

Equilibrium labor market effects of non-contributory health insurance: Evidence from Mexico

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Abstract

The Seguro Popular (SP) was introduced in 2002 by the Mexican government as a public health insurance program. It was directed to the half of the country's population, uncovered by social protection or employer-provided health insurances. In this paper, we study the effects of SP on labor market in Mexico. To the extent that SP is a transfer to informal sector workers and the nonemployed, it may have changed incentives for individuals to participate in the labor market or which sector to work (formal or informal). Firms in the formal sector face costs to provide health care insurance, while in the informal they do not.

This paper contributes to a substantial literature on labor market effects of SP by estimating a search equilibrium model where individuals can be nonemployed or employed in either sector formal or informal, with different wage and health insurance policies. The model is fitted to the Mexican Employment data and used to simulate welfare changes as well as effects on employment, informality and wages of alternative non-contributory health insurance policies.

1 Introduction

The Seguro Popular (SP) was introduced in 2002 in Mexico as a non-contributory health insurance program and it was directed to half of the country's population, uncovered by social protection or employer provided health insurance. That is, informal sector workers and the nonemployed.

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To be eligible to the SP, an individual needs to be non eligible to an employer provided health insurance. Thus, SP is a transfer(tax) to informal(formal) sector workers and a transfer to the nonemployed. In particular, if the value placed on SP benefits is high, the we should expect a negative impact on employment and/or formality rates. But, on the other hand, wages in equilibrium might compensate the increase in benefits in the informal sector, and in this case, the impact on formality rates is ambiguous. The welfare impacts of a non-contributory health insurance program like SP depend on how firms in each sector adjust wages given benefits, and on allocation of workers and firms across sectors.

In this paper, we analyze the effects of non-contributory health insurance programs like SP on labor market outcomes. In particular, employment, informality and wages. By modelling the choices of firms, that can offer formal or informal work arrangements, and the choices of workers, who can decide to be unemployed or work either in the formal or informal sector, we are also able to analyze the welfare effects of non-contributory health insurance programs. Specifically, we consider an economy with labor market frictions where individuals can be (i) nonemployed, (ii) formal sector workers or (iii) informal sector workers. The nonemployed and informal sector workers are entitled to SP benefits and the formal sector workers receive EP health insurance (employer-provided) plus other benefits secured by labor laws. In the formal sector, firms incur in EP health provision costs. In our estimation, we allow individuals to differ by education, age, family composition, that might be associated with a different valuation of the SP health benefits.

Our framework is similar to the equilibrium search model with heterogeneous firms and on-the-job search with endogenous choice of sector by firms of Meghir, Narita and Robin, 2014. Thus, we allow firms to differ in their productivity regardless of the sector in which they operate. As in their paper, firms can choose to operate in the formal and informal sector. Each sector has different wages and health insurance policies. But, unlike Meghir, Narita and Robin, 2014, we use the introduction of a non-contributory health insurance to identify the relative value attached to a job due to insurance coverage.

In the next section, we present the a summary of the literature on the labor market effects of health insurance schemes not attached to the employer. In Section 3 we explain the exact details of SP and context in it was introduced. Section 4 describes the data sets used in the paper. In Section 5 we present the broad trends in the Mexican labor market during the period before and after the introduction of SP and reduce estimates of the labor market effects of such policy. In Section 6 we present our model and the details of estimation of the model. This version of the paper still does not include the estimates from our structural model, but we plan to estimate the model for two benchmark economies: (i) before the introduction of Seguro Popular and (ii) in the early years of operation of the program. We

will also estimate the model for different segments of population separated by education (at most primary education and more than primary education, which we refer to as low and high education groups, respectively) and by age and family composition. These groups are chosen since they will likely have different valuations of health care benefits. Then, from each benchmark, we simulate real increases in the relative benefit of Seguro Popular and we will aim to answer to two main questions: (i) How much of the increase in informality in Mexico is due to the introduction of non-contributory health insurance? and (ii) What are the welfare impacts of increases in the value of non-contributory health insurance? Conclusions are in Section 7.

2 Literature Review

The evidence on the labor market effects of SP is mixed (see the review by Bosch, Cobacho and Pages, 2012). Most studies do not find any impact on the informality rate (Gallardo-Garca, 2006; Barros, 2011; Campos and Knox, 2010, Aguilera, 2011, Duval and Smith, 2011), if anything there are small increases in the share of informal workers for low education, married women with children or older adults (Azuara and Marinescu, 2010, Aterido et al 2010, Prez-Estrada, 2011, Bosch and Cobacho, 2011). Aterido et al, 2010, find that SP is associated with a reduction on the flow out of unemployment and out of the labor force, but del Valle, 2014, finds the women in families with disable or dependent individual reduce unemployment and inactivity to become informal workers.

There are few papers that analyze the effects of SP on wages, however, the few papers studying it find no effects (Barros, 2009, and Azuara and Marinescu, 2010), or a negative impact on informal wages (Aterido et al, 2010, Pérez-Estrada, 2011).

Finally, regarding the effects of SP on broad measures of welfare, there is some indirect evidence through lowered wages in the informal sector (Aterido et al, 2010, Pérez-Estrada, 2011) and better health outcomes, namely, lower infant mortality in poor municipalities (Conti and Ginja, 2014), a decrease in miscarriages (Pfutze, 2013), but most studies find no effect on health outcomes (Knox 2008, King et al. 2009, Barros 2011).

So far there is no work considering the general equilibrium effects of non-contributory health insurance on broader welfare measures.

The literature on search with formal and informal sectors is recent but two recent papers are particularly relevant for our study. Albrecht, Navarro and Vroman (2009) model formal and informal sectors following the Diamond-Mortensen-Pissarides approach, assume workers can only move to the formal sector from unemployment. They then use the model to simulate impact of tax policies in the formal sector. Meghir, Narita and Robin (forthcoming)

model formal and informal sectors using a Burdett-Mortensen approach, where workers and firms can choose their sector endogenously. They estimate the model and then simulate the impact of increasing the cost of informality.

3 Background

3.1 The Health Care System in Mexico before *Seguro Popular*

Before the reform, health care in Mexico was characterized by a two-tiered system and about half of the population served by a contributory system and the other half served by a non-contributory system. The contributory system was (and still is) guaranteed by the Social Security Institutions such as the *Instituto Mexicano del Seguro Social* (IMSS), which covers the workers employed in the private sector, the *Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado* (ISSSTE), for the civil servants, and *Petroleos Mexicanos* (PEMEX), covering those employed in the oil industries. Health coverage is provided by these institutions in public hospitals, but these individuals could also elect to use and pay for care in private hospitals, or to buy private health insurance. In 2000, IMSS covered 40% of the population, and ISSSTE 7% of the population (see Frenk et al., 2006). Beneficiaries of social programs also had automatic access to health services (*Instituciones de Asistencia Social* such as IMSS-Oportunidades, which was provided in the infrastructure of the IMSS). However, state hospitals only offered some selected primary (ambulatory and urgent care) and secondary care (health care provided by specialists), and payment was required for most services.

Those not covered by Social Security could seek health services in either public health clinics run by the *Secretaria de Salud* (SSA) or private clinics and hospitals. Thus, in 2000, approximately 50% of health expenditures was classified as "out-of-pocket expenses" (Frenk, 2001) and 50% of the Mexican population had no guaranteed health insurance coverage. The public per capita health expenditures on the insured were twice as much as those for the uninsured (see Frenk et al., 2006). In addition, the population served by the contributory and non-contributory systems presented different health profiles (see Conti and Ginja, 2014).

3.2 The Seguro Popular

The Pilot Years. Seguro Popular (SP) was launched as a pilot program in 2002 in 26 municipalities (in 5 states) under the name *Salud para Todos*.¹ The aim was to extend the

¹The municipalities (states) where the program was initially rolled-out are Calkin, Hecelchakan, Tenabo, Campeche, Holpechen (Campeche), Comalcalco, Cunduacan (Tabasco), Acatic, Atotonilco, Ayotlan, Cabo

program gradually to the rest of the country. The launching states were chosen due to “the existence of high social security coverage, the ability to provide services, large concentration of semi-urban population and the existence of groups of beneficiaries of social programs”, such as *Oportunidades*² (Secretaria de Salud, 2002)³. During the early stages of operation, SP targeted nuclear families⁴ in the first six deciles of the distribution of income who were not entitled to social security coverage and who were residing in semi-urban and urban areas (CESOP, 2005).

According to the official registry of affiliated families, the *Padron*, during 2002 15 additional states implemented the program (Baja California, Chiapas, Coahuila, Guanajuato, Guerrero, Hidalgo, Mexico, Morelos, Oaxaca, Quintana Roo, San Luis Potosi, Sinaloa, Sonora, Tamaulipas and Zacatecas). Although their entry was not planned, these states agreed with the federal government to provide the health services covered by SP. The pilot phase ended officially on December 31, 2003 (when Baja California Sur, Michoacán, Puebla, Tlaxcala, Veracruz and Yucatán joined SP), and by then 613,938 families were enrolled in the program.

The Ley General de Salud (LGS). The General Health Law was approved in early 2003, and officially implemented in January 1st 2004, effectively introducing the System of Social Protection in Health (SPSS, *Sistema de Protección Social en Salud*), to extend health coverage and financial protection to the eligible population.⁵ According to the rules of operation of the program the expansion of the coverage should prioritize areas with: (1) Low social security coverage; (2) Large number of uninsured in the first six deciles of income;

Corrientes, Arandas, Encarnacion de Diaz, Jalostotitlan, Jesus Maria, Puerto Vallarta, San Julian, San Miguel el Alto, San Sebastian del Oeste, Tepatitlan de Morelos, Tomatlan, Valle de Guadalupe, Canadas de Obregon (Jalisco), Aguascalientes (Aguascalientes), Colima, Villa de Alvarez (Colima).

²*PROGRESA (Programa de Educacion, Salud y Alimentación)* was launched in 1997 as the main anti-poverty program in Mexico in rural areas. It was renamed *Oportunidades* in 2002 and expanded to urban areas. The program *Oportunidades* targets families in extreme poverty in both rural and urban areas. The program has some overlap with Seguro Popular, since it consists of three components – health, nutrition and schooling, and the National Commission on Social Protection of Health (CNPSS) is also in charge of implementing the health component through three channels. First, by providing the Guaranteed Basic Health Package, which includes a set of interventions specifically tailored to individuals of different age groups and which is similar to the basic package offered under SP; second, by monitoring the nutrition of both children and pregnant women through monthly consultations (and providing nutritional supplements in case of malnutrition); third, by providing information on preventive health behaviors through community workshops.

³See the Appendix for a description of the social programs in place at the time of the introduction of SP.

⁴I.e., including the father, the mother and the children less than 18 years old, and eventually the grandparents over 64 years of age.

⁵The law was published in the Federal Official Journal in April 5, 2004 *Diario Oficial de la Federación* and revised in November 13, 2008. See http://www.salud.df.gob.mx/ssdf/seguro_popular/index/marcojuridico.php.

(3) Ability to ensure the provision of services covered by the program; (4) Potential demand for enrollment; (5) Explicit request of the state authorities; (6) Existence of sufficient budget for the program.⁶

The Federal Government and the states share the responsibility for social protection in health, with the Federal Government (through the SSA) responsible for regulating, developing, coordinating, evaluating and monitoring health actions, and the states responsible for managing the resources allocated by the Federation for the purchase of medicines, staffing and service delivery in general.

In 2004, three more states introduced the program (Nayarit, Nuevo Leon and Querétaro) reaching 29 states. In 2005, the last three states – Chihuahua, Distrito Federal and Durango – joined SP.

Eligibility, Enrolment and Permanence in the System. Families and individuals who are not beneficiaries of social security institutions, or who have not otherwise access to health services, are entitled to enroll in SP, on the basis of their place of residence. The household is the unit of protection.⁷

Enrollment into SP is voluntary, and it is granted upon compliance with the following requirements: proof of residence in the Mexican territory; lack of health insurance, ascertained with the mere declaration of the applicant; individual ID (*CURP - Clave Unica de Registro de Población*); information necessary for the application of the socio-economic assessment tool necessary to calculate the fees for the use of services. The temporary lack of documentation associated with the three first points does not prevent the incorporation into the System, and families/individuals can be provisionally registered for up to ninety days. The effective right to use the system for beneficiaries begins on the first day of the calendar month following the date of incorporation, and it is valid for twelve calendar months. After 12 months, the family has sixty days to renew the application. Information about all individuals affiliated in the system is listed in an administrative registry, called the *Padrón*. At the the end of 2010, the *Padrón* included 43,518,719 individuals and 15,760,805 families.⁸

⁶Diario Oficial, Viernes 4 de julio de 2003 for the *Reglas de operación e indicadores de gestión y evaluación del Programa Salud para Todos (Seguro Popular de Salud)*.

⁷The law considers the following as household members: (i) natural and the adopted children less than 18 years of age; (ii) children and adolescents aged 18 years or less who are part of the household and have blood relations with the above-mentioned beneficiaries; (iii) the direct ancestors, more than 64 years old, who live in the same home and are financially dependent, as well as the sons or daughters until 25 years of age, single, who prove to be students or disabled dependents. Take the example of IMSS, which covers 40% of the population. If an individual is covered by IMSS, his/hers spouse is also covered (or partner if co-habiting for at least 5 years), children under 16 (or under 25 if studying) and his/hers parents if they live with the insured. Such household is not eligible for SP.

⁸According to a survey in nine states, Baja California, Campeche, Distrito Federal, Guerrero, Hidalgo, Jalisco, Querétaro, Morelos and Zacatecas the main reasons for affiliation are access to free medicines and

Funding. Seguro Popular is a non-contributory health insurance system, funded by general taxes revenues. The funding is based on a tripartite structure with the following sources of funds: a social contribution (*Cuota Social*) from the federal government, solidarity contributions from both federal government and states (*Aportaciones Solidarias*) and a family contribution (*Cuota Familiar*). This structure is similar to that adopted by the two major social insurance agencies in Mexico, IMSS and ISSSTE.⁹

The *cuota social* is an annual contribution of the federal government for each affiliated family, and it equals 15% of the daily minimum wage for Mexico City (about USD200 a year per family). This figure is very similar to the contribution for each employee affiliated with the IMSS. The solidarity contributions come from both federal and state resources: the federal solidarity contribution per household amounts to on average 1.5 times the *cuota social*¹⁰ and the state solidarity contribution per household is half of the *cuota social*. Finally, the third contribution comes from the families and it is a fee introduced to replace the out-of-pocket payments made at the time of the delivery of services. Families are classified in one of two regimes: contributory or not. The contributory scheme implies a progressive annual fee to be paid by each family, defined based on the average household income relative to the national income distribution (the verification of the income decile for each affiliated family is held every three years). Families in the non-contributory are those (i) with a disposable income in bottom 20% of the distribution of national income; (ii) enrolled in federal programs to combat extreme poverty; (iii) residents in rural areas of very high marginalization with less than 250 inhabitants, and (iv) other specific requirements set by the CNPSS. In practice, in 2010 96.1% of the enrolled individuals are in the two first deciles of income distribution, and thus exempts from paying the family contribution.

In 2004 the public expenditure in health in Mexico reached 2.7% of GDPs (in the same year, in Denmark this value was 8.2% and this is the OECD country where public health expenditures represent the largest share of GDP; in the US they represented 6.9% of GDP and 3.4% in Brazil). Between 1999 and 2011, there was an increase in the public in expenditure per user either among eligible and not eligible for SP. The public expenditure on insured (not eligible) and uninsured (eligible) grew at similar rate between 2000 and 2003 (see figure A.1), but between 2004 and 2008 public expenditures on the uninsured grew annually about

access to primary care at reduced costs (see Nigenda, 2009).

⁹Public health expenditures in Mexico can be divided in two groups: (1) public health expenditures for the insured population, including the health expenditures for IMSS, ISSTE and PEMEX; (2) public health expenditures for the uninsured population, including the federal and the state health expenditures.

¹⁰The federal solidarity contribution is computed based on the following components: (i) number of beneficiary families; (ii) health needs, according to state's indicators of infant and adult mortality; (iii) additional contributions to institutions, which are called the "state effort" (*esfuerzo estatal*); and (iv) the performance of health services.

20-25%, whereas expenditures on insured grew between 2%-15%. This resulted in an increase in the ratio health expenditures to GDP for the public health expenditures on uninsured.

Use of Funds: Services and Health Conditions Covered by SP. The beneficiaries have access to a package of health services and interventions with approved providers. The number of interventions and conditions covered increased from 78 in 2002 to 284 in 2012.¹¹

In November 2004 it was introduced the *Fondo de Protección contra Gastos Catastróficos (FPGC)* to complement the basic coverage. The FPGC is a reserve fund of unlimited budget with the objective to support the financing of care for high-cost diseases – such as breast and womb cancers, and several cancers in children and adolescents (in Mexico cancer was associated with 15% of the deaths among children and adolescents in 2000).

On December 1st 2006, during his inaugural speech, President Calderón announced the *Seguro Medico para una Nueva Generación (SMNG)*. This represented an expansion of SP coverage for children under age five born in eligible families from that day onwards. Although the official regulations for SMNG were not released until 2008, the number of conditions covered was extended from 108 in 2008 to 131 in 2012 and they are associated with the perinatal period.

The use of the resources administered by Seguro Popular is regulated by the *Ley General de Salud*, which mandates the following partition of the resources: 89% must be transferred directly to the state governments; 8% must be transferred to the state governments through the FPGC; and 3% of the resources are transferred to the state governments through the *Fondo de Previsión Presupuestal* (Provident Budget Fund), to meet the infrastructure needs for basic primary care and in poorer states and to address unforeseen differences in the demand for services during each fiscal year.¹²

In Mexico, the non-contributory and the contributory systems have separated networks

¹¹The interventions covered can be broadly classified into nine types, according to the type of interventions and pathologic services. These areas of coverage are: (1) preventive actions, as vaccination and as medical check-ups, (2) ambulatory care, including general consulting and specialty services for the diagnosis, treatment and rehabilitation of infectious and chronic diseases, (3) dental interventions for all ages the removal of caries, removal of focus of infection and abscesses, and tooth extraction; (4) family planning; (5) prenatal, obstetric and perinatal care; (6) physical rehabilitation; (7) emergency care (situations that require immediate attention because they can endanger life and it includes diagnosis and treatment in the emergency room, inpatient hospital admission or surgery); (8) hospital care for pathologies requiring hospitalization; and (9) general surgery, for acute problems and chronic conditions, including diagnoses of major surgical frequency of gastrointestinal, gynecological, obstetric, genitourinary, ophthalmic, dermatological and orthopedic pathologies.

¹²Of the 89% of the resources that are directly transferred to state governments the yearly Mexican Public Sector Budgets establishes spending limits only. For example, since 2010, some of the limits are: 40% for wages of the personnel involved in providing health care for people affiliated to Seguro Popular; 30% to be used for acquiring medical supplies; 20% to be used for preventing and detecting diseases covered by SP; 6% to be used for "operational" expenses.

of hospitals and health centers to serve the eligible population of each system. The average number of doctors and nurses per potential use not very different in the non-contributory system (SP) and the contributory system (IMSS, ISSSTE, PEMEX and other small providers). In the Ministry of Health medical units, which are responsible to deliver the SP services, in 2000 there were .76 (SD 0.87) doctors or nurses per 1000 individuals eligible, and there were on average .46 (SD 0.80) doctors or nurses per 1000 individuals eligible to services in contributory system.¹³

Once a family is enrolled in SP, she is assigned a health center (which, in turn, is associated to a general hospital) and a family doctor for primary care. In the administrative records of families affiliated to SP, we observe the identifier of both the health center and hospital that families are assigned to. Table B.1 in Appendix presents the number of families enrolled per medical unit in each year. Within each year there is large variability in the number of families assigned to a health center and a hospital (overall, the standard deviation for the number of families is 1,496 and 22,206 per health center and hospital, respectively). There is also an increase in the number of families served by hospitals with the expansion of the program, with a relatively larger increase in the right tail of the distribution for hospitals, suggesting a potential risk of overcrowding of larger units, whereas the increase in the number of potential users of health centers is uniform across the distribution.¹⁴ Not all families in Padron are assigned to health centers run by the Health Ministry. Of the total of 17.6 million families observed in the data, about 816,000 are assigned to IMSS-Oportunidades' centers when they enroll in SP (less than 5% of the families) and 3.7 million of those families that entered SP through the Oportunidades program (about 22% of the total). Additionally, less than 0.03% of the families are assigned to IMSS and private health centers when first registered in SP.

We now turn to a brief description of the geographic coverage of the provision of services. Typically a health center serves more than one locality, so individuals may have to seek care outside their locality of residence. The average health center serves SP families in 13 localities per year (standard deviation is 22) and the average hospital serving SP families serves 196 localities per year (standard deviation is 221). Each locality contains on average families assigned to 2.1 health centers (standard deviation 3.4) and 1.2 hospitals (standard deviation 0.7) each year.

¹³Data for medical personnel by type of health provider comes from the the SIMBAD data set (*Sistema Estatal y Municipal de Bases de Datos* - State and Municipal System Databases). Information on the potential population in the non-contributory system (SP) and the contributory system (IMSS, ISSSTE, PEMEX and other small providers) from the CONAPO (Consejo Nacional de Población - National Council for Population.)

¹⁴In 2010 there is a large number of families that there were not assigned to a hospital. Missing information on health centers is between 9-10% for all years 2006-2010. Missing information about hospitals is between 9% and 13% in each year 2006-2009, and 63% in 2010.

Finally, families can be assigned a new health center if they move or if a new unit is built. 23% of all SP families changed their locality of residence at least once between the years 2005-2010. Of those families that never moved during their affiliation to SP, 7% changed the health center of affiliation and they did so by choice, since only 3-5% of changes for these families were due to re-assignment to new health center.

4 Data

In this paper we use data from three main sources.

Padrón The key treatment variable – the date of implementation of SP in each municipality – comes from the registry of all SP beneficiaries (*Padrón*). This is a consolidated registry of all families with a valid enrolment in Seguro Popular by December 31st of each year since 2002 (we have data until 2010) which is used by the Federal Government and by the States to decide the funds to be allocate to the program. The data contains detailed demographic and socioeconomic characteristics of the enrolled families, including employment status and occupation, and assets. Importantly, this data contains information on the exact place of residence and the identifiers of the health center and general hospital assigned to the family at the time of enrolment in Seguro Popular.¹⁵

The availability of the Padron data set allows us to exploit dimensions of the expansion of SP never used before in the literature. It provides information on the effective monthly rollout of SP across municipalities and localities in Mexico, and, more importantly, it allows to us to control for the baseline observable characteristics of the individuals taking-up the program at different points of the rollout of SP.

Using this data we consider that a municipality has direct access to SP when the number of families affiliated to the program is at least 10

Encuesta Nacional de Empleo (ENE) 2000-2004 and Encuesta Nacional de Ocupación y Empleo (ENEO) 2005-2012 We use quarterly data from the National Employment Surveys of Mexico, which is a rotating panel of households. There are two periods of implementation (ENE for 2000-2004) and (ENOE for 2005-2012). It is nationally representative but, strictly speaking, the ENE survey had an adequate frame only for the urban

¹⁵For the years 2002 and 2003 (in which the program ran as a pilot), only information on the date of enrolment and on the state of residence was recorded for each. However, it is possible to identify the exact date of implementation of SP in a given municipality since each family has a unique identifier. Thus it is possible to link families across year.

population. The data includes a rotating panel at the individual and household level (2000-2012) and it covers more than 10 million individuals from the second quarter of 2000 to fourth quarter of 2012 between 23 and 65 years old in 1404 municipalities across the country. About 100,000 households are covered per quarter.

From this data we observe the social security status of a specific individual changes status across quarters. We consider that an individual is an informal worker if he/she does not have access to health services provided by his/her job through one of the social security institutions in the country (IMSS, ISSSTE or PEMEX). In addition to access to social security coverage through his or her job in this data we also observe whether the individual is covered by social security through the spouse.

We use this data set to identify two types of transitions: if the social security status of a specific individual changes status across quarters and whether he/she switch jobs (within or across the formal and informal sectors).

Encuesta Nacional de Ingresos y Gastos de los Hogares-ENIGH We use the National Expenditure and Income survey (for the even years between 1998 and 2012), which is a representative sample of both rural and urban households, to obtain the mean expenditure per individual on health insurance. We obtain the mean expenditure per individual by gender, for three age groups: 20-29, 30-39 and 40 or over. We use this expenditure as a proxy for the firms cost to provide health insurance to each formal worker. We choose these three age groups based on the type of same age breakdown of the services offered by SP.

Other data sets We collected information from five other administrative data sets, which we use to characterize the municipalities which introduced SP in different years. First, we use administrative data on all death certificates, which are assembled by the civil registry and the public prosecutor (in case of accidental or violent deaths) in the entire country. The data contains information on the exact date, place and cause of death, the registration date as well as age, gender, type of health insurance and residence of the deceased, for the years 1994-2001.¹⁶ We use this data to correlate the date of implementation of SP with the number of deaths at different ages. Second, we use data on all fetal deaths between 1988 and 2001¹⁷ A fetal death is a death that occurs before complete expulsion or extraction of the fetus from the mother, regardless of the duration of pregnancy. The death is indicated by the fact that after delivery the fetus does not breathe or show any other sign of life. The Certificate of Fetal Death contains at least information on the gestational age of the fetus. Third, we

¹⁶We downloaded the data from the SINAIS website: <http://sinais.salud.gob.mx/mortalidad/>.

¹⁷The was obtained from the SINAIS website: http://www.sinais.salud.gob.mx/basesdedatos/std_muertesfetales.html.

use data on all births occurred (and registered) in Mexico between 1998-2001.¹⁸ Fourth, we use the universe of Hospital Discharges from the Health Ministry (*Secretaria de Salud*), for 2000.¹⁹ We use this data to correlate the timing of implementation of SP with the health status of those seek care in the hospitals run by SSA before the introduction of SP. Finally, we use data on the universe of all physical and human resources for all outpatient and inpatient units administered by the Health Ministry for 2001.²⁰ We use this to correlate the timing of implementation of SP with the supply of health services available in the municipality.

5 Main labor market facts

In this section we present some basic facts regarding the labor market in Mexico. To document these basic facts we use quarterly data from the Mexican Labor Force Survey ENE-ENOE for the period of 2000-2012 (see section 4). In all results presented below we restrict the sample to adults ages 23-65 years old with at most primary education. This restriction implies that we use half of the sample, in particular, our sample includes 3,617,609 observations.

We consider that in each moment an individual can be (1) unemployed or out-of-the-labor-force, (2) work in the formal sector or (3) work in the informal sector. We consider that an individual is an informal worker if he/she does not have access to health services provided by his/her job through on of the social security institutions in the country. In addition to access to social security coverage through his or her job in this data we also observe whether the individual is covered by social security through the spouse.

5.1 Trends in Employment Composition

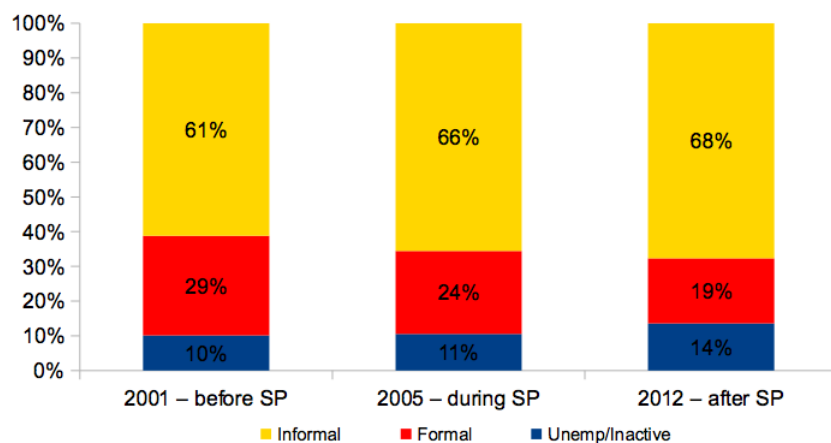
We start by presenting in figures 1 and 2 the average share of individuals in the sample that are unemployed or out-of-the-labor-force and whether they work in the formal or informal sectors. We present statistics separately for females and males and for three years: 2001 (the year just before the introduction of SP), 2005 (a year in which all states were already had introduced SP, but in which only 57% of municipalities had SP - see table B.2 in Appendix) and for 2012, where the program has already reached all eligible individuals.

¹⁸The was obtained from the SINAIS website: http://www.sinais.salud.gob.mx/basesdedatos/std_nacimientos.html.

¹⁹The data was obtained from <http://www.sinais.salud.gob.mx/egresoshospitalarios/basesdedatoseh.html>.

²⁰The data was downloaded from the SINAIS website: <http://www.sinais.salud.gob.mx/basesdedatos/recursos.html>.

Figure 1: Employment composition: Men ages 23-65 with at most primary education



Note: Percentage of individuals by job status at the date of first interview.

Figure 1 shows that about 2/3 of the working age males in Mexico have informal work arrangements. In terms of changes in changes in the composition of the (potential) labor force, between 2001 and 2012 among males there was an increase in the share of informal workers of 7pp and a decrease of 10pp in the share of workers employed in the formal sector. The share of unemployed or inactive males remained more or less constant.

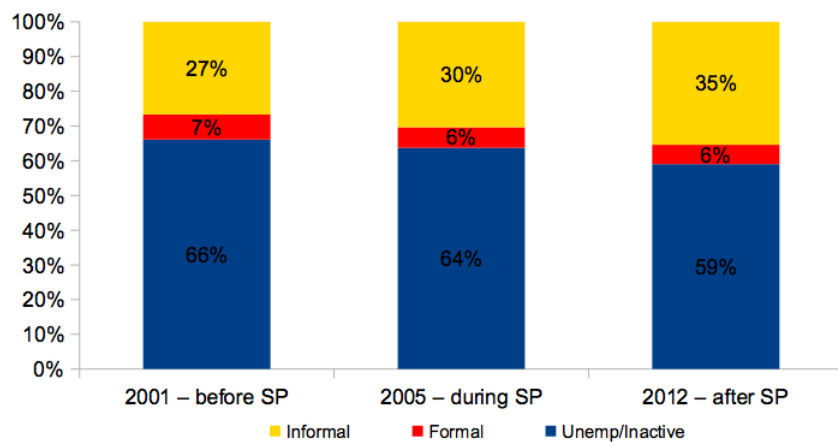
Figure 2 shows that about 2/3 of the working age women in Mexico are either unemployed or out of the labor force (this figure is similar in other Latin American countries). The figure also shows that between 2001 and 2012 among females there was an increase in the share of informal workers of 8pp and a decrease of 7pp in the share of women unemployed or out of the labor force. The share of women working in the formal sector remained more or less constant.

To understand the changes in the composition of labor force detected above, we now turn to analyze quarterly transitions between status. Figures 3 and 4 present the share of workers according to their status in two periods: the first quarter they are interviewed and the immediate quarter. Although figures 1 and 2 refer to stocks while figures 3 and 4 present transitions between two quarters, the latter provide at least a partial explanation for the changes in the composition observed between 2001 and 2014.

Figure 3 shows that among males there is an increase in the flow out of the unemployment pool to informality between 2001-2012, which can (at partially) explain the increase in the share of informal workers found in figure 1. Simultaneously, we document a decrease in the flow out of the unemployment pool to formality.

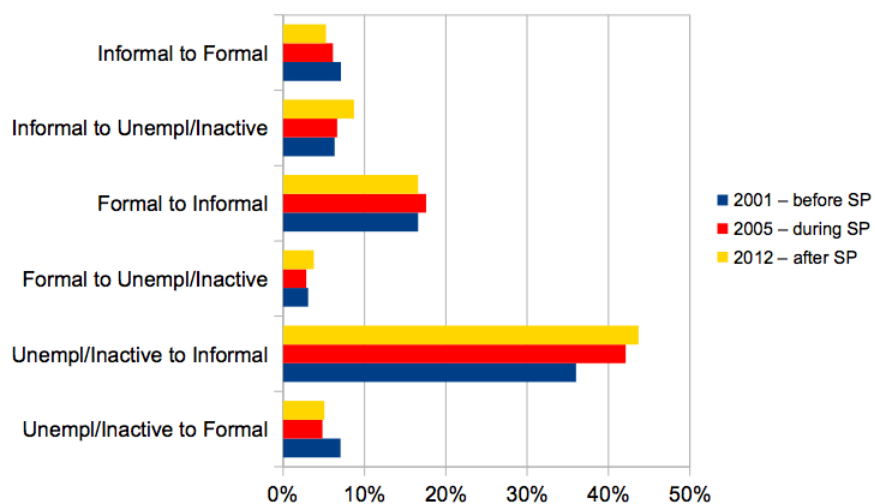
Figure 4 shows that among women there is a decrease in the flow out of the informality

Figure 2: Employment composition: Women ages 23-65 with at most primary education



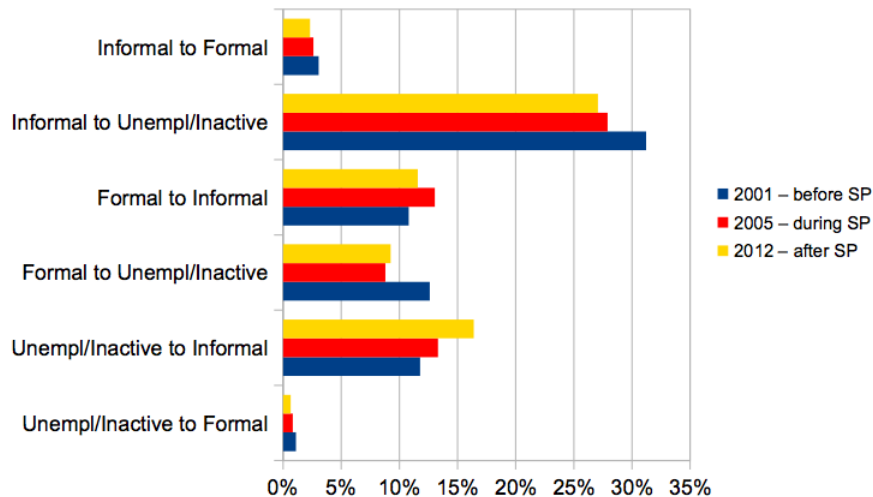
Note: Percentage of individuals by job status at the date of first interview.

Figure 3: Transitions (per quarter) : Men ages 23-65 with at most primary education



Note: Percentage of individuals by job status at the date of first interview.

Figure 4: Transitions (per quarter) : Women ages 23-65 with at most primary education



Note: Percentage of individuals by job status at the date of first interview.

Table 1: Log Mean Wages: individuals ages 23-65 with at most primary education

Year	Males			Females		
	Formal	Informal	Dif.	Formal	Informal	Dif.
2001	8.51	8.28	0.23	8.19	7.60	0.58
2005	8.55	8.25	0.30	8.24	7.66	0.58
2012	8.44	8.10	0.34	8.11	7.63	0.48

Note: Values in log of Mexican Pesos in 2011.

pool to unemployment between 2001-2012, together with an increase in the flow out of the unemployment pool to informality. These two transitions are consistent with the reduction in the pool of unemployed/inactive women and increase in the share of woman with informal work arrangements.

Finally, we summary the changes in wages. Table 1 shows that average wages in the informal sector decrease in 2001-2005 for males, which correspond to the years of the initial rollout of SP. This was a period of economic growth, since the average wage is rising in all other cells in the table. Also, there is an increase in the wage gap for males between formal-informal sectors, but do not for females.

5.2 Reduced Form Estimates

Before moving to our structural estimates, we exploit the variation in the timing of implementation of SP at the municipality level. We analyze both the stock variables (that is,

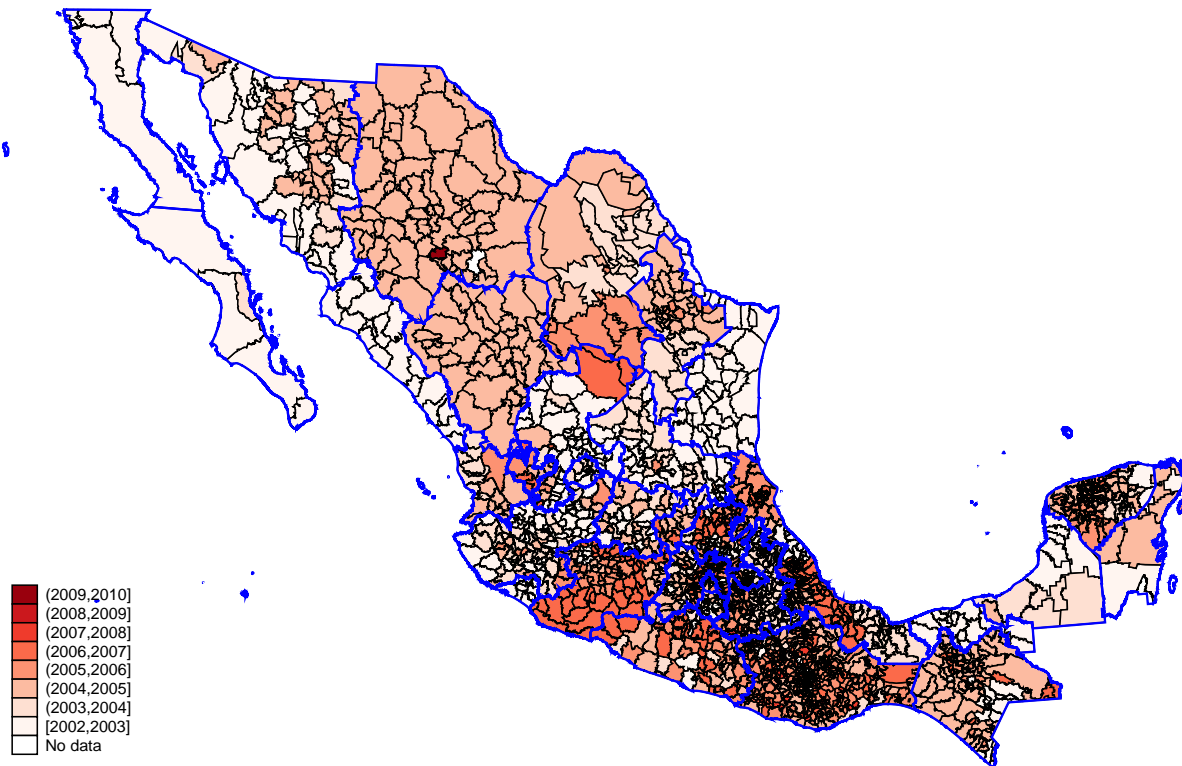
the share of formal and informal workers in a municipality-quarter and unemployed) and transitions.

Figure 5 displays the year of implementation of SP in each municipality in Mexico, between 2002 and 2010. This graph shows that there is considerable variation, both across municipalities and over time, regarding the timing of the adoption of SP in different municipalities in the country. Thus, we start with a basic specification which is a difference-in-differences model, where we compare changes in outcomes for individuals that reside in municipalities that introduced SP in different years between 2002 and 2010. The unit of analysis is the set at municipality-quarter level and we estimate:

$$y_{mst} = \beta SP_{mst} + \gamma X_{mst} + \mu_{ms} + \pi_t + \varphi_{st} + \varepsilon_{mst} \quad (1)$$

where m indexes the municipality of residence, s the state, t indexes the quarter. SP_{mst} is an indicator variable equal to one if municipality m in year t has implemented SP. In all our data sets the municipality of residence is measured in quarter t .

Figure 5: Year of implementation of SP by municipality.



Because municipalities adopted SP at different times, we compare those with or without SP access at the time of survey by virtue of their municipality of residence. Thus, we can

allow for unrestricted municipality effects μ_{ms} , which control for unobserved determinants of y_{mst} that are constant at municipality level and which affect the outcome independently of SP; unrestricted quarter effects π_t and state-year effects φ_{st} to account for state shocks which affect outcomes independently of SP (such as federal-state budget agreements independent of SP). The parameter of interest is β , the effect of exposure to SP, which is identified from variation across municipalities and quarter. We also control for X_{mst} are municipality-specific observable characteristics, in particular, we control for the share of males and in a given age per municipality-quarter. ε_{mst} are idiosyncratic shocks. The standard errors are clustered at municipality level to account for autocorrelation in the outcome (Bertrand, Duflo and Mullainathan, 2004). All our estimates are intention-to-treat effects.

Table 2 shows that SP is associated with an increase of 1.3pp in the share of informal workers ages 23-39 in a municipality.

When we turn to transitions (see tables 3-5), we only find that SP is associated with a decrease of 1.3pp in the flow of women out of unemployment/inactivity to informality (driven by women 40-65 years old; see table 5).

6 Model and Estimation

We consider an economy with labor market frictions and follow the wage-posting approach proposed first by Burdett and Mortensen (1998). That is, the firms offer a contract which the worker may accept or refuse. There is random search, and workers search while nonemployed and *on-the-job*. Firms are ex-ante heterogenous, and they can choose to post a formal or an informal contract to the worker. The two types of contract, which define two sectors in the economy arise because of the existence of taxes and regulations governing the employment of workers. Imperfect monitoring of compliance with the legal framework creates profitable opportunities for lower productivity firms to ignore the regulations and operate in the informal sector. The policy environment is described by the corporation tax on profits, income tax, social security contributions, severance pay upon laying off a worker, unemployment insurance and a health insurance plan. All these are implicitly funded by taxes. And all these features can be avoided when the worker is employed informally.

Time is continuous and workers seek to maximize their expected lifetime income. An individual can be: nonemployed (n), formal (f), or informal (i) and individuals have instantaneous utility given by $u(y, v) = y + v$, where

- $y = w$ if they work and
- $y = b$ if they are nonemployed

Table 2: The impact of Seguro Popular on informality rate of municipalities.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Sample	Share of Unemployed/Inactive			Share of Formal Workers			Share of Informal Workers		
	All	Males	Females	All	Males	Females	All	Males	Females
Panel A: 23 to 65 years old									
1[SP=1]	0.001 (0.003)	0.001 (0.003)	0.001 (0.005)	-0.002 (0.003)	-0.003 (0.005)	-0.001 (0.002)	0.001 (0.004)	0.002 (0.005)	-0.001 (0.005)
Observations	72,716	36,287	36,429	72,716	36,287	36,429	72,716	36,287	36,429
Mean 2000	0.390	0.0948	0.684	0.124	0.205	0.0435	0.487	0.701	0.273
Panel B: 23 to 39 years old									
1[SP=1]	-0.001 (0.004)	-0.003 (0.004)	0.001 (0.008)	-0.004 (0.004)	-0.010 (0.007)	0.001 (0.003)	0.005 (0.006)	0.013* (0.008)	-0.002 (0.008)
Observations	67,216	32,978	34,238	67,216	32,978	34,238	67,216	32,978	34,238
Mean 2000	0.365	0.0428	0.685	0.152	0.249	0.0556	0.483	0.708	0.260
Panel C: 40 to 65 years old									
1[SP=1]	0.002 (0.004)	0.001 (0.004)	0.003 (0.006)	-0.001 (0.003)	-0.000 (0.005)	-0.001 (0.002)	-0.001 (0.004)	-0.001 (0.006)	-0.002 (0.006)
Observations	72,320	36,004	36,316	72,320	36,004	36,316	72,320	36,004	36,316
Mean 2000	0.397	0.115	0.680	0.112	0.187	0.0376	0.490	0.698	0.283

Note: Estimates obtained using the ENE/ENE0 data, aggregated at municipality-quarter level. Each cell represents results for separate regressions. Controls excluded from table include: municipality of residence fixed effects, fixed effects for state of residence interacted with quarter, quarter fixed effects, characteristics of the municipality of current residence taken in 2000 (indicators for the degree of marginalization of the municipality - Very High, High, Medium, Low, Very Low, log to total population, share of population ages 0-4, 6-14 and ages 15-24, share of uninsured individuals, share of occupied individuals working on the primary, secondary and tertiary sectors, to capture the degree of rurality, and share of occupied individuals not receiving a salary, to capture the characteristics of the municipality labor market; the number of hospitals and health centers in 2001, total number of doctors and nurses in hospitals and health centers (per capita and per uninsured individuals, in 2001); and mortality rate in the first year of life (infant mortality), fetal mortality, average birth weight and an index of co-morbidity for adults and elderly (the Charlson Index)), and the proportion of deaths by year of age and gender.

Standard errors are clustered at the level of the municipality. *** Significant at 1%, ** Significant at 5%, * Significant at 10%.

Table 3: The impact of Seguro Popular on labor market transitions (adults ages 23-65).

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All	Males	Females	All	Males	Females
Panel A: From Unempl/Inactivity to						
	Formal			Informal		
1[SP=1]	-0.001 (0.002)	-0.005 (0.006)	-0.000 (0.001)	-0.010 (0.008)	-0.004 (0.018)	-0.013** (0.006)
Observations	60,129	24,285	35,844	60,129	24,285	35,844
Mean 2000	0.0239	0.0440	0.00758	0.272	0.445	0.131
Panel B: From Formal to						
	Unempl/Inactivity			Informal		
1[SP=1]	0.001 (0.006)	-0.001 (0.006)	-0.000 (0.014)	0.011 (0.010)	0.004 (0.012)	0.016 (0.017)
Observations	38,708	24,106	14,602	38,708	24,106	14,602
Mean 2000	0.0695	0.0305	0.125	0.182	0.202	0.153
Panel C: From Informal to						
	Unempl/Inactivity			Informal		
1[SP=1]	0.001 (0.006)	-0.001 (0.006)	-0.000 (0.014)	0.011 (0.010)	0.004 (0.012)	0.016 (0.017)
Observations	38,708	24,106	14,602	38,708	24,106	14,602
Mean 2000	0.0695	0.0305	0.125	0.182	0.202	0.153

Note: Estimates obtained using the ENE/ENE0 data, aggregated at municipality-quarter level. Each cell represents results for separate regressions. Controls excluded from table include: municipality of residence fixed effects, fixed effects for state of residence interacted with quarter, quarter fixed effects, characteristics of the municipality of current residence taken in 2000 (indicators for the degree of marginalization of the municipality - Very High, High, Medium, Low, Very Low, log to total population, share of population ages 0-4, 6-14 and ages 15-24, share of uninsured individuals, share of occupied individuals working on the primary, secondary and tertiary sectors, to capture the degree of rurality, and share of occupied individuals not receiving a salary, to capture the characteristics of the municipality labor market; the number of hospitals and health centers in 2001, total number of doctors and nurses in hospitals and health centers (per capita and per uninsured individuals, in 2001); and mortality rate in the first year of life (infant mortality), fetal mortality, average birth weight and an index of co-morbidity for adults and elderly (the Charlson Index)), and the proportion of deaths by year of age and gender.

Standard errors are clustered at the level of the municipality. *** Significant at 1%, ** Significant at 5%, * Significant at 10%.

Table 4: The impact of Seguro Popular on labor market transitions (adults ages 23-39).

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All	Males	Females	All	Males	Females
	Panel A: From Unempl/Inactivity to					
	Formal			Informal		
1[SP=1]	-0.001 (0.005)	-0.014 (0.021)	-0.002 (0.002)	-0.008 (0.010)	0.019 (0.033)	-0.010 (0.008)
Observations	42,105	9,968	32,137	42,105	9,968	32,137
Mean 2000	0.0458	0.139	0.0117	0.262	0.610	0.135
	Panel B: From Formal to					
	Unempl/Inactivity			Informal		
1[SP=1]	-0.003 (0.008)	-0.004 (0.006)	0.007 (0.019)	-0.002 (0.014)	-0.011 (0.018)	0.004 (0.021)
Observations	25,996	17,063	8,933	25,996	17,063	8,933
Mean 2000	0.0747	0.0263	0.152	0.180	0.208	0.135
	Panel C: From Informal to					
	Unempl/Inactivity			Informal		
1[SP=1]	0.003 (0.008)	0.001 (0.005)	0.001 (0.016)	0.003 (0.004)	0.003 (0.006)	0.005 (0.004)
Observations	57,525	30,835	26,690	57,525	30,835	26,690
Mean 2000	0.191	0.0382	0.354	0.0569	0.0775	0.0347

Note: Estimates obtained using the ENE/ENE0 data, aggregated at municipality-quarter level. Each cell represents results for separate regressions. Controls excluded from table include: municipality of residence fixed effects, fixed effects for state of residence interacted with quarter, quarter fixed effects, characteristics of the municipality of current residence taken in 2000 (indicators for the degree of marginalization of the municipality - Very High, High, Medium, Low, Very Low, log to total population, share of population ages 0-4, 6-14 and ages 15-24, share of uninsured individuals, share of occupied individuals working on the primary, secondary and tertiary sectors, to capture the degree of rurality, and share of occupied individuals not receiving a salary, to capture the characteristics of the municipality labor market; the number of hospitals and health centers in 2001, total number of doctors and nurses in hospitals and health centers (per capita and per uninsured individuals, in 2001); and mortality rate in the first year of life (infant mortality), fetal mortality, average birth weight and an index of co-morbidity for adults and elderly (the Charlson Index)), and the proportion of deaths by year of age and gender.

Standard errors are clustered at the level of the municipality. *** Significant at 1%, ** Significant at 5%, * Significant at 10%.

Table 5: The impact of Seguro Popular on labor market transitions (adults ages 40-65).

	(1)	(2)	(3)	(4)	(5)	(6)
Sample	All	Males	Females	All	Males	Females
	Panel A: From Unempl/Inactivity to					
	Formal			Informal		
1[SP=1]	-0.002 (0.002)	-0.009 (0.006)	0.001 (0.001)	-0.006 (0.008)	0.001 (0.019)	-0.015** (0.007)
Observations	57,824	22,493	35,331	57,824	22,493	35,331
Mean 2000	0.0184	0.0348	0.00549	0.258	0.418	0.131
	Panel B: From Formal to					
	Unempl/Inactivity			Informal		
1[SP=1]	0.006 (0.007)	0.003 (0.006)	0.005 (0.016)	0.012 (0.011)	0.007 (0.014)	0.018 (0.019)
Observations	33,185	21,014	12,171	33,185	21,014	12,171
Mean 2000	0.0573	0.0283	0.104	0.174	0.188	0.153
	Panel C: From Informal to					
	Unempl/Inactivity			Informal		
1[SP=1]	0.003 (0.007)	-0.005 (0.006)	0.012 (0.012)	-0.001 (0.002)	-0.000 (0.004)	-0.002 (0.003)
Observations	68,067	34,892	33,175	68,067	34,892	33,175
Mean 2000	0.204	0.0679	0.343	0.0329	0.0472	0.0183

Note: Estimates obtained using the ENE/ENE0 data, aggregated at municipality-quarter level. Each cell represents results for separate regressions. Controls excluded from table include: municipality of residence fixed effects, fixed effects for state of residence interacted with quarter, quarter fixed effects, characteristics of the municipality of current residence taken in 2000 (indicators for the degree of marginalization of the municipality - Very High, High, Medium, Low, Very Low, log to total population, share of population ages 0-4, 6-14 and ages 15-24, share of uninsured individuals, share of occupied individuals working on the primary, secondary and tertiary sectors, to capture the degree of rurality, and share of occupied individuals not receiving a salary, to capture the characteristics of the municipality labor market; the number of hospitals and health centers in 2001, total number of doctors and nurses in hospitals and health centers (per capita and per uninsured individuals, in 2001); and mortality rate in the first year of life (infant mortality), fetal mortality, average birth weight and an index of co-morbidity for adults and elderly (the Charlson Index)), and the proportion of deaths by year of age and gender.

Standard errors are clustered at the level of the municipality. *** Significant at 1%, ** Significant at 5%, * Significant at 10%.

We assume v varies according to job status. In particular, (i) $v = \gamma_{SP}$ if the individual is nonemployed or in the informal sector and (ii) $v = \gamma_{EP}$ for those employed in the formal sector. For simplicity, γ_{EP} is normalized to zero and γ_{SP} is the relative value of SP: the *marginal willingness to pay* for health insurance coverage outside the formal sector.

The value of employment in the formal sector can be written as

$$\begin{aligned} rW_f(w) &= w(1 - \rho) + \delta_f [W_n + s \times w - W_f(w)] \\ &\quad + \lambda_{ff} \int \max \{x - W_f(w), 0\} dF_f(x) + \\ &\quad + \lambda_{fi} \int \max \{x - W_f(w), 0\} dF_i(x) \end{aligned}$$

where, w is gross wage before pensions contributions, ρ is the income tax rate and s is the expected severance benefit. λ_{fi} (λ_{ff}) is the rate at which each worker may receive a better from the informal(formal) sector.

The value of employment in the informal sector can be written as

$$\begin{aligned} rW_i(w) &= w + \gamma_{SP} + \delta_i [W_n - W_i(w)] \\ &\quad + \lambda_{ii} \int \max \{x - W_i(w), 0\} dF_i(x) \\ &\quad + \lambda_{if} \int \max \{x - W_i(w), 0\} dF_f(x) \end{aligned}$$

where γ_{SP} is the relative value of SP health insurance.

Finally, the value of unemployment can be written as

$$\begin{aligned} rW_n &= b + \gamma_{SP} + \lambda_{nf} \int \max \{x - W_n, 0\} dF_f(x) \\ &\quad + \lambda_{ni} \int \max \{x - W_n, 0\} dF_i(x) \end{aligned}$$

where b is the value of leisure and γ_{SP} is the relative value of SP health insurance. λ_{ni} (λ_{nf}) is the rate at which each worker may receive a better from the informal(formal) sector.

6.1 Workers' Flow Conditions

Then, the worker's decision is characterized by a reservation value strategy, such that a job offer from either sector has to be equal or above their current value. That, is

- Formal sector

$$\begin{aligned} & [\delta_f + \lambda_{ff}\bar{F}_f(W)] m_f G_f(W) + \lambda_{fi} m_f \int_{W_n}^W \bar{F}_i(x) dG_f(x) \\ &= \lambda_{nf} m_n F_f(W) + \lambda_{if} m_i \int_{W_n}^W [F_f(W) - F_f(x)] dG_i(x) \end{aligned}$$

- Informal sector

$$\begin{aligned} & [\delta_i + \lambda_{ii}\bar{F}_i(W)] m_i G_i(W) + \lambda_{if} m_i \int_{W_n}^W \bar{F}_f(x) dG_i(x) \\ &= \lambda_{ni} m_n F_i(W) + \lambda_{fi} m_f \int_{W_n}^W [F_i(W) - F_i(x)] dG_f(x) \end{aligned}$$

Given the transition rates and the job offers distributions, we set $W = \bar{W}$, the mass of workers equal to one, and solve the above system for the stocks of workers in the steady state: m_f, m_i , and m_n . In the expressions above G_f and G_i are the distributions of accepted contracts in the formal and informal sectors.

6.2 Firms

Firms are heterogenous (have productivity $p \sim \Gamma^s(p)$ in sector $s = f, i$) and choose contract values that maximize profits. The profits in the *steady-state* are given by:

$$\begin{aligned} \pi_f(p) &= \max_{W \geq W_n} (1 - t) [p - (1 + \tau + \delta_f s) w_f(W) - \phi] \ell_f(W) \\ \pi_i(p) &= \max_{W \geq W_n} [p - w_i(W)] \ell_i(W) \end{aligned}$$

where t is the corporate tax; τ is payroll tax (cost to provide social health insurance); s is the severance rate and ϕ is the cost to provide private health insurance

6.3 Equilibrium Contract Value Distributions and Wages

The labor force size is derived from the flow conditions, with the mass of workers normalized to 1 and n_f and n_i are the fraction of formal and informal sector firms (respec.)

$$\begin{aligned}\ell_f(W) &= \frac{1}{n_f} \frac{\lambda_{nf}m_n + \lambda_{ff}m_f G_f(W) + \lambda_{if}m_i G_i(W)}{\delta_f + \lambda_{ff}\bar{F}_f(W) + \lambda_{fi}\bar{F}_i(W)} \\ \ell_i(W) &= \frac{1}{n_i} \frac{\lambda_{ni}m_n + \lambda_{ii}m_i G_i(W) + \lambda_{fi}m_f G_f(W)}{\delta_i + \lambda_{ii}\bar{F}_i(W) + \lambda_{if}\bar{F}_f(W)}.\end{aligned}$$

That is, the normalized firm size in steady state is obtained by $(1/n) \times$ "the ratio of total hiring over total job destruction rate".

The equilibrium distributions G_f and G_i are also obtained from the flow equations. Their solution can be obtained either numerically or as in Meghir, Narita and Robin (2014), who provide analytical solution for G as function of F distributions and the transition parameters.

Equilibrium wages are obtained from the workers equations, given the offer (F) distributions and the transition parameters.

6.4 Other parameters

6.4.1 Government

The government collects taxes from the formal sector (corporation tax t ; payroll tax τ) and it finances Seguro Popular for the uninsured (informal and nonemployed)

6.4.2 Unemployment Insurance and Taxes

Unemployment insurance, b is obtained by setting the value of nonemployment equal to the minimum expected value in the informal sector, $\min(W_i) = W_n$. This is a reasonable assumption given that the lowest wages in the economy are in the informal sector and the minimum wage is not imposed in the informal sector.

Finally, as for other parameters: $\{r, \tau, t, s\}$ are the interest rate per quarter, federal payroll, income, corporation and severance taxes and ϕ is estimated using the average cost of private basic health insurance.

6.4.3 Identification of the Value of Health Insurance

γ_{SP} is estimated from data on individual expenditures in health. In particular, we start by recovering γ_{SP} , the indirect utility of SP relative to employer-provided insurance, from data on health expenditures, prices and (potential) cost of use of care. Let F_i be the cost of insurance to firms. We can calibrate this by the payroll taxes paid by the firms to IMSS and the average cost of private health insurance.

Assume, that individuals' utility is given by $U(x, y) = x^\alpha y^{(1-\alpha)}$, where x is consumption of health services/products and y is a composite good. Let $p_y = 1$ and p_x is price of health insurance. Then, in the optimum, $x^* = \frac{\alpha Y}{p_x}$ and $y^* = \frac{(1-\alpha)Y}{p_y}$. Thus

$$V(Y, p_x) = \frac{AY}{p_x^\alpha}$$

with $A = \alpha^\alpha(1-\alpha)^{(1-\alpha)}$. Inverting and doing $Y = E$, $E = \frac{V p_x^{\alpha}}{A}$, where E is total expenditure and V is total indirect utility. We can then run separate regressions for the formal and informal people using budget data for

$$\ln E = \ln \frac{V}{A} + \alpha \ln p_x$$

where α is estimated, so we also get A (function of α). Then using the constant of the regression we recover V for the formal and informal sector. Then, $\gamma_{SP} = V_I - V_F$? Or we have still to separate out y ? If so, we do, $\max V = U = (x^*)^\alpha (y^*)^{(1-\alpha)}$, then $\ln V = \alpha \ln(x^*) + (1-\alpha) \ln(y^*)$, where $\alpha \ln x^* = \alpha \ln(\alpha \frac{E}{p_x})$ is the part of V corresponding to the value of consuming health insurance. Note that formal and informal probably have different α , E , p_x as we estimate them separately. Then we do the difference of this valuation to get the gamma.

6.5 Estimation

We solve for $\Theta = \{F_f, F_i, \delta_f, \delta_i, \lambda_{nf}, \lambda_{ni}, \lambda_{if}, \lambda_{fi}, b, \gamma_{SP}\}$ as follows:

1. Assume function form and support for the F_f and F_i distributions

$$F_j(x) = \text{Pareto} \left(\frac{x - \underline{W}_j}{\overline{W}_j - \underline{W}_j}; \alpha_j \right), \quad \underline{W}_j \leq x \leq \overline{W}_j, j = f, i$$

2. Given the transition parameters and setting $\underline{W}_i = W_n$, solve for b and the individuals values W_f, W_i, W_n
3. With the value contracts, and F_f and F_i distributions, obtain the model equilibrium G_f and G_i distributions
4. Estimate the stocks m_n, m_i, m_f
5. Estimate the transition rates using method of moments

6. Re-start process for many F_f and F_i , and choose the pair that solve:

$$\min \sum_{s=f,i} \sum_{k=1}^K \left(G_s(W_k) - \tilde{G}_s(W(w_k)) \right)^2$$

- for K values chosen on a discrete grid and \tilde{G}_s being the distribution of wages in the data

Transition Parameters

- Step 5: Given F_f and F_i , estimate the transition rates using method of moments
- We follow the individual from the first interview until *one* period ahead (1,2,3, or 4 quarters): we obtain the average transition from the data $\tilde{D}_{ss'}$; $s, s' = n, f, i$
- The durations are exponentially distributed, thus we construct the transitions from the model $D_{ss'}$; $s, s' = n, f, i$ as follows:
- Transitions to nonemployment:

$$D_{jn} = \int_{\underline{W}_j}^{\overline{W}_j} \frac{\lambda_{jn}}{d_j(x)} (1 - e^{-d_j(x) \times 1}) dG_j(x), \quad j = f, i$$

with $d_j(W) = \delta_j + \lambda_{jf} \overline{F}_f(W) + \lambda_{ji} \overline{F}_i(W)$, $j = f, i$

Transition Parameters (cont.)

- Transitions out-of nonemployment:

$$D_{nj} = \frac{\lambda_{nj}}{\lambda_{nf} + \lambda_{ni}} (1 - e^{-(\lambda_{nf} + \lambda_{ni}) \times 1}), \quad j = f, i$$

- Transitions job-to-job:

$$D_{jj'} = \int_{\underline{W}_j}^{\overline{W}_j} \frac{\lambda_{jj'} \overline{F}_{j'}(x)}{d_j(x)} (1 - e^{-d_j(x) \times 1}) dG_j(x), \quad j = f, i$$

- We have a just-identified system of 8 non-linear equations for 8 parameters (λ 's), we minimize the distance:

$$\sum_{s,s'=n,f,i} \left(D_{ss'} - \tilde{D}_{ss'} \right)^2$$

Recovering γ_{SP} from budget data

- We will use the indirect utility approach

- γ_{SP} is inferred from data on expenditures and prices, and time-use data for the resource constrained
- ENIGH data: expenditures

Other equilibrium results: productivity

The distribution of productivity in each sector

- Allows to obtain wages by productivity and sector
- What happens to wage-gap between sectors, given productivity, when the government raises transfers to the informal sector?

Other equilibrium results: firm size

Firm size in each sector

- What happens to the optimal size of firms when the government raises transfers to the informal sector?

7 Conclusion

The data shows that significant transitions took place around the period of implementation of SP. Among males there was an increase in the share of informal workers and less formal workers. Among women there is an increase in the informality rate and and decrease in nonemployment. Informal sector wages decreased for males, despite economic growth. Compensating differentials suggest increased value of amenities in the informal sector

In the next step we will estimate a model of the labor market to obtain equilibrium effects of non-contributory health insurance on the composition of workforce, wages and welfare. We will estimate the model for two benchmark economies: (i) before the introduction of Seguro Popular and (ii) in the early years of operation of the program. We will also estimate the model for different segments of population separated by education (at most primary education and more than primary education, which we refer to as low and high education groups, respectively) and by age and family composition. These groups are chosen since they will likely have different valuations of health care benefits. Then, from each benchmark, we simulate real increases in the relative benefit of Seguro Popular and we will aim to answer to two main questions: (i) How much of the increase in informality in Mexico is due to the introduction of non-contributory health insurance? and (ii) What are the welfare impacts of increases in the value of non-contributory health insurance?

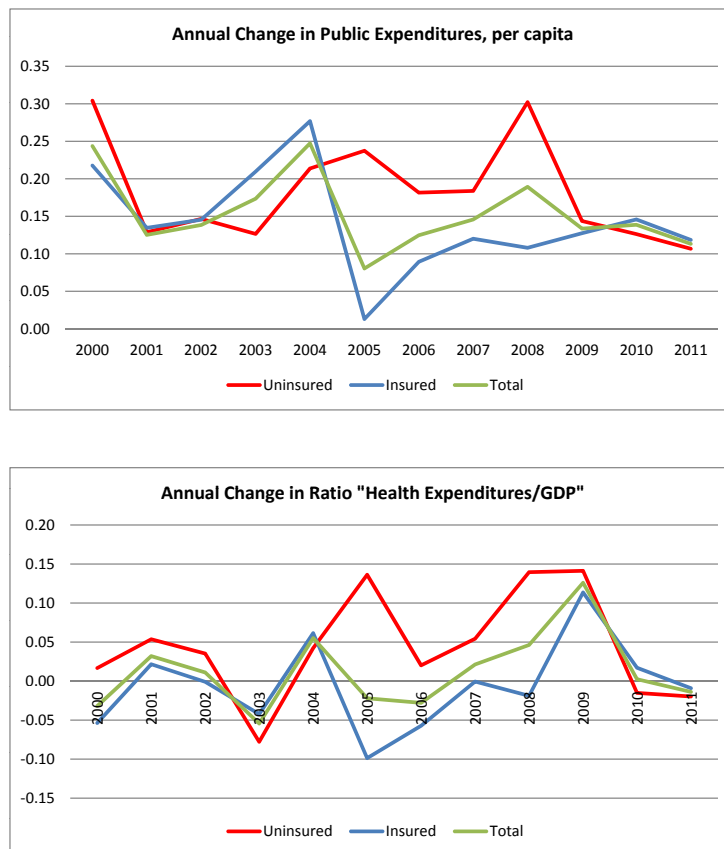
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A Appendix: Figures

Figure A.1: Public Expenditures in Health: overall and separately for the uninsured and insured population.



Note: The first shows the annual changes in each of the three types of public expenditures in health and the bottom panel presents the annual change in the weight of each type of health expenditure relative to the Mexican GDP.

The total public expenditure in health is the sum of the public expenditure in insured population, which includes the expenditure with the population affiliated at IMSS (Instituto Mexicano del Seguro Social), ISSSTE (Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado) and PEMEX (Petróleos Mexicanos), and the uninsured population. The public expenditure in the uninsured population includes both the federal and states expenditures; the federal expenditure includes (1) funds for the Ministry of Health (from the called *Ramo 12*), (2) the FASSA (*Fondo de Aportaciones para los Servicios de Salud*) or funding for the health services and (3) the funds for IMSS-Oportunidades (from the called *Ramo 19*).

B Appendix: Tables

Table B.1: Distribution of SP families per health center and general hospital

	(1)	(2)	(3)	(4)	(5)
	Mean	SD	Percentile 25	Percentile 75	Percentile 95
Year	Panel A: Number of SP families per general hospital				
2005	10,078	11,865	2,056	14,270	29,555
2006	12,607	16,313	2,635	16,380	40,398
2007	15,572	19,233	3,428	19,116	50,487
2008	18,000	21,700	4,557	22,952	56,946
2009	19,682	24,658	4,312	25,449	71,126
2010	25,164	36,425	2,831	29,343	87,307
	Panel B: Number of SP families per health center				
2005	530	1,168	69	523	2,023
2006	551	1,182	54	544	2,188
2007	535	1,199	28	532	2,113
2008	651	1,306	83	669	2,536
2009	728	1,449	112	737	2,826
2010	1,036	2,082	197	991	4,088

Note: Selected moments from the distribution of the number of families allocated to each health center and general hospital by December 31 of each year between 2005 and 2010 from the *Padron*.

Table B.2: Number of municipalities implementing SP per year under different definitions of rollout.

Definition	2 families		5 families		10 families	
	N	Percent	N	Percent	N	Percent
2002	306	12.47	257	10.49	241	9.86
2003	183	7.46	179	7.3	172	7.04
2004	421	17.16	403	16.44	403	16.5
2005	632	25.76	628	25.62	625	25.58
2006	529	21.57	507	20.69	494	20.22
2007	368	15	425	17.34	425	17.4
2008	13	0.53	39	1.59	59	2.42
2009	1	0.04	9	0.37	14	0.57
2010			4	0.16	10	0.41
Total	2,453	100	2,451	100	2,443	100

Note: Using the register of families enrolled in SP, we consider that a municipality has direct access to SP when the number of families affiliated to the program is at least 10; our results are not sensitive to this definition and this table presents the number of municipalities that implemented the program in each year under three possible definitions: least 2, 5 or 10 families enrolled per municipality.