible explanations for the (lack of) results of decentralization.

2 Literature review

Previous work on health decentralization has already pointed out the pros and cons of health provision by local state governments (see Asfaw *et al.*, 2007 and Robalino *et al.*, 2001 for a summary of these arguments). Among the advantages of decentralization the following can be listed: a) local authorities may have access to better information on local circumstances, needs and preferences of citizens; b) information is used more promptly and cuts costs without procedures that require central authorization, thereby enabling a more flexible operation of local governments; and c) it can also promote transparency, accountability, efficiency and community's participation. On the other hand, decentralization may hinder welfare gains due to: a) diseconomies of scale; b) lack of capacity, skills and information of local authorities on how to implement public policies; c) inability to collect own revenue to provide public goods; d) lack of interest from local elites in

6 In this case, we did not use the infant mortality rate because we cannot divide it between non-insured and insured population. Due to the way fetal deaths are registered, it is possible to construct a fetal death rate for non-insured and insured population. The way we construct these rates is explained in detail in Section 5.

community's needs (capture of rents if there is no transparency and accountability); and e) implementation and coordination problems with national policies across regions.

Notwithstanding the importance of the topic, the empirical evidence on the consequences of decentralization is scarce. In the particular case of the health sector, previous literature has found that a more decentralized health sector is associated with a lower infant mortality rate, results that are opposite to our findings. Countries covered in this literature include India (Asfaw *et al.*, 2007), Argentina (Habibi *et al.*, 2001), China (Uchimura and Jütting, 2007), Canada (Jiménez Rubio, 2011), Spain (Cantarero and Pascual, 2008), Colombia (Soto *et al.*, 2011) and others included in a cross country study (Robalino *et al.*, 2001).

Nevertheless, this empirical research on the effects of decentralization has not provided compelling answers. First, it has had difficulties finding data on health spending by local governments. For instance, Asfaw *et al.* (2007), Robalino *et al.* (2001), Habibi *et al.* (2001), and Uchimura and Jütting (2007) use the proportion of total public expenditure or revenue that is spent or collected by provincial or sub-national governments as a measure of decentralization, even if such resources are used in sectors different than health. This indicator of decentralization clearly fails to deliver credible evidence about the real impact of decentralization in particular sectors, such as the health sector. Moreover, it is common that countries differ in the spheres that are decentralized. For instance, a country may have high local fiscal autonomy in many spheres but health, or it may be that the only type of decentralized expenditure is health (see Jiménez Rubio, 2011), which may lead to an identification problem of the relationship between health decentralization and outcomes. The only works that tackle this issue are Cantarero and Pascual (2008), Jiménez Rubio (2011), and, Soto *et al.* (2011) as they use a health specific decentralization indicator.

An additional issue of just using the percentage of health decentralized resources is that the estimations do not control for the level of health expenditure. This may lead to obtain biased estimates due to omitted variable issues if the share of sub-national resources is correlated to the level of health expenditure – Jiménez Rubio (2011) is an exception. In the absence of health expenditure in the econometric estimation, the results that find a negative relationship between decentralization and infant mortality rate may be capturing the effect of higher health expenditure (see, for instance, Joumard *et al.* (2008), which shows a positive effect of health expenditure on outcomes).[7]

Our paper solves both shortcomings by using the actual money spent by state governments in the health sector from transfers of the federal government as measure of health decentralization, which represents a high portion of health expenditure for non-insured population (around 80 per cent between 1997 and 2003).

Moreover, following Jiménez Rubio (2011), we consider it is important to control for other types of health expenditure (private, federal and social security institutions) that may be also driving health outcomes. The absence of these controls could confound the actual effect of greater local and state government's health expenditures. In order to deal with this issue the econometric estimation presented in Section V controls for a variety of health expenditure made by private and public institutions.

Methodologically, this paper deals with the issue of reverse causality between infant mortality rate and decentralization, a topic seldom discussed in the health decentralization literature. An advantage of this paper is that, for the case of Mexico, there is little evidence to

[7] See also Mosca (2006) and Akin *et al.* (2005), which study the determinants of local health expenditures in Switzerland and Uganda, respectively.

support the hypothesis that the state assignment of decentralized resources is driven by health status, which allows us to have a clean identification strategy.

Finally, to the best of our knowledge, our paper distinguishes itself from previous literature as it is the only one that evaluates the effects on health of a reform that decentralized health provision from the federal government to state government. Therefore, we directly explore whether health state provision had better effects than the provision made by the federal government before the reform. In other words, we depart from the existent literature on health decentralization (which explores whether the degree of decentralization improves health outcomes) using a methodology that allows us to compare explicitly the performance of the health expenditure made by the federal government and state governments.

3 Mexican health system

3.1 Health institutions

The Mexican public health system is highly fragmented, with health services being provided by several institutions. Each institution is different in whether they provide care for the insured or non-insured population. "The insured receive care for free from providers belonging to their social insurance institution […][The] uninsured population, although not covered by an insurance mechanism, can still access health care services at markedly less than full-cost prices in publicly financed Ministry of Health and state health facilities"(OECD, 2005, pp. 29 and 30). Workers in the formal labor market and their families are covered by a set of social security institutions. Basically there are three types of public health insurance institutions: i) the Mexican Social Security Institute (IMSS for its Spanish acronym) provides services to 40 per cent of the population (private formal salaried workers and their families); ii) the Institute of Social Security and Services for Government Workers (ISSSTE) covers 9 per cent of the population (federal government workers and some state workers); and iii) others, which include social security systems for workers of the state-owned oil company (Petróleos Mexicanos, PEMEX), the Navy, the Army, among others, covering around 2 per cent of the population. These institutions are financed through tripartite contributions by the federal government (subsidies), the employer and, employees. Each institution has and operates its own set of clinics and hospitals and employs salaried doctors. The provision of health services is mandatory and there are no cost sharing mechanisms (OECD, 2005).

The responsibility to provide health care to those who do not have access to the social security system (less than half of the population) is shared by the MofH and state governments' health services. The rates charged for health services depend on the patient's income and varies among hospitals and states. The benefits include the provision of primary, secondary and tertiary care, as well as preventive and curative services, but services are subject to the availability of resources. Besides the rates charged, (a small portion of the non-insured expenditure) financing comes from the federal budget (Ramo12[8] and FASSA) and states' own resources (*participaciones*[9] and other own state income). In addition, numerous programs have been implemented in order to improve the access of non-insured and poor people to basic health services.

Finally, a minority of the population (around 3 per cent) has private health insurance (half

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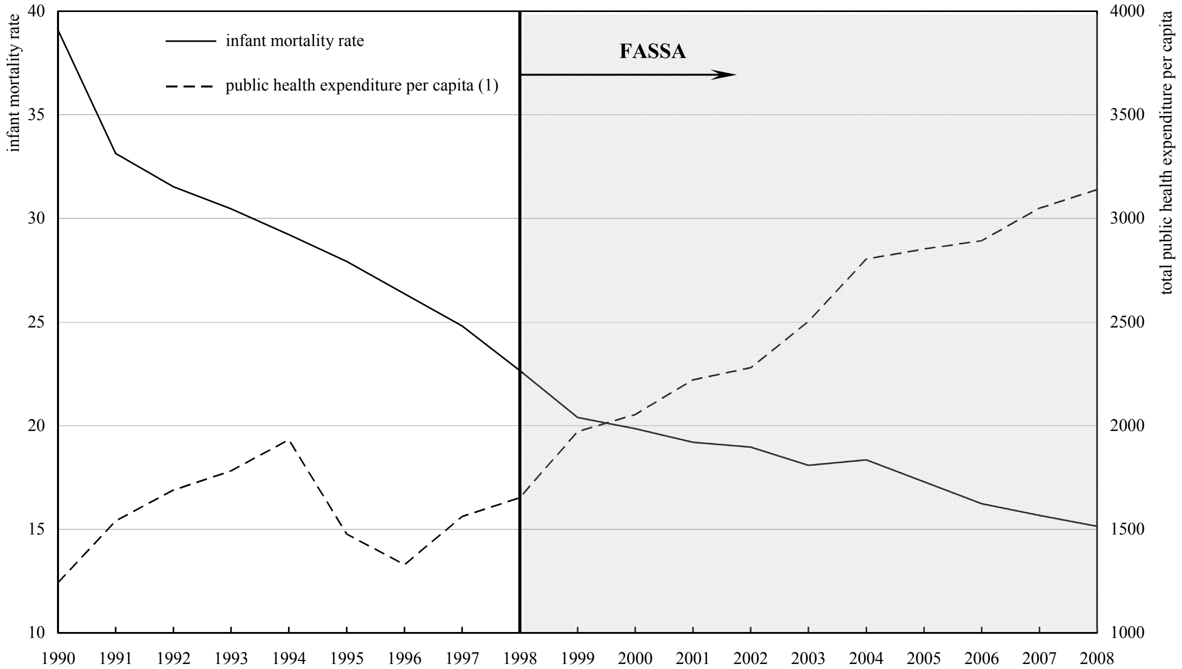
8 Ramo12 is the federal budget assigned for the provision of health services for the non-insured population. It includes the MofH budget, the health component of Oportunidades (an anti-poverty program based on conditional cash transfers), resources for public health programs and some resources for the Seguro Popular, the National Health Institutes and other large hospitals run by the federal government. IMSS-Oportunidades was previously financed through Ramo12 but these resources were directly transferred to the IMSS budget.

9 *Participaciones* are non-earmarked funds transferred from the federal government to state and local governments.

Figure 1

Infant Mortality Rate and Public Health Expenditure Per Capita, 1990-2008



(1) Units expressed in 2010 pesos.
Source: Own elaboration with data from SINAIS.

are financed by employers), which can be deduced from taxable income. There are two main types of private health policies: more than 97 per cent of the private insured population is covered through catastrophic medical insurance policies (*gastos médicos mayores*) for hospital expenses and various treatments for defined diagnoses; the remaining 3 per cent of the insured population on private institution has coverage through Products by Specialized Health Insurance Institutions (ISES), which is a "health care system that assumes or shares both the financial risks and delivery risks associated with providing comprehensive medical services to insured, usually in return for a fixed, prepaid fee" (OECD, 2005, p. 39). ISES offer full health coverage through private providers.

3.2 Health financing: amounts and evolution

Mexico spent 6.4 per cent of its GDP in health in 2009, up from 3.1 per cent in 1990. As of 2009, 48 per cent of the financing of the Mexican health system is public (up from 40 per cent in 1990).[10] As Figure 1 shows, the per capita public health expenditure more than doubled between 1990 and 2008. However, total and public health expenditure in Mexico is still the lowest among OECD countries, which on average spent 8.9 per cent of GDP in 2008. Most of the health expenditure in the OECD countries is financed by the public sector (72 per cent).

[10] Private health expenditure is mostly (92.3 per cent) done in the form of out-of-pocket payments. Within out-of-pocket expenditures, only a minor fraction is due to public sector cost sharing schemes. Most of the out-of-pocket is spent in the private sector. Just to have a perspective, OECD countries spend around 18.9 per cent of the total expenditure in out-of-pocket payments, versus almost 50 per cent in Mexico.

Covering around half of the population, social security institutions (IMSS, ISSSTE and PEMEX) were responsible of more than 80 per cent of the public health expenditure in 1993 and around two thirds in 2003. In 1993, Ramo12 represented 13.02 per cent of the overall public expenditure on health (0.33 per cent of GDP)[11] and in 2003 its participation decreased to 9.17 per cent of total health expenditure (0.26 per cent of GDP). While state governments (without FASSA)[12] had a share of around 5 per cent of health public expenditure[13] in 2003, FASSA represented about 16.8 per cent of the public health expenditure (0.47 per cent of GDP).

The growth in public health expenditure came along with a deeper penetration of health services in Mexico. Coverage has improved in the last years, as physicians per 1000 people went from 1.06 in 1990 to 1.44 in 2003 and nurses per 1000 increased from 1.55 to 1.76 between 1990 and 2003. Medical consultations also showed an important increase: in 1990, there were 1195 consultations per 1000 people; 13 years later, this indicator grew to 1726. Although these numbers show improvements over the last decade, Mexico still has one of the lowest health coverage among OECD countries.[14]

The expansion in health resources was translated into important progress in health status over the last twenty years. For instance, life expectancy at birth in 2008 was 75 years, up from 70 years in 1990; infant mortality rate went from 39 deaths per 1000 live births (see Figure 1) in 1990 to 15.2 deaths. As these numbers suggest, Mexico experienced great improvements in health but there is still some gap with respect to OECD countries.[15]

Historically, regional differences in health indicators have been important but the progress observed in the last years favored poor states as they have closed the gap. For instance, the state with the highest infant mortality rate in 1990 was Chiapas with 60.72 and Federal District had the lowest (22.36). Thirteen years later, Guerrero had the highest infant mortality rate (25.89) and Nuevo León had the lowest (12.44).

In spite of the recent achievements in health, Mexico still faces important challenges (OECD, 2005). The government has limited economic resources to deal with the demographic and epidemiological (from infectious to degenerative diseases) transition that will increase the demand for health care in the near future. An institutional reform is needed to avoid the current fragmentation of the various social security structures which has led to an inefficient provision of health care as well as to overcome the disparities in health expenditure among several dimensions such as: across states, between social security institutions and the non-insured population, and between federal and state governments. Moreover, it is important to minimize the out-of-pocket expenditure and to increase infrastructure and equipment investment in the sector (Gómez Dantés and Ortiz, 2004).

4 Decentralization and FASSA

4.1 Evolution of Health Decentralization in Mexico

In the last three decades, Mexico undertook two waves of health decentralization, mainly for the coverage of non-insured population. The first wave was in the 1980s but it was not generalized

[11] For the calculations before 1998, it is noteworthy that there is no available data for state governments' expenditure.

[12] Those resources come from own state resources and non-earmarked transfers from the Federation to states.

[13] State governments made an effort equivalent to 8 per cent of the all public sector effort in 2008.

[14] According to OECD data, Mexico had 2 doctors per 1000 population in 2008 and the OECD average was 3. The number of nurses per 1000 population averaged almost 9 in the OECD countries; Mexico had 2.4 nurses. Finally, doctor consultations per capita in Mexico were 2.8 compared to 7.1 among OECD countries.

[15] OECD life expectancy is 79 years old and infant mortality rate is 4.6 deaths per 1000 live births.

since only 14 states[16] out of 32 signed the agreement with the federal government. Although the program included the transfer of responsibilities to states for the operation of some hospitals and administrative tasks and the consolidation of the services provided by IMSS-Coplamar[17] and the MofH, the spending decisions, regulation and policy formulation remained controlled by the MofH (see Cabrero and Martínez Vázquez, 2000 and Merino, 2003). According to Birn (1999), the provision of health services and health outcomes from this attempt of decentralization were not different between the signers and non-signers of the health decentralization agreement of the '80s.

After some minor decentralizing actions during the administration of President Salinas (1988-94) (see Merino, 2003), a comprehensive decentralization reform was launched in 1996 as part of an important strategy of the Health Sector Reform Program 1995-2000. Centralism in the sector was seen as a cause of several problems such as low efficiency in the allocation of resources; lack of clarity in the responsibilities of each tier of government, excessive bureaucracy, inertia and inequality in the distribution of resources among states and absence of coordination between IMSS-Solidaridad,[18] the MofH and state health authorities (Merino, 2003). In order to tackle these issues, the reform defined clearly the health responsibilities of federal and state governments.[19] The federal government transferred operative functions, along with human, physical and monetary resources to states, thereby providing them with greater autonomy. Former employees of the federal MofH became part of state health units. Although the reform of the 1990s was deeper than the one implemented in the 1980s, Merino (2003) argues that the implementation of health decentralization was uniform across states without taking into account differences in administrative capacity, willingness to take the transfer of responsibilities or characteristics of population, services and geography, among others.

In order to meet their new responsibilities, states were endowed with FASSA, a fund that was created along with others in the context of a federalist reform in 1997. FASSA is a fund that transfers federal resources to states for health provision; it must be spent exclusively on health services for the non-insured population. FASSA represents the main source of financing for states as 77 and 64 per cent of the states' health expenditures came from this federal fund in 1998 and 2009, respectively.[20] Although FASSA is distributed among states according to criteria such as health infrastructure, health service workers, the budget assigned the previous year and a component that is aimed to equalize health accessibility,[21] the law does not set the weight of each component or the total amount allocated to the fund. Hence, the law does not establish a clear criterion for its distribution, allowing discretionary decisions by legislators and the federal government. Further, the resources obtained by every state were based on the amount originally

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16 Tlaxcala, Nuevo León, Guerrero, Jalisco, Baja California Sur, Morelos, Tabasco, Querétaro, Sonora, Colima, Estado de México, Guanajuato, Aguascalientes and Quintana Roo. Note that, on average, these states are more industrialized, have less population dispersion, and have fewer nutrition, health and education problems.

17 Coplamar stands for "General Coordination of the National Plan for Depressed Zones and Marginalized Groups", which was a social programs implemented in the seventies.

18 This is a poverty program implemented during the Presidency of Salinas (1988-94).

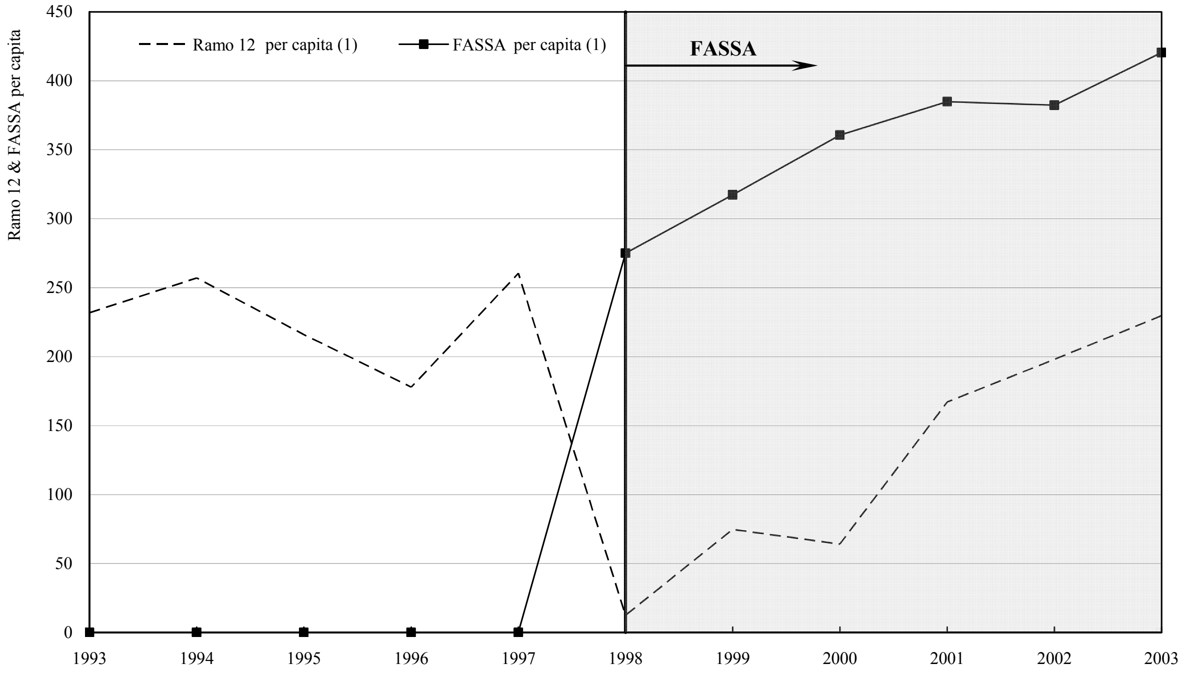
19 Articles 3rd, 13th and 18th of the Health Law establish the responsibilities of both levels of governments. In short, states are in charge of the organization and operation of health establishments and services, prevention of contagious diseases, maternity child care, nutrition, visual and auditive health, among others. The federation, in turn, operates most of the secondary and tertiary hospitals; designs health regulation and policies; watches the use of economic resources, deals with labor relations of the non-insured system, and takes mayor investment decisions.

20 Merino (2003) considers that the high dependence of states on transfers is not optimal for health provision as they have little flexibility to make adjustments to respond to their needs. Moreover, states may limit their health expenditures if they believe that a higher effort would be seen as a lower need for resources and thus less transfers from the federal government.

21 This component receives the remaining of the total budget of FASSA, which represents a low share. For instance, in 2001 its allocation was of only 100 million pesos when the overall FASSA budget was around 25,000 million pesos. The distribution of this component among states has a formula established in the Law and depends on the non-insured population, mortality, marginalization and federal budget (article 31 of the Fiscal Coordination Law). This is the only formula for FASSA in the Law.

Figure 2

Ramo12 and FASSA Per Capita
(national level)



(1) Units expressed in 2010 pesos.
Source: Own elaboration with data from SINAIS and the Ministry of Health.

agreed between the federal government and states in 1997 (Sour *et al.*, 2004), which depended on the expenditure made by the Ministry of Health before decentralization (Merino, 2003).

In fact, FASSA allocation between states in its first year of operation (1998) was very similar to the allocation of the MofH budget in 1997. Later, during the first years of the reform, federal expenditure to states was reduced considerably (see Figure 2). In 1997 MofH distributed resources to states equivalent to 0.34 per cent of GDP while in 1998 the number dropped to 0.02 per cent with 14 states not receiving any resources. In contrast, FASSA budget in 1998 was equal to 0.39 per cent of GDP. We next show the MofH budget for each state in 1997 is a good predictor of FASSA in any given year, suggesting that the fund has a strong inertial component.[22]

4.2 *What explains FASSA allocation among states?*

In this section we provide some empirical evidence on the determinants of expenditure allocation among states for the non-insured population (Ramo12 before 1998 and FASSA after 1997). First, we present the descriptive statistics of this exercise. After which we proceed to describe the empirical strategy and its results.

22 After 2004, the nature of FASSA changed because it was used by the federal government to finance the operation of a program called Popular Insurance (Seguro Popular) under different expenditure rules. For this reason the analysis of this paper stops in that year.

Table 1

Summary Statistics

Variables	Panel A – Ramo12 (1993-97)				Panel B – FASSA (1998-2003)			
	Mean	Std. Dev.	Min.	Max	Mean	Std. Dev.	Min.	Max
Ramo12	278.77	116.93	100.82	724.83	-	-	-	-
Ramo12 from 1992	253.94	100.6	108.34	583.68	-	-	-	-
FASSA	-	-	-	-	438.36	176.95	178.79	1034.61
Ramo12 from 1997	-	-	-	-	310.96	119.53	173.37	724.83
Infant Mortality Rate	27.51	4.89	16.59	40.87	19.56	3.97	12.44	32.86
DIP	0.25	0.09	0.12	0.73	0.2	0.06	0.09	0.42
DNIP	1.36	1.05	0.51	10.18	1.41	0.61	0.64	3.83
PUP	0.47	0.15	0.15	0.78	0.5	0.14	0.22	0.8
Pop	2.86	2.44	0.35	12.11	3.09	2.63	0.41	13.59
GSP	66.12	31.61	26.76	185.65	76.36	36.35	28.46	213.92
Number of observations	160				192			

Note: The definition and units of the variables are in Table 2.

4.2.1 Descriptive statistics

Table 1 shows the descriptive statistics for the two set of regressions: Ramo12 (1993-97) and FASSA (1998-2003) in per capita terms. The definition, corresponding acronym, units of measure and source for each of these variables is included in Table 2. We use one-year lagged covariates because health budget is allocated at the end of the previous year, when legislators approve the federal budget.

The dependent variables, Ramo12 and FASSA, are on average 279 and 438 pesos per person, respectively (see Table 1). The potential explanatory variables for the non-insured population are some proxies for health needs, resources, and socioeconomic variables. First, we include the infant mortality rate (the sample average is of 27.6 and 19.6 deaths of children younger than 1 year per 1000 live births in the pre and post reform years) and the infectious and parasitic mortality rate which is denoted as DIP_{it} (0.25 and 0.2 deaths per 1000 inhabitants, respectively).[23]

Second, according the Law of Fiscal Coordination, FASSA allocation should be partly determined by the physical and medical infrastructure available in each state. In order to control for these elements, we include total number of doctors assigned for the non-insured population in each state per 1000 non-insured individuals which is represented as $DNIP_{it}$ (1.36 and 1.41 doctors

[23] We also collected other variables like deaths by maternal causes, fetal deaths, deaths by conditions originated in the perinatal period, deaths by diabetes, and deaths by nutritional deficiencies, among others. We do not include these variables as regressors because many of them are highly correlated. However, the results are robust to the use of one specific variable instead of another.

Table 2

Definition of Variables

Variable	Definition	Units	Source
DIP_{it}	Deaths by infectious and parasitic diseases for state i and year t	Per 1000 inhabitants by state	Ministry of Health
$DNIP_{it}$	Doctors for non-insured population for state i and year t	Per 1000 inhabitants non-insured	SINAIS
DP_{it}	Population Density for state i and year t	Inhabitants per Km^2	INEGI
$FASSA_{it}$	Health services fund for state i and year t	Thousand pesos per capita	Ministry of Health
GSP_{it}	Gross state product for state i and year t	Thousand pesos per capita (2nd half dec 2010=100)	INEGI
$HBPS_{it}$	Hospital beds in the private health sector for state i and year t	Per 1000 inhabitants by state	SINAIS
$HEEP_{it}$	Health services expenditure from public institutions (IMSS, ISSSTE,PEMEX) for state i and year t	Thousand pesos per capita (2nd half dec 2010=100)	Ministry of Health
$I(t>1997)$	Is an indicator function that takes the value of zero before the reform was implemented and one after the reform	N.A.	N.A.
IMR_{it}	Natural logarithm of the infant mortality rate for state i and year t	Number of deaths of children less than one year old per 1000 live births by state	UN Millennium Development Goals
$IMR_{Biased,\ it}$	Natural logarithm of the infant mortality rate for state i and year t	Per 1000 live births by state	SINAIS
$IMR_{Ratio,\ it}$	$\log(IMR_{it}) - \log(IMR_{Biased,\ it})$	N.A.	N.A.
FDR_{ijt}	Natural logarithm of fetal deaths for state i, year t, and group j divided by population in state i, year t, and group j[(1)]	Per 100 insured or non-insured population	INEGI
$Ramo12_{it}$	Federal government directly spend on health services for state i and year t	Thousand pesos per capita	SINAIS
Pop_{it}	Total population for state i and year t	Total number of inhabitants per state	CONAPO
$PSCR_{it}$	Percentage of students who completed primary school in 6 years for state i and year t	Percentage	UN Millennium Development Goals
PUP_{it}	Proportion of non-insured population for state i and t	Between zero and one	Ministry of Health
THE_{ijt}	Total health expenditure for state i, year t and group j divided by population for state i, year t and group j[(1)]	Thousand pesos per insured or non-insured population	Ministry of Health

[(1)] j is insured or non-insured group.
Sources: National Population Council (CONAPO), Bureau of Health Information in Mexico (SINAIS), National Institute of Statistics, Geography and Informatics of Mexico (INEGI) and United Nations (UN) Millennium Development Goals Statistics.

before and after 1998).[24] Third, we also include socioeconomic variables such as the annual gross state product per capita (GSP_{it}); the ratio of the non-insured population over the total population, denoted as PUP (47 and 50 per cent), and total population, represented as Pop_{it} (2.9 and 3.1 millions).[25]

Finally, according to the Law of Fiscal Coordination, the allocation of FASSA also depends on the resources received in the previous year. In fact, when the FASSA started to operate, the allocation of such resources among states crucially depended on what the federal government directly spent on each state in 1997 through centralized resources, *i.e.*, Ramo12. This means that as of today, the allocation of FASSA between states still depends on what each state received in 1997 from Ramo12. For this reason, we add the amount of resources that each state received in 1997 through Ramo12 as a regressor. On average, this variable is 311 pesos per capita. Following the same logic in Ramo12 per capita regressions, we include Ramo12 per capita in 1992 (the state average of this variable was of 254 pesos per capita).

4.2.2 Health expenditure 1993-2003

Our empirical strategy aims to unveil the key determinants of the state allocation of non-insured health expenditure: Ramo12 for the previous years of the reform of 1997 and FASSA for the 1998-2003 period in order to check if there was a change in the criteria of assignation once decentralization took place.

For each period (before and after 1997), we run two sets of regressions on state level data. The first one is a pooled data approach, in which we regress per capita FASSA (and Ramo12) flows received by state i in year t in constant pesos, on a set of covariates that presumably determines the amount of resources that each state receives in a specific year. We include year dummies to the specification to control for aggregate time effects. In this estimation, we add a time-invariant regressor: the federal budget on health in 1997 (in 1992 for Ramo12 specifications) because we want to see how important this inertial component is for FASSA allocation, as some authors have suggested. We also include a state fixed effects estimations (removing the Ramo12 per capita component) in order to check whether our results hold under this alternative specification. The second set of estimations are cross section regressions for 1998 and 2003 (results are consistent for 1999, 2000, 2001 and 2002) as we are interested to analyze the criteria of individual years of the Federal Congress in the assignment of FASSA for all the period. We also run a similar set of regressions for the Ramo12 per capita before the reform (between 1993 and 1997) as we want to analyze whether its allocation is correlated to variables that indirectly could be affecting FASSA.

4.2.3 Results

The results for the determinants of FASSA and Ramo12 per capita are shown in Table 3. The results show a strong inertial component for health expenditure, as the coefficient of Ramo12 of 1992 and 1997 is significant at 1 per cent level (specifications 1, 3, 5, 7, 9 and 11). For instance, specification 7 shows that for every peso per capita that every state received from FASSA in 1997,

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[24] We also try other variables including the number of non-insured medical offices and appointments; number of dentists, number of nurses, and number of hospital beds of the Ministry of Health. As before, we do not include these variables as regressors because many of them are highly correlated. However, the results are robust to the inclusion of one of these variables instead of the one included in the specification.

[25] Education was also included in some specifications and the results remain unchanged.

Table 3

Ramo12 and FASSA Determinants

Independent Variables	Panel A – (1993-97)						Panel B – (1998-2003)					
	Dependent Variable is Ramo12 Per Capita						Dependent Variable is FASSA Per Capita					
	Panel Data		Cross Section				Panel Data		Cross Section			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	1993 to 1997	1993 to 1997	1993	1993	1997	1997	1998 to 2003	1998 to 2003	1998	1998	2003	2003
$Ramo12_{i\ 1992}$	0.963***	-	1.083***	-	0.909***	-	-	-	-	-	-	-
	(0.0461)	-	*(0.0582)*	-	*(0.122)*	-	-	-	-	-	-	-
$Ramo12_{i\ 1997}$	-	-	-	-	-	-	1.329***	-	1.401***	-	1.279***	-
	-	-	-	-	-	-	*(0.111)*	-	*(0.0891)*	-	*(0.191)*	-
IMR_{it-1}	0.354	–19.88	–0.571	17.87*	–2.163	11.77	–1.837	–18.11***	–3.637	8.341	7.228	13.52
	(2.638)	*(12.84)*	*(1.81)*	*(8.862)*	*(9.687)*	*(7.554)*	*(2.585)*	*(5.353*	*(2.185)*	*(11.3)*	*(5.234)*	*(15.47)*
DIP_{it-1}	78.12	134.7	56.57	–62.07	–170.6	–419.6	–172.7*	252.6	73.6	–351.5	–319.6**	–639.5
	(51)	*(136.1)*	*(47.42)*	*(158.2)*	*(163.2)*	*(258)*	*(92.49)*	*(211.4)*	*(59.97)*	*(314.7)*	*(146.1)*	*(413.5)*
$DNIP_{it-1}$	6.022	20.72	6.939	64.36	37.94**	89.14*	–7.265	9.011**	–13.19***	22.78	–4.81	145.8**
	(6.964)	*(25.97)*	*(6.42)*	*(43.65)*	*(14.15)*	*(45.2)*	*(4.723)*	*(3.655)*	*(4.709)*	*(23.18)*	*(27.9)*	*(64.1)*
PUP_{it-1}	–4.082	2.082**	–37.91	–126	207	120.9	–89.59	241.2	–208.7*	–310.8	–152.1	80.43
	(61.76)	*(880.3)*	*(64.34)*	*(240.1)*	*(197.7)*	*(288.9)*	*(92.46)*	*(326.7)*	*(105.2)*	*(479.3)*	*(135.8)*	*(389.8)*
Pop_{it-1}	–5.171***	77.86	–3.230*	–24.71**	–5.894*	–21.49**	–4.383*	–45.06	2.182	–34.39**	–7.270*	–30.19*
	(1.874)	*(46.21)*	*(1.731)*	*(11.63)*	*(3.274)*	*(10.04)*	*(2.541)*	*(35.56)*	*(2.172)*	*(16.13)*	*(3.923)*	*(15.43)*
GSP_{it}	–0.0607	0.378	–0.540**	0.201	0.643	0.956	–1.046**	0.986	–1.179**	–0.361	–0.889	–0.329
	(0.2)	*(0.763)*	*(0.224)*	*(0.875)*	*(0.437)*	*(0.926)*	*(0.432)*	*(0.63)*	*(0.45)*	*(1.684)*	*(0.734)*	*(1.752)*
Constant	17.36	–293.3	63.33	–235.6	1.177	–71.49	274.0***	715.1***	184.2***	467.3	218.4*	251.2
	(66.89)	*(401.1)*	*(52.5)*	*(232.8)*	*(158.2)*	*(144.4)*	*(61.69)*	*(202.3)*	*(49.51)*	*(309.4)*	*(117.2)*	*(330.9)*
Year Indicators	Yes	Yes	-	-	-	-	Yes	Yes	-	-	-	-
Fixed Effects	No	Yes	-	-	-	-	No	Yes	-	-	-	-
R^2	0.878	0.565	0.958	0.5	0.847	0.502	0.934	0.805	0.978	0.351	0.923	0.528
Observations	160	160	32	32	32	32	192	192	32	32	32	32

Panel data estimations show state cluster robust standard errors in parentheses & cross section estimations show robust standard errors in parentheses.
Note: The definition and units of the variables are in Table 2. Significance interpretation is as follows: *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

it will get from FASSA 1.33 pesos on average in the 1998-2003 period. The effect is statistically significant at 1 per cent level.

This result remains unchanged in the cross section specifications (3, 5, 9 and 11): the inertial component is crucial for the allocation of health public expenditure for the non-insured population. Probably this result should not be a surprise because there is persistence on health outcomes and resources over time and the initial allocation of expenditure might be capturing the effect of initial outcomes. However, we believe that health outcomes (such as infant mortality rate) should matter independently in how health expenditure was allocated in past years, even if that allocation depended on past health indicators. In this sense, we do not find consistency in the signs and significance of the different potential explanatory variables (even though they are explicitly contained in FASSA's formula) across the different regressions. This result suggests that legislators assign health budget exclusively taking into account the previous year's allocation but no other health fundamentals. The only variable that seems to be consistent in the significance and magnitude is Pop_{it-1}. The sign is negative, implying that more populous states obtained lower health transfers. It could be thought that this sign is due to its correlation with other variables. For instance, it is plausible that a state with high mortality has restricted access to health facilities that are negatively correlated to DP_{it-1}. However, discarding Pop_{it-1} as an explanatory variable does not change our results.

In particular, IMR_{t-1} and DIP_{t-1} yield no significant estimates in most of the cases. In some specifications they even have an opposite expected sign. The result would indicate that states with high health needs would receive fewer resources from FASSA, suggesting a regressive distribution allocation of the health budget.

With respect to the variable related to medical infrastructure ($DNIP_{it-1}$), the coefficient is positive for Ramo12 per capita but only the regressions for 1997 (columns 5 and 6) are significant. Interestingly, for FASSA per capita regressions without Ramo12 per capita for 1997 included, the results for medical infrastructure are positive and significant for the fixed effects and 2003 regressions (columns 8 and 12), which could be related to the FASSA allocation formula stated in the Law of Fiscal Coordination.

Finally, in few specifications, state GDP shows a negative and significant coefficient, indicating that there is some redistributive element in FASSA. However, this result is not consistent across the different specifications. It is surprising that the proportion of non-insured population is not significant because it is precisely the population that should be targeted by non-insured expenditure (either Ramo12 or FASSA).

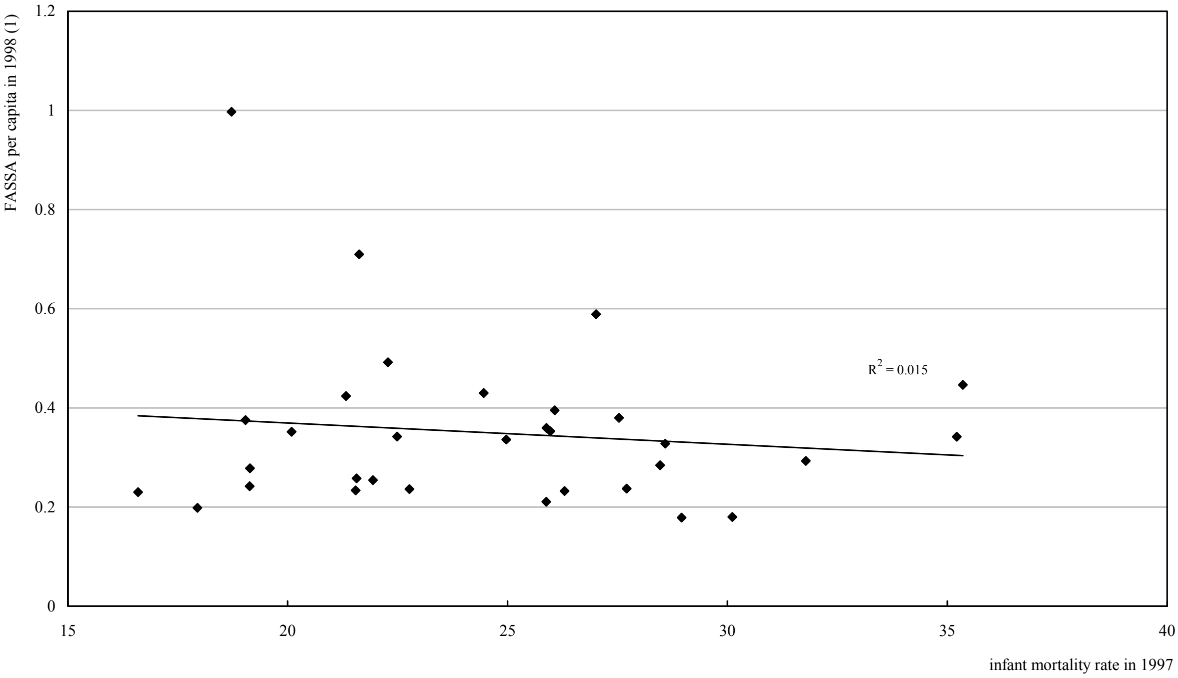
In sum, the results indicate that health outcomes (and other variables) do not determine how the resources are allocated. Our regressions suggest that the most important determinant of state non-insured expenditure is the past allocation. This finding is critical for our empirical strategy for the consequences of decentralization, as we do not have any evidence that FASSA is endogenously allocated as a result of health outcomes. So we are confident that, in particular, infant mortality rate is exogenous to how FASSA is determined (see Figure 3).

5 Does decentralization of resources for health services improve state-level health outcomes?

In this section we test, through different estimation procedures and specifications, whether the decentralization of resources for health services improve state-level health outcomes. First, we test whether state health outcomes improved in the years after the implementation of FASSA relative to how Ramo12 did in the years previous the reform. We find no significant difference

Figure 3

Infant Mortality Rate in 1997 vs. FASSA Per Capita in 1998



$$\textit{FASSA Per Capita}_{1998} = \underset{(0.158)}{0.455} - \underset{(0.006)}{0.004}\ \textit{IMR}_{1997}$$

[(1)] Units expressed in 2010 pesos.
Note: Standard errors are shown in parenthesis.
Source: Own elaboration with data from the Ministry of Health and UN Millennium Development Goals.

between the effectiveness of Ramo12 and FASSA. Second, we test whether states that received more FASSA resources observed better health outcomes than low FASSA states after the reform. Again, we find no significant difference. Third, we test whether there is a difference between state health outcomes of the uninsured relative to the insured population after the implementation of the reform. Since Ramo12 and FASSA focus on the non-insured population, we took the insured population as a control group. We find, as before, no significant difference between health improvements observed after the implementation of the reform among the treatment and control groups. Finally, focusing on expenditure amounts, we test whether FASSA and Ramo12, which focus on the non-insured population, between the years before the reform (1993-97) and the years after the reform was implemented (1998-2003) is more efficient than the health expenditure for the insured population.

Contrary to all previous results, we find that in fact FASSA and Ramo12 together are more effective than the IMSS, ISSSTE or PEMEX in reducing fetal deaths.

5.1 Summary statistics

Before presenting the final results, we briefly summarize the main variables used in this section. In Table 4 we show the summary statistics of these variables used by pooling the data from

Table 4

Summary Statistics 1993-2003

Variables	Mean	Std. Dev.	Min	Max
DP	266.3	1003	4.78	5920
Fetal death rate	0.262	0.121	0.026	0.783
Log(Fetal deaths)	–1.47	0.566	–3.666	–0.244
Fetal death rate for the non-insured population	0.304	0.130	0.035	0.783
Log(Fetal deaths) for the non-insured population	–1.307	0.538	–3.352	–0.244
Fetal death rate for the insured population	0.220	0.094	0.026	0.522
Log(Fetal deaths) for the insured population	–1.634	0.547	–3.666	–0.65
GSP	71.7	34.61	26.75	213.9
HBPS	0.297	0.132	0.082	0.832
HEEP	2.663	1.03	1.173	9.384
Log(infant mortality rate)	3.11	0.255	2.521	3.71
PSCR	85.52	9.185	43.42	99.16
PUP	0.49	0.148	0.148	0.798
Ramo12	0.19	0.144	0	0.725
THE	1.805	1.196	0.167	9.384
Log(*THE*)	0.355	0.736	–1.792	2.239
THE for the non-insured population	0.946	0.567	0.167	3.356
Log(*THE*) for the non-insured population	–0.218	0.577	–1.792	1.211
THE for the insured population	2.664	1.031	1.173	9.384
Log(*THE*) for the insured population	0.928	0.305	0.16	2.239

Total number of observations is 352 for all variables with exception of total health expenditure, fetal deaths and its logarithmic function which have 704 observations due the distinction between non-insured and insured population.
Note: The definition and units of the variables are in Table 2.

1993 through 2003. We follow the literature using as our preferred health status variable, infant mortality rate (deaths of babies younger than 1 year old divided by life births). According to summary statistics, the natural log of the infant mortality rate is on average 3.11, that is, approximately 22 infant deaths per thousand births among all states and years. There are various reasons we focus on IMR_{it} as our main dependent variable. Infant mortality rate is a good health outcome measure as it reflects health attention to sensitive care groups of population (children and pregnant women); it is also known that it responds rapidly to changes in the health systems (Jiménez Rubio, 2011); it is better measured than other indicators such as life expectancy; and is correlated with many other health indicators (Joumard *et al.*, 2008; and Jiménez Rubio, 2011). The other variable we use as measure of state health status is total fetal death rate. As shown in Table 4, the natural log of total fetal deaths (FDR_{it}) averages –1.470, that is, about 0.26 fetal deaths per thousand individuals. The main advantage of this variable relative to IMR_{it} is that we can obtain the fetal death rate for non-insured and insured population, respectively. According to summary statistics, for the non-insured population fetal death rate averages around 0.30 fetal deaths per thousand non-insured individuals. For insured population, there are on average 0.22 fetal deaths per thousand insured persons.

Continuing with the variables summarized in Table 4, $Ramo12_{it}$ is on average 190 pesos per capita between 1993 and 2003. The variable $FASSA_{it}$ averages 438 pesos per capita for the years after its implementation (see Table 1). Gross state product per capita (GSP_{it}) in constant pesos is on average 71,707 pesos. Population density (PD_{it}) is around 266 persons per squared kilometer on average.

The average expenditure by IMSS, ISSSTE and PEMEX is 2663 pesos per eligible person ($HEEP_{it}$). The proportion of uninsured population (PUP_{it}) over the total population per state is on average 0.49. The primary school completion rate ($PSCR_{it}$), a measure of schooling, is on average 85 per cent. We do not observe out-of-pocket expenditure on health services by the population for years before 1998. However, on average, there are 0.29 hospital beds in the private sector per 1000 inhabitants ($HBPS_{it}$).

5.2 *What was the impact on state health outcomes of FASSA relative to Ramo12?*

In this section we test whether state health outcomes improved in the years after the implementation of FASSA relative to how Ramo12 did in the years previous the reform. This is a way to test whether decentralizing resources from the federal to the state government improved the health of the population. Recall that before 1998 the resources for health services were channeled through Ramo12 and the federal government was responsible of their use in each state. After 1997, FASSA was created to channel those same health resources to states and now state governments are responsible of the administration of such budget. The empirical specification is the following:

$$\begin{aligned} IMR_{it} = \alpha + \beta_1 I\ (t > 1997) + \beta_2\ (Ramo12_{it}) + \beta_2\ [I(t > 1997) * (Ramo12_{it})] + \\ + \beta_4[I(t > 1997) * (FASSA_{it})] + X_{it}B_5 + c_i + u_{it} \end{aligned} \qquad (1)$$

$$I = 1, \dots 32 \qquad t = 1, \dots 11$$

In equation (1), IMR_{it} is the natural logarithm of the infant mortality rate in state i and year t; $I(t>1997)$ is an indicator function that takes value zero for the years before the reform was implemented and one after the reform; $Ramo12_{it}$ is the amount of resources per capita directly spent by the federal government for health services in state i and year t; $FASSA_{it}$ is the amount of decentralized resources per capita for health services provision in state i and year t after 1997; X_{it} refers to a vector of control variables which are described below; c_i denotes the state fixed effect which is assumed to be arbitrarily correlated with the regressors; and u_{it} denotes the idiosyncratic error for state i in year t. There are 32 states in Mexico and the analysis covers eleven years, from 1993 through 2003.

Notice that $FASSA_{it}$ enters only as an interaction with the reform-years indicator, *i.e.*, $I(t>1997)$. This is because FASSA was implemented in 1998 and thus it takes value zero for years before 1998. In contrast, $Ramo12_{it}$ operates both before and after the decentralization reform. $Ramo12_{it}$ appears by itself and as interaction with the reform-years indicator. Also, notice that β_2 is the effect of $Ramo12_{it}$ over the IMR_{it} in the years before the reform and β_4 is the effect of $FASSA_{it}$ on the IMR_{it} in the years after the reform. Thus, our interest is in β_4–β_2. We expect this difference to be negative. However, we also need this difference to be significant to be able to conclude that the decentralization improved health outcome of the population. If β_4–β_2 turns out to be not significant, even if it has the correct sign, it implies that there is no significant difference between what central government was doing with the money and what state governments do with the same resources.

Equation (1) also permits us to test whether the money spent on health services by state governments improves the IMR relative to the money spent by the federal government for the same purpose but considering both effects in the years after 1997, that is, after the decentralization reform took place. In this case our interest is in $\beta_4-(\beta_2+\beta_3)$. If this difference is negative it implies that FASSA is more efficient than Ramo12. However, regardless of the sign, if $\beta_4-(\beta_2+\beta_3)$ is not significant, we can only say that there is no difference between the two funds after the reform.

There are other variables besides $FASSA_{it}$ and $Ramo12_{it}$ that could explain the IMR_{it}. For this reason, we include different control variables in the specification equation (X_{it}). We include gross state product per capita (GSP_{it}) to control for level of income. We also try to control for the average distance between health facilities and the inhabitants by including population density ($PD_{it)}$ as control variable. As mentioned above, there are three main public institutions in charge of providing health services to eligible population: IMSS, ISSSTE and PEMEX. The expenditures made by these institutions could also be contributing to the decrease of the IMR_{it}. We added the per insured person expenditure made by these institutions in health services provision and name the variable $HEEP_{it}$. Another control variable we include is percentage of uninsured population (PUP_{it}) in each state and in each year. This variable is a proxy of the necessities of health services for non-insured population in each state. We control for the primary school completion rate per state, $PSCR_{it}$, as a measure of schooling. Finally, we do not observe the out-of-pocket expenditure on health services by the population for years before 1998. Of course, these expenses could also be improving the health outcomes of the population. Therefore, we proxy this variable with the number of hospital beds per 1000 inhabitants in the private health sector, *i.e.*, $HBPS_{it}$.

We estimated equation (1) by fixed-effects panel estimation method, correcting standard errors for cluster effects of states.

Results from estimating equation (1) are in Table 5. The second column contains the estimates of the coefficients of specification (1) with fixed effects but without control variables.[26] Results indicate that an increase by one thousand pesos per capita in $FASSA_{it}$ decreases IMR_{it} in 39.4 per cent whereas an increase by the same amount in $Ramo12_{it}$ before 1997 decreases IMR_{it} in 33.7 per cent (and both effects are statistically significant at the 1 per cent level). Recall that average $FASSA_{it}$ is 438 pesos, thus if it increases to 1438, an increase of 228 per cent, the infant mortality decreases 39.4 per cent. For the case of $Ramo12_{it}$ an increase from its average of 278 pesos per capita between 1993 and 1998 to 1278 pesos, a 1000 pesos increase or a 359 per cent increase, the infant mortality decreases by 33.7 per cent. The difference between the two semi-elasticities is $\beta_4-\beta_2 = -0.394 - (0.337) = -0.057$, but not statistically significant. This implies that $FASSA_{it}$ and $Ramo12_{it}$ are indistinguishable.

In column (3) we estimate the same specification as before but we added control variables. Results are similar as those in column (2), that is, there is no significant difference between how $Ramo12_{it}$ did before the decentralization reform and how $FASSA_{it}$ did after its implementation. However, the difference is positive and equal to 0.0129, which implies that the semi-elasticity related to $FASSA_{it}$ is 1 percentage points higher than the corresponding for $Ramo12_{it}$. In column (4) and (5) we show the results from estimating equation (1) when we include a time trend and year indicators, respectively. In both cases, $\beta_4-\beta_2$ is negative, as expected, though not statistically different from zero. Notice that increasing $Ramo12_{it}$ and $FASSA_{it}$ by 1000 pesos decreases the IMR_{it} by 1.8 and 6.8 per cent, respectively, but neither coefficient is statistically significant (column 5).

Using the results in Table 5, we also compare $Ramo12_{it}$ and $FASSA_{it}$ with each other but in the years after the reform. In other words, we test whether $\beta_4-(\beta_2+\beta_3)$ is different from zero. In all

26 Results in column (1) were included to compare the R^2 from equation (1) without including fixed effects and when including such effects. In such case the R^2 is 0.474. We also regress IMR on time dummies only and on fixed effects only. The corresponding R^2's are 0.539 and 0.452, respectively.

Table 5

Fixed Effects Panel Estimated Coefficients

Independent Variables		Log Infant Mortality Rate					Log Fetal Death Rate
		(1)	(2)	(3)	(4)	(5)	(6)
b_1	$I(t>1997)$	-0.239^{***}	-0.228^{***}	-0.189^{***}	-0.0807^{***}	-0.074^{***}	0.0864^{*}
		(0.047)	*(0.025)*	*(0.022)*	*(0.013)*	*(0.012)*	*(0.0427)*
b_2	$Ramo12_{it}$	0.201	-0.337^{***}	-0.353^{***}	–0.061	–0.018	0.123
		(0.252)	*(0.096)*	*(0.078)*	*(0.052)*	*(0.06)*	*(0.304)*
b_3	$Ramo12_{it} * I(t>1997)$	0.0387	0.006	0.088	0.093	0.014	–0.549
		(0.324)	*(0.131)*	*(0.126)*	*(0.059)*	*(0.065)*	*(0.499)*
b_4	$FASSA_{it} * I(t>1997)$	–0.177	-0.394^{***}	-0.340^{***}	-0.097^{*}	–0.068	–0.129
		(0.152)	*(0.055)*	*(0.08)*	*(0.05)*	*(0.056)*	*(0.203)*
	Time Trend	-	-	-	-0.047^{***}	-	-
		-	-	-	*(0.002)*	-	-
	GSP_{it}	-	-	-0.003^{***}	–0.0005	–0.0006	0.00119
		-	-	*(0.0007)*	*(0.0003)*	*(0.0004)*	*(0.0015)*
	DP_{it}	-	-	0.0002	0.0001	0.0003^{***}	0.00346^{***}
		-	-	*(0.0004)*	*(0.0001)*	*(0.0001)*	*(0.00124)*
	$HEEP_{it}$	-	-	0.073^{***}	0.036^{**}	0.027^{*}	0.0802^{*}
		-	-	*(0.01)*	*(0.013)*	*(0.013)*	*(0.0412)*
	PUP_{it}	-	-	-1.712^{***}	–0.159	-0.318^{*}	–0.894
		-	-	*(0.209)*	*(0.147)*	*(0.182)*	*(0.71)*
	$PSCR_{it}$	-	-	-0.005^{***}	0.001^{**}	0.002^{**}	0.00515
		-	-	*(0.001)*	*(0.0009)*	*(0.0008)*	*(0.00498)*
	$HBPS_{it}$	-	-	0.061	0.069	0.055	0.0156
		-	-	*(0.075)*	*(0.042)*	*(0.04)*	*(0.116)*
	Constant	3.243^{***}	3.393^{***}	4.596^{***}	3.402^{***}	3.012^{***}	1.021
		(0.072)	*(0.028)*	*(0.142)*	*(0.124)*	*(0.133)*	*(0.637)*
	Year Indicators	No	No	No	No	Yes	Yes
	Fixed effects	No	Yes	Yes	Yes	Yes	Yes
	$b_4 - b_2$	–0.378	–0.056	0.012	–0.036	–0.05	–0.252
	$Prob > F_1$	0.061	0.494	0.825	0.298	0.181	0.0671
	$b_4 - (b_2 + b_3)$	–0.417	–0.063	–0.076	–0.13	–0.064	0.298
	$Prob > F_2$	0.201	0.535	0.544	0.034	0.276	0.487
	Number of Groups	-	32	32	32	32	32
	Number of Observations	352	352	352	352	352	352
	R^2	0.474	0.872	0.936	0.973	0.983	0.316
	R^2 Overall	-	0.401	0.003	0.103	0.005	0.0869
	R^2 Between	-	0.0292	0.458	0.187	0.154	0.0923

Panel data estimations show state cluster robust standard errors in parentheses.
Note: The definition and units of the variables are in Table 2. Significance interpretation is as follows: *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

five columns, except for column (4), it is the case that $FASSA_{it}$ is not significantly different from $Ramo12_{it}$ after the reform was implemented. However, notice that such difference is negative in all five cases. According to results in column (5), when we added year indicators and control variables, the difference is 0.064 which implies that $FASSA_{it}$ decreases IMR_{it} relative to $Ramo12_{it}$ when comparing them after 1998.

From Table 5 it is also possible to compare $Ramo12_{it}$ performance in the years after the reform with the years before the reform, coefficient β_2 captures this difference. This coefficient is positive in all four columns, but fails to be statistically significant. This implies that there is no difference between $Ramo12_{it}$ nowadays compared to before the reform. In accordance to column (5), the coefficient is 0.014. This means that one thousand pesos increase in $Ramo12_{it}$ after the reform took place decreases in 1.42 per cent the IMR_{it} compared to the effect of $Ramo12_{it}$ in the years before the reform took place.

Finally, another coefficient of interest from Table 5, is the one associated to the decentralization reform, $I(t>1997)$. Notice that in all five columns this coefficient is negative and statistically significant at 1 per cent level. This coefficient is capturing the fact that over time the IMR_{it} is decreasing between 1993-97 and 1998-2003. The magnitude of the coefficient decreases when we include either a time trend or year fixed effects.

Results presented in Table 5 are robust to different measures of health well-being, specifically, infant mortality rate for children less than 5 years old, child deaths by respiratory diseases per 1000 births, child deaths by intestinal diseases per 1000 inhabitants, and fetal death rate per 1000 inhabitants. Results from estimating equation (1) using as the dependent variable the fetal death rate are shown in column 6 of Table 5. Notice results are the same as before, $\beta_4 – \beta_2$ is negative, although significant at 10 per cent level.

5.3 What was the impact of decentralization on health outcomes in states that received more resources from FASSA?

The lack of significance of the previous results is evidence that, in general, decentralization of responsibilities and funds from federal to state authorities regarding state health services provision did not significantly improve the well-being of the population. Although the sign of the coefficients of interest are negative, their magnitudes are rather small. However, perhaps states that received more resources from FASSA did a better job than states that received fewer resources.

In this section we follow a difference in difference approach which will enable us to address the following question: Did states that receive more FASSA get better health outcomes than states that received less FASSA after the reform? Ideally, we would like to have an experiment with one group of states that were treated with health decentralization and other set of control states that were not submitted to the institutional change, and compare the performance of both groups after the reform was implemented. However, as previously discussed, all states received FASSA funds. Thus, we perform a pseudo experiment. We divide the states into two groups according to FASSA transfers per capita received in the first year of the reform (1998).[27] We called the first group high FASSA states[28] (or treated group) and are those that are above the median of the 32 states. The low

[27] The range of the distribution of FASSA per capita is large as the descriptive statistics point out. The median of FASSA per capita in 1998 was 332 pesos of 2010 and the mean was 350 pesos, with the maximum value being 997 pesos and the minimum 179 pesos. The coefficient of variation (standard deviation/mean) is 0.48. The average FASSA per capita for the high group is 458 pesos and for the low group is 242 pesos.

[28] Baja California Sur, Colima, Campeche, Quintana Roo, Guerrero, Nayarit, Aguascalientes, Durango, Tabasco, Sonora, Tlaxcala, Tamaulipas, Yucatán, Morelos, Chiapas, and Querétaro.

FASSA states group (or control group) are the remaining states. We estimate a set of difference in difference regressions with the following simple framework:

$$IMR_{it} = \alpha + \beta_1(H_i) + \beta_2 I\,(t > 1997) + \beta_3\,[I(t > 1997) * (H_i)] + X_{it}B_4 + c_i + u_{it} \qquad (2)$$

$$i = 1, \ldots 32 \qquad\qquad t = 1, \ldots 11$$

In this specification the dependent variable refers to the natural log of the infant mortality rate; H_{it} is an indicator function that takes the value of one if the state i belongs to the high FASSA group and zero if it belongs to the low FASSA group; $I(t>1997)$ is also an indicator function defined as before; and the variable multiplied by β_3 is an interaction term between the previous variables. This is the coefficient of interest because it is the difference in difference effect on health of the reform on the treated states (high FASSA) relative to the control group (low FASSA). X_{it} refers to the same vector of control variables as before; c_i denotes the state fixed effect which is assumed to be arbitrarily correlated with the regressors; and u_{it} denotes the idiosyncratic error for state i in year t. Also, in some specifications we also include state fixed effects, a time trend common to all states, and year fixed effects, just as before.

The interpretation of the coefficients of interest is as follows: α refers to the health indicator average of low FASSA group before the intervention; β_1 is the difference in the average of the dependent variable of the high and low FASSA groups before 1998; and β_2 is the change in the average for the control group (low FASSA) after the reform relative to the pre reform period. Finally, β_3 captures the difference of health indicator average between high and low FASSA states after the decentralization relative to the difference between high and low FASSA states in the years prior to decentralization. We expect this last coefficient to be negative, but also significant. If it turns out to be not significant, then we cannot conclude that there is a difference between the control and treatment group due to the decentralization.

Before presenting our results, it is worth pointing out that our identification strategy requires that per capita FASSA assignment in 1998, and thus our classification of states according to FASSA, to be exogenous and not correlated to the error term conditioned on the variables included in the right hand side of equation (2). For instance, if FASSA is assigned to states according to their health indicators, that is, states with worse health indicators receive more FASSA, our classification of states according to FASSA would not be exogenous. Table 6 shows the average of both groups for a variety of health indicators and other controls in 1997, the previous year to the reform. Last column indicates the *p*-value for the *t*-test of differences in means between both groups. With the exception of two of our shown variables, it is not possible to reject the hypothesis that the difference in means is statistically different from zero. Given the classification of the groups and the persistency of FASSA per capita as a function of the allocation of Ramo12 per capita in 1997, it is not a surprise that such variables are the only ones that are significantly different from zero at 1 per cent level. This result suggests that the initial allocation of FASSA and its classification were not determined by health indicators, as one would expect.

Table 7 shows the results of the estimating equation (2) between 1993 and 2003. The difference-in-difference coefficient (β_3) is negative but not significant in any of the regressions. Although the direction of the coefficient indicates that states receiving more FASSA had lower infant mortality rate after the reform than low FASSA states, this coefficient is statistically not different from zero. Thus, the results suggest that there is no significant difference in health indicators between the treated and control states after the reform relative to the years previous to the introduction of FASSA. The very small magnitude of the coefficient provides further assurance that decentralizing resources did not have an impact on health indicators for states which received more resources relative to those states who received fewer resources from FASSA. According to the results in column (4), which include control variables and a time trend, the coefficient associated to the high FASSA (β_1) states is negative and statistically significant. This implies that

Table 6

Mean Comparison Between Low and High FASSA States
(null hypothesis: high FASSA mean – low FASSA mean = 0)

	Year	High FASSA per capita mean	Low FASSA per capita mean	*p*-value
FASSA	1998	457.66	242.18	0
*Ramo*12	1997	392.51	229.4	0
HBPS	1998	0.21	0.29	0.04
DP(1)	1997	77.46	451.1	0.3
Log (infant mortality rate)	1997	3.2	3.17	0.71
Infant mortality rate	1997	24.88	24.28	0.73
GSP	1997	65993	68259	0.85
PSCR	1997	86.96	87.4	0.89
PUP	1997	0.49	0.49	0.9
HEEP	1997	2343	2330	0.97
Number of observations		16	16	

(1) Population density of the Low FASSA group in 1997 (451.10) seems to be quite bigger than the High FASSA counterpart; this difference is mainly explained because Distrito Federal belongs to the Low FASSA group. Alone in 1997 Distrito Federal had a population density of 5786.15 habitants per square kilometer. By excluding Distrito Federal from the Low FASSA group the new population density mean would be 95.43 and the new *p*-value would be 0.6531.

previous to the reform, high FASSA states had a mortality rate 34 per cent lower than low FASSA states. This suggests that FASSA was not assigned accordingly to health necessities by states. Finally, β_2 is significantly negative (–0.080) reflecting the downward trend of infant mortality in control states.

Results presented in Table 7 are robust to different measures of health well-being, as the ones used for robustness in Table 5; results are also robust to excluding states around the median. For example, we pick only the 10 states with the highest and the 10 with the lowest FASSA and the results do not change (column 6). We also run the same specification with the top and bottom six FASSA states and results remain.

5.4 What was the impact of decentralization on the health outcomes of the non-insured population relative to the insured population?

So far we have not found evidence that health decentralization significantly improved the infant mortality rate, used as a proxy of the health conditions of the population. In this section we present two more empirical exercises. As mentioned before, all the states received FASSA funds, so in that sense, all states were treated, that is, all states were affected by the reform. However, recall that FASSA and Ramo12 have a target population: those who have no insurance. Thus there

Table 7

Difference in Difference Estimated Coefficients (Pseudo Experiment)

Independent Variables	**Log Infant Mortality Rate**						**Log Fetal Death Rate**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)** [(1)]	**(7)**
I(High FASSA group)	0.021	–0.264***	–0.573***	–0.348***	–0.407***	–0.393***	–0.275
	(0.057)	*(0.007)*	*(0.106)*	*(0.047)*	*(0.054)*	*(0.065)*	*(0.274)*
I(t>1997)	–0.341***	–0.341***	–0.255***	–0.080***	-	–0.066***	-
	(0.007)	*(0.008)*	*(0.024)*	*(0.012)*	-	*(0.017)*	-
*I(High FASSA group) * I(t>1997)*	–0.007	–0.007	–0.022	–0.003	–0.002	0.007	–0.147
	(0.013)	*(0.013)*	*(0.018)*	*(0.012)*	*(0.011)*	*(0.016)*	*(0.097)*
GSP_{it}	-	-	–3.875***	–0.548	–0.587	–0.864*	0.213
	-	-	*(0.765)*	*(0.396)*	*(0.431)*	*(0.446)*	*(1.474)*
$HEEP_{it}$	-	-	0.036**	0.028**	0.023*	0.026*	0.038
	-	-	*(0.018)*	*(0.011)*	*(0.012)*	*(0.013)*	*(0.044)*
$Ramo12_{it}$	-	-	–0.152**	0.045	0.036	0.101**	–0.332
	-	-	*(0.069)*	*(0.039)*	*(0.033)*	*(0.04)*	*(0.34)*
$PSCR_{it}$	-	-	–0.005***	0.002***	0.002***	0.003**	0.007
	-	-	*(0.001)*	*(0.001)*	*(0.001)*	*(0.001)*	*(0.006)*
DP_{it}	-	-	0.001	0.000**	0.000***	0	0.003***
	-	-	*(0.001)*	*(0)*	*(0)*	*(0)*	*(0.001)*
PUP_{it}	-	-	–2.107***	–0.166	–0.367*	–0.316	–0.894
	-	-	*(0.241)*	*(0.162)*	*(0.205)*	*(0.205)*	*(0.663)*
$HBPS_{it}$	-	-	0.019	0.076	0.048	0.153**	–0.016
	-	-	*(0.088)*	*(0.046)*	*(0.046)*	*(0.059)*	*(0.121)*
Time Trend	-	-	-	–0.049***	-	–0.049***	-
	-	-	-	*(0.002)*	-	*(0.003)*	-
Constant	3.288***	3.448***	5.114***	3.585***	2.962***	3.621***	–4.986***
	(0.044)	*(0.004)*	*(0.123)*	*(0.12)*	*(0.155)*	*(0.136)*	*(0.52)*
Year Indicators	No	No	No	No	Yes	No	Yes
Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	352	352	352	352	352	220	352
Number of Groups	32	32	32	32	32	20	32
R^2	0.457	0.904	0.958	0.985	0.991	0.983	0.948

[(1)] Only for Top 10 and Bottom 10 FASSA states.
Note: The definition and units of the variables are in Table 2. Significance interpretation is as follows: *** $p<0.01$, ** $p<0.05$, * $p<0.10$.
Panel data estimations show state cluster robust standard errors in parentheses.

is a fraction of the population in each state that was not affected by the reform, namely, those who had already health coverage. Taking advantage of this fact, we perform two exercises in which we consider the non-insured population as the treatment group and the insured population as the control group. Under this assumption, we are able to compare the performance of both groups for the years before (1993-97) and after (1998-2003) the reform was implemented.

To compare these groups we need to observe the infant mortality rate for each group. However, official statistics do not include IMR by insurance status, nor is there available data that permit us to construct the IMR for the insured and the uninsured population, respectively. Therefore, we rely on another health outcome: fetal deaths. This variable is part of *Estadísticas Vitales* published by INEGI. It is based on the information contained in Fetal Death Certificates. The main advantage of this variable is that it permits us to classify fetal deaths into our two groups of interest, according to whether the mother has insurance or not.

On the one hand, women who reported being beneficiary of either IMSS, ISSSTE, PEMEX, SEDENA,[29] SEMAR[30] or other institution are considered as insured. On the other hand, women who reported not having insurance are considered as non-insured.[31]

Using this data we construct the fetal deaths rate (FDR_{ijt}) defined as the number of fetal deaths occurred in state i, for group j, in year t as a fraction of the total population in state i which belongs to group j, in year t. In this case, j is equal to 1 for the non-insured population and equal to 2 for the insured population. Another advantage of this health outcome is that, similar to IMR, it responds relatively quickly to improvements in health provision. Moreover, this measure continues to be closely related to maternal health, one of the responsibilities transferred to states in the reform.

Nonetheless, FDR_{ijt} has one important problem. It tends to be biased because not all fetal deaths are reported to the corresponding authorities. Therefore not all fetal deaths have their corresponding certificate. This problem is more evident in poor, less educated and more disperse states, as well as states with a high proportion of uninsured population and less administrative capacity to register deaths. By controlling for some of these variables we take care for part of this bias. However, we do not observe other drivers of the bias. We have available two different series for the IMR, one that is biased (IMR_{Biased}) and one not (which corresponds to our IMR measure used along this study). We use the difference between these two series to approximate the bias in our FDR measure. By including this difference as a regressor, we try to control for the FDR bias we observe.

In a first exercise, we analyze whether the non-insured population had greater improvements in health outcomes after decentralization relative to the insured population. The identification strategy behind this specification is that the health provision decentralization was implemented for the benefit of non-insured people, leaving insured people unaffected. We expect that non-insured population observed improvements in fetal death rate relative to the insured population after the reform.

Our identification strategy requires that the distribution of people between the uninsured and insured cohorts is exogenous, *i.e.*, that insured population is almost the same as non-insured population but the treatment itself. There are many reasons we can think of that these two groups are not similar. However, Figure 4 graphs the national version of FDR_{ijt} per insurance eligibility group. As we would expect, insured population has a lower FDR than the one for non-insured

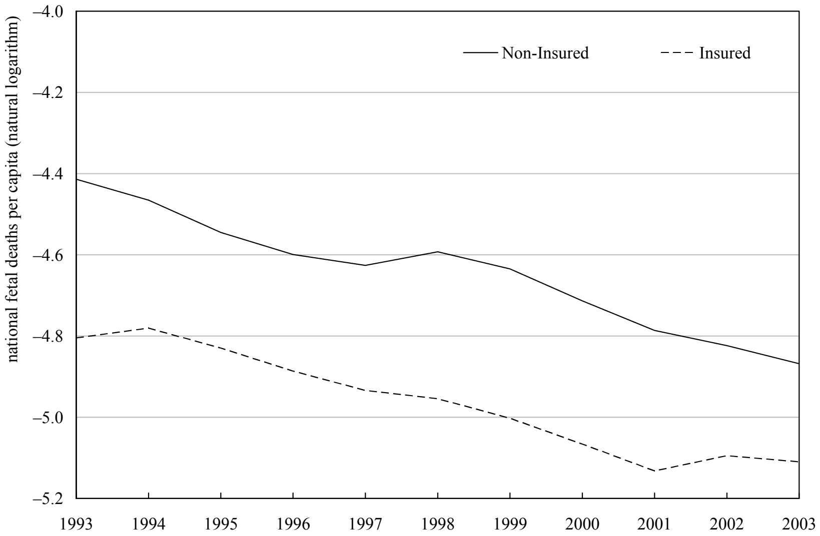
29 SEDENA stands for Secretaría de la Defensa Nacional, that is, Ministry of National Defense.

30 SEMAR stands for Secretaría de Marina, that is, Mexican Navy.

31 Those who reported insurance institution as unknown or not specified were excluded from the estimation. Nevertheless, as we will see in the results, classifying this group as insured or non-insured makes no significant difference in the results.

Figure 4

National Fetal Deaths Per Capita (Natural Logarithm) By Insurance Elegibility Group



Note: The insured fetal deaths per capita accounts for the fetal deaths of mothers who reported having some kind of medical insurance (*i.e.*, IMSS, ISSSTE, PEMEX, SEDENA, SEMAR or other institutions). Whereas the non-insured fetal deaths per capita accounts for the Fetal Deaths of mothers who reported not having any kind of medical insurance.
Source: Own elaboration with data from INEGI.

population. Second, from the graph it is also clear that both groups had very similar trends, particularly in the years before the reform took place. This is perhaps enough for our difference in difference approach to be credible. After 1997, the insured population continued with no particular changes whereas the non-insured population observed a small increase in 1998 to later show a steady decrease along the following years.

Another important assumption behind our identification strategy is that the composition of groups does not change over time, particularly as the result of decentralization. However, the insurance status depends on whether the person works in the formal or informal sector. Therefore, most people do not choose whether to have insurance or not, but in which sector of the labor market to work. Moreover, health services for non-insured people tend to be worse than health services for insured people.

We perform a difference in difference approach with fixed effects. The equation to regress is as follows:

$$FDR_{ijt} = \alpha + \beta_1 T_{ij} + \beta_2 I(t>1997) + \beta_3[I(t>1997) * (T_j)] + X_{ijt}B_4 + c_i + u_{ijt} \quad (3)$$

$i = 1, \ldots 32$ $\quad j =$ Non-insured population, Insured population $\quad t = 1, \ldots 11$

In this case, FDR_{ijt} is the natural log of the fetal death rate for state i, group j, in year t. T_{ij} is equal to one for the non-insured population in state i, and zero otherwise. Finally, $I(t>1997)$ is defined as before. Our interest focuses on the coefficient that accompanies the interaction the latter two variables: β_3. This coefficient is the difference in difference effect of the reform on FDR_{ijt} for the non-insured population relative to the control group, that is, the insured population. We expect this coefficient to be negative and significant. If it is only negative but not significant, we cannot conclude that the reform had an impact on the treatment group relative to the control group. As before, c_i denotes the state fixed effect which is assumed to be arbitrarily correlated with the regressors; and u_{it} denotes the idiosyncratic error for state i in year t.

The vector of control variables, X_{it}, is the same as in previous exercises, except for two differences. First, total health from public institutions per capita, THE_{ijt}, is equal to FASSA and Ramo12 expenditures for non-insured population, that is when j=1, and equal to the sum of the health expenses by IMSS, ISSSTE and PEMEX for insured population (j=2).[32] Second, since our dependent variable is most probably biased, we add $log(IMR)–log(IMR_{Biased})$ as an additional variable to control for the possible bias contained in the data.[33] As already mentioned, the assumption behind this inclusion is that the bias observed in *FDR* is the same as the bias observed in IMR. Our IMR measure does not have this problem because corresponding authorities already corrected the statistics from this bias. However, such bias can be observed at the national level, if we compare our measure of IMR, available at the Millennium Development Goals Statistics published by United Nations, and what we denote IMR_{Biased}, published by the Bureau of Health Statistics of Mexico, SINAIS.

Results of the difference in difference regressions are shown in Table 8. Columns from (1) to (4) were included to keep the table comparable with previous exercises. According to the results in column (5), which include year indicators and control variables, the coefficient β_3 is negative (–0.0269) but it is not significant. This result suggests that average FDR_{ijt} after the decentralization reform took place relative to previous years, is 0.026 lower for the treatment group relative to the control group, however, it is not statistically different from zero. According to the same set of results, β_1 suggests that fetal deaths rate for the non-insured is significantly higher (0.621) than the insured population in the years before the reform and the coefficient is statistically significant at 1 per cent level. Moreover, β_2 suggests that the fetal deaths rate for the insured population decreased (–0.162) after the reform relative to previous years, and the coefficient is statistically significant at 5 per cent level. In column (6) and (7) we run the same specification as in column (5); however, in column (6) we included those fetal deaths in which the insurance status was not specified as if they were part of the insured population group, and in column (7) those fetal deaths were instead included in the non-insured population group. In both cases, β_3 is negative and not significant. These columns are included to check whether omitting the unknown or unspecified insurance status fetal deaths makes a difference for our results. Concluding, we found no significant difference between the non-insured and the insured population when comparing the mean FDR_{ijt} after the reform relative to previous years.

In a second exercise we continue exploiting our identification strategy and study whether there are differences in expenditure efficiency for insured and non-insured population, respectively, after the reform was implemented relative to previous years.

Fortunately, we are able to measure the efficiency of the expenditure for each of the two groups, because we also have detailed data on health expenditures made by various public health institutions. This information is summarized in the variable THE_{ijt} explained above. In equation notation this variable is:

$$THEijt = \begin{cases} Ramo\ 12 + FASSA_{it} & if\ \ j = Non-insured\ \ population \\ IMSS + ISSSTE + PEMEX_{it} & if\ \ j = Insured\ \ population \end{cases}$$

Therefore, we study whether the change in the elasticity of FDR_{ijt} with respect to total health expenditure for the non-insured population between 1998-2003 and 1993-97 is different from the change in the same elasticity for the insured population. The equation to estimate is the following:

32 We do not have data about health expenditure realized by other health institutions, for example, private institutions. Nevertheless, IMSS, ISSSTE and PEMEX provide health coverage to more than 95 per cent of the insured population.

33 Results are not significantly different if we do not include this difference as control variable. Results are available upon request.

Table 8

Difference in Difference Estimated Coefficients

Independent Variables	Log Fetal Death Rate						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
I(Non-insured)	0.478***	0.478***	0.534***	0.587***	0.621***	0.512***	0.743***
	(0.0423)	*(0.0433)*	*(0.0952)*	*(0.0907)*	*(0.1)*	*(0.125)*	*(0.0902)*
I(t>1997)	–0.340***	–0.227***	–0.150**	–0.0196	–0.162**	–0.213***	–0.174**
	(0.045)	*(0.0492)*	*(0.0602)*	*(0.0517)*	*(0.0709)*	*(0.0632)*	*(0.0647)*
*I(Non-insured)*I(t>1997)*	0.0175	0.0175	0.000165	–0.0169	–0.0269	–0.0294	–0.0581
	(0.0311)	*(0.0318)*	*(0.0452)*	*(0.0454)*	*(0.0469)*	*(0.0499)*	*(0.0439)*
$HEEP_{it}$	-	-	0.0405	0.0795	0.104	0.148	0.104
	-	-	*(0.0692)*	*(0.0684)*	*(0.0798)*	*(0.0971)*	*(0.0725)*
$PSCR_{it}$	-	-	–0.00494*	0.0039	0.00305	0.00331	0.00285
	-	-	*(0.00269)*	*(0.00337)*	*(0.00361)*	*(0.00331)*	*(0.00332)*
DP_{it}	-	-	0.00250***	0.00251***	0.00258**	0.00253**	0.00280***
	-	-	*(0.00072)*	*(0.000896)*	*(0.000976)*	*(0.000927)*	*(0.000948)*
$HBPS_{it}$	-	-	–0.0606	0.00357	–0.0354	–0.0805	–0.0847
	-	-	*(0.0841)*	*(0.102)*	*(0.13)*	*(0.116)*	*(0.123)*
GSP_{it}	-	-	–3.72e–05**	–1.77E–06	1.59E–05	1.09E–05	1.20E–05
	-	-	*(1.62E–05)*	*(1.43E–05)*	*(1.60E–05)*	*(1.66E–05)*	*(1.54E–05)*
PUP_{it}	-	-	–2.471***	–0.637	–1.281*	–1.103	–1.498**
	-	-	*(0.577)*	*(0.652)*	*(0.751)*	*(0.716)*	*(0.691)*
$IMR_{Ratio,\ it}$	–0.823***	0.0189	–0.115	–0.157	–0.155	–0.187*	–0.157
	(0.141)	*(0.105)*	*(0.111)*	*(0.107)*	*(0.115)*	*(0.101)*	*(0.111)*
Trend	-	-	-	–0.0252***	-	-	-
	-	-	-	*(0.00437)*	-	-	-
Constant	–1.172***	–1.225***	–0.00731	–1.611***	–1.588***	–1.493***	–1.491***
	(0.0811)	*(0.0565)*	*(0.23)*	*(0.397)*	*(0.389)*	*(0.351)*	*(0.356)*
Year Indicators	No	No	No	No	Yes	Yes	Yes
Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Number of Observations	704	704	704	704	704	704	704
R^2	0.638	0.886	0.896	0.901	0.904	0.894	0.916

Panel data estimations show state cluster robust standard errors in parentheses.
Note: The definition and units of the variables are in Table 2. Significance interpretation is as follows: *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

$$FDR_{ijt} = \alpha + \beta_1 T_{ij} + \beta_2 I\,(t > 1997) + \beta_3\,[I(t > 1997) * T_{ij}] + \beta_4 \log(THE_{ijt}) + \beta_5[\log(THE_{ijt}) * \\ * I(t > 1997)] + \beta_6[\log(THE_{ijt}) * T_{ij}] + \beta_7[\log(THE_{ijt}) * I(t > 1997) * T_{ij}] + X_{it} B_8 + c_i + u_{ijt} \quad (4)$$

$i = 1, \ldots 32$ j = Non-insured population, Insured population $t = 1, \ldots 11$

Equation (4) is just an extension of equation (3) where we interact $log(THE_{ijt})$ with the decentralization reform indicator, the treatment indicator and with both indicators together. As in previous exercise, FDR_{ijt} is the natural log of the fetal death rate for state i, group j, in year t; T_{ij} is equal to one for the non-insured population in state i, and zero otherwise; $I(t>1997)$ is decentralization reform indicator; c_i denotes the state fixed effect which is assumed to be arbitrarily correlated with the regressors; and u_{it} denotes the idiosyncratic error for state i in year t. The vector of control variables, X_{it}, is the same as in the previous exercise, that is, includes all controls discussed before plus THE_{ijt} and $log(IMR)–log(IMR_{Biased})$.

In this case, the coefficient of interest is β_7. This coefficient compares the elasticity of the fetal death rate with respect to total health expenditure after the reform relative to years previous the reform for the non-insured population relative to the insured population. We expect this coefficient to be negative and significant. In other words, we expect health expenditure for non-insured population to have a greater impact in reducing fetal death rate after the reform relative to the control group.

Results for the difference in difference regressions are shown in Table 9. We again include columns (1) through (4) just to keep all tables comparable. Results in column (5) are the more general since they include control variables and year indicators. According to such results, which include control variables and year indicators, the coefficient β_7 is negative (–0.192) and significant at the 10 per cent level. It implies that the difference in elasticities from 1998-2003 and 1993-97 is 0.192 lower for the non-insured population relative to insured population. In other words, if health expenditure increases 1 per cent for both groups and both periods, the FDR exhibits a larger fall by 0.19 per cent for the non-insured population relative to the insured population. Contrary to our previous results, the health expenditure for the non-insured population, through Ramo12 and FASSA, is significantly more effective after the reform took place than the health expenditure for the insured population. This is perhaps an indication that the health production function in general is convex. Thus, further reductions of the FDR are more costly in the insured sector, for which the FDR is already low, compared to the non-insured sector. Another possible explanation is that when analyzing the performance of Ramo12 and FASSA expenditure together, they do much better than each by their own. Understanding what is explaining the obtained result certainly is an interesting line of future research.

This result can be explained by the fact that the elasticity of FDR with respect to THE did not improve for the insured group from 1993-97 to 1998-2003, that is, coefficient β_5 is 0.0322 and it is not statistically significant. This is in accordance with the implicit assumption that the insured population group was not affected by the decentralization reform. Moreover, for the non-insured group that same elasticity improved after the reform, *i.e.*, $\beta_5+\beta_7$, is –0.16 and it is statistically significant at 5 per cent level. This is because the elasticity of FDR with respect to THE for the period 1998-2003 is 0.02 and not significant, whereas the same elasticity for the period 1998-2003 is 0.184 and statistically significant at 1 per cent level (therefore, 0.18–0.02=–0.16). Although this implies that the reform did improve the health well-being of the population, notice that these elasticities are positive. In other words, increasing Ramo12 before the reform by 1 per cent increased the FDR by 0.18 per cent and increasing Ramo12+FASSA by 1 per cent for the years after the reform increased the FDR by 0.02 per cent although we cannot distinguish this effect from zero. This is thus in accordance to our results from previous sections.

Table 9

Health Expenditure Efficiency Comparison: Estimated Coefficients

Independent Variables		Log Fetal Deaths Rate						
		(1)	(2)	(3)	(4)	(5)	(6)	(7)
b_1	*I(Non-insured)*	0.510***	0.484***	0.452***	0.516***	0.538***	0.351**	0.642***
		(0.167)	*(0.133)*	*(0.125)*	*(0.125)*	*(0.144)*	*(0.163)*	*(0.118)*
b_2	*I(t>1997)*	–0.215	–0.189	–0.195**	–0.0414	–0.194*	–0.220**	–0.228**
		(0.177)	*(0.127)*	*(0.0926)*	*(0.0923)*	*(0.102)*	*(0.0924)*	*(0.0995)*
b_3	*I(J=Non-insured) * I(t>1997)*	–0.127	–0.114	–0.018	–0.0623	–0.063	–0.109	–0.0764
		(0.168)	*(0.128)*	*(0.0822)*	*(0.084)*	*(0.0885)*	*(0.0724)*	*(0.0877)*
b_4	THE_{ijt}	–0.0022	–0.104	–0.13	–0.0694	–0.0511	–0.105	–0.078
		(0.156)	*(0.137)*	*(0.122)*	*(0.125)*	*(0.147)*	*(0.169)*	*(0.115)*
b_5	THE_{ijt} * *I(t>1997)*	–0.123	–0.0254	0.0668	0.0287	0.0322	0.0126	0.0587
		(0.163)	*(0.132)*	*(0.0711)*	*(0.0737)*	*(0.0788)*	*(0.0685)*	*(0.0764)*
b_6	THE_{ijt} * *I(J=Non-insured)*	0.0637	0.269*	0.277**	0.241*	0.235*	0.339**	0.270**
		(0.155)	*(0.137)*	*(0.121)*	*(0.123)*	*(0.134)*	*(0.151)*	*(0.11)*
b_7	THE_{ijt} * *I(Non-insured) * I(t>1997)*	–0.187	–0.231	–0.260**	–0.199*	–0.192*	–0.161	–0.235**
		(0.177)	*(0.156)*	*(0.0987)*	*(0.102)*	*(0.102)*	*(0.1)*	*(0.098)*
	$PSCR_{it}$	-	-	–0.00615**	0.00214	0.00195	0.00237	0.0016
		-	-	*(0.00245)*	*(0.00299)*	*(0.00332)*	*(0.00295)*	*(0.00299)*
	DP_{it}	-	-	0.0019***	0.002**	0.00215**	0.0021**	0.00231**
		-	-	*(0.000584)*	*(0.000823)*	*(0.0009)*	*(0.000842)*	*(0.00088)*
	$HBPS_{it}$	-	-	0.00316	0.0562	–0.00393	–0.042	–0.0484
		-	-	*(0.0925)*	*(0.114)*	*(0.141)*	*(0.127)*	*(0.132)*
	GSP_{it}	-	-	–2.64e–05*	6.32E–06	1.82E–05	1.33E–05	1.36E–05
		-	-	*(1.51E–05)*	*(1.42E–05)*	*(1.54E–05)*	*(1.62E–05)*	*(1.47E–05)*
	PUP_{it}	-	-	–1.957***	–0.273	–0.83	–0.559	–1.039
		-	-	*(0.505)*	*(0.548)*	*(0.672)*	*(0.619)*	*(0.633)*
	$IMR_{Ratio,it}$	–0.826***	–0.0343	–0.127	–0.167	–0.17	–0.202*	–0.172
		(0.142)	*(0.108)*	*(0.113)*	*(0.109)*	*(0.114)*	*(0.0996)*	*(0.11)*
	Time Trend	-	-	-	–0.0234***	-	-	-
		-	-	-	*(0.00403)*	-	-	-
	Constant	–1.168***	–1.124***	0.056	–1.466***	–1.467***	–1.339***	–1.324***
		(0.169)	*(0.119)*	*(0.279)*	*(0.394)*	*(0.396)*	*(0.361)*	*(0.349)*
	Year Indicators	No	No	No	No	Yes	Yes	Yes
	Fixed Effects	No	Yes	Yes	Yes	Yes	Yes	Yes
	$b_4 + b_5 + b_6 + b_7$	–0.248	–0.0906	–0.0462	0.00152	0.0242	0.0862	0.0156
	$Prob > F_1$	0.000732	0.199	0.554	0.984	0.766	0.282	0.837
	$b_4 + b_6$	0.0615	0.165	0.147	0.172	0.184	0.235	0.192
	$Prob > F_2$	0.373	0.00267	0.00761	1.83E–03	2.89E–03	0.0000985	0.000778
	$b_5 + b_7$	–0.31	–0.256	–0.193	–0.17	–0.16	–0.148	–0.176
	$Prob > F_3$	0.0000336	2.47E–03	8.70E–03	0.0165	0.0228	0.0348	0.00915
	$b_4 + b_5$	–0.126	–0.129	–0.0631	–0.0406	–0.0189	–0.0922	–0.0193
	$Prob > F_4$	0.605	0.0506	0.432	0.648	0.861	0.445	0.821
	Number of Observations	704	704	704	704	704	704	704
	R^2	0.649	0.893	0.9	0.905	0.907	0.9	0.92

Panel data estimations show state cluster robust standard errors in parentheses.

Note: The definition and units of the variables are in Table 2. Significance interpretation is as follows: *** p<0.01, ** p<0.05, * p<0.10.

Just as in the previous exercise, column (6) and (7) are the same specification with the only difference being related to the dependent variable: in column (6) fetal death certificates with insurance status not specified were classified as in the insured population group; and in column (7) those same fetal deaths were classified in the non-insured population group. In both cases, β_7 is negative, however, it is not significantly different from zero in column (6). This is accordance to the hypothesis that those fetal deaths with unspecified insurance status are in fact non-insured because the magnitude of the coefficient β_7 in column (6) decreases sufficiently to become insignificant; and the magnitude of the same coefficient but in column (7) increases and becomes significant at 5 per cent level. As before, these columns are included to check that omitting the unknown or unspecified insurance status fetal deaths makes no significant difference for our results.

6 Conclusions

The results presented in this paper suggest that health decentralization in Mexico did not have the desired effects on state-level health outcomes. We did not find strong evidence that expenditure after the reform can explain improvements in health indicators, such as the child mortality or the fetal death rates. In particular, we did not find that the effectiveness of FASSA expenditure was higher than the impact of Ramo12 previous to the reform. Nevertheless, our exercises also suggest that the non-insured population had better outcomes derived from the reform than insured population. These results contrasts to what the policy makers that implemented the reform intended as well as what the classical theory of federalism would predict.

We believe that the results observed in Mexico may have obeyed to different factors that are worth exploring in future extensions of this paper. First, the reform was implemented from one year to the next and it is possible that states lacked the capacity to meet their new responsibilities immediately and neither were they able to administer the economic resources associated to health provision (Merino, 2003). The reforms may take some time in order to be effectively implemented as governments learn to operate and spend efficiently. A second hypothesis is that the institutional framework in which health was decentralized did not provide states with the incentives to provide better services to people. As we discussed in the text, the allocation of FASSA among states is rather unclear and it does not depend on the own state effort or health results. A merit-based system, in which future FASSA allocations depend on state's own contributions and the efficiency with which each state used its resources in previous years, could have helped to boost the impact of health expenditure. In this sense, a study of the effects of the Seguro Popular (which is partially financed by FASSA) would contribute to the discussion since the rules and uses of decentralized resources for that program are better defined. A third explanation is related to checks and balances that states have when spending public resources, the capacity of the taxpayers to know how efficiently their money is being spent and the availability of mechanisms for accountability. We think that these three potential explanations are not exclusive and certainly complement the results of the paper.

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