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The Value of Health Insurance: A Household Job Search Approach

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Keywords: Search; Household behavior; Health insurance; Informality; Unemployment.

JEL Codes: J64; D10; I13; J46.

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September 17, 2018

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1 Introduction

A central topic in the global health agenda is universal health care coverage. The World Health Organization has defined universal coverage as access for all people to comprehensive health services at affordable cost and without financial hardship through protection against catastrophic health expenditures. The primary goal of social health insurance schemes is to protect beneficiaries from the health and financial consequences of adverse health events. Many households lack sufficient financial resources to purchase essential health care, contributing to poor health outcomes. While in this sense there is scope for government intervention in providing insurance, the impacts of universal health coverage on labor markets in developing countries are less clear. We study this issue in the context of a large health insurance expansion in Mexico.

The *Seguro Popular* (SP) was introduced in 2002 in Mexico as a non-contributory health insurance program and it was directed to the half of the country's population uncovered by social protection or employer-provided health insurance (i.e. the informal sector workers and the nonemployed). Prior to the reform, health insurance in Mexico was tightly linked to employment. One of the few free health insurance services before SP was provided through the conditional cash transfer *Oportunidades* (now re-branded as *Prospera*, and called *Progresa* until 2002), which targets poor families with children; however most poor families without children would not have access to free health care services. Consequently, in 2002 half of the population of Mexico - uncovered by employer-provided health insurance - was eligible for SP.

Since prior to SP uninsured individuals could only access affordable health care through their employer, the introduction of a non-contributory public health insurance scheme as SP could have resulted in large effects on the labor market. In practice, the SP is a transfer(tax) to informal(formal) sector workers and to the nonemployed.[1] On the one hand, if the value placed on its benefits is high, SP can lead to a negative impact on employment and/or formality rates. 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 and employment is ambiguous. Thus, the labor supply and welfare impacts of a non-contributory health insurance program like SP depend on how much households value free healthcare and how firms in each sector adjust wages given benefits.

[1]This concern was voiced in the Mexican press (see, for example, http://archivo.eluniversal.com.mx/finanzas/59102.html).

In this paper, we analyze the effects of the introduction of SP on labor market outcomes and we provide an estimate for the value of this free health insurance scheme. We start by exploiting its staggered introduction across municipalities in Mexico in a difference-in-differences strategy. Using data from the Mexican Labor Force Survey between 2000 and 2012, we show that the implementation of SP in a municipality is associated with an increase in informality among low educated households with children of 2.8 percentage points (4%), and no impacts for the other groups studied (i.e., low-educated households without children or high-educated households).

Although a reduced-form approach is crucial to measuring the impact of the reform, it does not allow for the possibility to conduct counterfactual analysis. More importantly, it does not recover parameters such as job amenities and the valuation of free health care scheme for uninsured individuals. In order to understand how access to such schemes is valued by households when their members make labor market decisions, we develop and estimate a household search model that incorporates the value of free health care as well as the pre-reform valuation assigned to the amenities in each sector.

Our starting point is a model in which each member of a couple can be in one of three employment states: working in the formal or informal sectors, or not working at all. If one of the members joins the formal sector, the other spouse is automatically covered by employer-provided health insurance as well as other social security benefits treated as public goods within the household. If none of the members work in the formal sector, the household is uninsured and, as such, becomes eligible to SP after its implementation. The model is designed to capture the main features of an introduction/expansion of free health care coverage to the uninsured population as well as existing amenities such as employer-provided health insurance and social protection systems.

The framework used builds on Burdett and Mortensen (1998) in which workers search randomly on and off the job, with the additional feature that they may receive offers from heterogeneous formal or informal firms. The non-employed and informal sector workers are not entitled to any employment protection benefits, while the formal sector workers have access to employer-provided health insurance and other benefits secured by labor laws (for example, minimum wage and retirement pensions).

The main contribution of our paper is to combine (i) a household search model with on-the-job search that provides significant heterogeneity, with (ii) two working states that have a one-to-one relationship with the introduction of free health care for the informal but not formal workers, and (iii) a structure that accounts for pre-existing amenities across

formal and informal/non-employment sectors. Furthermore, we apply this dynamic labor market framework to estimate the value of a free health insurance scheme by exploiting the introduction of the *Seguro Popular* in Mexico.

The model is estimated using the method of moments and data from the Mexican Labor Force Survey for the period before the introduction of SP (in the municipality of residence of the household). It is estimated separately for low and high education head of households with children 0-14 to account for heterogeneity in health status/shocks. First, we estimate a utility value for SP of about 4% to 9% of the mean household income, respectively for high and low education households, respectively. These estimates indicate that the value of SP to families is below the government's costs of providing SP. The household utility gain is around 36-56 cents per each one Peso spent in the program. The figures are similar to those found for subsidized health insurance in US; in particular, to 20-50 cents per dollar spent in Medicaid in Oregon (Finkelstein, Hendren and Luttmer, 2016) and to less than 50 cents per dollar spent in CommCare (a subsidized health insurance in Massachusetts also for low income adults; Finkelstein, Hendren and Shepard (2017)). For Mexico, Bobba, Flabbi and Levy (2017) find an utility gain of 91 cents per peso estimating an individual search-matching model for men. Generally the free/subsidized systems are value less than their cost which means that individuals/families would rather be uninsured than buy the insurance at their full cost.

We then use the estimated model to simulate counterfactual scenarios of employment and labor formality in which we change the valuation of SP. Not surprisingly, the changes in employment are small when we simulate the introduction of the program as the estimated value of free health insurance to uninsured households is low. Household informality increases only by 1.3 p.p. (2%) which is comparable to our reduced-form estimates. We show that substantial labor market impacts would be detected only with large counterfactual increases in the value of SP. In equilibrium, an increase in the utility value of SP by 10 times its estimated value implies a 6 to 12p.p. raise in informality and a 2 to 4.7p.p. increase in nonemployment of spouses, for high and low educated households, respectively.

The paper proceeds as follows. In the next section, we describe the main features of SP and context in which it was introduced. Section 3 summarizes the relevant literature. Section 4 describes the data and reduced-form estimates of the impact of implementing SP in a municipality on informality rates. In section 5 we present then model; the estimation procedure is described in section 6. In section 7 we present the model estimates and results from counterfactual experiments. Section 8 concludes.

2 Background

2.1 The Mexican Health System and the Seguro Popular

Labor Relations Mexico is characterized by a dual system. Firms hire workers under a salaried contractual relations which broadly include three main components. First, a salary at least equal to the minimum wage. Second, Social Security which includes access to the public health care system, of which the Mexican Social Security Institute (*Instituto Mexicano del Seguro Social*, IMSS) is the largest provider of services, with benefits including basic health care and medications, attention to occupational accidents and care for illnesses. Finally, retirement pensions.[2] In parallel, many firms evade the payment of Social Security contributions and hire also workers without access to the benefits above (Antón, Hernández and Levy, 2013). Although firms can be monitored and fined if they do no comply with labor regulations, Kaplan and Sadka (2011) suggest that Mexico can be categorized as a weak rule-of-law country (see also Kaufmann, Kray and Zoido-Lobatón (1999)).

The Health Care System before *Seguro Popular* Up to 2002, the health care was characterized by a two-tiered system. About half of the population was covered through a contributory system guaranteed by the Social Security Institutions: the IMSS, covering the private sector workers; the Institute for Social Security and Services for State Workers (*Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado*, ISSSTE), covering the civil servants; and Mexican Petroleums (*Petroleos Mexicanos*, PEMEX), covering the employees in the oil industries. Health coverage was provided by these institutions in public hospitals; individuals could also pay for care in private hospitals, or buy private health insurance. In 2000, IMSS covered 40%, and ISSSTE 7% of the population, respectively (Frenk et al., 2006).

Health care was also available to the poor through two programs. The Expansion of Coverage Program (*Programa de Ampliacion de Copertura*, PAC), launched in 1996, with brigades visiting rural and marginalized areas; and, the basic health services provided by the Program for Education, Health and Nutrition (*Programa de Educacion, Salud y Alimentación*, Progresa). This was implemented in 1997 in rural areas as the main anti-poverty program in Mexico; it was renamed *Oportunidades* in 2002 and expanded to urban areas. The program has some overlap with SP, since it includes a health component offered in

[2] There is no unemployment insurance system in Mexico; e.g., workers insured by the IMSS who become nemployed may withdraw a maximum of 30 days' worth of pension savings every five years.

medical units managed by the IMSS-Oportunidades and *Secretaria de la Salud* (Ministry of Health).[3]

The uninsured population not covered by PAC or *Progresa* could seek health care either in public health units run by the Ministry of Health or in private ones. In both cases, payment was at the point of use and patients had to buy their own medications. Hence, in 2000, approximately 50% of health expenditures was classified as "out-of-pocket expenses" (Frenk et al., 2009), and 50% of the Mexican population - about 50 million individuals - had no guaranteed health insurance coverage.

The Implementation of *Seguro Popular* SP was launched as a pilot program in 2002 in 26 municipalities in 5 states (Campeche, Tabasco, Jalisco, Aguascalientes and Colima) under the name Health for All (*Salud para Todos*), with the goal of a gradual expansion to the rest of the country. During 2002, 15 additional states[4] implemented the program, and six more did it by the end of 2003.[5] The System of Social Protection in Health (*Sistema de Protección Social en Salud*, SPSS) was officially introduced in 2004 by the General Health Law to extend health coverage to the eligible population. The expansion of SP prioritized states with low social security coverage; large number of uninsured in the first six deciles of income; ability to deliver the services covered; and, existence of sufficient budget for the program. In 2004, three more states introduced the program (Nayarit, Nuevo Leon and Querétaro); the last three states joined in 2005 (Chihuahua, Distrito Federal and Durango).

Individuals not beneficiaries of social security institutions are eligible to SP. Enrollment in the program is voluntary, an granted upon compliance with simple requirements; i.e., proof of residence in Mexico, lack of health insurance, ascertained with self-declaration, and the individual ID. Thus in 2012, 98% of the Mexican population was covered by some health insurance (Knaul et al., 2012).

[3] *Progresa* beneficiaries receive free of charge a basic package of health services. The nutrition of both children and pregnant women is monitored through monthly consultations and nutritional supplements are distributed in case of malnutrition. It is also includes information on preventive health behaviors through community workshops; emergency services related to pregnancy and childbirth. Beneficiary families protected by Social Security have also access to second- and third-level care in the units administered by IMSS, while those unprotected have only limited access to second-level care. See http://www.normateca.sedesol.gob.mx/es/NORMATECA/Historicas (accessed May 10th 2015).

[4] Baja California, Chiapas, Coahuila, Guanajuato, Guerrero, Hidalgo, Mexico, Morelos, Oaxaca, Quintana Roo, San Luis Potosi, Sinaloa, Sonora, Tamaulipas and Zacatecas.

[5] Baja California Sur, Michoacán, Puebla, Tlaxcala, Veracruz and Yucatán.

Funding SP is funded by revenues from general taxes, on the basis of a tripartite structure similar to that adopted by the two major social insurance agencies in Mexico, IMSS and ISSSTE. In particular, a social contribution from the federal government; solidarity contributions from both the federal government and the states; and a family contribution (in 2010, 96.1% of the enrolled families were exempted from paying it on the basis of low self-reported income; own calculations from the registry of enrolled families, the *Padrón*).

Between 1999 and 2007, the ratio of the total public expenditure on health to GDP was stable at 2.6%. This was one of the lowest figures among OECD countries. Between 1999 and 2004, the ratio of the total public expenditure on health to GDP for insured (not eligible) and uninsured (eligible) was 1.8% and 0.9%, respectively. After 2004, the ratio for the uninsured increased steadily, from 1% to nearly 1.5% in 2009 (see Figure A.1).

Coverage and Delivery of Health Services Families enrolled in SP are assigned a health center (which in turn, is associated to a hospital) and a family doctor for primary care. The family has access to a package of health services with the number of interventions covered increasing yearly, from 78 in 2002 to 284 in 2012 (Knaul et al., 2012). A wide range of services were included, from prevention, family planning, prenatal, obstetric and perinatal care, to ambulatory, emergency and hospital care, including surgery. The basic coverage was complemented in 2004 with the introduction of the Fund for Protection against Catastrophic Expenses to support the financing of care for high-cost diseases associated with premature death– such as breast and womb cancer, and child leukemia. A further expansion took place in 2006 with the introduction of Health Insurance for a New Generation, which includes specific services for children under five.

The non-contributory and the contributory systems have separate networks of hospitals and health centers, each serving its own affiliates and the health services covered by the SP are delivered in the hospitals and health centers run by the Health Ministry.

One of the goals of the health reform was to increase investment in health care infrastructure and to achieve a more equitable distribution of health care resources. Thus, the Ministry of Health increased the proportion of the budget devoted to investment in health infrastructure from 3.8% in 2000 to 9.1% in 2006, with the construction of 2,284 outpatient clinics and 262 hospitals between 2001 and 2006; poor municipalities were prioritized in the allocation of resources (Conti and Ginja, 2017). Facilities providing services under the insurance scheme had to be accredited, which required a sufficient amount of resources to be in place to provide the covered interventions (Frenk et al., 2009). The gap between

individuals covered and not by Social Security was reduced in terms of the availability of general and specialist doctors, nurses and beds (Knaul et al., 2012).

2.2 Other policy changes

The period studied (2000-2012) was relatively stable with respect to other policy changes that could have affected the labor market choices of households. We briefly summarize here the main reforms (see Appendix D for details). The largest Social Security reform took place before the introduction of SP, in 1997, when the *IMSS* switched from a pay-as-you-go system to a fully funded system with personal retirement accounts. The tax system remained largely unchanged between 2000 and 2012. The child care system underwent a reform between 2007 and 2010, with the introduction of the program *Estancias Infantiles para Apoyar a Madres Trabajadoras* (Child Care Centers to Support Working Mothers), to cover approximately 90 percent of the cost of enrolling a child under age four at a formal child care center. This program targets women living in families without Social Security coverage, that are searching for work, enrolled in school, or working (Calderon, 2014).

3 Literature Review

SP and informality in Mexico The evidence on the labor market effects of SP is mixed (see the review by Bosch, Cobacho and Pages (2012)). The estimates range from no impact on the informality rates (Gallardo-Garcia, 2006; Barros, 2008; Campos-Vazquez and Knox, 2010; Aguilera, 2011) to small increases in the share of informal workers with less than nine years of schooling, married women with children or caring for older adults (Azuara and Marinescu, 2013; Aterido, Hallward-Driemeier and Pages, 2011; Pérez-Estrada, 2011; Bosch and Campos-Vazquez, 2014). Aterido, Hallward-Driemeier and Pages (2011) find that SP reduces the flow out of unemployment and out of the labor force, but del Valle (2014) finds that women in families with disabled or dependent individuals move out of unemployment or inactivity to become informal workers.

Few papers analyze the effects of SP on wages, and the findings range from no effects (Barros, 2008; Azuara and Marinescu, 2013) to negative impact on informal wages (Aterido, Hallward-Driemeier and Pages, 2011; Pérez-Estrada, 2011).[6]

[6]Recent US reforms, which have relaxed the link between employment and the provision of health insurance, have produced a stream of papers studying the effects of public health insurance on labor supply. Baicker et al. (2014) use a recent expansion in the eligibility to Medicaid in Oregon and find no effect on em-

Finally, evidence of the welfare effects of SP is only available through indirect evidence: lower wages in the informal sector (Aterido, Hallward-Driemeier and Pages, 2011; Pérez-Estrada, 2011), reduction in infant mortality and increase in the use of medical services in poor municipalities (Conti and Ginja, 2017), decrease in miscarriages (Pfutze, 2014), but no other health impacts (Knox, 2008; King et al., 2009; Barros, 2008; Conti and Ginja, 2017).

Theory Our contribution also relates to two theoretical lines of work. First, it relates to Dey and Flinn (2008), who develops a household search framework to estimate the marginal willingness to pay for employer-provided health insurance in the US. The authors show the importance of taking into account the spouse's job status to recover unbiased estimates of the willingness to pay. More recently, Fang and Shephard (2014) study the recent reform in the US health system, building on Dey and Flinn (2008), adding health shocks (following Aizawa and Fang (2013)) and endogenous compensation packages comprising a wage and a menu of insurance offerings (premiums and coverage) that workers can select from.

Second, our paper extends the literature on search with formal and informal sectors by allowing for intra-household dependency in labor market decisions. The literature of search segmented into formal and informal sectors is recent, but two papers are particularly relevant for our study. Albrecht, Navarro and Vroman (2009) model formal and informal sectors following Mortensen and Pissarides (1994). They use the model to simulate the impact of varying payroll taxes in the formal sector. Meghir, Narita and Robin (2015) model formal and informal sectors extending the Burdett and Mortensen (1998) approach. They estimate the model for Brazil and then simulate the impact of increasing the cost of informality.

Our paper builds a bridge between these two lines of work by estimating a household search model with three sectors. A related recent contribution is Bobba, Flabbi and Levy (2017) that uses an individual search and matching environment with formal and informal sectors and schooling decision taken prior entering the labor market; they also estimate the utility value of coverage by SP using a sample of males and data from municipalities with

ployment, but an increase in welfare dependence. Kolstad and Kowalski (2016) use the 2006-Massachusetts Health Reform and find compensating wage differentials due to employer provided health insurance, but no effects on employment or wages associated to the Reform. Garthwaite, Gross and Notowidigdo (2014) estimate large increases in the labor supply associated with an abrupt reduction in the Medicaid coverage in Tennessee. However, this evidence comes from a developed economy.

and without the program in 2005.

The value of Health Insurance and Job Amenities We also contribute to the literature which uses structural methods to recover the welfare benefit of health programs. Finkelstein, Hendren and Luttmer (2016) compare alternative utility frameworks for valuing a Medicaid expansion for low-income, uninsured adults that occurred by random assignment in Oregon. They find that the welfare benefit to recipients per dollar of government spending is between \$0.2-\$0.5. Similarly, Finkelstein, Hendren and Shepard (2017) find that the willingness to pay is always less than half of own expected costs in the Massachusetts' subsidized insurance system.[7]

Finally, earlier papers have estimated the value of job amenities using individual on-the-job search models. Search frictions can explain why workers with strong preference for amenities are paid higher wages, which is contrary to a conventional view of compensating wage differentials. Hwang, Mortensen and Reed (1998) estimate a general equilibrium on-the-job search model in which workers in each period may receive an offer that is characterized by a wage and by amenities. Firms have different cost of producing amenities and are, thus, differentiated by amenities, and workers select into jobs, trading lower wages for better amenities. Bonhomme and Jolivet (2009) estimate a partial equilibrium version of Hwang, Mortensen and Reed (1998) allowing two types of job-to-job mobility: voluntary and constrained (due to a reallocation shock); and, they account for five different amenities. Using data for several European countries, they generally find absence of compensating differentials because wages and amenities correlate in job offers and due to search frictions.

4 Data and Empirical Facts

4.1 Data

We use data from two main sources. The first data is the called *Padrón*, which is the consolidated registry of all families with a valid enrolment in *Seguro Popular* by December 31^{st} of each year between 2002 and 2010. This data is used by the Federal Government and States to decide the allocation of the funds to the program. It contains detailed demographic

[7] For developing countries it is also practice to estimate the value of health insurance relying on contingent valuation methods (e.g. Ahmed et al., 2016).

and socioeconomic characteristics of the enrolled families, including employment status, occupation and assets. It also has the exact date of affiliation, residence and the identifiers of the health center and general hospital assigned to each family at the time of enrolment in the program. The date of affiliation of each family is used to construct the date of implementation of the program at the level of the municipality.[8]

In the absence of a formal definition, we consider that SP is introduced in a municipality when the number of families affiliated to the program is at least 10. We adopt this number for three reasons. First, we prefer an absolute to a percentage measure since we want to capture the fact that the residents of a municipality can use the services provided by SP (and not the fact that a certain proportion of the population has been covered). Second, this definition has become relatively common in the SP-related literature (Bosch and Campos-Vazquez, 2014; del Valle, 2013; Conti and Ginja, 2017). Finally, Conti and Ginja (2017) show that their estimated impacts on health are not sensitive to the threshold number of families used to define program introduction.

Second, we use data from the labor force surveys of Mexico, the *Encuesta Nacional de Empleo* (ENE) 2000-2004 and the *Encuesta Nacional de Ocupación y Empleo* (ENOE) 2005-2012. These data have a quarterly frequency and are rotating panels at the individual and household level similar to the Current Population Survey in US. The data covers more than 11 million individuals between ages 18 and 59 from the second quarter of 2000 to fourth quarter of 2012; it has information on the Social Security status of each individual across quarters, as well as his/her labor income when employed. All monetary values are deflated to the first quarter of 2011 using the CPI of Banco de Mexico.

An individual is defined as an informal worker if he/she does not have access to the health services provided by his/her job through one of the Social Security institutions in the country. Since Social Security coverage is extended to the spouse and children in the household, a household is considered informal if the head nor the spouse have Social Security coverage through the job contract. We do not distinguish between self-employed and informal employees, as the definition of informality depends only on the Social Security coverage.

[8]For 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. Since each family has a unique identifier, we are able to identify the exact date of implementation of SP in a given municipality by backtracking the relevant information from the subsequent years. We have then confirmed the accuracy of the implementation date obtained with this procedure by cross-checking it against the official list of municipalities which adopted SP in the pilot period.

Construction of the sample The ENE covers just over 640 municipalities every quarter, whereas the ENOE covers about 1000. To keep a consistent sample of municipalities throughout the period of analysis, we focus on the sample of municipalities surveyed since 2000. Thus, we restrict our attention to the 640 municipalities present in both ENE and ENOE. Then, we impose the additional restriction that a municipality must be present in the data for at least 8 quarters, which further reduces the sample to 628 municipalities. This results in a sample of 8 millions of observations for husbands and wives, from which we drop 37,100 observations without information on work and social security status. We, then, discard the 1% of the workers under a formal contract who earn less than the minimum wage and less than 900 observations with missing information on wage on the formal sector. We restrict the sample to households where the head is married and between 20 (when the chance of returning to full-time education is very low among the low educated) and 59 years old (before age-eligibility for any non-contributory pension program for poor elderly); after imposing this restriction there are 3.6 million couples in the sample.[9] We then focus on male headed couples with non missing information on work situation and Social Security coverage on the first and second quarters of the survey, which implies dropping about 1.2 million couples. Lastly, we trim the top of wages distribution on formal and informal sector to 36,000 pesos (95th percentile of total sample); we trim also the bottom 5% of informal sector wages by education group and spouse. Our final sample includes just over 0.5 million couples.

We follow individuals between the first and second quarters they are surveyed.[10] Within this time frame, we obtain the job-to-job, unemployment-to-job, and job-to-unemployment transitions for each individual in our sample (i.e., heads and their spouses). The distribution of wages in the formal sector and incomes in the informal sector are obtained from the first interview.

We present results for two type of heterogeneity, which relate with the probability of facing health shocks, namely education level of the the head and presence of children ages 0-14 in the household. We define a family to be in the low education group if the head

[9] In Mexico, 65 is the usual retirement age, but the participation rate among informal workers is high among individuals between 65 and 70 years: 47% and 6% of males in this age range report to be informal and formal workers, respectively (own calculations from the ENE/ENOE).

[10] We only focus on transitions between the first and second interviews since about half of our sample of interest (households whose head is 20 to 59 years old) is not interviewed a third time. This restriction also minimizes concerns in the estimation of the transition rates in our model below. Using data on the first two interviews, the transition rates for each spouse are conditional on the state variables of the other spouse at the first interview.

has at most 6 years of completed education, which corresponds to elementary education in Mexico (in 2001, just before the implementation of SP, 40% of the families in our data were in this group). We also allow for heterogeneity by the presence of children under 15 in the household, for two reasons. First, the package of services covered by SP is especially generous for conditions prevalent among poor children (such as treatment of respiratory and intestinal infections; see Conti and Ginja (2017)). Second, the extension of coverage of Social Security to children depends on the age of the child: if the parent works in the private(public) sector the coverage is extended to children under 16(18). To keep the model treatable, we do not distinguish between parents working in private or public sectors, thus we use the most stringent definition, which also coincides with minimum school leaving age in Mexico.[11]

4.2 Basic Descriptives

We start by presenting some basic facts regarding the labor market in Mexico, using the Mexican Labor Force Survey. Panel A of Table 1 presents basic statistics on the proportion of households by employment type and education, before and after the introduction of SP; 2007 is the year when the program reached all municipalities in our sample. The table shows that prior to the introduction of SP about 33.5%(57.3%) of households in the high(low) education group did not have Social Security coverage. In 2007, while the proportion of households without Social Security coverage remained constant in the high education group, it increased by almost 3p.p. among the low educated. The table also includes the nine possible types of households according to the labor market situation of each member of the couple (i.e., not working, which includes individuals unemployed or out of the labor force, working in the formal sector or working in the informal sector). Among the low educated, there is an increase in the proportion of households with members working in informal sector, and a decrease in the proportion of households where the head is formal worker and the spouse is not working.

Panel B of Table 1 includes moments from the distribution of wages for the heads and spouses in both formal and informal households, respectively. The mean of the salaries of both heads and spouses are lower in the informal sector than in the formal sector; the

[11] We consider the presence of children under 15 in the household since the Labor Force Survey does not contain the date of birth and thus we do not know whether the child may be close to turn 16 at the survey date. If children are studying, coverage can be extended up to age 24. In 2001, 78% of the high educated and 69% of the low educated households in our data had children under 16.

standard deviation for salaries of heads is higher in the informal than in the formal sector. These differences partly reflect unobserved productivity differences between the individuals who select into either sector within educational groups. Between 2001 and 2007, there is an increase in salaries of heads, regardless of the educational group and sector. In the informal sector, the salaries for spouses in high education families working in the informal sector decreased.

Health Expenses Although, the study of the impact of SP on out-of-pocket expenditures is beyond the scope of our paper, in Table A.1 in Appendix we present basic descriptives of the amount of out-of-pocket health expenditures and its share on overall household expenditures. Because the Mexican Labor Force Survey does not have information on expenditures, we use data from the Household Income and Expenditure Survey (*Encuesta Nacional de Ingresos y Gastos de los Hogares*) for the years of 2002 (before SP) and 2008 (post SP). This table shows that over 99% of households do not report any expenditures on health insurance. The share of households with low education and kids 0-14 that do not spend on health increased from 42% to 44% between 2002 and 2008, suggesting an improvement of health status and/or increased availability of free health services for these households. For those households with high education and kids 0-14, this fraction remained stable around 37% in the same period. Consistently with previous work, there is a decrease in the relative weight of health expenditures on overall expenditures for low education households with children, but not for the other three groups in the table (i.e., household in the high education group and low educated households without children; see King et al. (2009); Barros (2008); Grogger et al. (2015)).

4.3 Reduced Form Analysis

Empirical Strategy We now present reduced-form evidence of the impact on informality of SP, exploiting the variation in the timing of implementation of the program at the municipality level. To motivate the structural model we develop below, we analyze the causal impact of SP on the proportion of formal and informal households both overall and by type, and on the mean wages for husbands and spouses. Figure A.2 in Appendix displays the year of implementation of SP in each municipality in Mexico between 2002 and 2010. This map shows that there is considerable variation in the timing of adoption of SP by different municipalities. We use this variation in a difference-in-differences model, where

we compare changes in outcomes for municipalities that introduced SP in different years between 2002 and 2007 (the last year a municipality implemented SP in our sample). We estimate the following model at the municipality-quarter level:

$$y_{msqt} = \beta SP_{msqt} + \gamma X_{msqt} + \mu_{ms} + \pi_{qt} + \varphi_s t + \varepsilon_{msqt} \quad (1)$$

where y_{msqt} is the share of households of a certain employment state, m indexes the municipality, s the state, q the quarter and t the year. SP_{msqt} is an indicator variable equal to one if municipality m of state s in which the individual lives in quarter q of year t has implemented SP. We control for unrestricted municipality effects μ_{ms}, to account for unobserved determinants of y that are constant at municipality level and can also be correlated with the timing of implementation of SP; for unrestricted quarter effects π_{qt} to account for common shocks; and for state-year linear trends $\varphi_s t$. The parameter of interest is β, the effect of access to SP, which is identified from variation across municipalities and quarters. The standard errors are clustered at the municipality level to account for autocorrelation in the outcomes (Bertrand, Duflo and Mullainathan, 2004).

The determinants of the timing of the municipality-level implementation of SP have been studied in detail in Conti and Ginja (2017). They find that, after accounting for state fixed effects, earlier implementation of SP occurred in more populous and richer municipalities, with a smaller proportion of eligible individuals, of children 0-4, with more hospitals, health centers and doctors per eligible, and where there is alignment between the party of the mayor and that of the governor of the state in the year in which the program was launched. These pre-existing differences in levels are accounted for by the municipality fixed effects. Conti and Ginja (2017) also show that the rollout of the program was unrelated with pre-existing municipality trends in the infant mortality rate and other health outcomes. Finally, earlier papers have also shown that the timing of SP implementation was not correlated with labor market characteristics (Azuara and Marinescu, 2013; Bosch and Campos-Vazquez, 2014).

Impact on Social Security coverage Table 2 shows that the implementation of SP in a municipality is associated with an increase in informality for low educated households with children of 2.8p.p. (column 1, Panel A.1), in line with the previous literature. By studying households of different job market status, we further show that the implementation of SP in a municipality is associated with a significant decrease in the proportion of households where both the head and spouse work in the formal sector ("FF" households; 1.3p.p.) and

where only the head works in the formal sector ("FI" households; 0.9p.p.) and an increase in the proportion of households where both members work in the informal sector ("II" households; 2.1p.p.) and where the members are not working ("NN" households; 0.7p.p.).

We have also re-estimated the reduced form model for alternative specification. In particular, (i) excluding the state linear trend from the model, and (ii) to controlling for a quadratic trend for state of residence. The results in Table 2 are robust to these alternative specifications (results available from the authors).

5 Joint Labor Search Model

5.1 The Basic Setup

We now present a household search model with two working sectors. We build on Burdett and Mortensen (1998) in which workers search randomly on and off the job, with the additional feature that there are two searchers per household who may receive offers from formal or informal firms. In this continuous time model, the discount value is r and households seek to maximize their expected lifetime income. Individuals can be in one of three labor market states: nonemployed (n), formal (f), or informal (i). At each point in time, one of the two household members – the head or the spouse – can receive a shock and make a labor supply decision, i.e., spouse 1 (head) and spouse 2 (spouse) face mutually exclusive shocks in the labor market. However, a shock that destroys the job of the employed spouse may instantly create an opportunity for the nonemployed spouse to move to the informal sector.[12] The instant utility of the household is given by:

- $\mathtt{u}(w_1(j) + w_2(j)) + a(1 - \mathbb{H}_i) + \gamma\mathbb{H}_i$, if both spouse 1 and 2 work
- $\mathtt{u}(w_1(j) + b_2) + a(1 - \mathbb{H}_i) + \gamma\mathbb{H}_i$, if only spouse 1 works
- $\mathtt{u}(b_1 + w_2(j)) + a(1 - \mathbb{H}_i) + \gamma\mathbb{H}_i$, if only spouse 2 works
- $\mathtt{u}(b_1 + b_2) + \gamma$, if neither works

with j = formal (f) or informal (i), $\mathbb{H}_i$ is an indicator function for informal household (when both household members are not formal), w_1 is the labor income of spouse 1, w_2

[12] We can also allow for the possibility that, when one spouse is working and the other is non-employed, and this latter receives a formal job offer, the working spouse may go into non-employment. We also estimated the model allowing for endogenous destruction, but this option was rejected compared to the option of remaining employed in all cases.

the labor income of spouse 2, b_1 the non-labor income of spouse 1, and b_2 the non-labor income of spouse 2. In the formal sector, w is after tax wage and but before social security contributions; in the informal sector no taxes or contributions are made, so the wage is just the gross wage.

The parameter a captures all amenities in the formal sector relative to those in the informal sector in the pre-reform period. We define γ as the value of health insurance provided by SP, which is offered when no household member works in the formal sector, after its introduction. Below, we show how these parameters are identified. The function $\mathtt{u}$ can be linear or may take a CARA form. For example, when both spouses are working, $\mathtt{u}(w_1(j) + w_2(j)) = \frac{1-\exp(-\theta(w_1(j)+w_2(j)))}{\theta}$, where θ is the coefficient of absolute risk aversion.

5.2 Household's Value Functions

Let W_{jk} be the value function for a household where the head (spouse 1) is in status $j = f, i, n$ and the spouse (spouse 2) is in status $k = f, i, n$. There are nine value functions, and in the following we describe each of them.

5.2.1 Only one member works

In the formal sector We start with the case of a household with only one member working in the formal sector; this is a formal household, i.e., with Social Security coverage. The flow value is:

$$\begin{aligned}
rW_{fn}(w_1) = {} & \mathtt{u}(w_1 + b_2) + a + \delta_f^{s_1}(1 - p^{s_2})\left(W_{nn} - W_{fn}(w_1)\right) + \\
& \delta_f^{s_1} p^{s_2} \int \max\left\{W_{ni}(x) - W_{fn}(w_1), W_{nn} - W_{fn}(w_1)\right\} dF_i^{s_2}(x) + \\
& \lambda_{ff}^{s_1} \int \max\left\{W_{fn}(x) - W_{fn}(w_1), 0\right\} dF_f^{s_1}(x) + \\
& \lambda_{fi}^{s_1} \int \max\left\{W_{in}(x) - W_{fn}(w_1), 0\right\} dF_i^{s_1}(x) + \\
& \lambda_{nf}^{s_2} \int \max\left\{W_{ff}(w_1, x) - W_{fn}(w_1), 0\right\} dF_f^{s_2}(x) + \\
& \lambda_{ni}^{s_2} \int \max\left\{W_{fi}(w_1, x) - W_{fn}(w_1), 0\right\} dF_i^{s_2}(x)
\end{aligned}$$

where $\delta_f^{s_1}$ is the rate at which spouse 1 faces formal job destruction, p^{s_2} is the probability that spouse 2 moves from nonemployment to informality given that spouse 1 loses his formal job,[13] $\lambda_{ff}^{s_1}$ and $\lambda_{fi}^{s_1}$ are the arrival rates of formal and informal job offers respectively for spouse 1, and $\lambda_{nf}^{s_2}$ and $\lambda_{ni}^{s_2}$ are the arrival rates of formal and informal job offers respectively for spouse 2. When the head loses the formal job by a $\delta_f^{s_1}$ shock, with probability p^{s_2} the spouse finds an opportunity to move to the informal sector. In this case the household decides by considering the flow of gains which will accrue if the spouse takes the informal offer paying x, $(W_{ni}(x) - W_{fn}(w_1))$, against the option of not taking it, $(W_{nn} - W_{fn}(w_1))$. With probability $1 - p^{s_2}$ the spouse does not find an opportunity to work in the informal sector, in which case there is no decision to be made by the household. New offers from the formal sector to the head arrive at rate $\lambda_{ff}^{s_1}$, and the household decides whether the head will take the offer or not. Empirically, we set $\lambda_{ff}^{s_1}$=0, since transitions within the same sector are not perfectly observed in our data. New offers from the informal sector to the head arrive at rate $\lambda_{fi}^{s_1}$, and the household decides whether the head will take the offer or not. Job offers from the formal sector to the spouse arrive at rate $\lambda_{nf}^{s_2}$, and the spouse decides whether to take the formal offer or remain nonemployed. Finally, job offers from the informal sector to the spouse arrive at rate $\lambda_{ni}^{s_2}$, in which case the household evaluates its current situation where the head is formal and the spouse non-employed against the situation where the spouse enters the informal sector.

The value function $W_{nf}(w_2)$ is similar to the above, the only difference is an exchange of the status between spouses 1 and 2 (see Appendix B).

In the informal sector In this case one member is working in the informal sector. This is an informal household, i.e., without Social Security coverage. The flow value is given by:

[13] Here we allow for the possibility that spouses instantly reallocate to job activities such as self-employment. Notice that instant reallocations to the formal sector are not allowed as they would require more time.

$$
\begin{aligned}
rW_{in}(w_1) = \mathtt{u}(w_1 + b_2) + \gamma + \delta_i^{s_1}(1 - q^{s_2})\left(W_{nn} - W_{in}(w_1)\right) + \\
\delta_i^{s_1} q^{s_2} \int \max\left\{W_{ni}(x) - W_{in}(w_1), W_{nn} - W_{in}(w_1)\right\} dF_i^{s_2}(x) + \\
\lambda_{ii}^{s_1} \int \max\left\{W_{in}(x) - W_{in}(w_1), 0\right\} dF_i^{s_1}(x) + \\
\lambda_{if}^{s_1} \int \max\left\{W_{fn}(x) - W_{in}(w_1), 0\right\} dF_f^{s_1}(x) + \\
\lambda_{nf}^{s_2} \int \max\left\{W_{if}(w_1, x) - W_{in}(w_1), 0\right\} dF_f^{s_2}(x) + \\
\lambda_{ni}^{s_2} \int \max\left\{W_{ii}(w_1, x) - W_{in}(w_1), 0\right\} dF_i^{s_2}(x)
\end{aligned}
$$

where $\delta_i^{s_1}$ is the rate at which spouse 1 faces informal job destruction, and q^{s_2} is the probability that spouse 2 moves from nonemployment to informal given that spouse 1 loses his informal job. When the head loses the informal job by a $\delta_i^{s_1}$ shock, with probability q^{s_2} the spouse finds an opportunity to move to the informal sector. In this case the household decides considering the flow of gains which will accrue if the spouse takes the informal offer paying x, $(W_{ni}(x) - W_{in}(w_1))$, against the option of not taking it, $(W_{nn} - W_{in}(w_1))$. With probability $1 - q^{s_2}$ the spouse does not find an opportunity to work in the informal sector. New offers from the informal sector to the head arrive at rate $\lambda_{ii}^{s_1}$, and the household decides whether the head will take the offer or not. We set $\lambda_{ii}^{s_1}$=0, since transitions within the same sector are not perfectly observed in our data. New offers from the formal sector to the head arrive at rate $\lambda_{if}^{s_1}$, and the household decides whether the head will take the offer or not. Job offers from the formal sector to the spouse arrive at rate $\lambda_{nf}^{s_2}$, and the spouse decides whether to take the formal offer and acquiring Social Security coverage for the household or it remains informal. Finally, job offers from the informal sector to the spouse arrive at rate $\lambda_{ni}^{s_2}$.

The value function $W_{ni}(w_2)$ is similar to the above, the only difference is an exchange of the status between spouses 1 and 2 (see Appendix B).

5.2.2 Both members work

In the formal sector This is a household with Social Security coverage.

$$
\begin{aligned}
rW_{ff}(w_1,w_2) = \mathtt{u}(w_1+w_2) + a + \delta_f^{s_1}\left(W_{nf}(w_2) - W_{ff}(w_1,w_2)\right) + \\
\delta_f^{s_2}\left(W_{fn}(w_1) - W_{ff}(w_1,w_2)\right) + \\
\lambda_{ff}^{s_1}\int \max\left\{W_{ff}(x,w_2) - W_{ff}(w_1,w_2), 0\right\} dF_f^{s_1}(x) + \\
\lambda_{fi}^{s_1}\int \max\left\{W_{if}(x,w_2) - W_{ff}(w_1,w_2), 0\right\} dF_i^{s_1}(x) + \\
\lambda_{ff}^{s_2}\int \max\left\{W_{ff}(w_1,x) - W_{ff}(w_1,w_2), 0\right\} dF_f^{s_2}(x) + \\
\lambda_{fi}^{s_2}\int \max\left\{W_{fi}(w_1,x) - W_{ff}(w_1,w_2), 0\right\} dF_i^{s_2}(x).
\end{aligned}
$$

Jobs in the formal sector can be destroyed at the rate δ_f^{s1} and δ_f^{s2} for the head and spouse, respectively. Each member of the couple may receive offers from either the current sector of employment (formal), or from the other sector (informal), and the household will decide if either member will take the offer or not.

In the informal sector This is a household without Social Security coverage.

$$
\begin{aligned}
rW_{ii}(w_1,w_2) = \mathtt{u}(w_1+w_2) + \gamma + \delta_i^{s_1}\left(W_{ni}(w_2) - W_{ii}(w_1,w_2)\right) + \\
\delta_i^{s_2}\left(W_{in}(w_1) - W_{ii}(w_1,w_2)\right) + \\
\lambda_{ii}^{s_1}\int \max\left\{W_{ii}(x,w_2) - W_{ii}(w_1,w_2), 0\right\} dF_i^{s_1}(x) + \\
\lambda_{if}^{s_1}\int \max\left\{W_{fi}(x,w_2) - W_{ii}(w_1,w_2), 0\right\} dF_f^{s_1}(x) + \\
\lambda_{ii}^{s_2}\int \max\left\{W_{ii}(w_1,x) - W_{ii}(w_1,w_2), 0\right\} dF_i^{s_2}(x) + \\
\lambda_{if}^{s_2}\int \max\left\{W_{if}(w_1,x) - W_{ii}(w_1,w_2), 0\right\} dF_f^{s_2}(x).
\end{aligned}
$$

Each member of the couple may receive offers from either the formal or informal sector. As before, empirically we set $\lambda_{ii}^{s_1}$ and $\lambda_{ii}^{s_1}$ equal to zero, since transitions within the same sector are not perfectly observed in the data. The head receives formal job offers at rate $\lambda_{if}^{s_1}$, in which case the head decides whether to take it so that the household now has Social Security coverage, or do nothing and the household remains informal. The same options holds if the spouse receives a formal job offer, which happens at rate $\lambda_{if}^{s_2}$.

Households with a member working in the formal sector and other in the informal sector These are households with Social Security coverage. For sake of brevity, these two value functions corresponding to these situations are presented in Appendix B. If spouse 1 works in the formal sector and spouse 2 works in the informal sector, then the head and the spouse may have their jobs destroyed at rates $\delta_f^{s_1}$ and $\delta_i^{s_2}$, respectively. The head receives job offers from the formal or informal sector at rates $\lambda_{ff}^{s_1}$ or $\lambda_{fi}^{s_1}$, respectively; the spouse receives job offers from the informal sector or formal sector at rates $\lambda_{ii}^{s_2}$ or $\lambda_{if}^{s_2}$, respectively. If spouse 2 works in the formal sector (and spouse 1 works in the informal sector) the situation is similar to the previous one, but with the roles swapped between head and spouse.

5.2.3 Neither member of the couple works

This is an informal household (i.e., without Social Security coverage).

$$
\begin{aligned}
rW_{nn} = {} & \mathtt{u}(b_1 + b_2) + \gamma + \\
& \lambda_{nf}^{s_1} \int \max\left\{W_{fn}(x) - W_{nn}, 0\right\} dF_f^{s_1}(x) + \lambda_{ni}^{s_1} \int \max\left\{W_{in}(x) - W_{nn}, 0\right\} dF_i^{s_1}(x) + \\
& \lambda_{nf}^{s_2} \int \max\left\{W_{nf}(x) - W_{nn}, 0\right\} dF_f^{s_2}(x) + \lambda_{ni}^{s_2} \int \max\left\{W_{ni}(x) - W_{nn}, 0\right\} dF_i^{s_2}(x).
\end{aligned}
$$

Each member of the couple receives offers from the formal or informal sector at rate $\lambda_{nj}^{s_1}$ and $\lambda_{nj}^{s_2}, j = f, i$, respectively.

5.3 Reservation Wages

Households make their decisions based on reservation wages. Because the value functions are strictly increasing in wages, there exists a reservation wage for each pair of choices. For example, when a $\lambda_{fi}^{s_1}$ shock arrives to spouse 1 in the formal sector while spouse 2 is also formal, the household decides to take the offer if the resulting wage is higher than $\hat{w}_{ff->if}(w_1, w_2)$. This critical value is the solution of $W_{ff}(w_1, w_2) = W_{if}(\hat{w}_{ff->if}(w_1, w_2), w_2)$. Figure A.3 in Appendix shows one possible scenario with the value function $W_{if}(w_1, w_2)$ dominating $W_{ff}(w_1, w_2)$ for lower wages of spouse 1 and given the wage of spouse 2 in the formal sector, w_2. Note that in this case, spouse 1 is willing to take a lower wage in the informal sector than his current wage in the formal sector.

5.4 Flow Conditions

The stock of households where spouse 1 is in status j and spouse 2 is in status j' is $m_{jj'}$, $(j, j' = f, i, n)$. We assume that the mass of households is equal to 1, so that the stocks across all types of households add up to 1. $G_{jj'}$ is the joint earnings CDF, and $g_{jj'}$ is the PDF. In steady state, the measure of couples in which spouse 1 is in status j and spouse 2 is in status j' $(j, j' = f, i, n)$ remains stable. For example, the measure of couples when both individuals are in the formal sector earning up to w_1 (spouse 1) and w_2 (spouse 2) is balanced when the flows in are equal to the flows out; this is given by the following equation:

$$
\begin{aligned}
m_{ff} G_{ff}(w_1, w_2) \left[\delta_f^{s_1} + \delta_f^{s_2} + \lambda_{ff}^{s_1} \overline{F}_f^{s_1}(w_1) + \lambda_{ff}^{s_2} \overline{F}_f^{s_2}(w_2)\right] + \\
\lambda_{fi}^{s_1} m_{ff} \int^{w_2} \int^{w_1} \overline{F}_i^{s_1}(\hat{w}_{ff->if}(x, w_2)) g_{ff}(x, w_2) dx dw_2 + \\
\lambda_{fi}^{s_2} m_{ff} \int^{w_1} \int^{w_2} \overline{F}_i^{s_2}(\hat{w}_{ff->fi}(w_1, x)) g_{ff}(w_1, x) dx dw_1 = \\
\lambda_{nf}^{s_1} m_{nf} \int^{w_2} \max\left(F_f^{s_1}(w_1) - F_f^{s_1}\left(\hat{w}_{nf->ff}(w_2)\right), 0\right) g_{nf}(w_2)\, dw_2 + \\
\lambda_{nf}^{s_2} m_{fn} \int^{w_1} \max\left(F_f^{s_2}(w_2) - F_f^{s_2}\left(\hat{w}_{fn->ff}(w_1)\right), 0\right) g_{fn}(w_1)\, dw_1 + \\
\lambda_{if}^{s_1} m_{if} \int^{w_2} \int^{w_1} \max\left(F_f^{s_1}(w_1) - F_f^{s_1}\left(\hat{w}_{if->ff}(x, w_2)\right), 0\right) g_{if}(x, w_2)\, dx dw_2 + \\
\lambda_{if}^{s_2} m_{fi} \int^{w1} \int^{w_2} \max\left(F_f^{s_2}(w_2) - F_f^{s_2}\left(\hat{w}_{fi->ff}(w_1, x)\right), 0\right) g_{fi}(w_1, x)\, dx dw_1.
\end{aligned}
$$

The outflow from the formal sector (LHS) is given by the job separation to nonemployment, to other jobs paying higher than w_1 (spouse 1) or w_2 (spouse 2) in the formal sector and to other jobs in the informal sector paying above the reservation wages. The inflow in the formal sector (RHS) is given by the job acceptance by the nonemployed and by informal sector workers willing to take the formal sector job offering until w_1 (spouse 1) or w_2 (spouse 2).

The balance equation is similar when both spouses are in the informal sector, and it is given by:

$$
\begin{aligned}
m_{ii}G_{ii}(w_1,w_2)\left[\delta_i^{s_1}+\delta_i^{s_2}+\lambda_{ii}^{s_1}\overline{F}_i^{s_1}(w_1)+\lambda_{ii}^{s_2}\overline{F}_i^{s_2}(w_2)\right]+ \\
\lambda_{if}^{s_1}m_{ii}\int^{w2}\int^{w1}\overline{F}_f^{s_1}\left(\hat{w}_{ii->fi}(x,w_2)\right)g_{ii}(x,w_2)dxdw_2+ \\
\lambda_{if}^{s_2}m_{ii}\int^{w1}\int^{w2}\overline{F}_f^{s_2}\left(\hat{w}_{ii->if}(x,w_2)\right)g_{ii}(w_1,x)dxdw_1= \\
\lambda_{ni}^{s_1}m_{ni}\int^{w2}\max\left(F_i^{s_1}(w_1)-F_i^{s_1}(\hat{w}_{ni->ii}(w_2)),0\right)g_{ni}(w_2)dw_2+ \\
\lambda_{ni}^{s_2}m_{in}\int^{w1}\max\left(F_i^{s_2}(w_2)-F_i^{s_2}(\hat{w}_{in->ii}(w_1)),0\right)g_{in}(w_1)dw_1+ \\
\lambda_{fi}^{s_1}m_{fi}\int^{w2}\int^{w1}\max\left(F_i^{s_1}(w_1)-F_i^{s_1}(\hat{w}_{fi->ii}(x,w_2)),0\right)g_{fi}(x,w_2)dxdw_2+ \\
\lambda_{fi}^{s_2}m_{if}\int^{w1}\int^{w2}\max\left(F_i^{s_2}(w_2)-F_i^{s_2}(\hat{w}_{if->ii}(w_1,x)),0\right)g_{if}(w_1,x)dxdw_1.
\end{aligned}
$$

The remaining six flow equations for the cases where at least one spouse is working are available from the authors upon request. We, then, set $w_1=\overline{w}_1$, $w_2=\overline{w}_2$ and the mass of couples across all states equal to one, which allows to obtain m_{nn}.

5.5 Firms and endogenous wages

We assume that wages of spouses 1 and 2 in the formal (f) and in the informal (i) sector are determined in separate markets. In each submarket, firms are heterogeneous in their productivity (p) which is continuous and follow the distribution: $\Gamma_f^{s_1}(p)$ for spouse 1 in the formal sector, $\Gamma_i^{s_1}(p)$ for spouse 1 in the informal sector, $\Gamma_f^{s_2}(p)$ for spouse 2 in the formal sector, and $\Gamma_i^{s_2}(p)$ for spouse 2 in the informal sector.

In the formal sector, we include minimum wage, mw, and payroll taxes (τ), to capture the labor market institutions in the Mexican regulatory setting. Formal firms in the spouse 1 market then choose a wage w_1 that maximizes its profits. Likewise, it chooses another wage w_2 for spouse 2. Thus, in each case ($j=1,2$), a formal firm solves:

$$
\max_{w_j\geq \mathsf{mw}}(p-(1+\tau)w_j)\ell_f^{s_j}(w_j) \tag{2}
$$

where $\ell_f^{s_j}(w_j)$ is the equilibrium size of a formal firm in the market of spouse j offering w_j. Firm size is obtained from the flow conditions in steady state. Normalizing the number of formal firms to one in each market $j=1,2$, we have

$$
\ell_f^{s_j}(w_j)=m_f^{s_j}\frac{dG_f^{s_j}(w_j)}{dF_f^{s_j}(w_j)} \tag{3}
$$

where $m_f^{s_1} = m_{ff} + m_{fi} + m_{fn}$, $m_f^{s_2} = m_{ff} + m_{if} + m_{nf}$, and $G_f^{s_j}(w_j)$, $j = 1, 2$, is the marginal CDF of wages obtained from integrating the joint distributions over the other spouses' wages $G_{fk}^{s_1}(w_1, w_2)$, $k = f, i, n$ for spouse 1 and $G_{kf}^{s_2}(w_1, w_2)$ for spouse 2.

Following Bontemps, Robin and van den Berg (1999, 2000), in equilibrium, $\Gamma_f^{s_j}(p) \equiv F_f^{s_j}(w_j(p))$ where $w_j(p)$ solves firm's profit maximization. That is,

$$w_j(p) = \begin{cases} p - \frac{\ell_f^{s_j}(w_j(p))}{\frac{d\ell_f^{s_j}(w_j(p))}{dw_j(p)}} & \text{if } w_j(p) > \mathsf{mw} \\ \mathsf{mw} & \text{otherwise} \end{cases} \tag{4}$$

In the informal sector, minimum wages are not enforced and firms do not pay taxes. We also assume that enforcement of labor regulations does not reach informal firms (Kaplan and Sadka, 2011). The informal sector firm solves:

$$\max_{w_j} (p - w_j) \ell_i^{s_j}(w_j) \tag{5}$$

where the equilibrium wage in the informal sector for spouse j, $w_j(p) \sim F_i^{s_j}(w_j(p))$ is

$$w_j(p) = p - \frac{\ell_i^{s_j}(w_j(p))}{\frac{d\ell_i^{s_j}(w_j(p))}{dw_j(p)}}. \tag{6}$$

and $\ell_i^{s_j}(w_j)$ is the equilibrium size of an informal firm in the market of spouse j offering w_j.

5.6 Identification

The value of leisure To identify the value of leisure, b_1 and b_2, we assume strong monopsony power for women who earn the lowest wages and that $\underline{w}$ (from F_f and F_i) are the minimum wage offers accepted by nonemployed individuals. Thus, we identify b_1 and b_2 by setting $W_{ni}(\underline{w}) = W_{nn}$ and $W_{ii}(\underline{w}_1, \underline{w}) = W_{in}(\underline{w}_1)$. The details are presented in Appendix C.1.

The utility value of amenities in the formal sector (a) and the value of health insurance provided by SP (γ) Households in which men work (either in the formal or in the informal sector) and women are nonemployed are the most prevalent in the data (these households represent 45% of our sample; see Table 1). Hence, to identify a and γ, we opt

to impose restrictions in the value functions $W_{fn}(w)$ and $W_{in}(w)$. We obtain these parameters setting $W_{fn}(\underline{w}) = W_{in}(\underline{w})$.[14] To separately identify a and γ, we use data on wages and transitions before and after the implementation of SP in a given municipality.[15]

1. Using data for the pre-Seguro Popular period (where $\gamma = 0$), we identify a by equating $W_{in}(\underline{w}^{t=0}) = W_{fn}(\underline{w}^{t=0})$.

2. Given a, other structural parameters, and using data for the period after the implementation of Seguro Popular (when γ is possibly $\neq 0$), we identify γ setting $W_{in}(\underline{w}^{t=1}) = W_{fn}(\underline{w}^{t=1})$.[16]

We assess the sensitivity of the values estimated for a and γ relaxing the assumptions above. In particular, we obtain similar estimates if, alternatively, we impose the following conditions using other lower percentiles of wages in the informal sector $W_{in}(w^{t=k}_{Percentile2}) = W_{fn}(\underline{w}^{t=k})$ or $W_{in}(w^{t=k}_{Percentile4}) = W_{fn}(\underline{w}^{t=k})$, $k = 0, 1$.

6 Estimation

The model includes (i) the wage offer distributions in the formal and informal sectors for each spouse ($F_f^{s_1}, F_i^{s_1}, F_f^{s_2}, F_i^{s_2}$), and (ii) the job offers arrival rates ($\boldsymbol{\lambda}$), job destruction rates ($\boldsymbol{\delta}$), and instant reallocation probabilities ($\boldsymbol{p}, \boldsymbol{q}$). Additional parameters are the values of leisure (b_1, b_2), the relative value of the amenities in the formal sector (a), and the value of SP (γ). All are denoted by:

$$\Theta = (F_f^{s_1}, F_i^{s_1}, F_f^{s_2}, F_i^{s_2}, \lambda_{if}^{s_1}, \lambda_{fi}^{s_1}, \lambda_{ni}^{s_1}, \lambda_{nf}^{s_1}, \delta_i^{s_1}, \delta_f^{s_1}, \lambda_{if}^{s_2}, \lambda_{fi}^{s_2}, \lambda_{ni}^{s_2}, \lambda_{nf}^{s_2}, \delta_i^{s_2}, \delta_f^{s_2}, q^{s_1}, p^{s_1}, q^{s_2}, p^{s_2}, b_1, b_2, a, \gamma).$$

[14] Here we assume weak monopsony power for men earning the lowest wage in the formal sector when the wife is nonemployed. In this case the main assumption is that the gains formal firms reap from male workers are not sufficient to "push" them to nonemployment. But they can lower his wage down such that the value of accepting a formal sector offer or an informal sector one is the same. In all numerical solutions we find that $W_{in}(\underline{w}) > W_{nn}$.

[15] A similar identification strategy is implemented by Bobba, Flabbi and Levy (2017) to estimate the utility value of SP using an individual search and matching model. They focus on males ages 35-55 and use data for the year of 2005.

[16] We assume that the structural parameters are similar between municipalities that implemented the program earlier or later. This is assumption is supported by strong evidence that the timing of SP implementation was not correlated with labor market characteristics (Azuara and Marinescu, 2013; Bosch and Campos-Vazquez, 2014).

We use the method of moments to recover (i) and (ii). We assume the distributions of wage offers $F_f^{s_1}(w)$, $F_i^{s_1}(w)$, $F_f^{s_2}(w)$ and $F_i^{s_2}(w)$ to have a non-standard $\mathsf{Beta}(\underline{\mathsf{w}}, \overline{\mathsf{w}}, \alpha, \beta)$ CDF specific for each sector and spouse. The minimum and maximum support for all distributions are obtained from the data and linearly interpolated. Thus, we estimate $\Im = \{\alpha_f^{s_1}, \beta_f^{s_1}, \alpha_i^{s_1}, \beta_i^{s_1}, \alpha_f^{s_2}, \beta_f^{s_2}, \alpha_i^{s_2}, \beta_i^{s_2}\}$. Conditional on $\Lambda = \{\boldsymbol{\delta}, \boldsymbol{\lambda}, \boldsymbol{p}, \boldsymbol{q}\}$, $\Im$ is solved by minimizing a distance between moments of $\widetilde{G}_k^{s_j}$ and $G_k^{s_j}$, $(k = f, i;\ j = 1, 2)$ respectively, the cross-section and the model distribution of wages for each spouse.[17] That is

$$\min_{\Im} \|\boldsymbol{G}(\boldsymbol{w}, \Im | \boldsymbol{\Lambda}) - \widetilde{\boldsymbol{G}}(\boldsymbol{w})\|. \tag{7}$$

To obtain the transition parameters, we use the transition probabilities in the data ($\widetilde{\boldsymbol{D}}$) and their model counterparts ($\boldsymbol{D}$). For example, consider the observed proportion of spouse 1 in the formal sector in interview 1 who are nonemployed in interview 2, $\widetilde{D}_{fn}^{s_1}$. We assume that the remaining duration can be exponentially distributed. Hence the implied proportion of spouse 1 who left a formal job in interview 1 to become nonemployed one period ahead is

$$D_{fn}^{s_1} = \int \frac{\delta_f^{s_1}}{d_f^{s_1}(x)} (1 - e^{-d_f^{s_1}(x) \times 1}) dG_f^{s_1}(x)$$

where $d_f^{s_1}(w_1) = \delta_f^{s_1} + \lambda_{ff}^{s_1} \overline{F}_f^{s_1}(w_1) + \lambda_{fi}^{s_1} \sum_{j'=n,f,i} \int \overline{F}_i^{s}(\hat{w}_{fj'->ij'}(w_1, w_2)) \frac{m_{fj'}}{m_f^{s_1}} g_{fj'}(w_1, w_2) dw_2$ is the formal job separation rate for spouse 1, and $m_f^{s_1} = \sum_{j'=n,f,i} m_{fj'}$.

We construct a theoretical moment for each transition parameter, as shown in appendix C.3. We then solve a system of 16 equations, through which we choose Λ that minimize a distance between $\boldsymbol{D}$ and $\widetilde{\boldsymbol{D}}$. That is, conditional on the wage offers distributions ($\Im$),

$$\min_{\Lambda} \|\boldsymbol{D}(\boldsymbol{\Lambda} \mid \Im) - \widetilde{\boldsymbol{D}}\|. \tag{8}$$

The solution for $\Im$ and Λ is iterative. In 2-steps, we solve (8) given $\Im$ and (7) given Λ. This is repeated until both distances are arbitrarily close to zero. The details are provided in Appendix C.4; the standard errors are obtained by bootstrap with 50 replications.

[17] We could have also matched the joint distribution of wages from the data, as Dey and Flinn (2008) (who use cross moments to estimate their joint search model) *in addition* to the moments we match, i.e., the marginal wage distributions and the transition rates.

7 Estimation Results

We now present the model estimates. The model is estimated separately for two different types of households: high and low education, defining high education household that have heads with more than 6 years of education (i.e., at least primary education) with children ages 0-14 years.

We start by estimating all parameters using the period before the introduction of SP in the municipality of residence. To do so, we set the value of health insurance in the informal sector and nonemployment, γ, to zero. In the sample of municipalities covered by the Labor Force Survey, SP was staggeringly implemented between 2002 and 2007. We, then, use the period after the introduction of SP to estimate γ as described in Section 5.6, taking a fixed as estimated on data from the pre-reform period.

We present results for two model specifications: the first uses a linear utility, and the second specification uses an exponential function with the coefficient of absolute risk aversion calibrated from Cohen and Einav (2007), $\theta = 0.0000073$. The time period in the model is one quarter. We set the interest rate to $r = 0.03$, which corresponds to the average for the Mexican benchmark rate in the period 2000-2004 and $\tau = 0.10$ for employer contributions following Satchi and Temple (2009).

7.1 The Model Fit

Table 3 compares the stocks of households where members are employed in formal or informal sectors or non-working and the transitions predicted by the model and observed in the data, in the pre-SP period. The model, with either linear or concave instant utility, fits most transitions and stocks remarkably well across the two samples and two specifications. The model overestimates the stock of households where the head is not working with wives working on the informal sector or not working (i.e., m_{ni} and m_{nn}), but these also have lowest prevalence on our sample.

Table 4 presents selected moments for the distribution of wages in the data and as predicted by the model. We assume that the F distributions (by sector and spouse) follow a non-standard Beta distribution with support obtained from the data. Considering this, and given the flexibility of the Beta function, we replicate well the distributions of accepted wages in the data, particularly, in the formal sector for both the head and the spouse in one of the two education groups and for spouses working on the informal sector; the model underestimates the wages for the 75th and 90th of the distribution of heads in the informal

sector (for the high and low education groups).

7.2 Model Estimates

Transition Parameters Table 5 shows the parameter estimates which are obtained from the model for the transition rates. First, the job destruction rates are, as expected, much higher for the spouse than for the head, regardless of the sector. For both men and women, the destruction rates are also higher in the informal than the formal sector; this is expected and similar to the findings in Meghir, Narita and Robin (2015). Second, as expected, the destruction rates are higher for individuals (heads and spouses) in low education families than in high education families.

Third, job arrival rates are higher for heads than for spouses; the exception are the arrival rates of formal offers for spouses working in the informal sector, which are higher for spouses in the low education group than for their heads. Fourth, women in either low or high education families are very unlikely to enter the labor market through the formal sector, as the arrival rates for formal offers for nonemployed women are very low. Fifth, low educated heads working in the formal sector face higher arrival rates of informal sector offers than high educated heads; for spouse, we see the opposite relation, i.e., spouses in the low education group working in the formal sector face lower arrival rates of informal sector offers than spouses in the high education group (the inverse holds for the arrival rates for formal sector offers for informal workers). Finally, the instant reallocation probabilities are higher for the spouse than for the head (for spouses they are always equal to 1).

The estimates of the transition parameters are similar under linear or concave instant utility.

Value of leisure, formal sector amenities and value of SP Table 6 shows the parameter estimates obtained from the model. Panel A includes three estimates for the pre-reform period, namely, the value of leisure for heads and spouses, b_1 and b_2, respectively, and the utility value of being in the formal sector, a, and one for the post-reform period – the value of health insurance provided by SP γ; in Panel A parameter estimates are measured in currency units divided by the mean wage of husbands in the informal sector for the model estimated under risk neutrality. Panel B presents the estimates for a and γ in Mexican Pesos.

The table shows that the value of leisure is negative, reflecting that job offers arrive

more frequently out of than on-the-job. The value of leisure is higher for the less educated households and even higher for spouses than for heads in low education households.

The third row of the table includes the estimates for a. Before the introduction of SP, less educated households (column 1) are willing to forgo a 68% of their earnings to be in the informal sector rather than in the formal sector, while this value drops to 13% for more educated households (column 3). In panel B of Table 6 we also present the value in MXP: the estimate of a is about 5500MXP and nearly 1700MXP per quarter, for the low and high education groups, respectively. The larger values of informal sector amenities relative to those in formal sector may reflect several pre-existent differences between low and high and education families. On one hand, it can reflect preferences for more flexible work schedules in informal sector; on the other hand, it may reflect access to other policies target poor informal families in place before the implementation of SP. Among the programs that poor families with young children have available the conditional cash transfer program *Oportunidades* has special prominence; this program is means-tested and it depends on whether an household index of wealth is above a pre-specified threshold. Once eligible, households may be entitled a transfer that represents 17-21% of their total consumption (Angelucci and Attanasio, 2009). Information about participation in *Oportunidades* is not collected in the Labor Force Survey, but it is collected in the Household Income and Expenditure Survey (ENIGH) and, in 2002, the participation rate in *Oportunidades* is 21% and 3% among the low and high educated households with children less than 15 years old, respectively.

The estimate of γ shows that the value-added of SP, given a, is positive and it represents 9% and 4% of the mean wage of husbands in the informal sector, for the low and high education sample, respectively (columns 1 and 3). As for a, in panel B we present the estimates of γ in MXP, which are 710-730MXP for low education households and 468-500MXP for the high education sample. Using information on government expenditures in SP, we can compare the utility gain of families of SP to the cost of funding the program. Since the government spends per quarter around 1,300MXP (in 2010 pesos; about 100USD) per each family enrolled in the program (CNPSS, 2013), these figures are equivalent to saying that the families assign a value of 56 and 36 cents to each one Peso the government spends in the program, for low and high education households, respectively.

Sensitivity Analysis To understand the sensitivity of the estimates of γ to the value of a (i.e., to the value of pre-existing amenities in the formal sector) we re-estimate the model in the post-reform period for different values of a. If $a = 0$ the value of γ is also very close

to our estimate; in particular, the estimates are 708.03 and 494.88 pesos, respectively, for the low and high education groups. If a equals 8% of the mean wage of the husband in the uninsured sector (the estimate obtained in Dey and Flinn (2008)), the value of γ would be 704.95 and 415.36 pesos for the low and high education samples. Hence, the estimates of γ are not sensitive to the value of a.

It is also possible that municipalities that implemented SP earlier had different relative amenities in the formal sector than those introducing the program later, although in a similar trend. To account for this possibility, we estimated the model for four different samples defined by treatment group (i.e., where SP started in 2004-2005), control (i.e., municipalities where SP started in 2006 or after); for each group, we define the before (2000-2003) and after (2004-2005) periods. Under concave utility, for control municipalities we find that, before the program, the a is smaller than for treatment municipalities (-6074.38 and -2466.93 for low and high education households, respectively) and it slightly reduces after the program (-6217.58 and -3096.66 for low and high education households, respectively). For treatment municipalities, the value of a before the program is -5619.15 and -1508.58 for low and high education households, respectively. We then assume a parallel trend as in a DD strategy and obtain the value of a for treatment municipalities after the program (if γ was equal to zero); this implies a value of -5762.35 and -2138.30 for low and high education households, respectively. Thus, we can obtain γ conditional to this counterfactual a, which is 574.64 and 476.57, for low and high education households, respectively.

Notice that to use the values in the paragraph above we only relied on data up 2005. This allows also to exclude the period of 2007-2010 during which the Child Care Centers to Support Working Mothers was rolled out. This program subsidized most of the cost of enrolling a child under age four at a formal child care center and it targeted women living in families without Social Security coverage searching for work, enrolled in school, or working. Therefore, using data post-2007, γ could partially capture an increase in the relative value of non-employment or informality due to the availability of Child Care Centers to Support Working Mothers. For the high education sample the estimates for γ are nearly the same; for the low education sample, the estimates for the restricted sample above are 80% of those presented in the bottom row of Table 6 (column 2).

Summing up, the main message from these estimates of a and γ is that (i) in the period prior to the SP, low educated families are willing to pay a much larger amount to be in the informal sector than high educated families, and (ii) after the introduction of SP, both low and high educated households assign a positive value to the change in amenities in

the informal sectors and values are statistically significant but at most 9% of the mean earnings of husbands in the informal sector. We claim this is the utility gain of the health insurance provided by SP, given that no other changes in the relative value of formal vs. informal sectors occurred at a similar timing of implementation of SP across municipalities in Mexico.

7.3 Policy Experiments

We now use the model to simulate the impacts of changing the value of SP, γ, on distributions of wages, reservation wages, stocks, firm size and profit and welfare. We take as benchmark the wage distributions, stocks and transitions estimated from the data in the period prior to the implementation of the program.

7.3.1 Simulating changes in γ

The limited impacts of this new health policy on the labor market estimated in reduced form work seem counterintuitive. Thus, to understand the role played by the value of health insurance provided by SP in household decisions we depart from the benchmark economy in which γ is equal to zero. We then simulate changes in the economy with γ equal to the value estimated from the period after the implementation of SP and also successively consider increases of 5, 10 and 20 times this estimate, across the two samples studies: low- and high- educated households with children. The results of the simulations are presented in Tables 7-8 and in Tables A.2-A.4 in Appendix, where we consider stocks of households, salaries, welfare, transitions, and firm size and profits. All tables include the simulations based on parameter estimates for the linear ("no risk aversion") and concave utility ("risk aversion").

We first comment on the results based on the specification with linear utility reported in Panels A and C of Tables 7-8. Column (1) shows that if the pre-SP economy is simulated with the estimated value of SP, then the changes in employment and wages would indeed be very small, with household informality increasing by 1.3 p.p. and wages varying by less than 1% in absolute terms (Table 8). Nonemployment of spouses goes up and of heads falls, although these effects are very small (in line with the reduced-form analysis in Section 4). When we successively increase γ across columns (2) to (4) of Panel A of Tables 7 and 8, the wages compensate in the expected direction, that is, wages decrease in the informal sector for the heads. The same occurs in Panel C for the sample of high education households. For

the spouses in the low education sample, negative selection into nonemployment explains why wages do not decrease in the informal sector. In particular, a 10 times higher value of SP, about 12p.p. of households become informal, that is, no spouse is in the formal sector; this increases to 17p.p./13p.p. (respectively, for low/high education households) once we simulate a 20 times higher value of SP. Table A.2 in Appendix shows that the increase in the stock of households informal-nonemployed (the largest stock) is driven by an increase in transition of heads from the formal to the informal sector and a decline in the transition of spouses from nonemployment (to either the formal or the informal sector).

Panels B and C of Tables 7 and 8 show the results using a concave utility function. Risk aversion plays a similar role in the low and high education samples and it slightly magnifies the impact on some aggregates; in particular, the household informality and the nonemployment among heads. On the other hand, the same level of risk aversion implied a decline in the number of nonemployed spouses in the low education sample and almost no change in the high education one. These results are consistent with those in Table 6, in which risk aversion does not change the utility value of being outside the formal sector for either sample.

The bottom panel of Table 7 shows that, despite an increase in the informal sector and nonemployment, the welfare increases in all simulations and even when we simulate γ equal to its estimated value (Columns (1), (5), (9) and (13) of Table 7). For low education households, this is due the utility value of health insurance brought by SP that raised the value of households in the informal sector (including nonemployment) and the option value of households in the formal sector. For high education households the increase in welfare is due to an increase in salaries in the formal sector and to the value of health insurance by SP, that raised the value of jobs in the informal sector. The main difference between the low education and the high education samples (Panels A and C of Table 7) is that spouses in the high education sample move less into nonemployment than those in the low education sample; thus, for high education households, SP increases the fraction of households with heads and spouses working in informal sector (m_{ii}) and with informal heads and nonemployment spouses (m_{in}).

We now turn to firms; the results are presented in Tables A.3 and A.4 in Appendix. Table A.3 shows that increasing γ, increases the mean profit for informal firms employing heads, due to the decrease in mean wage for heads in the informal sector (Table 8) and an increase in average informal firm size (Table A.4). In contrast, the mean profit for formal firms employing heads decreases, which is accompanied by the decrease in mean wage for

heads in the formal sector (Table 8) and a decrease in average formal firm size (Table A.4); the same holds for spouses, regardless of the sector of employment.

7.3.2 Reservation Wages

Figure 1 depicts the reservation wages of heads and spouses at the benchmark economy after simulating an increase in γ of 10 times relative to the estimated value in the post-reform period. These plots help to explain why the fraction of households informal-nonemployed increases. Panel (a) shows that nonemployed heads of households become more reluctant to take a formal job with the simulated change and this occurs regardless of the spouse's wage level (dashed blue line). Instead, Panels (b) shows that spouses become more demanding as their reservation wages go up with larger γ. In addition, in the high education sample, rather than a parallel shift in reservation wage, spouses become more reluctant to take an informal job but only if they head earns high wages (Panel (b.2) – Figure 1; dashed blue line).

These figures also show the importance of studying labor supply decisions at household rather than at individual level (see also Guler, Guvenen and Violante (2012) and Flabbi and Mabli (2018)). First, the positively sloped functions for the reservation wage of the spouse in Panel (b) show that she is more picky as the husband's wage increases. Second, the graphs in Panel (a) show that the wage of the wife is less important for the head, particularly if she is in the informal sector.

7.3.3 Compositional Effects and Compensating Wage Differentials

How much of the changes documented above are due to compositional effects and how much can be attributed to compensating wage differentials? To understand this, we turn to Table A.5. In this table, we perform the same set of simulations as above, but considering exogenous wages, and thus, we shut down the possibility of changes due to compensating wage differentials. The results in the table are similar to those in Table 7, which suggests that γ captures compositional changes across sectors, rather than compensating wage differentials attributed to SP.

8 Conclusion

In this paper we study how access to universal health coverage affects the labor market decisions of households. To do so, we develop and estimate for the first time a household-level model of job search for a developing/middle-income country. In particular, we use the case of Mexico, that introduced in 2002 a non-contributory health insurance scheme directed to the half of the country's population uncovered by Social Security protection (the SP). Before SP uninsured individuals could only access affordable health care through their employer, hence the introduction of a non-contributory public health insurance scheme could have resulted in large effects on the labor market. In practice, SP is a transfer(tax) to the informal(formal) sector workers and to the nonemployed. On the one hand, if the value placed on SP benefits is high, the introduction of fully subsidized health insurance can lead to negative impacts on employment and/or formality. On the other hand, wages in equilibrium might compensate the increase in benefits in the informal sector, in which case the impact on formality and employment is ambiguous.

Difference-in-differences estimates using the staggered introduction of SP across municipalities show that the program is associated with an increase in informality by 4% for low-education families with children and no impacts for the other groups studied (i.e., low-educated households without children or high-educated households).

Then, to study why the policy change had limited impacts on the labor market, we develop and estimate a household search model which incorporates the value of free health care by SP as well as the pre-reform valuation assigned to the amenities in the formal sector relative to the alternatives (i.e., informal sector and non-employment), in order to recover the value of SP by households. Our results show that the value of health insurance coverage provided by SP is low, amounting to 4%-9% of the mean wage in the informal sector, with the largest valuation coming from the poorest group of households (low-education families with children). Our estimates also indicate that the value of the new health program to individuals is generally below the government's average costs of providing it, which can be explained by moral hazard and other aspects related to poor quality care. Not surprisingly, when we use the estimated model to simulate the introduction of SP program we find that it increases household informality by at the most 2%, which is comparable to our reduced-form estimate. In counterfactual scenarios in which we increase the valuation of the free health system, we find that large increases in the value of SP can raise informality and nonemployment of spouses, despite potential positive impacts on welfare.

Our results have policy implications for those countries introducing and/or expanding schemes that cut the link between the job contract and access to health services, such as expansions of Medicaid for low income uninsured individuals or the 2010 Affordable Care Act in the USA.

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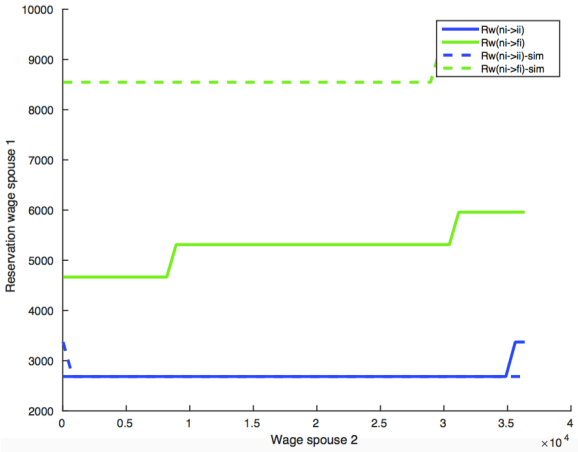
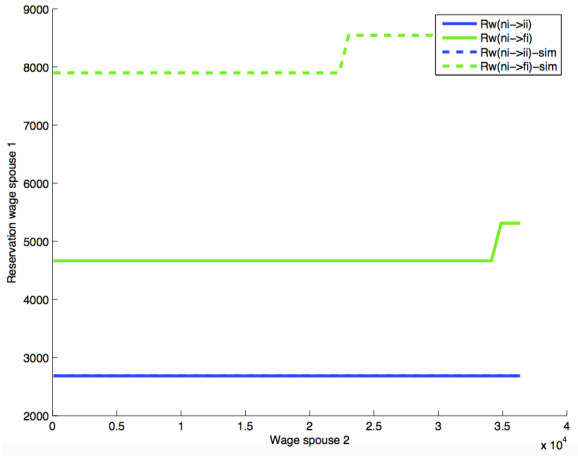
9 Figures and Tables

Figure 1: Simulated changes in γ (concave utility).

(a) Reservation wage of the spouse 1 (head) for each level of wage in the informal sector wage of the spouse 2 (spouse)

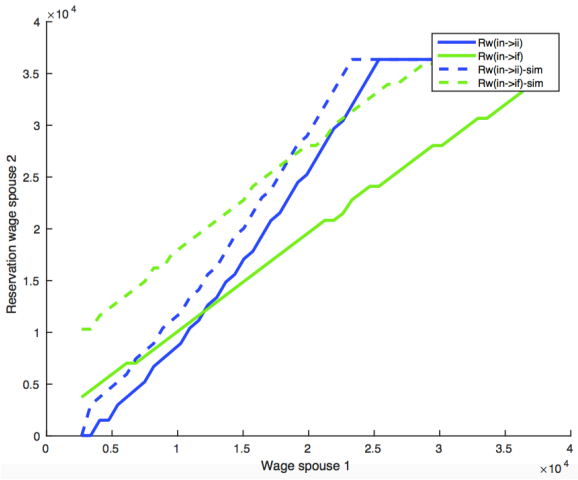


(a.1) Low education

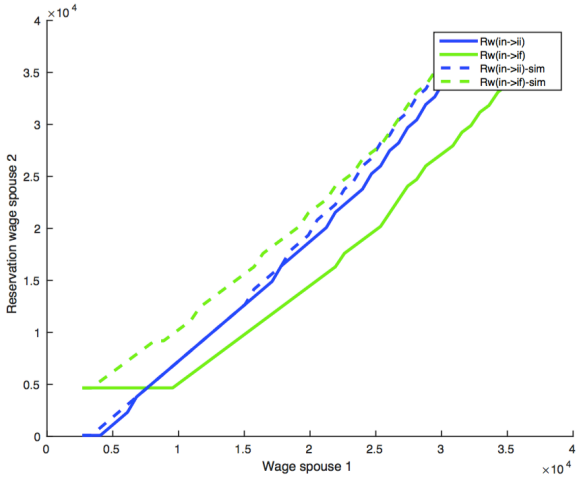


(a.2) High education

(b) Reservation wage of the spouse 2 (spouse) for each level of wage in the informal sector wage of the spouse 1 (head)



(b.1) Low education



(b.2) High education

NOTE: Panel (a) plots the reservation wage of the spouse 1 for each wage in the informal sector for spouse 2. The blue line plots the reservation wage for the informal sector (denoted Rw(ni→ii)); the lighter line plots the reservation wage for the formal sector (denoted Rw(ni→fi)). Panel (b) plots the reservation wage of the spouse 2 for each wage in the informal sector for spouse 1. The dark line plots the reservation wage for the informal sector (denoted Rw(in→ii)), whereas the lighter line plots the reservation wage for the formal sector (denoted Rw(in→if)). In both panels, the solid lines are the reservation wages resulting from estimating the model on the pre-SP period (baseline economy, with $\gamma = 0$). The dashed lines are the reservation wages from simulating the baseline economy with $\gamma 10\times$ the value obtained by estimating the model on the post-introduction of SP period.

Table 1: Employment and wages in the formal and informal sector.

	High Education		Low Education	
	Before 2001	After 2007	Before 2001	After 2007
Panel A: Proportion of households, by employment type				
Number of Households-Quarters	20,699	11,709	18,518	7,750
Share of Households without Social Security coverage (informal hhlds.)	0.335	0.342	0.573	0.604
Households by type				
With Social Security				
Head Formal-Spouse Formal (FF)	0.141	0.137	0.046	0.041
Head Formal-Spouse Informal (FI)	0.077	0.111	0.058	0.076
Head Formal-Spouse Not Working (FN)	0.389	0.349	0.282	0.240
Head Informal-Spouse Formal (IF)	0.048	0.049	0.035	0.033
Head Not Working-Spouse Formal (NF)	0.010	0.012	0.006	0.007
Without Social Security/Informal				
Head Informal-Spouse Informal (II)	0.060	0.080	0.103	0.140
Head Informal-Spouse Not Working (IN)	0.227	0.208	0.394	0.384
Head Not Working-Spouse Informal (NI)	0.008	0.011	0.017	0.019
Head Not Working-Spouse Not Working (NN)	0.040	0.043	0.059	0.061
Panel B: Wages in the formal and informal sectors				
Wages: Formal Sector				
Head				
Mean	17,880	18,804	14,498	15,919
SD	6,990	6,831	5,754	5,764
Observations	12,563	6,994	7,141	2,760
Spouse				
Mean	16,085	16,993	12,289	13,198
SD	6,839	7,038	5,195	5,630
Observations	4,109	2,312	1,607	625
Wages: Informal Sector				
Head				
Mean	15,800	16,731	12,912	14,154
SD	7,367	7,576	6,427	6,549
Observations	6,945	3,949	9,854	4,315
Spouse				
Mean	9,085	8,997	6,637	7,360
SD	6,884	6,396	4,996	4,992
Observations	3,021	2,366	3,311	1,817
Wage Growth (2007-2001): Formal Sector				
Head	0.050		0.094	
Spouse	0.055		0.071	
Wage Growth (2007-2001): Informal Sector				
Head	0.057		0.092	
Spouse	-0.010		0.103	

NOTE: ENE-ENOE 2001 and 2007, sample of families whose head is 20-59 years old. A household belongs to the "high education" group if the head has more than six years of education. Wages in the formal and informal sector by education group are measured by quarter.

Table 2: Reduced Form Estimates: Impact of SP on Employment.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Informal	Formal Households (with SS)					Informal Households (Without SS)			
	Households	FF	FI	FN	IF	NF	II	IN	NI	NN
					Panel A: With Children					
					Panel A.1: Low Education					
SP	0.028**	-0.013***	-0.009*	-0.009	0.006	-0.002	0.021***	0.004	-0.005*	0.007*
	(0.011)	(0.005)	(0.005)	(0.010)	(0.004)	(0.002)	(0.007)	(0.010)	(0.003)	(0.004)
Mean Pre-SP	0.680	0.033	0.052	0.214	0.018	0.003	0.137	0.482	0.017	0.044
					Panel A.2: High Education					
SP	-0.015	0.004	0.008*	-0.004	0.006	0.000	-0.002	-0.016	-0.003	0.006
	(0.011)	(0.005)	(0.005)	(0.008)	(0.004)	(0.002)	(0.006)	(0.011)	(0.002)	(0.004)
Mean Pre-SP	0.440	0.093	0.081	0.340	0.038	0.009	0.085	0.319	0.011	0.024
Observations	26,934									
					Panel B: Without Children					
					Panel B.1: Low Education					
SP	0.005	0.001	0.008	-0.011	-0.003	0.001	0.013	-0.009	0.002	-0.001
	(0.018)	(0.007)	(0.007)	(0.015)	(0.007)	(0.003)	(0.010)	(0.019)	(0.004)	(0.009)
Mean Pre-SP	0.667	0.029	0.0536	0.214	0.031	0.005	0.120	0.413	0.026	0.109
					Panel B.2: High Education					
SP	-0.005	0.003	0.014**	-0.004	-0.009	0.001	-0.009	-0.009	0.000	0.012
	(0.018)	(0.010)	(0.007)	(0.0142	(0.006)	(0.003)	(0.008)	(0.016)	(0.005)	(0.011)
Mean Pre-SP	0.446	0.131	0.078	0.282	0.047	0.016	0.090	0.228	0.014	0.114
Observations	18,329									

NOTE: OLS estimates obtained using the ENE/ENEO data aggregated at the municipality-quarter level. Estimates are weighted by the population of the municipality in 2000. Controls excluded from table are: the share of households in each municipality-quarter by education group (incomplete primary, complete primary, complete lower secondary education or complete upper secondary and higher education) and by age of the head (20-29; 30-39; 40-49 and 50-59); municipality of residence fixed effects, state-year linear trends, quarter fixed effects, and a linear trend in the characteristics of the municipality of residence taken in 2000 (indicator for large city, index of deprivation, log of total population, share of population less than 5 years old, share of occupied individuals working in the primary, secondary and tertiary sectors, number of hospitals and health centers in 2001, total number of doctors and nurses in hospitals per 1,000 uninsured individuals in 2001). The pre-SP mean is measured the year before the implementation of SP in a municipality. Standard errors clustered by municipality. *** Significant at 1%, ** Significant at 5%, * Significant at 10%.

Table 3: Model Fit: Stocks and Transitions.

	(1)	(2)	(3)	(4)	(5)	(6)
Education		Low			High	
Risk Aversion		No	Yes		No	Yes
	Data	Model	Model	Data	Model	Model
Employment						
m_{ff}	0.040	0.027	0.025	0.125	0.106	0.106
m_{fi}	0.057	0.051	0.050	0.081	0.068	0.069
m_{fn}	0.277	0.208	0.209	0.409	0.329	0.326
m_{if}	0.030	0.033	0.033	0.045	0.050	0.049
m_{nf}	0.005	0.008	0.009	0.008	0.005	0.006
m_{ii}	0.107	0.103	0.105	0.063	0.054	0.054
m_{in}	0.428	0.455	0.454	0.237	0.281	0.285
m_{ni}	0.014	0.026	0.026	0.007	0.016	0.016
m_{nn}	0.042	0.089	0.089	0.024	0.091	0.090
Transitions: Head						
Nonemployment-Formal	0.110	0.110	0.110	0.233	0.233	0.233
Nonemployment-Informal	0.497	0.497	0.497	0.353	0.353	0.353
Formal-Nonemployment	0.024	0.024	0.024	0.018	0.018	0.018
Formal-Informal	0.155	0.155	0.155	0.087	0.087	0.087
Informal-Nonemployment	0.052	0.052	0.052	0.039	0.039	0.039
Informal-Formal	0.098	0.098	0.098	0.145	0.145	0.145
Nonemp.-Inf., if spouse looses formal job	0.093	0.000	0.000	0.086	0.000	0.000
Nonemp.-Inf., if spouse looses informal job	0.109	0.052	0.052	0.081	0.040	0.040
Transitions: Spouse						
Nonemployment-Formal	0.015	0.015	0.015	0.025	0.025	0.025
Nonemployment-Informal	0.090	0.090	0.090	0.079	0.079	0.079
Formal-Nonemployment	0.148	0.148	0.148	0.111	0.111	0.111
Formal-Informal	0.083	0.083	0.083	0.044	0.044	0.044
Informal-Nonemployment	0.385	0.385	0.385	0.363	0.363	0.363
Informal-Formal	0.034	0.034	0.034	0.065	0.065	0.065
Nonemp.-Inf., if head looses formal job	0.046	0.037	0.038	0.014	0.014	0.014
Nonemp.-Inf., if head looses informal job	0.039	0.039	0.039	0.023	0.023	0.023

NOTE: All estimates presented in the table are obtained using data from the period before the introduction of SP.

Table 4: Model Fit: Log-wages.

	(1)	(2)	(3)	(4)	(5)	(6)
Education		Low			High	
Risk Aversion		No	Yes		No	Yes
	Data	Model	Model	Data	Model	Model
Formal wage: head						
P10	8.889	8.889	8.889	9.126	9.126	9.194
P25	9.126	9.194	9.194	9.374	9.428	9.428
P50	9.428	9.428	9.428	9.659	9.699	9.738
P75	9.699	9.659	9.659	9.975	9.913	9.975
P90	9.975	9.847	9.847	10.215	10.061	10.141
Mean	9.538	9.493	9.495	9.759	9.720	9.771
Informal wage: head						
P10	8.465	8.123	8.123	8.719	8.600	8.465
P25	8.922	8.465	8.465	9.165	8.922	8.922
P50	9.299	8.922	8.922	9.524	9.234	9.360
P75	9.619	9.234	9.234	9.862	9.472	9.707
P90	9.931	9.472	9.472	10.168	9.664	9.931
Mean	9.407	9.017	9.020	9.633	9.279	9.440
Formal wage: spouse						
P10	8.760	8.858	8.760	8.975	9.126	9.194
P25	8.947	9.105	9.105	9.258	9.374	9.428
P50	9.241	9.361	9.361	9.573	9.617	9.699
P75	9.518	9.565	9.565	9.880	9.847	9.944
P90	9.809	9.772	9.734	10.166	10.033	10.115
Mean	9.369	9.405	9.398	9.671	9.671	9.753
Informal wage: spouse						
P10	6.653	6.653	6.653	7.364	7.748	7.364
P25	7.722	7.722	7.722	8.025	8.242	8.025
P50	8.408	8.408	8.408	8.702	8.818	8.818
P75	8.916	8.916	8.916	9.255	9.182	9.448
P90	9.320	9.320	9.320	9.748	9.504	9.790
Mean	8.690	8.645	8.649	9.014	8.964	9.086

NOTE: All estimates presented in the table are obtained using data from the period before the introduction of SP.

Table 5: Model Estimates: Transition Rates

	(1)	(2)	(3)	(4)
Education	Low		High	
Risk Aversion	No	Yes	No	Yes
Head				
δ_f	0.0262	0.0262	0.0194	0.0194
	(0.0010)	(0.0010)	(0.0007)	(0.0007)
δ_i	0.0562	0.0562	0.0429	0.0429
	(0.0019)	(0.0019)	(0.0024)	(0.0024)
λ_{nf}	0.1887	0.1894	0.3668	0.3671
	(0.0105)	(0.0106)	(0.0191)	(0.0197)
λ_{ni}	0.8636	0.8663	0.5584	0.5593
	(0.0314)	(0.0313)	(0.0254)	(0.0262)
λ_{fi}	0.5560	0.5373	0.3197	0.3088
	(0.0363)	(0.0362)	(0.0117)	(0.0278)
λ_{if}	0.1240	0.1249	0.1879	0.1879
	(0.0066)	(0.0067)	(0.0062)	(0.0063)
p_1	1.0000	1.0000	0.4436	0.4272
	(0.0509)	(0.0490)	(0.2912)	(0.2648)
q_1	0.1439	0.1439	0.0808	0.0807
	(0.0166)	(0.0157)	(0.0095)	(0.0096)
Spouse				
δ_f	0.1687	0.1687	0.1203	0.1203
	(0.0064)	(0.0064)	(0.0060)	(0.0060)
δ_i	0.4989	0.4988	0.4737	0.4737
	(0.0129)	(0.0129)	(0.0101)	(0.0101)
λ_{nf}	0.0207	0.0212	0.0279	0.0285
	(0.0020)	(0.0020)	(0.0016)	(0.0016)
λ_{ni}	0.1879	0.1956	0.1092	0.1132
	(0.0083)	(0.0082)	(0.0037)	(0.0037)
λ_{fi}	0.1644	0.1540	0.2206	0.1594
	(0.0159)	(0.0146)	(0.0666)	(0.0342)
λ_{if}	0.1598	0.1732	0.1314	0.1525
	(0.0132)	(0.0140)	(0.0153)	(0.0234)
p_2	1.0000	1.0000	1.0000	1.0000
	(0.000)	(0.000)	(0.000)	(0.000)
q_2	1.0000	1.0000	1.0000	1.0000
	(0.000)	(0.000)	(0.000)	(0.000)

NOTE: All parameters estimates presented in the table are obtained using data from the period before the introduction of SP. The bootstrap standard errors in parenthesis are computed from 50 replications.

Table 6: Model Estimates: utility value of leisure, of being in the formal sector, and of health insurance in the informal sector.

	(1)	(2)	(3)	(4)
Education	Low		High	
Risk Aversion	No	Yes	No	Yes
	Panel A: Relative to wages			
$\frac{b_1}{\overline{w}_i^{head}}$	-0.538		-0.681	
	(0.035)		(0.033)	
$\frac{b_2}{\overline{w}_i^{spouse}}$	-0.478		-0.804	
	(0.014)		(0.029)	
$\frac{a}{\overline{w}_i^{Head}}$	-0.677		-0.134	
	(0.029)		(0.041)	
$\frac{\gamma}{\overline{w}_i^{Head}}$	0.091		0.037	
	(0.004)		(0.005)	
	Panel B: Utility value			
b_1	-4434.32	-4459.80	-8583.60	-8535.27
	(373.52)	(268.19)	(431.91)	(477.81)
b_2	-2716.40	-2761.50	-7164.40	-7122.00
	(153.14)	(174.83)	(258.68)	(373.23)
a	-5581.20	-5438.50	-1689.00	-1676.90
	(186.42)	(406.24)	(503.62)	(442.61)
γ	731.65	710.85	467.71	499.96
	(15.72)	(15.20)	(57.02)	(40.67)

NOTE: All parameters estimates presented in the table are obtained using data from the period before the introduction of SP in the municipality of residence of individuals. The exception is γ, which, conditional on the estimate for a, is obtained from the period after the introduction of SP. The bootstrap standard errors in parenthesis are computed from 50 replications.

Table 7: Counterfactual Experiments: Effects of changing the utility value of having HI outside the formal sector (γ) on stocks and welfare.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Panel A Low Educ, No Risk Aversion				Panel B Low Educ, Risk Aversion				Panel C High Educ, No Risk Aversion				Panel D High Educ, Risk Aversion			
	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$
Stocks (p.p)																
m_{ff}	-0.176	-0.787	-1.438	-2.098	-0.134	-0.762	-1.342	-2.012	-0.109	-0.930	-1.868	-3.802	-0.128	-0.912	-1.982	-4.404
m_{fi}	-0.281	-1.419	-2.610	-3.062	-0.240	-1.478	-2.594	-2.918	-0.077	-0.396	-0.854	-1.851	-0.101	-0.509	-1.056	-2.221
m_{fn}	-0.751	-3.911	-6.325	-8.872	-0.794	-3.754	-6.299	-9.122	-0.176	-1.131	-2.638	-5.837	-0.184	-1.346	-2.926	-6.488
m_{if}	-0.095	-0.548	-1.248	-2.338	-0.056	-0.495	-1.119	-2.350	-0.108	-0.294	-0.608	-1.266	-0.088	-0.270	-0.366	-0.556
m_{nf}	-0.025	-0.162	-0.344	-0.656	-0.041	-0.154	-0.355	-0.723	-0.006	-0.017	-0.014	0.010	-0.004	-0.016	-0.015	0.029
m_{ii}	0.165	0.745	0.499	-0.729	0.178	0.825	0.564	-0.077	0.025	0.462	1.176	2.469	0.112	0.507	1.168	2.654
m_{in}	1.236	6.240	12.014	16.067	1.129	5.977	11.640	14.870	0.498	2.363	4.636	9.426	0.414	2.593	5.085	9.973
m_{ni}	0.029	0.207	0.452	1.523	0.028	0.194	0.442	1.633	0.010	0.057	0.151	0.390	0.010	0.065	0.163	0.472
m_{nn}	-0.102	-0.365	-0.999	0.166	-0.068	-0.352	-0.937	0.699	-0.055	-0.114	0.019	0.461	-0.031	-0.112	-0.072	0.540
Household informality (p.p.)	1.328	6.828	11.966	17.027	1.267	6.644	11.709	17.125	0.477	2.768	5.982	12.746	0.505	3.053	6.345	13.639
Nonemployment – head (p.p.)	-0.098	-0.319	-0.891	1.033	-0.081	-0.312	-0.850	1.609	-0.052	-0.075	0.156	0.860	-0.025	-0.063	0.077	1.041
Nonemployment – spouse (p.p.)	0.383	1.964	4.690	7.361	0.267	1.871	4.404	6.447	0.267	1.118	2.017	4.050	0.199	1.135	2.087	4.025
Welfare workers: average (%)	6.063	32.585	68.824	151.490	6.118	32.897	69.263	153.866	1.425	7.502	16.488	36.508	1.486	8.492	18.627	42.449
Welfare per sector – head (%)																
formal sector	2.591	15.858	30.240	32.249	2.322	15.273	29.951	30.319	0.651	3.261	7.339	15.246	0.508	3.607	7.826	16.374
informal sector	7.020	35.314	73.384	166.590	7.182	35.682	73.747	168.025	2.110	11.096	22.882	48.223	2.439	12.423	25.749	54.890
nonemployment	13.400	73.917	144.224	323.661	13.090	72.323	138.223	334.435	5.769	33.401	85.310	186.750	5.798	36.347	89.249	212.867
Welfare per sector – spouse (%)																
formal sector	3.073	17.802	38.790	74.780	3.386	18.409	40.395	79.246	0.583	3.107	6.791	14.612	0.452	3.123	7.345	18.112
informal sector	6.952	36.335	75.764	162.792	7.015	37.014	76.511	169.065	1.592	8.305	18.530	41.288	1.454	8.879	20.068	46.338
nonemployment	6.305	33.753	70.780	155.173	6.292	33.792	70.736	156.261	1.882	9.865	21.250	45.967	1.993	10.975	23.439	51.740

NOTE: Changes are in relation to benchmark levels (pre-SP period, where γ is set to 0).

Table 8: Counterfactual Experiments: Effects of changing the utility value of having HI outside the formal sector (γ) on the distribution of wages.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Panel A Low Educ, No Risk Aversion				Panel B Low Educ, Risk Aversion				Panel C High Educ, No Risk Aversion				Panel D High Educ, Risk Aversion			
	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$
Head: Formal Sector (%)																
10th	0.000	0.000	0.000	-10.507	0.000	0.000	0.000	-9.340	0.000	0.000	0.000	6.360	0.000	0.000	0.000	0.000
25th	-7.400	0.000	-7.396	-15.336	-6.800	-6.800	-6.800	-21.970	0.000	0.000	0.000	0.000	5.070	5.070	5.070	5.070
50th	0.000	0.000	0.000	-18.011	0.000	0.000	-5.340	-16.980	0.000	0.000	3.841	3.740	0.000	0.000	0.000	3.740
75th	0.000	4.193	0.000	-8.924	0.000	0.000	0.000	-8.620	0.000	0.000	3.008	3.000	0.000	0.000	0.000	3.000
90th	0.000	3.423	0.000	-7.200	0.000	3.370	0.000	-7.090	0.000	0.000	0.000	2.500	0.000	0.000	0.000	2.500
Mean	-0.050	1.120	-1.140	-10.390	-0.480	0.020	-2.500	-11.940	0.130	0.660	1.690	2.990	0.150	0.780	1.510	2.670
Head: Informal Sector (%)																
10th	0.000	0.000	0.000	22.836	0.000	0.000	0.000	22.836	0.000	0.000	0.000	-18.476	0.000	0.000	0.000	-15.640
25th	0.000	0.000	-15.640	0.000	0.000	0.000	-18.476	0.000	0.000	-9.620	-9.620	-22.708	0.000	-9.620	-9.620	-20.260
50th	0.000	-9.782	-20.260	-22.708	0.000	-9.620	-22.708	-22.708	0.000	-6.100	-6.100	-13.450	0.000	-6.100	-6.100	-19.530
75th	0.000	-7.515	-14.400	-15.594	0.000	-6.940	-15.594	-15.594	0.000	-4.280	-4.280	-13.815	0.000	-4.280	-4.280	-13.410
90th	0.000	-5.733	-5.430	-11.803	0.000	-5.160	-5.733	-11.803	-3.290	-3.290	-6.690	-10.247	0.000	0.000	-3.400	-6.920
Mean	-0.850	-5.450	-10.790	-9.320	-0.690	-5.160	-10.640	-8.790	-0.410	-2.140	-4.750	-10.520	-0.470	-2.440	-5.330	-11.730
Spouse: Formal Sector (%)																
10th	0.000	0.000	0.000	10.093	0.000	9.810	26.950	18.750	0.000	0.000	-6.800	0.000	0.000	0.000	0.000	0.000
25th	0.000	0.000	0.000	14.970	0.000	0.000	7.050	13.630	0.000	0.000	-5.340	0.000	0.000	0.000	0.000	0.000
50th	0.000	0.000	17.209	16.729	0.000	0.000	5.500	15.660	0.000	0.000	0.000	-4.176	0.000	-4.050	-4.050	-4.050
75th	0.000	0.000	10.644	13.539	0.000	0.000	4.510	12.950	0.000	3.060	0.000	-3.178	0.000	-3.160	-3.160	-3.160
90th	0.000	0.000	0.000	7.388	0.000	0.000	3.820	11.040	0.000	0.000	2.600	0.000	0.000	0.000	-2.600	-2.600
Mean	0.030	1.920	6.010	12.800	0.070	1.700	5.790	14.060	-0.070	-0.510	-1.330	-2.590	-0.440	-1.970	-3.250	-2.310
Spouse: Informal Sector (%)																
10th	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25th	0.000	0.000	0.000	-49.527	0.000	0.000	0.000	-49.527	0.000	0.000	0.000	27.015	0.000	0.000	0.000	0.000
50th	0.000	0.000	15.310	-21.504	0.000	0.000	14.209	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.390	10.390
75th	0.000	0.000	9.490	10.644	0.000	0.000	10.644	10.644	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
90th	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mean	0.500	1.660	4.780	-1.910	-0.110	1.750	3.990	-2.630	0.340	0.460	0.480	1.050	-0.010	0.020	0.420	1.270

NOTE: Changes are in relation to benchmark levels (pre-SP period, where γ is set to 0).

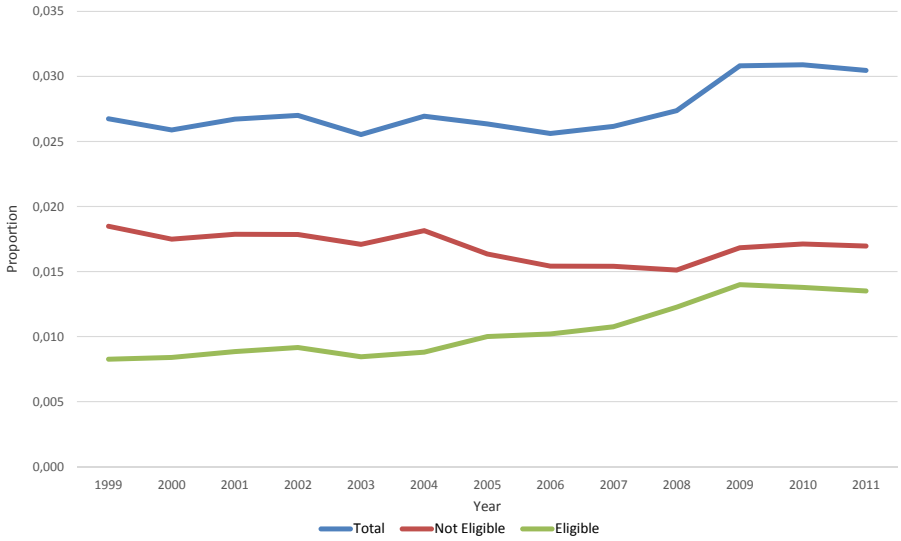
The Value of Health Insurance: A Household Job Search Approach

Gabriella Conti, Rita Ginja, & Renata Narita

ONLINE APPENDIX

A Additional Figures and Tables

Figure A.1: Public Expenditure on Health, Overall and by SP Eligibility Group



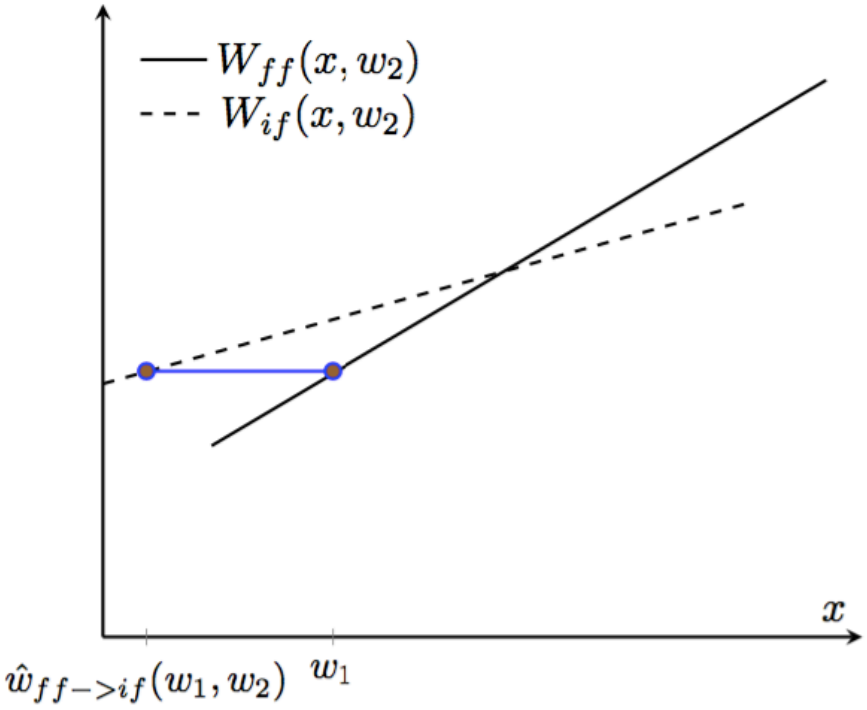
Note: The figure shows the ratio of public expenditure on health to GDP, overall and by SP eligibility group. The total public expenditure on health is the sum of the public expenditure for the insured population (not eligible to SP), i.e. those affiliated with IMSS (*Instituto Mexicano del Seguro Social*), ISSSTE (*Instituto de Seguridad y Servicios Sociales de los Trabajadores del Estado*) and PEMEX (*Petroleos Mexicanos*), and for the uninsured population (eligible to SP). This latter includes both federal and state expenditures, where the former combines resources assigned to (1) the Ministry of Health (*Ramo 12*), (2) the FASSA (*Fondo de Aportaciones para los Servicios de Salud, Ramo 33*) - these two constitute the *Aportaciones Federales* - or other health services funds; and (3) the IMSS-Oportunidades (*Ramo 19*). Source: own calculations from the official budget.

Figure A.2: Year of implementation of SP by municipality.

NOT INCLUDED TO SAVE SPACE

NOTE: Own calculations from the *Padron*.

Figure A.3: Two Value Functions and the Reservation Wage



NOTE: The graph displays the value functions for the case in which both spouses initially work in the formal sector.

Table A.1: Expenditures in Health and Health Insurance.

	High Education		**Low Education**	
	Before 2002	After 2008	Before 2002	After 2008
Households without children 0-14	1,678	4,124	1,809	2,640
Health Insurance (HI) Expenditure	27.83	106.56	9.37	19.41
Health Expenditure	906.30	1067.98	561.87	402.98
Proportion without Expenditures on HI	0.99	0.97	0.99	0.99
Proportion without Expenditures on Health	0.46	0.42	0.47	0.47
Ratio (Expenditures HI/Total Expenditures)	0.00	0.00	0.00	0.00
Ratio (Expenditures Health/Total Expenditures)	0.02	0.02	0.03	0.02
Total Expenditures	38130.11	33166.34	16297.85	15622.73
Households with children 0-14	4,634	9,121	5,256	6,433
Health Insurance (HI) Expenditure	20.62	74.19	1.29	7.32
Health Expenditure	879.05	855.96	485.45	437.10
Proportion without Expenditures on HI	0.99	0.99	1.00	0.99
Proportion without Expenditures on Health	0.37	0.37	0.42	0.44
Ratio (Expenditures HI/Total Expenditures)	0.00	0.00	0.00	0.00
Ratio (Expenditures Health/Total Expenditures)	0.02	0.02	0.03	0.02
Total Expenditures	30769.35	28473.93	15806.98	16745.68

NOTE: The table is constructed using data from the Household Income and Expenditure Survey (*Encuesta Nacional de Ingresos y Gastos de los Hogares*) for the years of 2002 (before SP) and 2008 (post SP). This survey is available biannually. A household belongs to the "high education" group if the head has more than six years of education. All monetary values are deflated to the first quarter of 2011 using the CPI of Banco de Mexico.

Table A.2: Counterfactual Experiments: Effects of changing the utility value of having HI outside the formal sector (γ) on transitions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A Low Educ, No Risk Aversion		Panel B Low Educ, Risk Aversion		Panel C High Educ, No Risk Aversion		Panel D High Educ, Risk Aversion	
	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$
Transitions: Head (p.p.)								
Nonemployment-Formal	-2.801	-8.758	-2.795	-9.254	-1.200	-4.696	-1.257	-5.707
Nonemployment-Informal	0.472	-2.628	0.460	-2.402	0.300	1.126	0.325	1.426
Formal-Nonemployment	-0.229	-0.306	-0.228	-0.293	-0.035	-0.077	-0.040	-0.089
Formal-Informal	15.947	21.341	15.889	20.450	3.424	7.521	3.981	8.767
Informal-Nonemployment	0.005	0.000	0.005	0.003	0.005	0.011	0.007	0.017
Informal-Formal	-0.162	-0.002	-0.187	-0.089	-0.242	-0.507	-0.315	-0.776
Nonemployment-Informal, if spouse looses formal job	3.238	5.000	3.431	5.132	0.528	1.261	0.558	1.237
Nonemployment-Informal, if spouse looses informal job	0.215	-0.082	0.204	-0.078	0.165	0.233	0.167	0.244
Transitions: Spouse (p.p.)								
Nonemployment-Formal	-0.872	-1.283	-0.822	-1.246	-0.156	-0.449	-0.230	-0.876
Nonemployment-Informal	-2.504	-3.507	-2.367	-2.827	-0.478	-0.776	-0.533	-1.286
Formal-Nonemployment	-0.158	-0.261	-0.101	-0.196	-0.094	-0.161	0.051	-0.001
Formal-Informal	0.291	1.496	0.103	1.221	1.416	2.545	0.858	1.727
Informal-Nonemployment	0.102	0.390	0.093	0.440	0.221	0.449	0.309	0.507
Informal-Formal	-1.062	-2.309	-0.863	-2.371	-1.024	-2.050	-0.828	-1.720
Nonemployment-Informal, if head looses formal job	-9.003	-7.618	-8.937	-7.416	-8.568	-8.382	-8.381	-8.011
Nonemployment-Informal, if head looses informal job	-5.730	-5.729	-5.699	-5.717	-4.094	-4.085	-3.982	-3.959

NOTE: Changes are in relation to benchmark levels (pre-SP period, where γ is set to 0).

Table A.3: Counterfactual Experiments: Effects of changing the utility value of having HI outside the formal sector (γ) - on profits.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Panel A Low Educ, No Risk Aversion				Panel B Low Educ, Risk Aversion				Panel C High Educ, No Risk Aversion				Panel D High Educ, Risk Aversion			
	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$
Profit per sector - head (%)																
Formal sector	-4.789	-23.195	-33.135	-37.285	-3.418	-21.233	-31.194	-36.228	-1.359	-8.017	-15.848	-26.786	-1.208	-9.279	-16.270	-28.732
Informal sector	2.826	13.722	25.935	15.314	2.741	13.477	25.639	14.388	1.293	7.574	16.150	34.953	1.318	8.333	18.062	39.548
Profit per sector - spouse (%)																
Formal sector	-4.970	-29.531	-53.610	-79.064	-3.032	-27.502	-51.226	-79.152	-0.612	-5.792	-12.498	-29.787	-0.832	-5.070	-11.517	-31.670
Informal sector	-1.102	-2.786	-8.883	-8.151	-1.256	-3.526	-9.127	-3.598	-0.211	1.008	3.394	6.859	0.141	0.423	1.687	5.656

NOTE: Changes are in relation to benchmark levels (pre-SP period, where γ is set to 0).

Table A.4: Counterfactual Experiments: Effects of changing the utility value of having HI outside the formal sector (γ) on firm size

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Panel A Low Educ, No Risk Aversion				Panel B Low Educ, Risk Aversion				Panel C High Educ, No Risk Aversion				Panel D High Educ, Risk Aversion			
	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$
Head: Formal Sector (%)																
10th	0.040	-28.194	-21.565	-5.029	1.400	-26.147	-18.990	-3.854	-0.300	-7.587	-10.327	-36.193	0.944	-6.863	-7.983	-33.615
25th	-1.134	-18.364	-31.791	-18.584	0.260	-15.777	-29.334	-17.370	-4.123	-7.124	-13.498	-43.289	-3.430	-6.275	-12.497	-45.311
50th	2.685	-24.761	-37.600	-43.244	-6.162	-22.787	-36.473	-42.891	0.085	-6.311	-11.931	-23.959	-4.573	-6.618	-15.847	-28.016
75th	-8.671	-29.022	-43.130	-60.331	-4.381	-24.187	-40.016	-58.205	-2.576	-5.162	-13.006	-24.113	-2.450	-7.651	-16.129	-26.299
90th	-0.469	-20.790	-43.140	-61.363	-4.906	-22.618	-40.490	-60.053	0.461	-2.290	-7.328	-18.613	-1.385	-3.719	-8.940	-24.132
Mean	-4.877	-22.049	-36.934	-49.741	-4.712	-21.684	-36.598	-50.018	-0.840	-5.001	-10.769	-22.942	-0.822	-5.523	-11.904	-26.174
Head: Informal Sector (%)																
10th	4.519	25.403	64.109	-92.946	3.252	24.226	63.160	-93.926	0.260	4.112	15.650	54.759	0.391	3.417	16.567	64.411
25th	3.676	26.795	55.554	121.963	3.790	23.392	56.408	116.556	1.167	8.350	24.483	64.066	0.441	13.122	30.434	78.247
50th	5.414	25.225	45.255	76.956	4.577	25.879	44.914	76.632	1.177	15.177	29.303	52.585	4.540	13.428	27.554	58.472
75th	3.654	10.780	11.627	18.826	1.698	6.660	7.114	13.378	-0.723	4.868	12.567	23.637	3.650	8.877	16.658	27.988
90th	0.940	-2.923	-9.353	-9.363	-0.217	-2.426	-9.324	-9.094	-0.422	1.673	3.421	1.940	0.836	2.200	3.403	1.754
Mean	2.519	11.198	19.364	22.300	2.438	10.970	19.035	21.326	1.176	6.670	13.609	27.685	1.128	7.303	15.192	31.151
Spouse: Formal Sector (%)																
10th	-7.365	-71.249	-75.625	-83.987	-6.321	-40.637	-76.998	-84.072	0.702	-1.577	-4.744	-27.884	-1.292	1.542	-3.902	-30.733
25th	-6.714	-30.643	-79.921	-86.063	-4.839	-24.874	-78.936	-85.143	1.623	-1.528	-5.824	-23.003	2.122	1.298	-1.961	-23.578
50th	-5.927	-16.105	-38.609	-83.577	1.187	-14.299	-28.866	-87.200	-0.747	-5.134	-10.174	-23.333	-0.777	-5.550	-12.226	-29.777
75th	-4.915	-19.820	-43.351	-80.370	-3.033	-19.636	-39.541	-79.472	-3.892	-17.288	-25.398	-33.840	-0.767	-5.134	-11.122	-25.016
90th	-3.681	-15.490	-30.170	-54.470	-2.196	-16.105	-30.788	-52.895	-0.658	-8.506	-24.331	-47.868	-5.124	-23.141	-28.430	-37.898
Mean	-4.996	-22.658	-45.193	-75.506	-3.212	-20.747	-41.627	-75.345	-1.053	-7.367	-15.094	-31.012	-1.377	-7.506	-14.793	-30.863
Spouse: Informal Sector (%)																
10th	-9.471	-4.094	1.400	37.740	-8.066	-5.984	-0.598	41.949	-1.292	0.642	1.136	1.633	-0.020	0.070	-0.459	-0.070
25th	-12.759	-16.831	-21.855	4.436	-1.134	-13.108	-10.747	20.804	-0.827	-0.985	2.173	3.490	0.733	0.451	0.060	1.755
50th	2.891	-4.142	-24.656	-19.780	4.039	-3.198	-25.584	-17.304	0.471	1.400	4.728	8.535	0.924	1.025	3.634	8.112
75th	2.265	0.944	-5.955	-37.155	-2.547	-4.849	-6.031	-24.731	-0.399	1.238	4.519	9.593	0.220	-0.876	1.928	9.867
90th	-0.130	0.511	2.963	-8.972	-1.499	2.675	0.070	-8.241	-1.262	1.369	3.510	8.883	-0.200	1.066	3.552	8.665
Mean	-0.134	-2.243	-8.881	-12.265	-0.470	-2.821	-9.067	-7.817	-0.087	1.119	3.656	7.551	0.151	0.454	1.983	6.518

NOTE: Changes are in relation to benchmark levels (pre-SP period, where γ is set to 0).

Table A.5: Counterfactual Experiments: Effects of changing the utility value of having HI outside the formal sector (γ) - **exogenous wages**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Panel A Low Educ, No Risk Aversion				Panel B Low Educ, Risk Aversion				Panel C High Educ, No Risk Aversion				Panel D High Educ, Risk Aversion			
	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$
Stocks (p.p)																
m_{ff}	-0.218	-0.829	-1.479	-2.140	-0.138	-0.766	-1.346	-2.016	-0.090	-0.911	-1.849	-3.783	-0.128	-0.912	-1.982	-4.404
m_{fi}	-0.288	-1.426	-2.617	-3.069	-0.234	-1.472	-2.588	-2.911	-0.088	-0.407	-0.866	-1.862	-0.101	-0.509	-1.056	-2.221
m_{fn}	-0.888	-4.048	-6.462	-9.009	-0.969	-3.929	-6.474	-9.297	-0.245	-1.200	-2.707	-5.906	-0.184	-1.346	-2.926	-6.488
m_{if}	-0.094	-0.547	-1.248	-2.337	-0.044	-0.484	-1.107	-2.338	-0.077	-0.263	-0.576	-1.235	-0.088	-0.270	-0.366	-0.556
m_{nf}	-0.028	-0.165	-0.348	-0.659	-0.034	-0.146	-0.348	-0.715	-0.002	-0.014	-0.010	0.014	-0.004	-0.016	-0.015	0.029
m_{ii}	0.208	0.788	0.542	-0.686	0.102	0.749	0.488	-0.153	0.065	0.503	1.217	2.509	0.112	0.507	1.168	2.654
m_{in}	1.376	6.380	12.154	16.207	1.388	6.236	11.899	15.129	0.465	2.330	4.603	9.393	0.414	2.593	5.085	9.973
m_{ni}	0.057	0.236	0.480	1.551	0.047	0.213	0.461	1.651	0.011	0.058	0.152	0.392	0.010	0.065	0.163	0.472
m_{nn}	-0.125	-0.387	-1.022	0.143	-0.117	-0.401	-0.986	0.650	-0.038	-0.097	0.036	0.478	-0.031	-0.112	-0.072	0.540
Household informality (p.p.)	1.52	7.02	12.15	17.22	1.42	6.80	11.86	17.28	0.50	2.79	6.01	12.77	0.51	3.05	6.34	13.64
Nonemployment – head (p.p.)	-0.10	-0.32	-0.89	1.04	-0.10	-0.34	-0.87	1.59	-0.03	-0.05	0.18	0.88	-0.02	-0.06	0.08	1.04
Nonemployment – spouse (p.p.)	0.36	1.94	4.67	7.34	0.30	1.91	4.44	6.48	0.18	1.03	1.93	3.96	0.20	1.13	2.09	4.03
Mean Wage:																
Head: Formal Sector (%)	-0.240	0.930	-1.330	-10.580	-0.400	0.100	-2.420	-11.860	0.190	0.720	1.750	3.050	0.150	0.780	1.510	2.670
Head: Informal Sector (%)	-0.560	-5.160	-10.500	-9.030	-0.960	-5.430	-10.910	-9.060	-0.350	-2.080	-4.690	-10.460	-0.470	-2.440	-5.330	-11.730
Spouse: Formal Sector (%)	-0.140	1.750	5.840	12.630	0.060	1.690	5.780	14.050	-0.130	-0.570	-1.390	-2.650	-0.440	-1.970	-3.250	-2.310
Spouse: Informal Sector (%)	1.460	2.620	5.740	-0.950	1.120	2.980	5.220	-1.400	0.140	0.260	0.280	0.850	-0.010	0.020	0.420	1.270
Welfare – average %	5.786	32.239	68.383	150.833	5.990	32.737	69.059	153.560	1.297	7.367	16.341	36.336	1.486	8.492	18.627	42.449
Welfare per sector – head %																
formal sector	2.184	15.399	29.724	31.725	2.576	15.559	30.274	30.643	0.552	3.159	7.234	15.132	0.508	3.607	7.826	16.374
informal sector	6.925	35.194	73.229	166.353	6.897	35.322	73.286	167.313	1.956	10.929	22.697	48.000	2.439	12.423	25.749	54.890
nonemployment	11.783	71.437	140.742	317.621	12.218	70.994	136.387	331.085	5.933	33.607	85.597	187.194	5.798	36.347	89.249	212.867
Welfare per sector – spouse %																
formal sector	2.717	17.396	38.312	74.177	3.334	18.350	40.326	79.157	0.417	2.938	6.615	14.423	0.452	3.123	7.345	18.112
informal sector	6.634	35.930	75.241	162.010	7.169	37.211	76.765	169.453	1.243	7.933	18.123	40.802	1.454	8.879	20.068	46.338
nonemployment	6.074	33.463	70.410	154.620	6.083	33.529	70.401	155.758	1.759	9.732	21.104	45.791	1.993	10.975	23.439	51.740

Note: Changes are in relation to benchmark levels (pre-SP period, where γ is set to 0).

B Other Value Functions

Spouse 2 works in the formal sector and spouse 1 does not work The value function $W_{nf}(w_2)$ is similar to that for a household where the head works in the formal sector and the spouse is non-employed ($W_{fn}(w_1)$). There is only an exchange in the status between spouses 1 and 2:

$$\begin{aligned}
rW_{nf}(w_2) = w_2 + b_1 + a + \delta_f^{s_2}(1-p^{s_1})\left(W_{nn} - W_{nf}(w_2)\right) + \\
\delta_f^{s_2} p^{s_1} \int \max\left\{W_{in}(x) - W_{nf}(w_2), W_{nn} - W_{nf}(w_2)\right\} dF_i^{s_1}(x) + \\
\lambda_{ff}^{s_2} \int \max\left\{W_{nf}(x) - W_{nf}(w_2), 0\right\} dF_f^{s_2}(x) + \\
\lambda_{fi}^{s_2} \int \max\left\{W_{ni}(x) - W_{nf}(w_2), 0\right\} dF_i^{s_2}(x) + \\
\lambda_{nf}^{s_1} \int \max\left\{W_{ff}(x, w_2) - W_{nf}(w_2), 0\right\} dF_f^{s_1}(x) + \\
\lambda_{ni}^{s_1} \int \max\left\{W_{if}(x, w_2) - W_{nf}(w_2), 0\right\} dF_i^{s_1}(x)
\end{aligned}$$

where p^{s_1} is the probability that spouse 1 moves from nonemployment to informality given that spouse 2 moves from a formal job to nonemployment.

Spouse 2 works in the informal sector and spouse 1 does not work The value function $W_{ni}(w_2)$ is similar to that for a household where the head works in the informal sector and the spouse is non-employed ($W_{in}(w_1)$). There is only an exchange in the status between spouses 1 and 2:

$$\begin{aligned}
rW_{ni}(w_2) = w_2 + b_1 + \gamma + \delta_i^{s_2}(1-q^{s_1})\left(W_{nn} - W_{ni}(w_2)\right) + \\
\delta_i^{s_2} q^{s_1} \int \max\left\{W_{in}(x) - W_{ni}(w_2), W_{nn} - W_{ni}(w_2)\right\} dF_i^{s_1}(x) + \\
\lambda_{ii}^{s_2} \int \max\left\{W_{ni}(x) - W_{ni}(w_2), 0\right\} dF_i^{s_2}(x) + \\
\lambda_{if}^{s_2} \int \max\left\{W_{nf}(x) - W_{ni}(w_2), 0\right\} dF_f^{s_2}(x) + \\
\lambda_{nf}^{s_1} \int \max\left\{W_{fi}(x, w_2) - W_{ni}(w_2), 0\right\} dF_f^{s_1}(x) + \\
\lambda_{ni}^{s_1} \int \max\left\{W_{ii}(x, w_2) - W_{ni}(w_2), 0\right\} dF_i^{s_1}(x)
\end{aligned}$$

where q^{s_1} is the probability that spouse 1 moves from nonemployment to informal given that spouse 2 moves from an informal job to nonemployment.

Spouse 1 works in the formal sector and spouse 2 works in the informal sector This is a household with Social Security coverage.

$$
\begin{aligned}
rW_{fi}(w_1, w_2) = \mathtt{u}(w_1 + w_2) + a + \delta_f^{s_1}\left(W_{ni}(w_2) - W_{fi}(w_1, w_2)\right) + \\
\delta_i^{s_2}\left(W_{fn}(w_1) - W_{fi}(w_1, w_2)\right) + \\
\lambda_{ff}^{s_1} \int \max\left\{W_{fi}(x, w_2) - W_{fi}(w_1, w_2), 0\right\} dF_f^{s_1}(x) + \\
\lambda_{fi}^{s_1} \int \max\left\{W_{ii}(x, w_2) - W_{fi}(w_1, w_2), 0\right\} dF_i^{s_1}(x) + \\
\lambda_{ii}^{s_2} \int \max\left\{W_{fi}(w_1, x) - W_{fi}(w_1, w_2), 0\right\} dF_i^{s_2}(x) + \\
\lambda_{if}^{s_2} \int \max\left\{W_{ff}(w_1, x) - W_{fi}(w_1, w_2), 0\right\} dF_f^{s_2}(x).
\end{aligned}
$$

Head and spouse may have his/her job destroyed at rate $\delta_f^{s_1}$ and $\delta_i^{s_2}$, respectively. The head receives job offers from the formal or informal sector at rates $\lambda_{ff}^{s_1}$ or $\lambda_{fi}^{s_1}$, respectively; the spouse receives job offers from the informal sector or formal sector at rates $\lambda_{ii}^{s_2}$ or $\lambda_{if}^{s_2}$, respectively.

Spouse 1 works in the informal sector and spouse 2 works in the formal sector The value function for a household where spouse 2 works in the formal sector and spouse 1 works in the informal sector is given by:

$$
\begin{aligned}
rW_{if}(w_1, w_2) = \mathtt{u}(w_1 + w_2) + a + \delta_i^{s_1}\left(W_{nf}(w_2) - W_{if}(w_1, w_2)\right) + \\
\delta_f^{s_2}\left(W_{in}(w_1) - W_{if}(w_1, w_2)\right) + \\
\lambda_{ii}^{s_1} \int \max\left\{W_{if}(x, w_2) - W_{if}(w_1, w_2), 0\right\} dF_i^{s_1}(x) + \\
\lambda_{if}^{s_1} \int \max\left\{W_{ff}(x, w_2) - W_{if}(w_1, w_2), 0\right\} dF_f^{s_1}(x) + \\
\lambda_{ff}^{s_2} \int \max\left\{W_{if}(w_1, x) - W_{if}(w_1, w_2), 0\right\} dF_f^{s_2}(x) + \\
\lambda_{fi}^{s_2} \int \max\left\{W_{ii}(w_1, x) - W_{if}(w_1, w_2), 0\right\} dF_i^{s_2}(x)
\end{aligned}
$$

C Identification and Estimation

C.1 The value of leisure, the value of amenities in the formal sector, and the value of health insurance by SP

From the restrictions imposed in the model $W_{ni}(\underline{w}_2^i) = W_{nn}$, $W_{in}(\underline{w}_1^i) = W_{ii}(\underline{w}_1^i, \underline{w}_2^i)$, and $W_{in}(\underline{w}_1^i) = W_{fn}(\underline{w}_1^f)$, we obtain b_1, b_2, a and γ, respectively. Under the restriction $\gamma = 0$, i.e before SP, the parameters a, b_1 and b_2 are:

$$
\begin{aligned}
b_1 &= rW_{nn} - \underline{w}_2^i - A \\
b_2 &= rW_{ii}(\underline{w}_1^i, \underline{w}_2^i) - \underline{w}_1^i - B \\
a &= rW_{in}(\underline{w}_1^i) - b_2 - \underline{w}_1^f - C
\end{aligned}
$$

where

$$
\begin{aligned}
A = \delta_i^{s_2} q^{s_1} & \int \max\left\{W_{in}(x) - W_{ni}(\underline{w}_2), 0\right\} dF_i^{s_1}(x) + \\
& \lambda_{ii}^{s_2} \int \max\left\{W_{ni}(x) - W_{ni}(\underline{w}_2), 0\right\} dF_i^{s_2}(x) + \\
& \lambda_{if}^{s_2} \int \max\left\{W_{nf}(x) - W_{ni}(\underline{w}_2), 0\right\} dF_f^{s_2}(x) + \\
& \lambda_{nf}^{s_1} \int \max\left\{W_{fi}(x, \underline{w}_2) - W_{ni}(\underline{w}_2), 0\right\} dF_f^{s_1}(x) + \\
& \lambda_{ni}^{s_1} \int \max\left\{W_{ii}(x, \underline{w}_2) - W_{ni}(\underline{w}_2), 0\right\} dF_i^{s_1}(x)
\end{aligned}
$$

$$
\begin{aligned}
B = \delta_i^{s_1}(1 - q^{s_2}) & \left(W_{nn} - W_{in}(\underline{w}_1)\right) + \\
& \delta_i^{s_1} q^{s_2} \int \max\left\{W_{ni}(x) - W_{in}(\underline{w}_1), W_{nn} - W_{in}(\underline{w}_1)\right\} dF_i^{s_2}(x) + \\
& \lambda_{ii}^{s_1} \int \max\left\{W_{in}(x) - W_{in}(\underline{w}_1), 0\right\} dF_i^{s_1}(x) + \\
& \lambda_{if}^{s_1} \int \max\left\{W_{fn}(x) - W_{in}(\underline{w}_1), 0\right\} dF_f^{s_1}(x) + \\
& \lambda_{nf}^{s_2} \int \max\left\{W_{if}(\underline{w}_1, x) - W_{in}(\underline{w}_1), 0\right\} dF_f^{s_2}(x) + \\
& \lambda_{ni}^{s_2} \int \max\left\{W_{ii}(\underline{w}_1, x) - W_{in}(\underline{w}_1), 0\right\} dF_i^{s_2}(x)
\end{aligned}
$$

$$
\begin{aligned}
C = {} & \delta_f^{s_1}(1-p^{s_2})\left(W_{nn} - W_{fn}(\underline{w}_1)\right) + \\
& \delta_f^{s_1} p^{s_2} \int \max\left\{W_{ni}(x) - W_{fn}(\underline{w}_1), W_{nn} - W_{fn}(\underline{w}_1)\right\} dF_i^{s_2}(x) + \\
& \lambda_{ff}^{s_1} \int \max\left\{W_{fn}(x) - W_{fn}(\underline{w}_1), 0\right\} dF_f^{s_1}(x) + \\
& \lambda_{fi}^{s_1} \int \max\left\{W_{in}(x) - W_{fn}(\underline{w}_1), 0\right\} dF_i^{s_1}(x) + \\
& \lambda_{nf}^{s_2} \int \max\left\{W_{ff}(\underline{w}_1, x) - W_{fn}(\underline{w}_1), 0\right\} dF_f^{s_2}(x) + \\
& \lambda_{ni}^{s_2} \int \max\left\{W_{fi}(\underline{w}_1, x) - W_{fn}(\underline{w}_1), 0\right\} dF_i^{s_2}(x)
\end{aligned}
$$

Given a, b_1 and b_2 estimated using data before SP, γ is obtained using data from a period after the SP implementation:

$$\gamma = rW_{fn}(\underline{w}_1^f) - b_2 - \underline{w}_1^i - B$$

C.2 Implementation of the value functions

We use integration by parts to obtain the Emax functions in terms of the F distributions and the transition parameters. We first re-write the integrals to eliminate the max function. For example:

$$\int \max\left\{W_{in}(x) - W_{fn}(w_1), 0\right\} dF_i^{s_1}(x) = \int_{\hat{w}_{fn->in}(w_1)}^{\infty} \left(W_{in}(x) - W_{fn}(w_1)\right) dF_i^{s_1}(x)$$

Then we use the definition of reservation wage so that $W_{in}(\hat{w}_{fn->in}(w_1)) = W_{fn}(w_1)$. We also differentiate the value function $W_{in}(w_1)$ with respect to w_1

$$
\begin{aligned}
W_{in}'(w_1) = {} & [r + \delta_i^{s_1}(1-q^{s_2}) + \delta_i^{s_1} q^{s_2} \overline{F}_i^{s_2}\left(\hat{w}_{in->ni}(w_1)\right) + \\
& \lambda_{ii}^{s_1} \overline{F}_i^{s_1}\left(w_1\right) + \\
& \lambda_{if}^{s_1} \overline{F}_f^{s_1}\left(\hat{w}_{in->fn}(w_1)\right) + \\
& \lambda_{nf}^{s_2} \overline{F}_f^{s_2}\left(\hat{w}_{in->if}(w_1)\right) + \\
& \lambda_{ni}^{s_2} \overline{F}_i^{s_2}\left(\hat{w}_{in->ii}(w_1)\right)]^{-1}
\end{aligned}
$$

The above integral becomes:

$$\int_{\hat{w}_{fn->in}(w_1)}^{\infty} \left(W_{in}(x) - W_{fn}(w_1)\right) dF_i^{s_1}(x) = \int_{\hat{w}_{fn->in}(w_1)}^{\infty} \overline{F}_i^{s_1}\left(x\right) W_{in}'(x) dx$$

C.3 Transition parameters

Given F_f^s and F_i^s ($s = s_1, s_2$), we estimate the transition rates using method of moments. We follow the individual from the first interview to the next quarter (second interview), and we obtain a measure for average transition from the data $\widetilde{D}_{j\ell};\ j, \ell = n, f, i$, which is the probability of transition conditional to status j at the first interview. We assume remaining durations can be exponentially distributed, and we construct the theoretical counterpart for this measure, $D_{j\ell}$, as follows:

- Transitions to nonemployment:

$$D_{jn}^s = \int \frac{\delta_j^s}{d_j^s(x)}(1 - e^{-d_j^s(x)\times 1})dG_j^s(x),\ j = f, i$$

where $d_j^s(w_1) = \delta_j^s + \lambda_{jj}^s \overline{F}_j^s(w_1) + \lambda_{jk}^s \sum_{j'=n,f,i} \int \overline{F}_k^s(\hat{w}_{jj'->kj'}(w_1, w_2))\frac{m_{jj'}}{m_j^s} g_{jj'}(w_1, w_2)dw_2$ is the total job separation rate. s indicates the spouse. $j, k = f, i$ with $j \neq k$, $m_j^{s_1} = \sum_{j'=n,f,i} m_{jj'}$ and $m_j^{s_2} = \sum_{j'=n,f,i} m_{j'j}$.

- Transitions out-of nonemployment:

$$D_{nf}^s = \frac{\lambda_{nf}^s \sum_{j=n,f,i} \int \overline{F}_f(\hat{w}_{nj->fj}(w_2))\frac{m_{nj}}{m_n} g_{nj}(w_2)dw_2}{a^s}(1 - e^{-a^s\times 1}),$$

$$D_{ni}^s = \frac{\lambda_{ni}^s \sum_{j=n,f,i} \int \overline{F}_i(\hat{w}_{nj->ij}(w_2))\frac{m_{nj}}{m_n} g_{nj}(w_2)dw_2}{a^s}(1 - e^{-a^s\times 1}),$$

$$D_{ni|s' \text{ had a } \delta_f \text{ shock}}^s = \frac{\delta_f^{s'} p^s \int \overline{F}_i(\hat{w}_{nf->in}(w_2))g_{nf}(w_2)dw_2}{a^s}(1 - e^{-a^s\times 1}),$$

$$D_{ni|s' \text{ had a } \delta_i \text{ shock}}^s = \frac{\delta_i^{s'} q^s \int \overline{F}_i(\hat{w}_{ni->in}(w_2))g_{ni}(w_2)dw_2}{a^s}(1 - e^{-a^s\times 1}),$$

where $a^s = \lambda_{nf}^s \sum_{j=n,f,i} \int \overline{F}_f(\hat{w}_{nj->fj}(w_2))\frac{m_{nj}}{m_n} g_{nj}(w_2)dw_2 + \lambda_{ni}^s \sum_{j=n,f,i} \int \overline{F}_i(\hat{w}_{nj->ij}(w_2))\frac{m_{nj}}{m_n} g_{nj}(w_2)dw_2 + \delta_f^{s'} p^s \int \overline{F}_i(\hat{w}_{nf->in}(w_2))g_{nf}(w_2)dw_2 + \delta_i^{s'} q^s \int \overline{F}_i(\hat{w}_{ni->in}(w_2))g_{ni}(w_2)dw_2$ is the total job acceptance rate for the nonemployed (this holds for the head, spouse 1, since we are integrating over the distribution of the spouse 2).

- Job-to-job transitions:

$$D_{jj} = \int \frac{\lambda_{jj}^s \overline{F}_j(x)}{d_j^s(x)}(1 - e^{-d_j^s(x)\times 1})dG_j^s(x),\ j = f, i,$$

$$D_{jk} = \int \frac{\lambda_{jk}^s \sum_{j'=n,f,i} \int \overline{F}_k^s(\hat{w}_{jj'->kj'}(x, w_2))\frac{m_{jj'}}{m_j} g_{jj'}(x, w_2)dw_2}{d_j^s(x)}(1 - e^{-d_j^s(x)\times 1})dG_j^s(x),\ j, k = f, i \text{ and } j \neq k$$

C.4 Estimation details

The implementation is as follows. For each guess of $\Im$, we obtain Λ and other objects and parameters of the model using fixed point iteration. Specifically, we

1. Define initial values for Λ,
2. Define initial values for the minimum and maximum support of the value functions,[18]
3. Calculate the reservation wages,
4. Obtain the values of leisure, formal sector amenities and health insurance post-reform using model restrictions,
5. Define initial values for $\frac{m_{jj'}}{m_{nn}} G_{jj'}(w_1, w_2)$,
6. Set w_1 and w_2 to infinity and the mass of couples across all joint states to one to obtain the stocks and the joint $G_{jj'}$ distributions separately,
7. Update $\frac{m_{jj'}}{m_{nn}} G_{jj'}(w_1, w_2)$ using the flow equations,
8. Update the value functions,
9. Update Λ using (8),
10. Repeat above steps for many combinations of $\Im$. Choose the one that solves (7).

To assess the fit of the model we construct the model stocks $m_{jj'}$ $(j, j' = n, f, i)$, the marginal $G_j(w)$ distributions and the transition probabilities, and check them against:

- the empirical proportion of households in the status jj' at the first interview date.
- the empirical individual wage distributions at the first interview date.
- the empirical transition probabilities.

[18] We interpolate them using Clenshaw-Curtis quadrature.

D Institutional Setup: Mexican pension system, taxes and child care

D.1 The Pension System

The current pension system is characterized by two parallel systems, where a contributory social security system, with a package of defined benefits for formal workers in the private and public sectors, coexists with a set of fragmented noncontributory services and benefits offered through diverse social protection programs to the population living in poverty, with low income, and in the informal sector of the economy.

The largest reform on the Social Security took place in 1997, when the IMSS (the Social Security system for workers in the private workers) switched the pay-as-you-go (PAYG) system to a fully funded system with personal retirement accounts (PRAs). The pension benefit depends on the amount accumulated and capitalized in an individual account (Aguila, 2014). Under the PAYG system the benefits can be claimed through normal or early retirement. There is no mandatory retirement age, but the normal retirement age is 65, and the IMSS requires at least 10 years (500 weeks) of contributions to retire under PAYG rules. Social security benefits are then computed as a proportion of the average wage in the 5 years before retirement, and benefits increase for each year of contribution beyond the required 10 years. There is also a minimum payment guarantee, which is equal to the minimum wage in Mexico City (to be entitled to this benefit, the worker must contribute for at least 1,250 weeks over his work life). The ISSSTE underwent a similar reform in 2007, however, the change to a fully funded scheme was voluntary for workers who were already active (Villagómez and Ramírez, 2015).

Since 2001 there are also several non-contributory programs for poor elderly over 60. In 2001 the government of the Federal District implemented the Nutritional Support, Medical Attention, and Free Medicines Program for the Elderly (*Programa de Apoyo Alimentario, Atención Médica y Medicamentos Gratuitos para Adultos Mayores*), covering elderly residents older than 70 in the poorest areas of the Distrito Federal (Villagómez and Ramírez, 2015). In 2003 the government introduced the program *Attention to the Elderly in Rural Areas* for individuals nonparticipants in any other social protection program like the *Opportunities*. The program targeted adults older than 60 living in nutritional poverty and resident poor rural communities with less than 2,500 inhabitants. Finally, the *Oportunidades* created in 2006 a complement to beneficiary families with adults older than 70.

D.2 Taxes

During most of the period in analysis there were no changes in the income or corporation taxes in Mexico. The exception was 2010, when a tax reform increased the marginal income tax rates for some workers but not others. Mexico operated a dual income tax system for business income where the taxpayer is liable to the higher of either the standard income tax (ISR) or a cashflow business tax called the *Impuesto Empresarial de Tasa Única* (IETU) from 2008 to 2013. The flat tax under IETU was not increased as part of the 2010 tax reform, whilst the top rates of ISR were (see Abramovsky and Philips, 2015).

D.3 Child Care for Children of Mother in the Formal and Informal Sectors

The government introduced in 2007 the program *Estancias Infantiles para Apoyar a Madres Trabajadoras*, which covers approximately 90 percent of the cost of enrolling a child under age four at a formal child care center and is intended to benefit women who are looking for work, in school, or working, that live in families without Social Security coverage. This program was expanded between 2007 and 2010.