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SUMMARY

Introduction: The main goal of Seguro Popular is to improve the financial protection of the uninsured population against excessive health expenditures. Seguro Popular (SP) covers a variety of preventive and curative procedures, as well as medicines, and hospital care for the poorest segment of the Mexican population.

Data: This paper estimates the impact of Seguro Popular on catastrophic health expenditures, as well as out-of-pocket health expenditures, from three different sources: National Household Survey of Income and Expenditures (ENIGH 2006); National Health and Nutrition Survey (ENSANUT 2006); and SP Impact Evaluation Survey.

Methods: We first estimate naive probit models, and then compare them against bivariate probit models which use instrumental variables that take advantage of the specific SP implementation mechanisms to address the endogeneity of insurance selection choices.

Results: No effect on catastrophic health expenditures is observed in the ENIGH sample. However, we find a statistically significant effect on the reduction of household's expenditures on medicines and outpatient care. On the other hand, Seguro Popular reduces the probability of catastrophic health expenditures using the other two datasets: SP Impact Evaluation Survey, and ENSANUT. We also observe a reduction of the probability of expenditures on medicines and outpatient care among the SP insured families.

AEA-JEL classification: 012, 038, 054, I18, I38

Key terms: catastrophic health expenditures; health insurance; instrumental variables; non-linear methods; Mexico

1. INTRODUCTION

This paper has two main goals. First, we provide estimates of the treatment effect of universal health insurance targeted to the poorest families on catastrophic health expenditures in Mexico using three different data sources. Second, we compare the results and survey methodologies, and try to explain some of the differences encountered in the estimation of the treatment effect. We draw on previous analyses of the issues around catastrophic health expenditures in Mexico (Parker and Wong 1997; Perez-Rico, Sesma-Vazquez et al. 2005; Sesma-Vazquez, Perez-Rico et al. 2005; Gakidou, Lozano et al. 2006; Knaul, Arreola-Ornelas et al. 2006), but we add a new dimension in the literature by using non-linear models with selection correction for the potentially endogenous treatment variable. To the best of our knowledge, this paper provides the first non-experimental evidence of a causal effect of Seguro Popular on catastrophic health expenditures. Previous analyses using non-experimental data demonstrated strong associations but have not used methods to show causal effects.

The results presented here are relevant in the Mexican context, but they go beyond that. The issue of the impact of universal health insurance on financial protection is of wide relevance across Latin America and other regions.

This paper proceeds as follows. In Section 2 we present a brief background of the Seguro Popular program in Mexico. Section 3 shows the methods used including data sources and study population. Section 4 presents the results, followed by a discussion. The paper ends with some conclusions for policy and future research.

2. BACKGROUND

The Popular Health Insurance (or "Seguro Popular") was implemented in Mexico as a comprehensive health reform effort to provide financial protection in health for the poorest segment of the population (Frenk, Gonzalez-Pier et al. 2006). Until 2001 health insurance coverage in Mexico was directed only to employees working in the formal sector of the economy. Coverage for formal sector workers included the Mexican Social Insurance System (Instituto Mexicano del Seguro Social, or IMSS), the Government Workers' Social Security and Services Institute (Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado, or ISSSTE), as well as insurance programs for employees of such state-run enterprises as PEMEX (petroleum) and SEDENA (national defence). Participants in the informal sector of the economy had to attend government-sponsored facilities through the Ministry Health (Secretaría de Salud, or SSA) or pay out-of-pocket for medical care at private health services. These private facilities varied considerably in price, quality, and availability. Whilst a modern network of private health services for the middle and upper classes served those individuals who had insurance coverage or could pay out-of-pocket (OOP) for their health care, there was also a lower-priced private health providers of variable quality. By 2002 there was evidence of excessive health-related spending for the poorest rural families in Mexico, particularly for the care of older adults (over 60 years of age) and the care of pregnancy (Torres and Knaul 2003; Knaul, Arreola-Ornelas et al. 2005; Sesma-Vazquez, Perez-Rico et al. 2005). Most of the catastrophic expenditures among the poor were attributed to outpatient care and medications. This situation is common among the poorest segments of the population in most developing countries where "a relatively small payment can mean financial catastrophe to a poor person or household, forcing them to reduce other basic expenses such as food, shelter, or their children's

education" (Xu, Evans et al. 2007), or even suffer financial catastrophe (Van Damme, Van Leemput et al. 2004).

The explicit goal of the Seguro Popular program was to financially protect the poorest families (within the poorest two income deciles) that did not have any health insurance coverage. Although the campaigns to be enrolled were targeted to the poorest sections of the population in rural an urban areas, the decision of enrolling to SP was a family's voluntary choice (Frenk, Gonzalez-Pier et al. 2006). The program objectives were to assure:

(i) the protection of poor families against catastrophic health expenditures and its impoverishing effect; and

(ii) the universal access to adequate secondary and tertiary medical care.

Additionally, on the supply-side, all SP-sponsored health facilities from the public health providers had to offer a minimum level of health-services quality in order to belong to the SP-sponsored health facilities network.

The process of health unit accreditation to Seguro Popular was rolled out gradually during 2001–2005. Five states (Aguascalientes, Campeche, Colima, Jalisco and Tabasco) were incorporated into the program in 2001 as part of a pilot study. An additional 15 states were integrated in the program in 2002; four more states were incorporated in 2003; and the remaining states were incorporated in during 2004 and 2005. By the end of 2005, all 32 of Mexico's states had been incorporated, and approximately 4 million families (comprising about 12 million individuals) had signed up for the voluntary program (SSA 2006a).

Overall, through the first quarter of 2007, approximately 5.2 million (44 %) of the estimated 11.9 million eligible households nationwide had enrolled in the program. Although the indicators of coverage have widely shown the proven capacity of the SP programme to enrol a large group of uninsured households, there has been limited evidence about the medium-term improvements in the financial protection of the poorest households.

Analyses about the trends and evolution of catastrophic and impoverishing health spending have shown a decreased incidence of catastrophic spending among the poorest households, but this trend was not clearly found in the case of the out-of-pocket expenditures (Knaul, Arreola-Ornelas et al. 2005).

There have been only few studies that have empirically estimated the effect of the health insurance coverage on the incidence of catastrophic health spending in developing countries with experimental data (Wagstaff and Yu 2007), and fewer with observational data (Jowett, Contoyannis et al. 2003).

3. METHODS

3.1 Data Sources and Study Population

We analysed the impact of Seguro Popular on the incidence of catastrophic health expenditures and out-of-pocket health expenditures among poor households using three different data sources of household expenditure and insurance enrolment. We used data from:

- Encuesta Nacional de Ingreso y Gasto de los Hogares (ENIGH 2006) [National Household Survey of Income and Expenditures]; and
- Encuesta Nacional de Salud y Nutrición (ENSANUT 2005-2006) [National Health and Nutrition Survey].
- Encuesta de Impacto del Seguro Popular [SP Impact Evaluation Survey];

For all surveys, we had strict selection criteria such that we identified households where *all* members of the household were enrolled into Seguro Popular ("insured" group); that is, our "treatment" is that everyone in the household be officially enrolled into the SP program. Then, we created a comparison group of households with no insurance coverage at all ("uninsured" group); that is, our controls are households where *no person* had any type of health insurance.

The ENIGH 2006 is a cross-sectional dataset with nationally representative data, with a sample of 20,875 dwellings (INEGI 2006). Its main purpose was to obtain information about income and expenses of the households. It collected information about occupational characteristics, socio-demographic characteristics of the members of the households, infrastructure characteristics of the dwellings and household assets. It also has information about the access to public programmes by households (including transfers and subsidies). From the original sample with health expenditure data and health insurance data, we selected 1,736 SP-insured households and 12,936 uninsured households.

The ENSANUT 2006 is also a cross-sectional dataset with nationally representative data, which was collected for 48,304 dwellings (INSP 2006). This dataset contains

information about individual's health, use of health services, socio-economic characteristics of households, access to health programmes, and biological health indicators. From the original sample, we took those 45,699 households with health expenditure data and health insurance data. After this, we end up with the analytical samples: 4,440 SP-insured households and 16,376 uninsured households.

The SP Impact Evaluation Survey is a panel dataset composed with 36,000 dwellings for which there was baseline information (August 2005) in 32,506 dwellings, and first-wave of data collected in mid-2006 with information in 29,836 dwellings (King and et al 2006; SSA 2006b; King, Gakidou et al. 2007). The data were collected in seven states in Mexico (Sonora, San Luis Potosi, Jalisco, Estado de Mexico, Guerrero, Morelos and Oaxaca). Its main purpose was to measure the impact of Seguro Popular among eligible households (poor households without any coverage of health insurance). The criteria to select the location of the treatment and control clusters were: i) to include those zones were the rate of penetration of the programme was very low; ii) to include those places where the incorporation of the SP programme was being postponed. Note that this data was experimental in design with a baseline and follow-up rounds of data collection. However, we are using only the follow-up data, as if it was a cross-section, so that we can maximize the comparability with the other two data sources. (Details on the experimental design have been presented elsewhere (King, Gakidou et al. 2007)). From the 29,836 households with the relevant data (in the first-wave of data follow-up), we selected the following analytical samples: 7,952 SP-insured households and 21,884 uninsured households.

3.2 Variables and Analysis

Based on the literature, the basic econometric specification we used to analyze the impact of health insurance on catastrophic health expenditures (CHE) was of the form:

$$Y = \boldsymbol{X} + T + \quad + e_1 \qquad (1)$$

$$T = \boldsymbol{X} + \quad + \boldsymbol{Z} + e_2 \qquad (2)$$

where:

Y = catastrophic health expenditure

$\boldsymbol{X}$ = covariate vector

T = household enrolment into Seguro Popular

Z= instrumental variables

We defined expenditure as being catastrophic with a dummy variable equal to the unity if a household's financial contributions to the health system exceed 30% of income remaining after subsistence needs ($2 USD per capita) have been met; and zero otherwise. This definition is the most widely used in the literature (Murray, Knaul et al. 2000; Xu, Klavus et al. 2003), but there are other alternatives (Xu, Evans et al. 2003)[4].

In the naïve probit models, we assumed that the error terms e_1 and e_2 were not correlated, and thus we could directly estimate equation (1), independently of equation (2). However, considering a potentially endogenous treatment variable, we also used a model with a bivariate normal distribution for the error terms (Maddala 1994; Wooldridge 2002; Greene 2003), with the variance normalized to the unity and the correlation coefficient denoted as ρ, in the following manner:

[4] Other criteria that have been used to define catastrophic expenditures is when the household's financial contributions to the health system exceed 40% of income and subsistence needs of $1 USD per capita).

$$\begin{pmatrix} e_1 \\ e_2 \end{pmatrix} \sim BVN\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}\right) \qquad (3)$$

The correlation between e_1 and e_2 captures the correlation between the likelihood of having catastrophic health expenditures, and at the same time having enrolled in Seguro Popular. We hypothesized that $\rho>0$ because those households which may be more prone to have high health care expenditures (relative to the level of household income), would also have more incentives to sign up for Seguro Popular.

To select an appropriate covariate vector we searched the literature (Makinen, Waters et al. 2000; Kawabata, Xu et al. 2002; Xu, Evans et al. 2003) and found that the main determinants of CHE seem to relate to poverty, aging, chronic illnesses, low levels of insurance coverage, urban/rural differences, socio-economic status, types of illnesses, demographic composition of the household, and characteristics of the household head (age, sex, education). Health spending would be affected by the family's wealth/physical assets, its income or financial assets as well as their insurance coverage. We have used an asset index as a proxy for household wealth (McKenzie 2004). Additionally, we have used the deprivation index at the municipality/locality level to control for general levels of wellbeing at the local level (CONAPO 2005).

Thus, the main explanatory or "treatment" variable (T) to be analysed was enrolment into Seguro Popular (SP), a public insurance scheme for the poor and otherwise uncovered population in Mexico. Enrolment into Seguro Popular would be determined by equation (2) above, which has the same covariate vector $\boldsymbol{X}$, and a set of instrumental variables ($\boldsymbol{Z}$). These set of "instruments" would strongly affect the probability of a household being part of the SP program, but they would not be correlated with the

outcome of interest (catastrophic expenditures in health) through channels other than the enrolment into SP. The instrumental variables approach has been used in several studies of CHE (Pradhan and Prescott 2002; Jowett, Contoyannis et al. 2003; Jowett, Deolalikar et al. 2004; Sepehri, Sarma et al. 2006)

The instrumental variables we used take advantage of the fact that Seguro Popular was implemented gradually across the different 32 Mexican states. First, we used the year of incorporation as a proxy for the length of time that a particular state has had Seguro Popular. For example, if a state was incorporated by 2003, a dummy variable for 2001 would be zero, a dummy for 2002 would also be zero, but the dummy variables for 2003 and 2004 would be equal to the unity. By 2005 all states were incorporated, so that 2005 serves as the reference year (except in the SP Impact Survey where the reference year was 2002). The marginal effect of the incorporation dummy measures the effect incorporation a year earlier on the household SP enrolment probability. This instrument has been implemented successfully in a similar context (Sosa-Rubi, Galarraga et al. 2007).

We recognize that the official dates of incorporation (SSA 2006b) may not be necessarily exact indicators of program availability, because some health centres may still have been going through accreditation by the end of the year. Thus, we view these instruments as indicators of likelihood that SP was available to each household in the survey. This use of year-of-incorporation dummies as instruments follows the spirit of Duflo's use of distance from schools as instruments a study of impact of school construction on educational attainment and wages in Indonesia (Duflo 2001).

Second, similar to the first set of instrumental variables, we used the level of penetration of the program at the locality level to help us determine the probability of enrolment. The logic was that households living in localities with higher SP penetration or coverage had higher probabilities of enrolling into the program. We constructed the variable with a ratio of SP enrolled households over eligible (uninsured households) at the locality level using the latest round of Census data (INEGI 2005). Households located in areas where the level of diffusion of Seguro Popular was higher tended to have higher probability of being enrolled into the SP program. We see this instrumental variable as an aggregate continuous proxy for program participation at the household level. We are implicitly assuming that the level of program diffusion or penetration has a direct impact on the behavioural choices of households; but assuming that there is no underlying aggregate effect over expenditures, other than through the channel of insurance choice (Angrist, Imbens et al. 1996; Heckman 1997; Angrist and Krueger 2001).

The regional and temporal variations in incorporation and coverage rates helped us to identify Seguro Popular household enrolment, independently of the outcomes of interest: catastrophic health expenditures. Thus, the year-of-incorporation dummies as well as SP coverage rates (as a continuous variable: 0-100%) were excluded from the equation (1).

We have encountered no evidence of "policy endogeneity". That is, there is no reason to believe that states made harder efforts to enrol earlier because of evidence that families living there where particularly prone to excessive health expenditures. Neither do we have evidence that excessive health expenditures at the aggregate level have been

correlated with higher levels of program diffusion, penetration or coverage. The rates of incorporation and program coverage at the state and locality levels were driven primarily by political considerations (party in power); administrative issues (rate at which clinics and hospitals where accredited to belong to the SP program) and budget availability.

In addition to estimating the impact of SP on CHE, we also used the same econometric framework to estimate the effect of SP on out-of-pocket expenditures. We defined out-of-pocket expenditures as any positive expenditure related to outpatient care, inpatient care, and medicines. Thus, we created three dichotomous variables equal to the unity if there was positive spending, and equal to zero otherwise.

To control for important predictors and enrolment and CHE, in the main results for ENSANUT we controlled for covariates regarding to indigenous language and indigenous self-identification, as well as the presence of a chronic illness by someone in the household. Unfortunately those variables were available neither in the ENIGH nor in the SP Impact Evaluation Survey. Thus, sensitivity analyses exercises tested all the models using the same set of covariates for the three surveys.

For all model specifications, we compared the results from "naïve" estimates where the choice of health insurance use was assumed to be exogenous, to the results we obtained using instrumental variables. Analyses were conducted using STATA™ (StataCorp 2005), including the probit and biprobit procedures.

4. RESULTS

Table 1 shows the description of the dependent and explanatory variables for the three datasets. The main dependent variable was catastrophic health expenditures which were more comparable in the ENIGH and ENSANUT surveys, than in the SP Impact Survey, which showed higher CHE. Similarly, out-of-pocket expenditures were also more prevalent in the SP Impact Survey dataset.

The characteristics of the household-head we analysed included: age, female-headed, formal education, indigenous self-identity, speak indigenous language. For these variables we did not find important differences between SP insured vs. uninsured households, particularly with the ENSANUT and the SP Impact Survey; differences between the two groups were more noticeable for the ENIGH survey. For both uninsured and insured groups the mean of the age of the household-head in ENSANUT, ENIGH and SP impact survey fluctuated between 44 to 50 years. However, the percentage of household that were female-headed was considerably higher among the uninsured in the ENIGH with approximately 29% with respect to 21-22% found in the ENSANUT and SP Impact Survey. In the three surveys the percentage of female-headed households among the insured was between 19 and 22%. The number of years of education for the household head was around 5 to 6 years, although in the ENIGH this variable was considerable lower among the sample of insured households: approximately only 3.7 years of schooling.

We also included characteristics of the household such as: the household asset index as a proxy of family income, household size, and benefits from other social programmes, particularly the Oportunidades programme. At this level, we considered those variables

that denoted the composition of the family: children who were one year old or younger, and children who were 7 years old or younger, as well as adults 65 years-old or older. For the specific case of ENSANUT we included additional variables that informed us about the presence of some chronic health conditions among at least one of the members of the family (diabetes, hypertension and gastritis). The mean for the household asset index was generally lower for the SP insured population, indicating lower levels of family wealth. The mean household size was around 3 to 4 members; although this indicator was slightly higher among SP insured households, particularly in the SP Impact Survey dataset (with almost 5 members). Differences in the composition of the household were notable in the percentage with children 7 years-old or younger. While in the ENIGH this percentage was around 37% in the insured sample, it was considerable higher (about 53%) in the insured sample in the SP Impact Survey. The percentage of families with adults 65 years-old or older varied in the three surveys between 15 to 35% in both insured and uninsured sub-samples.

Comparing insured and uninsured, we did not find statistically significant differences between households reporting at least one member of with a chronic condition in the ENSANUT survey. However, we found differences in the percentage of families who reported to be beneficiaries of the Oportunidades programme among the different surveys. Specifically, we found a considerable lower percentage of families from the ENSANUT survey who reported to be benefited from this programme than the rest of the surveys. Generally, though, across the surveys, SP insured households seemed to be consistently more enrolled in Oportunidades.

At locality level we incorporated variables that described the rural or urban condition of the municipalities and the deprivation index (CONAPO 2005). While there was 56 to 53% of SP insured households, and 30 to 34% of the uninsured living in rural localities reported in the ENIGH and ENSANUT surveys, the SP Impact Survey showed 96% of the insured, and about 89% of uninsured living in rural areas. Most of the households from the SP Impact Survey were poor, and lived in rural areas with a high deprivation index. Insured and uninsured households were much poorer in the SP Impact Survey than in the other two surveys.

Table 2 reports the effect of SP on CHE results for the ENIGH survey. The first two columns represent the coefficients and marginal effects for the naïve probit model. Note that the enrolment into Seguro Popular was not a statistically significant determinant of catastrophic health expenditures. Having an infant less one year of age or younger increased the probability of CHE by five percentage points; similarly, the presence of an older adult (65 years of age or older) also increased that probability by 2.2 percentage points.

The last three columns in Table 2 present the bivariate probit model which corrects for endogeneity in the selection into SP using instrumental variables. First, note that in the SP equation, the instrumental variables were significant and of the expected sign. Since there are no formal tests for instrumental variables in the non-linear context, we conducted informal checks with linear specifications. In the linear models (with all three data sources), the IVs were highly relevant. The *F* test statistics of excluded instruments were very high; all much higher than the "rule of thumb" of 10 to detect weak instruments (Bound, Jaeger et al. 1995). (Additional details for the linear models and formal tests are presented elsewhere: *Salud Pública de México*, forthcoming).

Even though the IVs seemed to be working well (longer time of program exposure at the state level, and higher coverage at the locality level increased the household probability of having SP insurance), after we addressed the selection issue, we found no effect of SP on CHE using the ENIGH sample: the effect was not statistically different from zero.

Table 3 presents the results from the National Health and Nutrition Survey (ENSANUT 2006). As before, we contrasted naïve versus selection-correction non-linear models. In the naïve probit model, where we estimated the CHE equation independently, we can see that SP enrolees had a 2 percentage-point lower probability of incurring CHE. On the other hand, having small children or older adults in the household made CHE more likely. Similarly, the presence of someone with chronic health conditions (particularly, diabetes and hypertension) also increased the likelihood of CHE.

In the bivariate probit model, once we addressed selection bias, the effect of SP on CHE, was even more protective. Households insured with SP had a probability of CHE that was 3.6 percentage points lower than uninsured households.

The instruments in the ENSANUT data were also significant and worked well. The seemingly unusual negative sign of "*Incorporation by 2003*" can be explained as the effect with respect to the following year. Furthermore, the aggregated effect (adding the yearly effects) was positive as expected. Households in states that incorporated earlier to the SP network had a higher probability of enrolling into SP.

Note also in the SP equation of Table 3 that that the estimates for the coefficient of correlation (ρ) were positive and significant, meaning that unobservable factors associated with the outcome (excessive health expenditures) were also associated with the treatment variable (SP enrolment). That is, household with SP insurance had unobserved characteristics that made them more likely to incur into CHE.

Table 4 presents the naïve and selection correction models using the SP Impact Evaluation Survey. Note that the naïve estimate of the protective effect of SP on CHE was of about 1.8 percentage points, while the effect grew to a 5.3 percentage-point difference once we corrected for endogeneity.

Table 4 also shows that both instruments were statistically significant, and of the hypothesized sign. As the SP coverage increased at the locality level, the probability households to participate in SP also increased. The year of incorporation dummy also worked as expected. If the state incorporated into SP by 2001, the household probability of enrolment was larger than if the state incorporated by 2002 (the reference year in this sample, given that all seven states included in the SP Evaluation Survey incorporated to SP by 2002). The coefficient of correlation was also positive and significant as hypothesized.

Table 5 shows the results for the effect of SP on out-of-pocket (OOP) expenditures, including outpatient care, inpatient care, and medicines. Note that the effect of SP on outpatient care expenditures was protective for all the samples, but was much stronger for the SP Impact Survey population. On the other hand, we found a protective effect against inpatient care expenditures only in the SP Impact Survey population; the effect

was not different from zero in the other two datasets. Finally, for out-of-pocket expenditures related to medicines, we found again that SP reduced the probability of spending out-of-pocket for medicines for all samples, but the effect was stronger in the SP Impact Survey.

5. DISCUSSION

The overall larger protective effect of Seguro Popular on catastrophic health expenditures (CHE) and out-of-pocket expenditures in the SP Impact Evaluation Survey can be explained as that survey was targeted to a population with lower socio-economic status. As seen in Table 1, the SP Impact Survey population was poorer, more rural, and in more marginalized communities. On the other hand, the ENSANUT and ENIGH surveys are nationally representative samples of the entire Mexican population (including middle- and high-income households). It is expected then that the effect of SP on the general population be somewhat diminished.

The ENIGH survey has the advantage of being more accurate in collecting information about the total household's expenditure in comparison to the other two surveys. Although ENSANUT and the SP Impact Evaluation Survey had similar contents, mainly related to health and use of health services; the first one is representative at nationally level, whilst the second one was gathered in a few states in Mexico where the SP programme had a low rate of SP penetration at the time of the development of the survey. Note that the differences between ENSANUT and ENIGH were not due to the additional control variables in ENSANUT. In Appendix Tables A1 and A2 we show that the protective effect of SP on CHE is still present when we do not control for

indigenous language and self-identity and the chronic health condition variables in ENSANUT.

By using the same non-experimental (IV) approach and the same covariates with all three datasets, we can ascribe the differences in results to the differences in data collection methods only. Nevertheless, it is still puzzling that no effect is observed using the ENIGH, but that a significant protective effect of SP against CHE is present in both ENSANUT and the SP Impact Survey.

On the other hand, note that our results of SP program participation on CHE are similar to those found by King and collaborators (King and et al 2006; King, Gakidou et al. 2007), when analyzing experimental data with the SP Impact Evaluation Survey. They found that SP reduces the probability of incurring catastrophic health expenditures by 1.5% (intention to treat analysis) and by 3% using the complier causal average effect (CACE). These differences with our results are explained from the treatment effect methodology used, although in both cases the effects were significant.

6. CONCLUSION AND LIMITATIONS

The results in this paper show that the universal insurance system for the poor in Mexico, Seguro Popular, has a protective effect on excessive health expenditures, as well as out-of-pocket health-related expenditures, particularly for the poorest segments of the population.

Given these results, the SP program should continue to concentrate in enrolling the poorest households, in the most marginalized localities, because it is in those populations where we observe a higher prevalence of excessive health expenditures, but also where the SP program seems to be more effective for financial protection.

The fact that we have defined our analytical sample for insured households as only those where *all* members of households are enrolled in SP, is likely to be under-estimating the number of families enrolled in SP, and the potential effect of the programme. In that sense, given the strict criteria to define the analytical sample, we view the results provided as conservative estimates.

One of the limitations of the definition of catastrophic health expenditures is the fact that it does not consider all those households that postpone their health care for the lack of financial resources. We do not address the issue of selection into CHE. Health expenditure is, by definition, conditional on utilization. Thus, there is another possible econometric specification to take into account of the endogeneity generated by health seeking behavior. Such correction requires specific data on non-users (which was not available to us); just a few papers attempt to correct such inherent endogeneity (Pradhan and Prescott 2002; Hatt 2006).

The present analysis does not include other alternative indicators that can also describe the effect of the incidence of health expenditures on the household's financial status such as the impoverishing expenditures; which are the expenditures do not provoke family's bankruptcy but do move the household's economic status below the poverty line.

Lastly, at the household level, the cross-sectional surveys do not provide information about the length of treatment (i.e., how long the households have been enrolled in the SP programme), which could have an important effect on excessive health expenditures.

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Table 1. Descriptive Statistics, with and without Seguro Popular, by data source

	ENIGH		ENSANUT		SP, Impact Survey	
	With SP	Without SP	With SP	Without SP	With SP	Without SP
	n=1,736	n=12,936	n=4,440	n=16,376	n=7,952	21,884
Outcomes						
Catatrophic Health Expenditures	4.18 (0.18)	4.38 (0.49)	4.71 (0.32)	6.67 (0.19)	7.33 (0.30)	8.63 (0.19)
Out of Pocket Expenditures						
Outpatient Care	26.80 (1.06)	38.74 (0.43)	26.37 (0.66)	32.66 (0.37)	39.70 (0.55)	44.41 (0.33)
Inpatient Care	7.37 (0.63)	12.43 (0.30)	6.85 (0.38)	7.41 (0.20)	12.16 (0.36)	12.99 (0.23)
Medicines	54.46 (1.20)	63.29 (0.42)	34.91 (0.71)	40.31 (0.38)	46.34 (0.56)	46.06 (0.37)
Covariates						
Characteristics of the household head						
Age	46.38 (0.38)	50.14 (0.15)	44.66 (0.22)	46.65 (0.12)	47.37 (0.17)	48.37 (0.11)
Female-headed	22.94 (1.00)	28.58 (0.40)	19.35 (0.59)	21.02 (0.32)	20.94 (0.45)	22.13 (0.28)
Formal education (years)	3.71 (0.10)	5.84 (0.06)	5.04 (0.05)	5.71 (0.03)	6.02 (0.05)	6.47 (0.03)
Indigenous self-identity			23.28 (0.63)	24.55 (0.33)		
Speak indigenous language			10.29 (0.45)	12.87 (0.26)		
Characteristics of the household						
Asset Index	-0.53 (0.02)	-0.12 (0.01)	-0.50 (0.01)	-0.29 (0.01)	-0.215 (0.01)	0.08 (0.006)
Children <= 1	9.70 (0.71)	14.06 (0.31)	14.08 (0.52)	15.41 (0.28)	17.18 (0.42)	14.31 (0.23)
Children <= 7	37.46 (1.16)	32.88 (0.41)	54.05 (0.75)	46.98 (0.39)	52.83 (0.55)	45.02 (0.33)
Adults >= 65	26.40 (1.06)	34.58 (0.42)	15.54 (0.54)	18.73 (0.30)	19.96 (0.44)	22.42 (0.28)
Someone with diabetes			3.83 (0.29)	3.52 (0.14)		
Someone with hypertension			7.72 (0.40)	6.19 (0.18)		
Someone with gastritis			6.31 (0.36)	5.33 (0.17)		
Household size (# of persons)	3.96 (0.05)	4.04 (0.02)	4.41 (0.03)	4.37 (0.02)	4.88 (0.03)	4.38 (0.01)
Enrolled in Oportunidades	54.18 (1.20)	20.63 (0.35)	19.91 (0.60)	11.16 (0.24)	65.57 (0.53)	33.62 (0.32)
Characteristics of the locality						
Rural area	55.96 (1.19)	30.33 (0.40)	52.93 (0.74)	34.42 (0.37)	96.21 (0.21)	88.99 (0.21)
Deprivation index	-0.37 (0.02)	-0.76 (0.01)	-0.60 (0.01)	-0.76 (0.01)	-0.04 (0.01)	-0.42 (0.01)
Instrumental Variables						
Locality SP coverage	22.45 (0.44)	8.76 (0.10)	39.93 (0.39)	11.36 (0.13)	27.91 (0.28)	9.87 (0.10)
Incorporated by 2001	20.92 (0.98)	9.56 (0.26)	34.92 (0.72)	0.10 (0.002)	0.42 (0.07)	1.50 (0.08)
Incorporated by 2002	71.41 (1.08)	58.55 (0.43)	70.64 (0.69)	58.90 (0.39)		
Incorporated by 2003	83.86 (0.88)	76.56 (0.37)	81.40 (0.59)	77.97 (0.33)		
Incorporated by 2004	93.94 (0.57)	87.57 (0.29)	96.32 (0.28)	91.18 (0.22)		

Sources: Author's calculations based on ENSANUT (INSP 2006), ENIGH (INEGI 2006), SP Impact Survey (SSA 2006b), Census data (INEGI 2005), and SP evaluation data (SSA 2006a).

Notes: Standard error in parenthesis.

In households *with Seguro Popular (SP)* all members have enrolled into the voluntary health insurance program, whereas in households *without SP*, none of the members have any type of health insurance.

Table 2. ENIGH 2006: Effect of Seguro Popular on Catastrophic Health Expenditures

	Naive Probit Model		Bivariate Probit Model		
	CHE equation		SP Equation	CHE equation	
	Coefficients	Marginal Effects	Coefficients	Coefficients	Marginal Effects
Enrolled in Seguro Popular (d)	0.029	0.002		0.028	0.002
	[0.061]	[0.005]		[0.176]	[0.014]
Characteristics of the household head					
Age	0.005	0.000	-0.011	0.005	0.000
	[0.002]**	[0.000]**	[0.001]**	[0.002]**	[0.000]**
Female-headed (d)	0.023	0.002	-0.161	0.023	0.002
	[0.043]	[0.003]	[0.036]**	[0.043]	[0.003]
Formal education (years)	-0.014	-0.001	-0.033	-0.014	-0.001
	[0.004]**	[0.000]**	[0.003]**	[0.004]**	[0.000]**
Characteristics of the household					
Asset Index	-0.055	-0.004	-0.036	-0.055	-0.004
	[0.027]*	[0.002]*	[0.022]+	[0.027]*	[0.002]*
Children <= 1 (d)	0.473	0.05	-0.464	0.473	0.05
	[0.069]**	[0.009]**	[0.058]**	[0.071]**	[0.010]**
Children <= 7 (d)	-0.043	-0.003	0.237	-0.043	-0.003
	[0.064]	[0.005]	[0.041]**	[0.065]	[0.005]
Adults >= 65 (d)	0.259	0.022	-0.067	0.259	0.022
	[0.061]**	[0.006]**	[0.050]	[0.063]**	[0.006]**
Family size	-0.039	-0.003	-0.098	-0.039	-0.003
	[0.011]**	[0.001]**	[0.009]**	[0.012]**	[0.001]**
Enrolled in Oportunidades (d)	-0.148	-0.011	0.759	-0.147	-0.011
	[0.055]**	[0.004]**	[0.042]**	[0.064]*	[0.004]*
Characteristics of the locality					
Rural area (d)	0.158	0.013	0.11	0.158	0.013
	[0.050]**	[0.004]**	[0.041]**	[0.051]**	[0.004]**
Deprivation index	0.03	0.002	-0.162	0.03	0.002
	[0.024]	[0.002]	[0.021]**	[0.023]	[0.002]
Instrumental Variables					
Locality SP coverage			2.727		
			[0.113]**		
Incorporated by 2001 (d)			0.026		
			[0.049]		
Incorporated by 2002 (d)			0.202		
			[0.045]**		
Incorporated by 2003 (d)			0.017		
			[0.065]		
Incorporated by 2004 (d)			-0.156		
			[0.073]*		
Coefficient of correlation (rho)			0.001		
			[0.098]		
Constant	-1.99		-0.846	-1.989	
	[0.113]**		[0.102]**	[0.120]**	
Observations	14,628		14,628		

Notes: marginal effects estimated at the mean of the covariate vector $\boldsymbol{X}$.
(d) marginals for a discrete change of dummy variable from 0 to 1
robust standard errors in brackets
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 3. ENSANUT 2006: Effect of Seguro Popular on Catastrophic Health Expenditures

	Naive Probit Model		Bivariate Probit Model		
	CHE equation		SP Equation	CHE equation	
	Coefficients	Marginal Effects	Coefficients	Coefficients	Marginal Effects
Enrolled in Seguro Popular (d)	-0.185	-0.02		-0.359	-0.036
	[0.040]**	[0.004]**		[0.067]**	[0.006]**
Characteristics of the household head					
Age	0.007	0.001	-0.007	0.006	0.001
	[0.001]**	[0.000]**	[0.001]**	[0.001]**	[0.000]**
Female-headed (d)	-0.03	-0.003	-0.061	-0.036	-0.004
	[0.034]	[0.004]	[0.029]*	[0.035]	[0.004]
Formal education (number of years)	-0.007	-0.001	-0.027	-0.008	-0.001
	[0.004]	[0.001]	[0.004]**	[0.004]+	[0.001]+
Indigenous self-identity (d)	0.046	0.005	-0.1	0.046	0.006
	[0.042]	[0.005]	[0.033]**	[0.038]	[0.005]
Speak indigenous language (d)	-0.179	-0.019	-0.069	-0.189	-0.02
	[0.058]**	[0.005]**	[0.047]	[0.055]**	[0.005]**
Characteristics of the household					
Asset Index	0.002	0.000	-0.038	0.00	0.00
	[0.021]	[0.002]	[0.016]*	[0.020]	[0.002]
Children <= 1 (d)	0.211	0.027	-0.137	0.206	0.027
	[0.044]**	[0.006]**	[0.035]**	[0.043]**	[0.006]**
Children <= 7 (d)	0.017	0.002	0.216	0.025	0.003
	[0.039]	[0.004]	[0.030]**	[0.039]	[0.005]
Adults >= 65 (d)	0.124	0.015	-0.063	0.125	0.016
	[0.048]**	[0.006]*	[0.041]	[0.047]**	[0.006]*
Someone with diabetes (d)	0.159	0.021	0.148	0.171	0.023
	[0.071]*	[0.010]*	[0.059]*	[0.068]*	[0.010]*
Someone with hypertension (d)	0.097	0.012	0.147	0.102	0.013
	[0.053]+	[0.007]+	[0.045]**	[0.054]+	[0.007]+
Someone with gastritis (d)	0.104	0.013	0.09	0.103	0.013
	[0.060]+	[0.008]	[0.047]+	[0.059]+	[0.008]
Family size	-0.035	-0.004	-0.038	-0.036	-0.004
	[0.009]**	[0.001]**	[0.007]**	[0.009]**	[0.001]**
Enrolled in Oportunidades (d)	-0.056	-0.006	0.543	-0.019	-0.002
	[0.042]	[0.005]	[0.031]**	[0.040]	[0.005]
Characteristics of the locality					
Rural area (d)	0.096	0.011	-0.171	0.101	0.012
	[0.039]*	[0.005]*	[0.031]**	[0.037]**	[0.004]**
Deprivation index	0.069	0.008	-0.098	0.061	0.007
	[0.020]**	[0.002]**	[0.017]**	[0.018]**	[0.002]**
Instrumental Variables					
Locality SP coverage			3.083		
			[0.063]**		
Incorporated by 2001 (d)			0.234		
			[0.035]**		
Incorporated by 2002 (d)			0.04		
			[0.033]		
Incorporated by 2003 (d)			-0.151		
			[0.041]**		
Incorporated by 2004 (d)			0.049		
			[0.054]		
Coefficient of correlation (rho)			0.141		
			[0.045]**		
Constant	-1.698		-1.155	-1.642	
	[0.094]**		[0.088]**	[0.096]**	
Observations	20,810		20,601		

Notes: marginal effects estimated at the mean of the covariate vector ***X***.
(d) marginals for a discrete change of dummy variable from 0 to 1
robust standard errors in brackets
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 4. SP Impact Survey: Effect of Seguro Popular on Catastrophic Health Expenditures

	Naive Probit Model		Bivariate Probit Model		
	CHE equation		SP Equation	CHE equation	
	Coefficients	Marginal Effects	Coefficients	Coefficients	Marginal Effects
Enrolled in Seguro Popular (d)	-0.128	-0.018		-0.409	-0.053
	[0.026]**	[0.003]**		[0.073]**	[0.009]**
Characteristics of the household head					
Age	0.004	0.001	-0.001	0.004	0.001
	[0.001]**	[0.000]**	[0.001]+	[0.001]**	[0.000]**
Female-headed (d)	0.000	0.000	0.039	0.003	0.000
	[0.026]	[0.004]	[0.022]+	[0.027]	[0.004]
Formal education (number of years)	-0.007	-0.001	-0.003	-0.008	-0.001
	[0.003]**	[0.000]**	[0.002]	[0.003]**	[0.000]**
Characteristics of the household					
Asset Index	-0.046	-0.007	-0.04	-0.045	-0.007
	[0.015]**	[0.002]**	[0.012]**	[0.015]**	[0.002]**
Children <= 1 (d)	0.366	0.063	0.021	0.369	0.065
	[0.033]**	[0.007]**	[0.027]	[0.033]**	[0.007]**
Children <= 7 (d)	-0.003	0.000	0.075	0.009	0.001
	[0.030]	[0.004]	[0.023]**	[0.030]	[0.004]
Adults >= 65 (d)	0.214	0.034	-0.043	0.203	0.032
	[0.031]**	[0.005]**	[0.028]	[0.032]**	[0.005]**
Family size	-0.034	-0.005	0.019	-0.031	-0.005
	[0.006]**	[0.001]**	[0.005]**	[0.006]**	[0.001]**
Enrolled in Oportunidades (d)	-0.048	-0.007	0.556	0.006	0.001
	[0.024]*	[0.003]*	[0.019]**	[0.028]	[0.004]
Characteristics of the locality					
Rural area (d)	0.204	0.026	-0.122	0.199	0.026
	[0.046]**	[0.005]**	[0.038]**	[0.046]**	[0.005]**
Deprivation index	0.108	0.016	0.25	0.141	0.021
	[0.019]**	[0.003]**	[0.017]**	[0.020]**	[0.003]**
Instrumental Variables					
Locality SP coverage			2.341		
			[0.048]**		
Incorporated by 2001 (d)			0.202		
			[0.101]*		
Coefficient of correlation (rho)			0.195		
			[0.048]**		
Constant	-1.62		-1.16	-1.558	
	[0.075]**		[0.062]**	[0.078]**	
Observations	29,783		28,565		

Notes: marginal effects estimated at the mean of the covariate vector $\boldsymbol{X}$.
(d) marginals for a discrete change of dummy variable from 0 to 1
robust standard errors in brackets
+ significant at 10%; * significant at 5%; ** significant at 1%

Table 5. Effect of Seguro Popular on Out of Pocket (OOP) Expenditures

	ENIGH		ENSANUT		SP, Impact Survey	
Effect of SP on OOP expenditures	Coefficients	Marginal Effects	Coefficients	Marginal Effects	Coefficients	Marginal Effects
Outpatient Care	-0.363	-0.129	-0.214	-0.073	-0.804	-0.294
	[0.110]**	[0.036]**	[0.046]**	[0.015]**	[0.042]**	[0.014]**
Inpatient Care	-0.076	-0.013	0.062	0.008	-0.416	-0.073
	[0.144]	[0.023]	[0.064]	[0.009]	[0.063]**	[0.010]**
Medicines	-0.204	-0.079	-0.228	-0.086	-0.408	-0.159
	[0.108]+	[0.042]+	[0.043]**	[0.016]**	[0.046]**	[0.018]**

Notes:
Bivariate probit models for effect of SP on OOP expenditures controlling for all covariates in Table 1.
Marginal effects estimated at the mean of the covariates.
Robust standard errors in brackets
+ significant at 10%; * significant at 5%; ** significant at 1%

Appendix Table A1: Sensitivity Analysis 1:
Effect of Seguro Popular on Catastrophic Health Expenditures using ENSANUT with restricted covariables

	Naive Probit Model		Bivariate Probit Model		
	CHE equation		SP Equation	CHE equation	
	Coefficients	Marginal Effects	Coefficients	Coefficients	Marginal Effects
Enrolled in Seguro Popular (d)	-0.173	-0.019		-0.336	-0.034
	[0.040]**	[0.004]**		[0.067]**	[0.006]**
Characteristics of the household head					
Age	0.007	0.001	-0.006	0.007	0.001
	[0.001]**	[0.000]**	[0.001]**	[0.001]**	[0.000]**
Female-headed (d)	-0.024	-0.003	-0.057	-0.03	-0.003
	[0.033]	[0.004]	[0.029]*	[0.035]	[0.004]
Formal education (number of years)	-0.008	-0.001	-0.027	-0.009	-0.001
	[0.004]+	[0.001]+	[0.004]**	[0.004]+	.
Characteristics of the household					
Asset Index	0.017	0.002	-0.02	0.016	0.002
	[0.020]	[0.002]	[0.016]	[0.020]	[0.002]
Children <= 1 (d)	0.212	0.028	-0.137	0.208	0.027
	[0.044]**	[0.006]**	[0.035]**	[0.043]**	[0.006]**
Children <= 7 (d)	0.014	0.002	0.215	0.022	0.003
	[0.038]	[0.004]	[0.030]**	[0.038]	[0.005]
Adults >= 65 (d)	0.129	0.016	-0.057	0.13	0.016
	[0.048]**	[0.006]*	[0.042]	[0.048]**	[0.006]*
Family size	-0.035	-0.004	-0.038	-0.036	-0.004
	[0.009]**	[0.001]**	[0.007]**	[0.009]**	[0.001]**
Enrolled in Oportunidades (d)	-0.06	-0.007	0.539	-0.028	-0.003
	[0.043]	[0.005]	[0.031]**	[0.040]	[0.005]
Characteristics of the locality					
Rural area (d)	0.104	0.012	-0.166	0.111	0.013
	[0.040]**	[0.005]*	[0.031]**	[0.037]**	[0.005]**
Deprivation index	0.054	0.006	-0.116	0.046	0.005
	[0.020]**	[0.002]**	[0.016]**	[0.018]*	[0.002]*
Instrumental Variables					
Locality SP coverage			3.083		
			[0.063]**		
Incorporated by 2001 (d)			0.243		
			[0.035]**		
Incorporated by 2002 (d)			0.048		
			[0.033]		
Incorporated by 2003 (d)			-0.167		
			[0.040]**		
Incorporated by 2004 (d)			0.045		
			[0.054]		
Coefficient of correlation (rho)			0.132		
			[0.044]**		
Constant	-1.702		-1.176	-1.65	
	[0.094]**		[0.087]**	[0.095]**	
Observations	20,816		20,607		

Notes: Sensitivity analysis does not use indigenous (language and self-identity) or presence of chronic conditions.
Marginal effects estimated at the mean of the covariate vector $\boldsymbol{X}$.
(d) marginals for a discrete change of dummy variable from 0 to 1
robust standard errors in brackets
+ significant at 10%; * significant at 5%; ** significant at 1%

Appendix Table A2. Sensitivity Analysis 2: Effect of Seguro Popular on Out of Pocket (OOP) Expenditures using ENSANUT with restricted covariables

	ENSANUT	
Effect of SP on OOP expenditures	Coefficients	Marginal Effects
Outpatient Care	-0.185	-0.063
	[0.045]**	[0.015]**
Inpatient Care	0.093	0.013
	[0.064]	[0.009]
Medicines	-0.202	-0.076
	[0.043]**	[0.016]**

Notes:
Sensitivity analysis does not use indigenous (language and self-identity) or presence of chronic conditions.
Bivariate probit models for effect of SP on OOP expenditures controlling for all other covariates in Table 1.
Marginal effects estimated at the mean of the covariates.
Robust standard errors in brackets
+ significant at 10%; * significant at 5%; ** significant at 1%