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Non-Contributory Health Insurance and Household Labor Supply: Evidence from Mexico

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Abstract

Mexico introduced in 2002 a non-contributory health insurance scheme directed to the half of the country's population which was uncovered by Social Security protection (the *Seguro Popular*, SP). The implementation of SP in a municipality is associated with an increase in informality by 2 percentage points for low education families with children. To understand the mechanisms behind the program impact, we build a household search model which incorporates the value of SP program. The model is estimated using the Mexican Labor Force Survey and is able to replicate (1) the stocks of household types according to their Social Security coverage and (2) the transitions in and out of employment and between formal and informal jobs found in the data. We find that the steady-state marginal willingness to pay for the health insurance coverage from SP is only 1.3 to 4.2 percent of mean wage. We then use the model to simulate counterfactual scenarios of employment and labor formality under different valuations of the new health system implemented in Mexico.

JEL Codes: I13, J33, J42, O17
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1 Introduction

A central topic in the global health agenda is universal health care coverage. The World Health Organization (WHO) has defined universal coverage as access of all people to comprehensive health services at affordable cost and without financial hardship through protection against catastrophic health expenditures (WHO, 2010). 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, resulting in poor health conditions. 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.

The Seguro Popular (SP) was introduced in 2002 in Mexico as a non-contributory health insurance program and it was directed to half of the country's population, uncovered by social protection or employer provided health insurance. That is, the informal sector workers and the nonemployed. Prior to 2002, health insurance in Mexico was tightly linked to employment. One of the few public health insurance schemes 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, upon fulfilling some conditionalities related with school attendance by children and medical examinations. *Oportunidades* has a component of public health insurance that includes free access to preventive health care, however families without children would not qualify for other public health insurance. To be eligible to the SP, an individual needs to be uncover by employer provided health insurance. This group constituted half of the Mexican population in 2002.

Prior to SP, uninsured individuals could only access affordable health care through their employer, thus the introduction of a non-contributory public health insurance scheme could have resulted in large effects on the labor market. In practice, the SP is a transfer(tax) to informal(formal) sector workers and a transfer to the nonemployed.[1] On one hand, if the value placed on SP 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 firms in each sector adjust wages given benefits, on the allocation of workers and firms across sectors and on how the newly free health services are valued by families.

In this paper, we analyze the effects of non-contributory health insurance programs like SP on labor market outcomes. We start by using the staggered introduction of *Seguro Popular* across municipalities in Mexico in a differences-in-difference strategy. Specifically, we use data from the Mexican Labor Force Survey between 2000 and 2012 and we start by showing that the implementation of SP in a municipality is associated with an increase in the informality of low educated households with children of 2 percentage points. This increase is driven by the transition from the

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

formal to the informal sector of low educated males. Second, the salaries decrease in the informal sector, with the decrease concentrated on the lower end of the within municipality distribution of salaries. This decrease in salaries due to possible change in compensating wage differential associated with the introduction of SP is consistent with the small impact of SP in informality.

Although the reduced form is crucial to understand whether the reform had important impacts or not, it is not informative about the mechanisms through which the policy changes occur. It does not offer the possibility to do counterfactual analysis or understand changes in the job sectors and welfare. Thus, to understand the extent to which the access to free-health services is valued by households members when they make their labor market decisions, we develop and estimate a household search model which incorporates the value of the SP program. In the model, workers search randomly on and off the job and they may receive offers from formal or informal firms. The nonemployed and informal sector workers are not entitled any employment protection benefits, whereas the formal sector workers receive employer-provided health insurance and other benefits secured by labor laws (for example, guaranteed minimum wage and retirement pensions).

We model the choices of the members of the couple (heads and spouses) to capture the main features of a social protection system like the one in Mexico. In particular, in our model each of the members of the couple decides between three possibilities: working in the formal or informal sectors or not working at all. In case one of the members decides to work in the formal sector, then the other spouse will automatically be covered by Social Security. Children in the family will covered by Social Security if they are under age 16 (if the parents work in the private sector; or 18 if the parents work in the public sector). If none of the members works in the formal sector, the household is uninsured and, as such eligible to SP after its implementation.

The labor market model we propose innovates in two important aspects. First, it models the choice of members of a couple between jobs in the formal and informal sectors, besides nonemployment, which are the relevant alternatives in developing countries. Second, if one spouse looses his/her job, the other spouse may exert effort to become an informal sector worker.

The model is estimated on the Mexican Labor Force Survey on the periods before and after the introduction of SP. We use the quarter of the implementation of SP in the municipality of residence of the household to define the periods before and after the introduction of the program. Due to possible heterogeneity in valuation of health insurance, the model is estimated for 8 different groups based on demographic and geographic characteristics. In particular, education of the head (whether the head has more or less than 6 years of education, which corresponds to elementary education in Mexico), area of residence according to level of poverty (states in the north and south of country) and family composition (with and without young children).

The model is able to replicate (1) the stocks of household types according to job status (2) the transitions in and out of employment and between formal and informal jobs found in the period before the implementation of SP. We then use the estimated parameters to simulate counterfactual scenarios of employment and labor formality in which we change the valuation of SP health system. Our results aim to shed light on why the empirical literature has found limited impacts of Seguro

Popular on employment and informality, and the mechanisms which explain it.

The paper proceeds as follows. In the next section, we present a summary of the literature on the labor market effects of health insurance schemes not attached to the employer. In Section 3 we explain the main features of SP and context in which it was introduced. Section 4 describes the data. In Section 5 we present reduced form estimates of the impact of implementing SP in a municipality on informality rates and on the distribution of wages in the formal and informal sectors. In Section 6 we present our model and in Section 7 we describe the estimation procedure used. The estimates from the structural model are presented in Section 8. Conclusions are in Section 9.

2 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-García, 2006; Barros, 2011; Campos and Knox, 2013, Aguilera, 2011, Duval and Smith, 2011) to small increases in the share of informal workers for those with less than 9 years of schooling, married women with children or older adults (Azuara and Marinescu, 2011, Aterido et al. 2011, Pérez-Estrada, 2011, Bosch and Cobacho, 2011). Aterido et al, 2010, find that SP is a associated with a reduction on the flow out of unemployment and out of the labor force, but del Valle, 2015, finds the women in families with disable or dependent individual reduce unemployment and inactivity to become informal workers.

There are few papers that analyze the effects of SP on wages, and the findings range from no effects (Barros, 2011, and Azuara and Marinescu, 2011), to a negative impact on informal wages (Aterido et al, 2010, Pérez-Estrada, 2011).

Finally, regarding the effects of SP on broader measures of welfare, there is some indirect evidence through lower wages in the informal sector (Aterido et al., 2010, Pérez-Estrada, 2011) and reduction in postneonatal and child mortality in poor municipalities (Conti and Ginja, 2016, and Conti, del Valle and Ginja, 2016), a decrease in miscarriages (Pfutze, 2015), and of no effect on health outcomes (Knox 2008, King et al. 2009, Barros 2011).

Health Insurance Reform in US and Labor Market Recent reforms in the US health insurance system, which relaxed the link between employment and the provision of health insurance are associated to 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 employment, 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. Garthwaite, Gross and Notowidigdo (2014) estimate large increases in the labor supply associated to an abrupt reduction in the Medicaid coverage in Tennessee.

However, so far, for developing countries there is no work considering equilibrium effects of

non-contributory health insurance on broader welfare measures.

Theory The approach we use relates mainly to the following papers. Dey and Flinn, 2005, use a search and matching framework to study the effect of employer-provided health insurance on mobility rates. Dey and Flinn, 2008, extends the framework in the 2005 paper from a single agent model to incorporate potential dependence of couples labor market decisions. Aizawa and Fang, 2015, is the first labor search model which incorporates health shocks. Finally, Fang and Shephard, 2014, estimate a household search model with health shocks where the distribution of job offers is determined endogenously, with compensation packages comprising of a wage and menu of insurance offerings (premiums and coverage) that workers select from.

The literature on search with 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 the Mortensen and Pissarides (1994) approach, and they assume workers can only move to the formal sector from unemployment. They then use the model to simulate impact of tax policies in the formal sector. Meghir, Narita and Robin (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. However, the Brazilian setup lacks a *policy* change, such as the introduction of non-contributory health insurance, which allows us to recover the value added of the new health insurance system that affects workers in the informal sector and the nonemployed.

Finally, we also relate to Finkelstein, Hendren and Luttmer (2015) who recover the welfare benefit to recipients per each dollar spent in Medicaid. They find it varies between \$0.2-\$0.4.

3 Background

We now describe the health system in Mexico and the context in which the health reform occurred.

3.1 The Mexican Health System and the Seguro Popular

The Health Care System before *Seguro Popular* Before SP, health care in Mexico was characterized by a two-tiered system. About half of the population was covered through a contributory system (still in place today) guaranteed by the Social Security Institutions: the Mexican Social Security Institute (*Instituto Mexicano del Seguro Social*, 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; however, 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 first one was the Expansion of Coverage Program (*Programa de Ampliacion de Copertura*, PAC), which started in 1996 and consisted of brigades visiting the more rural and marginalized areas of the country. Besides PAC, part of the uninsured population had access to basic health services through the Program for Education, Health and Nutrition (*Programa de Educacion, Salud y Alimentación*, Progresa). This was launched 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 medical units managed by the IMSS-Oportunidades and *Secretaria de la Salud* (Ministry of Health).[2]

The uninsured population not covered by PAC or *Progresa* could seek health care either in public health units run by the Ministry of Health (*Secretaria de Salud*, SSA) 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 public per capita health expenditure on the insured was twice as much as that on the uninsured (see Frenk et al., 2006).

The Implementation of *Seguro Popular* SP was launched as a pilot program in 2002 in 26 municipalities (in 5 states: Campeche, Tabasco, Jalisco, Aguascalientes, Colima) under the name Health for All (*Salud para Todos*), with the aim to extend it gradually to the rest of the country. During 2002, 15 additional states[3] implemented the program, by agreeing with the federal government to provide the health services covered by SP. By the end of the pilot phase, on 31 December 2003, six additional states[4] had joined, for a total of 613,938 families enrolled.

The System of Social Protection in Health (*Sistema de Protección Social en Salud*, SPSS) was officially introduced on January 1st 2004 by the General Health Law (*Ley General de Salud*, LGS), with the aim to extend health coverage to the eligible population. According to the rules of operation of SP, the expansion should prioritize states with: (1) low social security coverage; (2) large number of uninsured in the first six deciles of income; (3) ability to ensure the provision of services covered by the program; (4) potential demand for enrollment; (5) explicit request of the state authorities; (6) existence of sufficient budget for the program.[5] In 2004, three more states

[2]First, *Progresa* beneficiaries receive free of charge the Guaranteed Basic Health Package (*Paquete Básico Garantizado de Salud*), which includes a set of age-specific interventions; second, the nutrition of both children and pregnant women is monitored through monthly consultations (and nutritional supplements are distributed in case of malnutrition); third, information on preventive health behaviors is provided through community workshops; fourth, emergency services are secured by the Ministry of Health, IMSS-Oportunidades (the dedicated network of medical units for families enrolled in the program) and other state institutions (only in relation to pregnancy and childbirth); lastly, 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).

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

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

[5]Diario Oficial, 4 de julio de 2003, *Reglas de operación e indicadores de gestión y evaluación del Programa Salud*

introduced the program (Nayarit, Nuevo Leon and Querétaro). The last three states (Chihuahua, Distrito Federal and Durango) joined SP in 2005.

Eligibility and Enrolment Individuals who are not beneficiaries of social security institutions, or who do not have otherwise access to health services, are eligible to enroll in SP. The basic unit of protection is the household.

Enrollment in the program is voluntary, and is granted upon compliance with simple requirements.[6] Information about all individuals affiliated in the system is listed in an administrative registry, called the *Padrón*. At the end of 2010, the *Padrón* included 15,760,805 families, for a total of 43,518,719 individuals. By April 2012, 98% of the Mexican population was covered by some health insurance (Knaul et al., 2012).

Funding Between 1999 and 2007, the ratio of the total public expenditure on health to GDP was relatively stable at 2.6% (see Figure A.1 in the Appendix). This was one of the lowest figures among OECD countries: the corresponding figures for Denmark (the country with the highest share), US and Brazil in 2004 were 8.2%, 6.9% and 3.4%, respectively. Between 1999 and 2004, the ratio of the total public expenditure on health to GDP for insured (not eligible) and uninsured (eligible) was also stable at 1.8% and 0.9%, respectively. However, after 2004, the ratio for the uninsured (eligible) experienced a steady increase, from 1% to nearly 1.5% in 2009, while that for the insured (not eligible) remained constant after a temporary drop between 2004 and 2008.[7] Hence, the program seems to have been successful in accomplishing one of its goals, that of redistributing resources from the insured to the uninsured.

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: (1) a social contribution (*Cuota Social*) from the federal government; (2) solidarity contributions from both the federal government and the states (*Aportaciones Solidarias*);[8] (3) and a family contribution (*Cuota Familiar*). The *cuota familiar* is an annual fee introduced to replace the out-of-pocket payments previously made at the point of use. It is based on the average household income relative to the national income distribution, but in 2010, 96.1% of the enrolled families were exempted from paying it, on the basis of their low socioeconomic status, so that very few households contributed.

Coverage and Delivery of Health Services Once a family is enrolled in SP, she is assigned a health center (which, in turn, is associated to a general hospital) and a family doctor for primary care. The family has access to a package of health services, whose number of interventions covered

para Todos (Seguro Popular de Salud).

[6]The requirements are: proof of residence in the Mexican territory; lack of health insurance, ascertained with self-declaration; and possession of the individual ID (*Clave Unica de Registro de Población*, CURP).

[7]This was due to a failed attempt to increase public revenues to fund SP (Nigenda, 2005).

[8]The federal solidarity contribution is computed based on the following elements: (i) number of beneficiary families; (ii) health needs, proxied by state's indicators of infant and adult mortality; (iii) additional contributions called the "state effort" (*esfuerzo estatal*); and (iv) the performance of health services.

increased yearly, from 78 in 2002 to 284 in 2012, and it was listed in a 'Catalogue of Health Services' (since 2006 called *Catalogo Universal de Servicios de Salud*, CAUSES) revised annually (see 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 November 2004 with the introduction of the Fund for Protection against Catastrophic Expenses (*Fondo de Protección contra Gastos Catastróficos*, FPGC). The FPGC is a reserve fund of unlimited budget with the objective to support the financing of care for high-cost diseases typically 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 (*Seguro Medico para una Nueva Generación*, SMNG), which offers a specific package of services for children under five.

The non-contributory and the contributory systems have separate networks of hospitals and health centers, each to serve its own affiliates and the health services covered by the SP are delivered in the hospitals and health centers run by the *Secretaria de la Salud* (Health Ministry).

Supply of Health Care One of the main objectives of the health reform was to increase investment in health care infrastructure and to achieve a more equitable distribution of health care resources, on the basis of a specific master plan (*Plan Maestro de Infraestructura*). Indeed, the proportion of the Ministry of Health budget devoted to investment in health infrastructure increased from 3.8% in 2000 to 9.1% in 2006, with the construction of 2,284 outpatient clinics and 262 (community, general and specialized) hospitals between 2001 and 2006;[9] as a consequence, the number of municipalities covered by each hospital declined from a 2000 average of 7 to a 2010 average of 5. Additionally, under the LGS, no facility providing services could participate in the insurance scheme unless it was accredited - and accreditation was given only in presence of the required resources to provide the covered interventions (Frenk et al., 2009). As a result, the gap between individuals covered and not by Social Security was significantly reduced in terms of the availability of general and specialist doctors, nurses and beds (Knaul et al., 2012). Further redistribution was achieved by prioritizing the resources in poor municipalities (see Conti and Ginja, 2016).

3.2 Other policy changes

The period studied (2000-2012) was relatively stable with respect to policy changes that could have affected the labor market choices of individuals. Nevertheless, we describe here the Mexican pension system, taxes and child care.

The Pension System The current Mexican 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, which coexists with a set of fragmented noncontributory services

[9] In the public sector as a whole, 1,054 outpatient clinics and 124 general hospitals were built in the same period (Frenk et al., 2009).

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).[10] 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).

There are also several non-contributory programs for poor elderly. 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 Distrito Federal in areas of high and very high level of marginalization (Villagómez and Ramírez, 2015). The program became universal in 2003, and in 2008 the benefit age was lowered to 68 years. 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 in highly and very highly marginalized rural communities with less than 2,500 inhabitants. In 2007, it was integrated into the program *70 y más*. The *Oportunidades* created in 2006 a complement to beneficiary families with adults older than 70.[11]

3.3 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).

[10] The PAYG system is a well defined-benefit system and the benefits can be claimed through normal or early retirement. Mexico has no mandatory retirement age, but the normal retirement age is 65. The IMSS requires at least 10 years (500 weeks) of contributions to retire under PAYG rules. Social security benefits are 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. Under the PAYG rules, the minimum payment guarantee, that is the minimum social security benefits individuals can receive or social security benefit, 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.

[11] From 2007 on, the benefit was provided to families living in communities of more than 2,500 inhabitants, while those living in communities up to 2,500 inhabitants and being part of the Opportunities program were supported through the program *70 y más*.

3.4 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 (see Calderon, 2014).

4 Data

In this paper we use data from two main sources.

Padrón This is a consolidated registry of all families with a valid enrolment in Seguro Popular by December 31st of each year since 2002 (we have data until 2010) and it is used by the Federal Government and by the States to decide the funds to be allocate to the program. The key treatment variable – the date of implementation of SP in each municipality – is constructed from this data. The data contains detailed demographic and socioeconomic characteristics of the enrolled families, including employment status, occupation and assets. It also contains information on 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.[12] The exact date of affiliation of families is used to construct the date of implementation of the program in each municipality. We consider that a municipality has SP when the number of families affiliated to the program is at least 10 (our results are not sensitive to this definition).[13]

Encuesta Nacional de Empleo (ENE) 2000-2004 and Encuesta Nacional de Ocupación y Empleo (ENOE) 2005-2012 We use quarterly data from the National Employment Surveys of Mexico, which is gathered under the ENE between 2000 and 2004, and it was implemented quarterly between the second quarter of 2000 and the second quarter of 2004, for 4 locality sizes in all the 32 Mexican states and for one each city in each state. The ENOE started in 2005 and households are followed for five quarters. The data is a rotating panel at the individual and household level and it covers more than 11 million individuals from the second quarter of 2000 to fourth quarter of 2012 between 18 and 65 years old. From this data set we observe the Social Security status of a specific individual across quarters, as well as his/hers labor income when employed.

[12] 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 for each. However, it is possible to identify the exact date of implementation of SP in a given municipality since each family has a unique identifier. Thus, it is possible to link families across years.

[13] In a companion paper (Conti and Ginja, 2016), we also adopt this definition. In addition, 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, we do not use smaller figures such as 2 or 5 households since these could be more prone to measurement error. Third, we use a definition which has become relatively common in the SP-related literature, see e.g. Bosch and Campos-Vazquez (2014) and Del Valle (2015).

An individual is an informal worker if he/she does not have access to health services provided by his/her job through one of the Social Security institutions in the country (IMSS, ISSSTE or PEMEX). Since Social Security coverage is extended to the spouse and children in the household, a household is considered informal if the head or the spouse do not have Social Security coverage through the job contract. We do not make a distinction between self-employed and informal employees, as the definition of informality depends on the Social Security coverage. As we show below, about 50% of all families in Mexico in 2001 did not have Social Security coverage.

All monetary values are deflated to the first quarter of 2011 using the CPI of Banco de Mexico.

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 in analysis, we focus on the sample of municipalities surveyed since 2000. Thus, we restrict our attention to municipalities only in ENE and ENOE. That is, 640 municipalities. Then, we impose the additional restriction that a municipality must be present in the data at least for 2 years (8 quarters), which reduces the sample to 628 municipalities.

We restrict the sample to households where the head is married and between 20 (where the chance of returning to full-time education is very low among the low educated) and 59 years old, who are still not eligible for any non-contributory pension program for poor elderly.[14] The restriction to married households individuals discards 22% (243,229) households. Finally, we drop 7% of households where the head of household is a female (60,005 households) and 2% of households with missing information about the gender of the spouse (21,604 households). Our final sample includes 748,181 households.

The minimum wage is binding in Mexico and should be the minimum amount paid to all formal employees. Of individuals in our final sample only 1% workers under a formal contract earns less than the minimum wage, and we drop these individuals.

We follow individuals for three months between their first and second surveys. We identify job-to-job transitions, unemployment-to-job, or job-to-unemployment transitions during this period. We use transitions between the first and second interviews since about half of the observations households-quarter whose head is 20 to 59 years old are observed only in the first and second interviews only. For each individual in our sample (ie, heads and their spouses), we observe the employment status in the first and second interviews. From the second interview, we construct the transition indicators and we observe the wage among individuals (ie, heads and their spouses) which transitioned between non-employment and formal or informal work.

We present results for the sample of high and low educated families, where we define a family to be in the low education group if the head has at most 6 years of completed education. This corresponds to elementary education in Mexico and in 2001, just before the implementation of SP, 40% families in our data were in this group. We also allow for heterogeneity by the presence of

[14] In Mexico 65 is the retirement age, but the participation rate among informal workers is very 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).

children under 15 in the household for two reasons. First, the package of services covered by SP includes a number of conditions prevalent among poor children. Second, the extension of coverage of Social Security to children depends on the sector where the parent that earns coverage works. If the parent works in the private sector the coverage is extended to children under 16 (under 25 if they are studying) or if under 18, in case the parent works in the public sector. We do not distinguish parents working on private and public formal sectors, thus we use the most stringent definition, which also coincides with the age at which children terminate mandatory education in Mexico.[15] The estimates for the structural model are also presented by region of residence, in particular, whether the family resides in the north and south of Mexico, which vary in the level of poverty, according to the index of marginalization of 2000. The Northern includes the states of: Baja California, Baja California Sur, Chihuahua, Durango, Sinaloa, Sonora, Coahuila, Nuevo Len, Tamaulipas, Aguascalientes, Guanajuato, Quertaro, San Luis Potos, Colima Jalisco, Michoacn, Nayarit and Zacatecas. The Southern includes the following states: Distrito Federal, Mexico, Morelos, Hidalgo, Puebla, Tlaxcala, Veracruz, Campeche, Quintana Roo, Tabasco, Yucatn, Chiapas, Guerrero and Oaxaca.[16]

5 Empirical Facts

Before moving to the behavioral model, we exploit the variation in the timing of implementation of SP at the municipality level. To motivate the model developed below, we analyze the impact of Seguro Popular on the proportion of informal families, on the situation of each member of the couple (head and spouse) and on the distribution of wages for males and females within a municipality.

5.1 Basic Descriptives

We start by presenting some basic facts regarding the labor market in Mexico, using the Mexican Labor Force Survey. We consider that in each moment an individual can be (1) unemployed or out-of-the-labor-force, (2) work in the formal sector or (3) work in the informal sector.

Table 1 includes basic statistics of the data. In the table we include the employment status and wages for both heads and their spouses taken just before the introduction of SP in 2001 and after the introduction of SP (we choose the year of 2007, this is year when the program reached all municipalities in our sample[17]). The statistics are presented separately for two groups of education: high education households (where the head has more than 6 years of education) and low education

[15] We consider the presence of children under 15 in the household since the Labor Force Survey does not contain the data of birth and thus, the child may be close to turn 16 at the survey date at which she would loose eligibility to Social Security coverage if not enrolled in school.

[16] The index of marginalization is constructed by CONAPO (*Consejo Nacional de Población* - National Population Council) and it can take five possible values: Very High (marginalization), High, Medium, Low and Very Low. A map with the level of marginalization of states is available in the following provided by CONAPO: `http://www.conapo.gob.mx/work/models/CONAPO/indices_margina/indices/pdfs/mapas/a_1.pdf`.

[17] This is also the year before the implementation of the child care program for working mothers in families without Social Security coverage.

(if the head has at most 6 years of education). The table shows that prior to the introduction of SP about 36% of households in the high education group did not have Social Security coverage, and this figure reached 61.5% among the low education group. The proportion of households without Social Security coverage remained constant in the high education group, but increased by almost 4p.p. among low educated families. The second panel of the table includes the nine possible types of households according to the labor market situation of each member of the couple. Interestingly, the increase in informality among low educated families is associated with an increase in the proportion of households where both members are informal, a decrease in the share of households where both members are formal workers and a decrease in the proportion of households where the head works in the formal sector and the spouse is not working. The main changes in the quarterly transitions of heads of household between 2001 and 2007 point to an increase the share of informal households: the transitions from non-employment to a formal job decrease by 2.4p.p., whereas the transitions from non-employment to an informal job increase 10.6p.p., and when the spouse looses a formal job, the heads is also more like to enter the labor market through the informal sector (the transitions from non-employment to an informal job, when the spouse looses a formal job increase by 1.7p.p.). Finally, among spouses there is an increase in entry in labor market through the informal sector, with transitions from non-employment to informality increasing by 3.2p.p., and there is a decrease in destruction of informal jobs (the transitions from informality to non-employment decrease by 4.3p.p.).

Table 2 shows that the salaries of both heads and spouses are lower in the informal sector than in the formal sector among low educated households. This is generally the case also among high educated households, except for high educated heads in the period before SP. The standard deviation of salaries is also higher in the informal sector. These differences reflect unobserved productivity differences between the individuals who select into the informal sector within educational groups. Between 2001 and 2007, there is an increase in salaries in the formal sector, regardless of the educational group. In the informal sector, the salaries decrease in the high education group; for low educated families the growth in salaries in half than for those in the formal sector.

5.2 Empirical Strategy

We now present evidence on the causal impacts of the introduction of SP. Figure A.3 in Appendix displays the year of implementation of SP in each municipality in Mexico, between 2002 and 2010. This graph shows that there is considerable variation, both across municipalities and over time, regarding the timing of the adoption of SP in different municipalities in the country. Thus, we use the staggered implementation of SP across Mexico in a difference-in-differences model, where we compare changes in outcomes for municipalities that introduced SP at different years between 2002 and 2007. We estimate the following model at municipality-quarter level:

$$y_{mst} = \beta SP_{mst} + \gamma X_{mst} + \mu_{ms} + \pi_t + \varphi_s t + \varepsilon_{mst} \tag{1}$$

where y_{mst} is on of the two outcomes we study: share of informal households in a municipality-quarter and log wages (of males and females). m indexes the municipality, s the state, t indexes the quarter. SP_{mst} is an indicator variable equal to one if municipality m in year t has implemented SP. The municipality of residence is measured in quarter t.

Since municipalities adopted SP at different quarters, we compare those with or without SP access at the time of survey by virtue of the municipality of residence. Thus, we can allow for unrestricted municipality effects μ_{ms}, which control for unobserved determinants of y_{mst} that are constant at municipality level and which affect the outcome independently of SP; unrestricted quarter effects π_t and state-year linear trends $\varphi_s t$ to account for state specific trends which affect outcomes independently of SP (such as federal-state budget agreements in place and independent of SP). The parameter of interest is β, the effect of exposure to SP, which is identified from variation across municipalities and quarters.

Conti and Ginja (2016) study in detail the determinants of the timing of implementation of SP in a given municipality. They find that after accounting by state fixed effects, earlier implementation of SP occurred in more populous and less poor municipalities, with a smaller share of eligible individuals and of population working in the primary sector, and in municipalities with a greater share of children 0-4 years old. After these are accounted for, only the availability of health centers (but not of hospitals or doctors) and the political alignment between the mayor of the municipality and the governor of the state are the two key factors determining the timing of the rollout. Health conditions and mortality were unrelated to the timing of the implementation of SP. These findings justify our choice of controls. In particular, we control for the following demographic characteristics of municipalities: 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), share of households by locality size, stata-year quadratic trend and quarter fixed effects. We also allow for linear trends in characteristics of the municipality residence of the household taken in 2000, such as: quadratic in the index of deprivation, log of total population, share of population less than 5 years old, share of population over 15 that does not know how to read and write, share of occupied individuals working on the primary, secondary and tertiary sectors, and the number of hospitals and health centers in 2001, total number of doctors and nurses in hospitals per 1,000 uninsured individuals (taken in 2001). ε_{imst} are idiosyncratic shocks. The standard errors are clustered at municipality level to account for autocorrelation in the outcome (Bertrand, Duflo and Mullainathan, 2004).

Impact on Social Security coverage The estimates in table 3 show that the implementation of SP in a municipality is associated with an increase in the probability of loss of Social Security protection by low educated households with children of 2p.p (column 1, Panel A.2). This increase in informality is driven by a shift from formal to informal sector jobs by low educated males (columns 3 and 4 in Panel A.2). Panel B shows that SP is not associated to changes in the informality rates

of high educated families. However, SP is associated to an entry in the labor market through the informal sector by women with children in high educated families (see columns 5 and 7 in Panel B.2).

Impact on Salaries We now turn to the impacts on salaries on table 4. Column 3 shows that SP is associated to a decrease in the mean wage of low educated women working in informal sector. There is also a small decrease in the wage of formal low high male workers (column 2).

6 Joint Labor Search Model

6.1 The Basic Setup

We now present a labor market model, which we use to compare our causal estimates to the predictions from the model. The model parameters are estimated in the pre-reform period.

Time in the model is continuous and households seek to maximize their expected lifetime income. We consider shocks and decisions taken by spouses 1 (the head) and 2 (the spouse) in a household. Individuals can be: nonemployed (n), formal (f), or informal (i). The household enjoys instant utility given by:

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

with j = formal or informal; and $\mathbb{H}_i$ an indicator function for informal household (when both j are not formal). Throughout the exposition we consider a household to be informal if it does not have Social Security coverage. w_1 is the labor income of spouse 1, w_2 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 (but before social security contributions); w in the informal sector is the gross wage.

The parameter a captures all amenities in the formal sector relative to those in the informal sector, except the value of health insurance by Seguro Popular. This parameter can be negative. We assume that γ is the value of health insurance provided by Seguro Popular, which is offered when no spouse works in the formal sector. We explain below how these two parameters are identified.[18]

Spouse 1 and spouse 2 who face mutually exclusive shocks in the labor market. There is one exception to this: when spouse 1 has a job and spouse 2 is nonemployed, a shock that destroys the job of spouse 1 may instantly create an opportunity for spouse 2 to move the informal sector.

We consider that when spouse 1 gets a formal job opportunity, spouse 2 may go into nonemployment. The same holds for spouse 2.

[18] In this version we assume that individuals are risk neutral. In future work we will allow for risk aversion.

6.2 Household's Value Functions

Let W_{jk} be the value function for a household where the head (spouse 1) is in status $j = f, i$ and the spouse (spouse 2) is in status $k = f, i$. Further, for $j = f, i$ we use $W_{jj}(w_1, w_2) = W_{jn}(w_1)$ if $w_2 = 0$, $W_{jj}(w_1, w_2) = W_{nj}(w_2)$ if $w_1 = 0$, and equal to $W_{jj}(w_1, w_2) = W_{nn}$ if $w_1 = w_2 = 0$. There are nine value functions.

6.2.1 Only one member works

In the formal sector

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

where p^{s_2} is the probability that spouse 2 moves from nonemployment to informal given that spouse 1 moves from a formal job to nonemployment. This is a formal household, with Social Security coverage. When the head looses the formal job, then with probability p^{s_2} the spouse gets an offer from the informal sector. In this case the household may re-evaluate its plan by considering the flow of gains if the spouse takes the informal offer ($W_{ni}(x)$) against the option of not taking it. With probability $1 - p^{s_2}$ the spouse does not get the offer from 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 do not consider this hypothesis, since transitions within the same sector are not perfectly observed in our main data sets (ie, there is no information about whether the individual switched jobs with sector between the first and second interviews). 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 household now faces 3 possibilities: (1) the spouse may take the new formal offer, (2) since the household will Social Security coverage if the spouse becomes a formal worker, then the head may quit his formal job, finally, (3) the household may do nothing (ie, the formal offer by the spouse is not accepted). 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 worker 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 equation and its also a formal household. There is only an exchange in the status between spouses 1 and 2:

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

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

In the informal sector

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

where q^{s_2} is the probability that spouse 2 moves from nonemployment to informal given that spouse 1 moves from an informal job to nonemployment. This is an informal household, without Social Security coverage. When the head looses the informal job, then with probability q^{s_2} the spouse gets an offer from the informal sector. In this case the household may re-evaluate its plan by considering the flow of gains if the spouse takes the informal offer ($W_{ni}(x)$) against the option of not taking it. With probability $1 - q^{s_2}$ the spouse does not get the offer from the informal sector, in which case there is no decision to be made by the household. 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. 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 household now faces 3 possibilities: (1) the spouse may take the new formal offer (conditional

on the current wage of the head), (2) since the household will Social Security coverage if the spouse becomes a formal worker, then the head may quit his informal job, finally, (3) the household may do nothing (ie, the formal offer by the spouse is not accepted in which case the household 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 equation. There is only an exchange in the status between spouses 1 and 2:

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

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.

6.2.2 Both members work

In the formal sector

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

This is a formal household. If both members of the household are working on the formal sector, then each one may have his job destroyed at rate δ_f. Each member of the couple may receive offers from either the current sector of employment (formal), or from the other sector (informal).

In the informal sector

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

This is an informal household, without Social Security coverage. Each member of the couple may have his job destroyed at rate δ_i. Each member of the couple may receive offers from either the formal or informal sector. When a member of the couple receives an offer from the formal sector, then the household may consider between 3 possible scenarios. The head receives formal job offers at rate $\lambda_{if}^{s_1}$ then (1) the head may decide to the take the formal offer and the household now has Social Security coverage, whereas the spouse remains informal worker, (2) the head may take the formal job offer, but the spouse may quit the informal job, or (3) do nothing. The same set of options hold if the spouse receives a formal job offer.

Spouse 1 in the formal sector (and spouse 2 in the informal sector)

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

This is a formal household. Each member of the couple may have his job destroyed at rate $\delta_j, j = i, f$. The head receives job offers from the formal or informal at rates $\lambda_{ff}^{s_1}$ or $\lambda_{fi}^{s_1}$, respectively. Conditional on the wage of the spouse (w_2), the household re-evaluates its situation. The spouse receives job offers from the informal at rate $\lambda_{ii}^{s_2}$; and if she received an offer from the formal sector, which happens at rate $\lambda_{if}^{s_2}$, the household decides between the following three possibilities: (1) the spouse takes the new formal offer; (2) given that the household still has Social Security coverage if the spouse takes the new offer and the head may decide to quit his formal job; or (3) do nothing

(the spouse does not take the new offer).

Spouse 2 in the formal sector (and spouse 1 in the informal sector) The situation is symmetric to the previous one, but now the household faces three possibilities if the head (who is informal worker in the initial stage) receives a formal job offer.

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

6.2.3 Neither member of the couple works

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

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

6.3 Reservation Wages

The reservation wages exist because $W_{jj}(w, w_2)$ and $W_{jj}(w_1, w)$ $(j = n, f, i)$ are increasing functions of w. There is one reservation wage for each choice of the worker. The exceptions are the eight problems in which the worker chooses among three options instead of two. In those cases, there are three reservation wages that define the worker's optimal strategy. Consider $\hat{w}_{j'j'-jj}^{s_1}(w_1, w_2)$ $j = n, f, i$, the critical wage that makes spouse 1 to accept a job offer from sector j' given the current status of spouse 1 earning w_1 in state j (or $w_1 = 0$ if j=n) and the current status of spouse 2 earning w_2 in state j, who can only move into nonemployment while shocks arrive to spouse 1. For example, when a $\lambda_{fi}^{s_1}$ shock arrives to spouse 1 in the formal sector while spouse 2 is informal,

the spouse 1 decides whether to take the informal job if $w \geq \hat{w}^{s_1}_{ii-fi}(w_1, w_2)$. This critical value is the solution of $W_{ii}(\hat{w}^{s_1}_{ii-fi}(w_1, w_2), w_2) = W_{fi}(w_1, w_2)$. The reservation functions for spouse 2 are similar $\hat{w}^{s_2}_{j'j'-jj}(w_1, w_2)$ $j = n, f, i$.

6.4 Flow Conditions

In steady state, the measure of couples where 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 are in the formal sector earning up to w_1 (spouse 1) and w_2 (spouse 2) is balanced and it is given by the following equation:

$$
\begin{aligned}
m_{ff} G_{ff}(w_1, w_2) \left[\delta^{s_1}_f + \delta^{s_2}_f + \lambda^{s_1}_{ff}\overline{F}^{s_1}_f(w_1) + \lambda^{s_2}_{ff}\overline{F}^{s_2}_f(w_2)\right] + \\
\lambda^{s_1}_{fi} m_{ff} \int^{w2} \int^{w1} \overline{F}^{s_1}_i(\hat{w}_{if-ff}(x, w_2)) g_{ff}(x, w_2) dx dw_2 + \\
\lambda^{s_2}_{fi} m_{ff} \int^{w1} \int^{w2} \overline{F}^{s_2}_i(\hat{w}_{fi-ff}(w_1, x)) g_{ff}(w_1, x) dx dw_1 = \\
\lambda^{s_1}_{nf} m_{nf} \int^{w2} \max\left(F^{s_1}_f(w_1) - F^{s_1}_f\left(\hat{w}_{ff-nf-fn}(w_2)\right), 0\right) g_{nf}(w_2) dw_2 + \\
\lambda^{s_2}_{nf} m_{fn} \int^{w1} \max\left(F^{s_2}_f(w_2) - F^{s_2}_f\left(\hat{w}_{ff-fn-nf}(w_1)\right), 0\right) g_{fn}(w_1) dw_1 + \\
\lambda^{s_1}_{if} m_{if} \int^{w2} \int^{w1} \max\left(F^{s_1}_f(w_1) - F^{s_1}_f\left(\hat{w}_{ff-if-fn}(x, w_2)\right), 0\right) g_{if}(x, w_2) dx dw_2 + \\
\lambda^{s_2}_{if} m_{fi} \int^{w1} \int^{w2} \max\left(F^{s_2}_f(w_2) - F^{s_2}_f\left(\hat{w}_{ff-fi-nf}(w_1, x)\right), 0\right) g_{fi}(w_1, x) dx dw_1
\end{aligned}
$$

where the reservation wage $\hat{w}_{ff-nf-fn}(w_2) = \max\left(\hat{w}_{ff-nf}(w_2), \hat{w}_{ff-fn}(w_2)\right)$ for all w_1 such that $W_{ff}(w_1, w_2) > \max\left(W_{fn}(w_1), W_{nf}(w_2)\right)$ and $W_{ff}(\bar{w}_1, w_2) > W_{fn}(\bar{w}_1)$, or $\hat{w}_{ff-nf-fn}(w_2) = \hat{w}_{ff-nf}(w_2)$ if $W_{ff}(w_1, w_2) > \max\left(W_{fn}(w_1), W_{nf}(w_2)\right)$ and $W_{ff}(\bar{w}_1, w_2) \leq W_{fn}(\bar{w}_1)$. All other situations in which $W_{ff}(w_1, w_2) \leq \max\left(W_{fn}(w_1), W_{nf}(w_2)\right)$ are offers to spouse 1 that are rejected.

Symmetrically, $\hat{w}_{ff-fn-nf}(w_1) = \max\left(\hat{w}_{ff-fn}(w_1), \hat{w}_{ff-nf}(w_1)\right)$ for all w_2 such that $W_{ff}(w_1, w_2) > \max\left(W_{nf}(w_2), W_{fn}(w_1)\right)$ and $W_{ff}(w_1, \bar{w}_2) > W_{nf}(\bar{w}_2)$, or $\hat{w}_{ff-fn-nf}(w_1) = \hat{w}_{ff-fn}(w_1)$ if $W_{ff}(w_1, w_2) > \max\left(W_{nf}(w_2), W_{fn}(w_1)\right)$ and $W_{ff}(w_1, \bar{w}_2) \leq W_{nf}(\bar{w}_2)$. If $W_{ff}(w_1, w_2) \leq \max\left(W_{nf}(w_2), W_{fn}(w_1)\right)$ spouse 2 does not take the offer.

Similarly, the reservation wage $\hat{w}_{ff-if-fn}(x, w_2)$ limits the offers that are accepted by spouse 1 to go into the formal sector while spouse 2 is in the formal sector and $\hat{w}_{ff-fi-nf}(w_1, x)$ defines the wages above which spouse 2 accepts an offer to become formal while spouse 1 is in the formal sector.

The outflow from the formal sector is given by the job separation to nonemployment, to other jobs paying higher than w in the formal sector and to other jobs in the informal sector while the inflow in the formal sector is given by the job acceptance by the nonemployed and by informal sector workers willing to take the formal sector job offering until w.

The balance equation is simpler when both spouses are in the informal sector because we assumed that moves of spouse 1 into this sector does not cause spouse 2 to move anywhere. Note, however, that when either agent leaves the informal sector to a formal sector job the other spouse may move into nonemployment.

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

In appendix, we show the remaining 6 flow equations where at least one spouse in working and we set the mass of couples in any joint states equal to one. Thus, we obtain m_{nn}.

6.5 Identification of parameters

The value of leisure To identify the value of leisure, b_1 and b_2, we assume strong monopsony power for the low earners and that $\underline{w}$ (from F_f and F_i) are the minimum wage offer accepted by nonemployed individuals. Thus, we identify b_1 by setting $\min(W_{in}) = W_{nn}$ and b_2 by equating $\min(W_{ni}) = W_{nn}$.

The marginal willingness to pay for amenities in the formal sector (a) and the value of health insurance provided by Seguro Popular (γ) We recover the marginal willingness to pay parameters by equating the minimum values of job offers accepted by the nonemployed in the insurance type 1 sector (formal) and in the insurance type 2 sector (informal), in the situation when the head of household is nonemployed. When the pool of nonemployed is large enough the reservation wage converges to the minimum wage in each sector. As the pool of nonemployed is relatively larger for spouse 2 (empirically, spouses 2 are women), we set $\min(W_{nf}) = \min(W_{ni})$, so we obtain the marginal willingness to pay parameters. To separately identify a and γ, we use data on wages and transitions before and after the Seguro Popular policy implementation.

1. Using data pre-Seguro Popular (under $\gamma = 0$), we identify a $W_{ni}(\underline{w}^{t=0}) = W_{nf}(\underline{w}^{t=0})$,

2. Given a and using data after the implementation of Seguro Popular (when γ is possibly $\neq 0$), we identify γ setting

   $W_{ni}(\underline{w}^{t=1}) = W_{nf}(\underline{w}^{t=1})$.

7 Estimation

Given the model specified in section 6, we need to estimate the wage offer distributions in the formal and informal sector, the arrival rates, the job destruction rates, the instant reallocation shocks, the values of leisure, the relative value of the amenities in the formal sector, and the value of Seguro Popular, all denoted by

$$\Theta = (F_f^{s1}, F_i^{s1}, \lambda_{if}^{s1}, \lambda_{fi}^{s1}, \lambda_{ni}^{s1}, \lambda_{nf}^{s1}, \delta_i^{s1}, \delta_f^{s1}, q^{s_1}, p^{s_1}, b_1,$$
$$F_f^{s2}, F_i^{s2}, \lambda_{if}^{s2}, \lambda_{fi}^{s2}, \lambda_{ni}^{s2}, \lambda_{nf}^{s2}, \delta_i^{s2}, \delta_f^{s2}, q^{s2}, p^{s2}, b_2, a, \gamma).$$

Firstly, we obtain the wage offer distributions non-parametrically, that is F_f and F_i are obtained from the data from the wages accepted by the nonemployed. Then, we use a fixed point solution to solve for the remaining model parameters. Our procedure is described below in detail.

1. Given the F distributions and an initial guess for all unknowns: the transition parameters, the value of leisure, the marginal willingness to pay parameters, the measure of couples in any joint state $\frac{m_{jj'}}{m_{nn}} G_{jj'}(w_1, w_2)$, and the minimum and maximum support for each value function:

   (a) We interpolate the minimum and maximum support of the value functions.[19]

   (b) We calculate the reservation wages using the value functions.

   (c) Given F_f and F_i distributions, transition rates, value of leisure, and marginal willingness to pay parameters, we solve $\frac{m_{jj'}}{m_{nn}} G_{jj'}(w_1, w_2)$ using the flow equations.

   (d) We then set w_1 and w_2 to infinity and set the mass of couples across all joint states to one to obtain the stocks and the joint $G_{jj'}$ distributions separately.

   (e) We update the value of leisure and marginal willingness to pay parameters using the restrictions we impose above.

   (f) We update the value functions.

   (g) We update the transition parameters using the transition moments we construct and match to the data.

   (h) We update $\frac{m_{jj'}}{m_{nn}} G_{jj'}(w_1, w_2)$.

2. Model fit: we construct the model stocks $m_{jj'}$ $(j, j' = n, f, i)$ and the marginal $G_j(w)$ distributions. We also obtain the transition probabilities calculated using the model parameters. These are checked against:

[19] We use Clenshaw-Curtis quadrature.

(a) the empirical proportion of households in the situation jj' at the first interview date.

(b) the empirical individual wage distributions at the first interview date.

(c) the empirical transition probabilities.

Transition rates Given F_f^s and F_i^s $(s = 1, 2)$, we estimate the transition rates using method of moments. We follow the individual from the first interview to the next quartet, and we obtain the average transition from the data $\widetilde{D}_{jk}$; $j, k = n, f, i$ for each sample used. The durations are exponentially distributed, and we construct the transitions from the model D_{jk}; $j, k = n, f, i$ 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 $d_j^s(w_1) = \delta_j^s + \lambda_{jj}^s \overline{F}_j^s(w_1) + \lambda_{jk}^s \sum_{j'=n,f,i} \int \overline{F}_k^s(\hat{w}_{kj'-jj'}(w_1, w_2))\frac{m_{jj'}}{m_j} g_{j'}(w_2)dw_2,\ j = f, i$ is the total job separation rate. s indicates the spouse.

- Transitions out-of nonemployment:

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

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

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

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

where $a^s = \lambda_{nf}^s \sum_{j=n,f,i} \int \overline{F}_f(\hat{w}_{fj-nj}(w_2))\frac{m_{nj}}{m_n} g_{nj}(w_2)dw_2 + \lambda_{ni}^s \sum_{j=n,f,i} \int \overline{F}_i(\hat{w}_{ij-nj}(w_2))\frac{m_{nj}}{m_n} g_{nj}(w_2)dw_2 + \delta_f^{s'} p^s \int \overline{F}_i(\hat{w}_{in-nf}(w_2))g_{nf}(w_2)dw_2 + \delta_i^{s'} q^s \int \overline{F}_i(\hat{w}_{in-ni}(w_2))g_{ni}(w_2)dw_2$ 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).

- Transitions job-to-job:

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

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

This a just-identified system of 20 non-linear equations for 20 parameters (two $\delta's$ and eight $\lambda's$ for each spouse) and we obtain λ^s_{jj}, $s = 1, 2; j = i, f, n$ and δ^s_j, $s = 1, 2; j = i, f$ by minimizing the following quadratic distance:

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

.

8 Estimation Results

We present here the model estimates. We estimate the model separately by 8 groups defined based on the following characteristics. Area of residence (North or South of Mexico); for 2 groups of education: high education households (where the head has more than 6 years of education) and low education (if the head has at most 6 years of education; for families with children ages 0-14 years and families family composition (with/out children 14 years old or under) and gender.

All parameters are estimates 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. We then use the period after the introduction of Seguro Popular to estimate γ as described in Section 6.5.

8.1 The Model Fit

Table 5 compares the stocks of households across formal employment, informal employment and unemployment and the transitions predicted by the model and in the data. The model fits transitions and stocks remarkably well across all eight samples.

Table 6 presents selected moments for the distribution of wages in the data and predicted by the model. The distribution of wages for spouses in the formal sector is well replicated from the 25th percentile to the top of the distribution and at the mean. The mean wages for head of households in the informal sector is reasonably replicated by the model. The model performs less well to approximate the left hand side of the distribution of salaries for spouses in the informal sector.

8.2 The value of leisure, the value of formal sector's amenities, and the value of health insurance by Seguro Popular

Table 7 shows the parameter estimates which are recovered from the model for the pre-reform period for the value of leisure for heads and spouses, b_1 and b_2, respectively, and for the marginal willingness to pay to be outside the formal sector, $-a$. Both measures are presented in currency units divided by the mean wage in the informal sector. The table shows that before the introduction of SP, less educated households with children (column 1) are willing to forgone a higher share of their wage to be in the informal sector rather than in formal sector. This could reflect for example other policies that were in place before SP, such as the Oportunidades cash transfers program. The estimate of γ shows that the value-added of SP program, given a, is positive but small (1.3-4.2

percent depending on the sample). This explains why the SP reform, as it was implemented, should not be expected to change significantly the economy.

8.3 Policy Experiments

In this subsection, we use the model to assess the impacts of changing the value of Seguro Popular, γ. In the simulations, we departure from the estimated wage distributions, stocks and transitions estimated from the data on the period prior to the implementation of SP.

Simulating changes in γ One major policy concern is to understand why most literature has found limited impacts of this new health policy in terms of employment and sector composition. Departing from the benchmark economy where γ is equal to zero, we simulate changes in the economy with γ equal to the value estimated from the model using the for the period after the implementation of SP. Next, we consider increases of 5, 10 and 20 times higher than this estimate. We apply the same proportional increase across two extreme samples: (1) the poorest sample for households living in the South of Mexico with low educated and with children, and the (2) richest sample which includes families living in Northern states, with high educated heads and no children. The results of the simulations are presented in Table 9 which presents the results for the stocks of households, salaries and welfare, and in Table 10 which includes the impacts on transitions.

We first comment the results for the poorest households, which are Panel A of Table 9. 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 very small, with wages changing by much less than 1%. Thus, there is not much effect on welfare. However, when we successively increase γ across columns (2) to (4), we start to observe that wages compensate in the expected direction, that is, wages increase in the formal sector and they decrease in the informal sector. This also occurs in Panel B for the sample of richest households. Consider the sample of poorest households, selection explains why wages of spouses do not decrease in the informal sector, where the relatively worst paid go into nonemployment. With a 10 times higher value of SP, about 3.5pp of households become informal-nonemployed, that is, with the head working in the informal sector and the spouse nonemployed. This effect appears to be monotonic once we simulate a 20 times higher value of SP there is an increase of 4.6pp in the stock of households informal-nonemployed. Table 10 shows that the increase in the stock of households informal-nonemployed 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.

Figure 1 depicts the reservation wages of heads and spouses at the benchmark and after the simulation that applies a 10 times higher value of γ. These plots help to explain why the fraction of households informal-nonemployed increases. In Panel C shows that nonemployed heads of households become less reluctant to take an informal job with the simulated change. Whereas Panels A and B show that spouses in the same situation become more demanding, as their reservation wages go up particularly for those with lower wage heads.

The simulations show that despite an increase in the informal sector and nonemployment, the

overall welfare increases by 2 and 5 percent in the simulations of 10 and 20 times higher value of γ, respectively. This is due to an increase in salaries in the formal sector and the value of health insurance by SP also raised the value of jobs in the informal sector.

Among the richest households (Panel B of Table 9), we found that the effects are similar for heads of households than for those in the poorest sample. They tend to go into the informal sector. However, richer spouses (women) tend to go less into nonemployment than poorer spouses. As a result, the increased value of SP for richer households increases both the fraction of those in the situation informal-informal and informal-nonemployment.

Figures 1 and 2 reveal the importance of considering the choices of the household rather than an individual isolated. First, the positively sloped function for the reservation wage of the spouse in Panels A and B relative to the head's, shows that she is more picky the as husband's wage increases. Second, Panel C shows that the wage of the wife is less important for the head, particularly if he is to take a job in the formal sector (see Panel C). Finally, the curves become flatter with higher γ (value of HI), so the wages of a spouse become less important for the head and vice-versa.

9 Conclusion

The data shows that significant transitions took place around the period of implementation of non-contributory health insurance in Mexico, with an increase in the share of informal households where heads are less educated and have younger children.

We estimate a household search model which allows us to understand to which extent the increase in informality is associated to the free access to health care associated to the non-contributory health insurance.

We recovered the value of health insurance by Seguro Popular from the model and by using data on wages and transitions before and after the implementation of Seguro Popular. We estimate the model for different segments of population separated by region, family composition and education. The model is well fitted to the data on stocks and transitions. The estimated value of Seguro Popular is between 1.3 to 4.2 percent of the mean informal sector wage, depending on the sample.

We use the model to simulate employment, wage and welfare effects from the introduction of health insurance by Seguro Popular by giving the households the value of health insurance as we estimated it. We then simulate counterfactual increases in the estimated value of health insurance. We find that the Seguro Popular system would have to be significantly more generous than it was to have impacts on the economy.

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10 Tables

Table 1: Description of the data: employment and transitions by education group.

	High Education		Low Education	
	Before	After	Before	After
Number of Households-Quarters	76,445	49,420	49,972	24,999
Informal Households	0.357	0.358	0.615	0.653
Households by type				
With Social Security				
Head Formal-Spouse Formal (FF)	0.156	0.163	0.044	0.037
Head Formal-Spouse Informal (FI)	0.075	0.103	0.054	0.067
Head Formal-Spouse Not Working (FN)	0.341	0.298	0.244	0.200
Head Informal-Spouse Formal (IF)	0.062	0.066	0.036	0.036
Head Not Working-Spouse Formal (NF)	0.008	0.011	0.006	0.007
Without Social Security/Informal				
Head Informal-Spouse Informal (II)	0.104	0.126	0.157	0.200
Head Informal-Spouse Not Working (IN)	0.221	0.196	0.395	0.386
Head Not Working-Spouse Informal (NI)	0.007	0.009	0.015	0.018
Head Not Working-Spouse Not Working (NN)	0.026	0.026	0.048	0.046
Transitions of Head				
Nonemployed-Formal	0.196	0.171	0.105	0.080
Nonemployed-Informal	0.324	0.350	0.425	0.531
Formal-Nonemployed	0.017	0.017	0.027	0.024
Formal-Informal	0.095	0.082	0.157	0.144
Informal-Nonemployed	0.033	0.042	0.052	0.064
Informal-Formal	0.137	0.114	0.085	0.071
Nonemployment-Informal, when spouse looses formal job	0.059	0.094	0.088	0.105
Nonemployment-Informal, when spouse looses informal job	0.073	0.073	0.093	0.086
Transitions of Spouse				
Nonemployed-Formal	0.027	0.029	0.015	0.011
Nonemployed-Informal	0.094	0.129	0.113	0.144
Formal-Nonemployed	0.098	0.069	0.143	0.094
Formal-Informal	0.051	0.053	0.074	0.077
Informal-Nonemployed	0.309	0.277	0.347	0.304
Informal-Formal	0.069	0.058	0.031	0.025
Nonemployment-Informal, when head looses formal job	0.008	0.024	0.029	0.032
Nonemployment-Informal, when head looses informal job	0.012	0.019	0.034	0.035
Share ages 20-39	0.605	0.513	0.410	0.375
Share with Children 0-14	0.777	0.727	0.692	0.648

Note: ENE-ENOE 2001 and 2007. Families where head is 20-59 years old.

Table 2: Description of the data: wages in the formal and informal sector by education group.

	High Education		Low Education	
	Before	After	Before	After
Wages: Formal Sector				
Head				
Mean	28412	28786	15886	17385
SD	33510	27656	9592	11081
Observations	39,604	23,686	16,021	6,876
Spouse				
Mean	21688	23577	13258	14370
SD	14521	16626	7914	8412
Observations	15,280	10,001	4,006	1,786
Wages: Informal Sector				
Head				
Mean	30080	27171	14872	15507
SD	34993	35000	15435	19615
Observations	26,398	15,327	27,162	12,942
Spouse				
Mean	15393	13721	7604	8425
SD	22255	19397	8531	9310
Observations	10,501	8,659	8,548	5,405
Change in W (2007-2001)				
Formal Sector				
Head	0.013		0.090	
Spouse	0.083		0.081	
Informal Sector				
Head	-0.102		0.042	
Spouse	-0.115		0.103	

Note: ENE-ENOE 2001 and 2007. Families where head is 20-59 years old.

Table 3: Reduced Form Estimates: the dependent variable is the share of informal households (ie, without Social Security coverage) in a municipality in a given quarter.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Informal		Head			Spouse	
	Household	Not Working	Formal	Informal	Not Working	Formal	Informal
				Panel A: Low Education			
				A.1: Without Children			
SP	-0.004	-0.012	0.025	-0.013	-0.001	-0.010	0.011
	(0.018)	(0.013)	(0.018)	(0.022)	(0.021)	(0.009)	(0.020)
Mean Pre-SP	0.708	0.114	0.239	0.646	0.547	0.112	0.341
SP	0.021**	-0.000675	-0.027***	0.028**	-0.001	-0.001	0.002
	(0.010)	(0.007)	(0.010)	(0.012)	(0.013)	(0.005)	(0.013)
Mean Pre-SP	0.791	0.071	0.213	0.717	0.679	0.035	0.287
Observations	21,376						
				Panel B: High Education			
				B.1: Without Children			
SP	-0.001	-0.008	0.026	-0.018	0.068**	-0.038*	-0.030
	(0.027)	(0.016)	(0.029)	(0.032)	(0.031)	(0.022)	(0.028)
Mean Pre-SP	0.475	0.185	0.296	0.519	0.580	0.259	0.160
				B.2: With Children			
SP	0.007	-0.003	-0.011	0.014	-0.031***	0.012	0.019*
	(0.011)	(0.005)	(0.012)	(0.012)	(0.012)	(0.008)	(0.011)
Mean Pre-SP	0.580	0.038	0.384	0.578	0.659	0.117	0.224
Observations	20,966						

Note: Estimates obtained using the ENE/ENEO data. Controls excluded from table include: 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), share of households by locality size, municipality of residence fixed effects, state-year quadratic trend, quarter fixed effects, and a linear trend in characteristics of the municipality of residence taken in 2000 (quadratic in the index of deprivation, log of total population, share of population less than 5 years old, share of population over 15 that does not know how to read and write, share of occupied individuals working on the primary, secondary and tertiary sectors; the number of hospitals and health centers in 2001, total number of doctors and nurses in hospitals per 1,000 uninsured individuals in 2001). Control mean is taken 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 4: Reduced Form Estimates: the dependent variable is the log salary.

	(1)	(2)	(3)	(4)
	Head		Spouse	
	Informal	Formal	Informal	Formal
		Panel A: Low Education		
SP	0.013	-0.028**	-0.056**	-0.029
	(0.016)	(0.012)	(0.025)	(0.021)
		Panel B: High Education		
SP	0.021	-0.013	-0.041	-0.003
	(0.018)	(0.012)	(0.026)	(0.016)

Note: Estimates obtained using the ENE/ENEO data. Controls excluded from table include: 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), share of households by locality size, municipality of residence fixed effects, state-year quadratic trend, quarter fixed effects, and a linear trend in characteristics of the municipality of residence taken in 2000 (quadratic in the index of deprivation, log of total population, share of population less than 5 years old, share of population over 15 that does not know how to read and write, share of occupied individuals working on the primary, secondary and tertiary sectors; the number of hospitals and health centers in 2001, total number of doctors and nurses in hospitals per 1,000 uninsured individuals in 2001). Control mean is taken 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 5: Model Fit: Stocks and Transitions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Region	South								North							
Education	Low				High				Low				High			
Children 0-14	Yes		No		Yes		No		Yes		No		Yes		No	
	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model
Employment																
m_{ff}	0.017	0.010	0.020	0.009	0.119	0.103	0.129	0.072	0.052	0.044	0.035	0.012	0.159	0.148	0.160	0.086
m_{fi}	0.041	0.019	0.038	0.021	0.074	0.063	0.073	0.052	0.056	0.046	0.043	0.023	0.080	0.071	0.071	0.050
m_{fn}	0.157	0.126	0.153	0.134	0.321	0.289	0.274	0.280	0.270	0.240	0.209	0.208	0.371	0.336	0.294	0.325
m_{if}	0.021	0.075	0.023	0.047	0.057	0.120	0.066	0.096	0.040	0.091	0.028	0.045	0.061	0.104	0.066	0.095
m_{nf}	0.003	0.020	0.006	0.033	0.007	0.016	0.015	0.075	0.006	0.031	0.009	0.027	0.008	0.017	0.016	0.049
m_{ii}	0.207	0.184	0.185	0.138	0.125	0.095	0.131	0.080	0.133	0.114	0.139	0.099	0.092	0.065	0.104	0.060
m_{in}	0.507	0.474	0.438	0.406	0.272	0.240	0.232	0.209	0.389	0.343	0.358	0.347	0.204	0.187	0.201	0.173
m_{ni}	0.015	0.042	0.028	0.106	0.007	0.020	0.015	0.050	0.013	0.038	0.027	0.075	0.006	0.014	0.012	0.041
m_{nn}	0.031	0.049	0.108	0.106	0.018	0.054	0.066	0.086	0.042	0.054	0.152	0.163	0.018	0.057	0.077	0.121
Transitions: Head																
Nonemployment-Formal	0.081	0.081	0.036	0.036	0.203	0.203	0.091	0.091	0.119	0.119	0.054	0.054	0.260	0.260	0.105	0.105
Nonemployment-Informal	0.552	0.552	0.332	0.332	0.423	0.423	0.231	0.231	0.490	0.490	0.280	0.280	0.374	0.374	0.218	0.218
Formal-Nonemployment	0.021	0.021	0.036	0.036	0.016	0.016	0.022	0.022	0.025	0.025	0.046	0.046	0.016	0.016	0.025	0.025
Formal-Informal	0.185	0.185	0.158	0.158	0.111	0.111	0.110	0.110	0.156	0.156	0.142	0.142	0.089	0.089	0.094	0.094
Informal-Nonemployment	0.035	0.035	0.080	0.080	0.027	0.027	0.059	0.059	0.053	0.053	0.104	0.104	0.032	0.032	0.067	0.067
Informal-Formal	0.050	0.050	0.048	0.048	0.116	0.116	0.116	0.116	0.102	0.102	0.075	0.075	0.147	0.147	0.137	0.137
Nonemp.-Inf., if spouse looses formal job	0.055	0.044	0.023	0.023	0.012	0.012	0.034	0.025	0.032	0.032	0.042	0.041	0.011	0.011	0.018	0.018
Nonemp.-Inf., if spouse looses informal job	0.030	0.030	0.046	0.046	0.014	0.014	0.021	0.021	0.028	0.028	0.043	0.043	0.014	0.014	0.018	0.018
Transitions: Spouse																
Nonemployment-Formal	0.008	0.008	0.009	0.009	0.022	0.022	0.024	0.024	0.018	0.018	0.011	0.011	0.030	0.030	0.031	0.031
Nonemployment-Informal	0.137	0.137	0.123	0.123	0.106	0.106	0.102	0.102	0.108	0.108	0.094	0.094	0.094	0.094	0.084	0.084
Formal-Nonemployment	0.117	0.117	0.121	0.121	0.088	0.088	0.090	0.090	0.153	0.153	0.130	0.130	0.096	0.096	0.103	0.103
Formal-Informal	0.122	0.122	0.114	0.114	0.064	0.064	0.075	0.075	0.080	0.080	0.081	0.081	0.048	0.048	0.057	0.057
Informal-Nonemployment	0.358	0.358	0.346	0.346	0.309	0.309	0.290	0.290	0.368	0.368	0.333	0.333	0.316	0.316	0.289	0.289
Informal-Formal	0.023	0.023	0.021	0.021	0.063	0.063	0.075	0.075	0.032	0.032	0.031	0.031	0.070	0.070	0.075	0.075
Nonemp.-Inf., if head looses formal job	0.115	0.000	0.108	0.000	0.101	0.000	0.035	0.000	0.091	0.000	0.040	0.000	0.071	0.000	0.023	0.000
Nonemp.-Inf., if head looses informal job	0.130	0.033	0.083	0.075	0.081	0.025	0.053	0.053	0.078	0.051	0.056	0.056	0.069	0.031	0.035	0.035

Table 6: Model Fit for Households: Log-wages.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Region	South								North							
Education	Low				High				Low				High			
Children 0-14	Yes		No		Yes		No		Yes		No		Yes		No	
	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model	Data	Model
Formal wage: head																
P10	8.778	9.652	8.859	9.161	9.098	9.398	9.173	9.568	9.043	9.260	9.025	9.277	9.282	9.399	9.284	9.590
P25	9.069	10.040	9.086	9.464	9.398	9.798	9.437	9.964	9.260	9.585	9.277	9.528	9.516	9.633	9.590	9.998
P50	9.361	10.526	9.388	10.069	9.798	10.198	9.964	10.491	9.476	9.910	9.528	9.864	9.867	10.102	9.998	10.407
P75	9.652	10.720	9.691	10.826	10.198	10.698	10.359	11.414	9.801	10.559	9.780	10.284	10.336	10.570	10.509	10.917
P90	9.943	11.109	10.069	10.977	10.698	11.298	10.887	11.678	10.018	10.992	10.116	10.787	10.804	11.156	11.019	11.529
Mean	9.544	10.559	9.608	10.434	10.147	10.634	10.331	11.026	9.675	10.331	9.698	10.144	10.224	10.470	10.380	10.870
Informal wage: head																
P10	7.498	8.474	7.824	8.238	8.734	8.991	8.806	8.933	8.573	8.842	8.512	8.643	9.136	9.136	9.148	9.148
P25	8.474	9.032	8.513	8.789	9.119	9.376	9.187	9.441	8.977	9.111	9.036	9.167	9.472	9.472	9.457	9.664
P50	9.032	9.450	9.064	9.202	9.633	9.762	9.695	10.076	9.380	9.514	9.430	9.692	9.921	9.921	9.974	10.283
P75	9.450	9.729	9.477	9.615	10.147	10.276	10.330	10.584	9.783	9.783	9.823	10.216	10.481	10.481	10.593	10.696
P90	9.868	10.426	9.891	9.891	10.661	11.047	10.965	11.219	10.186	10.320	10.216	10.740	11.041	11.041	11.212	11.315
Mean	9.276	9.781	9.407	9.498	10.061	10.272	10.258	10.463	9.679	9.808	9.737	10.048	10.366	10.340	10.476	10.601
Formal wage: spouse																
P10	8.762	8.822	8.715	8.834	9.021	9.109	9.008	9.232	8.863	8.926	8.886	8.961	9.073	9.073	9.111	9.281
P25	8.943	9.063	8.893	9.071	9.374	9.374	9.381	9.530	9.054	9.118	9.111	9.111	9.407	9.324	9.451	9.535
P50	9.184	9.304	9.250	9.309	9.727	9.815	9.829	9.903	9.309	9.309	9.336	9.336	9.741	9.657	9.790	9.875
P75	9.546	9.666	9.606	9.665	10.079	10.168	10.202	10.426	9.564	9.564	9.561	9.561	10.158	10.074	10.214	10.299
P90	9.968	9.968	9.962	10.378	10.520	10.608	10.575	10.874	9.883	9.819	9.935	9.935	10.491	10.491	10.638	10.723
Mean	9.429	9.473	9.457	9.649	9.971	10.028	10.060	10.184	9.470	9.437	9.524	9.558	9.974	9.931	10.072	10.159
Informal wage: spouse																
P10	6.949	7.083	7.281	6.933	7.783	7.920	8.134	7.795	7.569	7.457	7.641	7.531	7.948	8.113	8.240	8.240
P25	7.755	7.889	7.975	7.859	8.330	8.467	8.587	8.474	8.132	8.244	8.298	8.188	8.443	8.607	8.748	8.875
P50	8.427	8.561	8.554	8.554	8.878	9.152	9.153	9.153	8.694	8.807	8.735	8.845	9.102	9.267	9.256	9.510
P75	8.830	9.234	9.017	9.133	9.562	9.836	9.833	9.946	9.144	9.369	9.173	9.283	9.596	9.926	9.891	10.145
P90	9.234	9.771	9.480	9.827	10.109	10.383	10.398	10.625	9.482	9.932	9.720	9.830	10.255	10.585	10.526	10.653
Mean	8.722	9.065	8.877	9.089	9.468	9.656	9.663	9.825	8.984	9.251	9.138	9.226	9.594	9.795	9.844	9.969

Table 7: Model Estimates: marginal willingness to pay to be in formal and informal sectors and value of leisure.

	(1)	(2)	(3)	(4)
Education	Low		High	
Children 0-14	Yes	No	Yes	No
		Panel A: South		
$\frac{b_1}{\overline{w}_i^{head}}$	0.025	0.036	0.087	0.089
$\frac{b_2}{\overline{w}_i^{spouse}}$	0.036	0.046	0.059	0.067
$\frac{a}{\overline{w}_i^{spouse}}$	-0.544	-0.497	-0.253	-0.195
$\frac{\gamma}{\overline{w}_i^{spouse}}$	0.013	0.035	0.029	0.027
		Panel B: North		
$\frac{b_1}{\overline{w}_i^{head}}$	0.066	0.058	0.171	0.126
$\frac{b_2}{\overline{w}_i^{spouse}}$	0.067	0.069	0.069	0.073
$\frac{a}{\overline{w}_i^{spouse}}$	-0.395	-0.421	-0.202	-0.162
$\frac{\gamma}{\overline{w}_i^{spouse}}$	0.030	0.042	0.029	0.021

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.

Table 8: Transition rates to unemployment and between jobs (quarterly).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Education high	Low		High		Low		High	
Children 0-14	Yes	No	Yes	No	Yes	No	Yes	No
	Panel A: South				Panel B: North			
Head								
δ_f	0.024	0.040	0.017	0.024	0.027	0.051	0.017	0.027
δ_i	0.037	0.086	0.029	0.065	0.058	0.115	0.036	0.075
λ_{nf}	0.146	0.048	0.337	0.139	0.198	0.071	0.457	0.139
λ_{ni}	1.033	0.445	0.702	0.375	0.821	0.369	0.630	0.289
λ_{fi}	4.878	1.000	0.510	0.693	0.718	1.878	0.285	0.788
λ_{if}	0.066	0.063	0.180	0.182	0.148	0.096	0.244	0.209
p_1	1.000	0.251	0.257	1.000	0.326	0.504	0.235	0.360
q_1	0.123	0.148	0.062	0.081	0.103	0.143	0.066	0.077
Spouse								
δ_f	0.134	0.138	0.095	0.098	0.174	0.147	0.104	0.113
δ_i	0.450	0.431	0.387	0.361	0.470	0.413	0.399	0.359
λ_{nf}	0.031	0.033	0.050	0.053	0.083	0.024	0.059	0.062
λ_{ni}	1.067	0.621	0.430	0.425	0.720	0.275	0.269	0.234
λ_{fi}	0.644	0.401	0.335	0.531	0.226	0.503	0.217	0.348
λ_{if}	0.059	0.055	0.155	0.143	0.105	0.061	0.167	0.161
p_2	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
q_2	1.000	1.000	1.000	0.943	1.000	0.554	1.000	0.535

Table 9: Counterfactual Experiment: Effects of changing willingness to pay to have HI outside the formal sector (γ).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A				**Panel B**			
	South, Low Educ, Children				**North, High Educ, No Children**			
	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$\widehat{\gamma}$	$5 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$
Stocks (p.p.)								
m_{ff}	-0.01	-0.08	-0.15	-0.23	-0.07	-0.36	-0.78	-1.48
m_{fi}	0.00	-0.07	-0.31	-0.37	-0.04	-0.15	-0.30	-0.58
m_{fn}	0.00	-0.60	-0.85	-0.95	0.06	0.12	-0.15	-0.26
m_{if}	-0.09	-0.41	-0.83	-1.54	-0.08	-0.36	-0.72	-1.61
m_{nf}	-0.01	-0.03	-0.03	-0.10	-0.03	-0.12	-0.14	-0.19
m_{ii}	0.06	0.46	-0.79	-0.77	0.08	0.33	0.62	1.23
m_{in}	0.05	0.66	3.53	4.64	0.08	0.56	1.58	3.01
m_{ni}	0.00	0.03	-0.18	-0.21	0.01	0.04	0.09	0.22
m_{nn}	0.00	0.03	-0.39	-0.48	-0.01	-0.06	-0.18	-0.33
Mean Wage of Head: Formal Sector (%)	0.05	2.89	4.46	5.52	0.17	1.33	3.88	7.28
Mean Wage of Head: Informal Sector (%)	-0.07	-2.93	-3.97	-6.02	-0.29	-1.93	-4.69	-8.41
Mean Wage of Spouse: Formal Sector (%)	0.35	1.66	3.09	5.40	0.43	1.99	3.90	7.63
Mean Wage of Spouse: Informal Sector (%)	-0.01	0.00	0.93	2.25	-0.06	-0.41	-1.27	-2.78
Avg. Welfare (%)	0.37	0.21	2.12	5.16	0.21	1.17	2.69	5.32
Welfare per sector: head (%)								
formal sector	0.06	3.29	5.13	6.43	0.17	1.35	4.02	7.62
informal sector	0.51	0.03	1.91	5.72	0.43	1.78	2.92	6.77
nonemployment	0.17	-0.03	3.52	3.15	0.06	0.22	0.62	1.50
Welfare per sector: spouse (%)								
formal sector	0.46	1.68	3.77	7.56	0.23	1.03	1.93	3.99
informal sector	0.59	2.25	4.52	10.92	0.26	1.20	2.19	4.52
nonemployment	0.30	-0.28	-0.09	1.73	0.13	0.87	2.28	4.47

Note: Changes are in relation to benchmark levels.

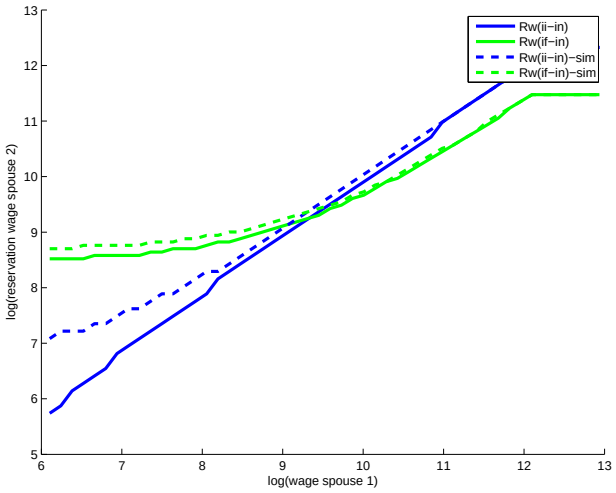
Table 10: Counterfactual Experiment: Effects of changing willingness to pay to have HI outside the formal sector (γ).

	(1)	(2)	(3)	(4)
	Panel A		**Panel B**	
	South, Low Educ, Children		**North, High Educ, No Children**	
	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$	$10 \times \widehat{\gamma}$	$20 \times \widehat{\gamma}$
Transitions: Head (pp)				
Nonemployment-Formal	-0.06	-0.11	-0.05	-0.13
Nonemployment-Informal	0.09	0.25	0.26	0.33
Formal-Nonemployment	-0.02	-0.01	-0.01	-0.02
Formal-Informal	0.89	0.48	0.88	1.60
Informal-Nonemployment	0.00	0.00	0.00	0.00
Informal-Formal	0.04	0.06	0.04	0.03
Nonemployment-Informal, if spouse looses formal job	0.43	0.83	0.36	0.61
Nonemployment-Informal, if spouse looses informal job	0.05	0.04	0.13	0.16
Transitions: Spouse (pp)				
Nonemployment-Formal	-0.10	-0.16	-0.24	-0.49
Nonemployment-Informal	-1.64	-2.05	-0.28	-0.49
Formal-Nonemployment	-0.10	-0.19	-0.04	-0.09
Formal-Informal	1.39	2.64	0.74	1.55
Informal-Nonemployment	0.06	0.11	0.14	0.27
Informal-Formal	-0.29	-0.54	-0.78	-1.56
Nonemployment-Informal, if head looses formal job	0.00	0.00	0.01	0.01
Nonemployment-Informal, if head looses informal job	0.03	0.04	0.01	0.02

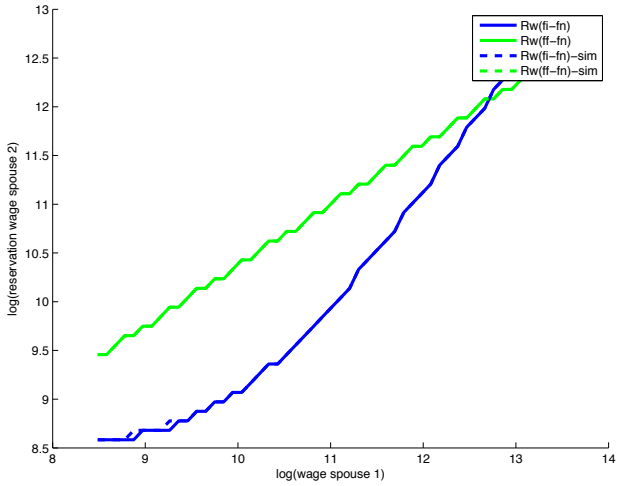
Note: Changes are in relation to benchmark levels.

11 Figures

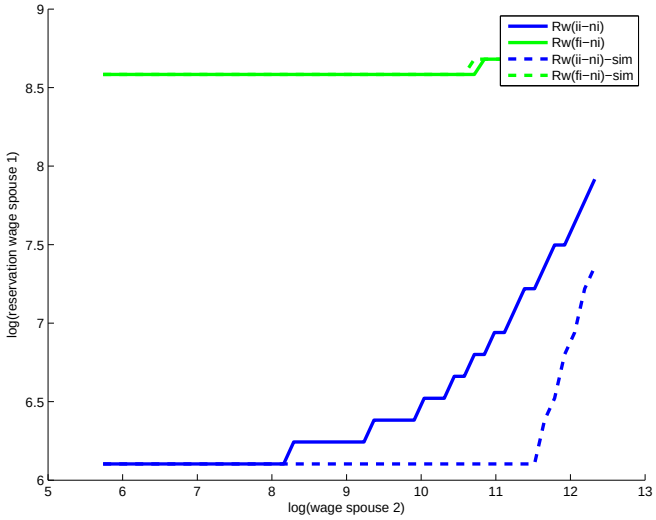
Figure 1: Simulated changes in γ (sample: Southern states, low educated households with children).



Panel A

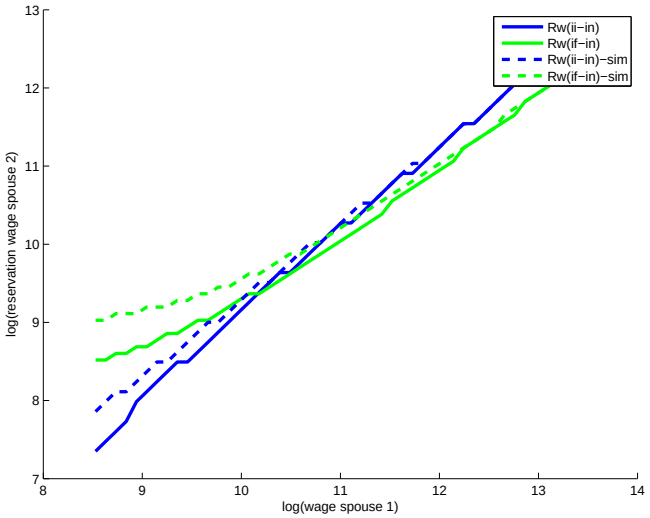


Panel B

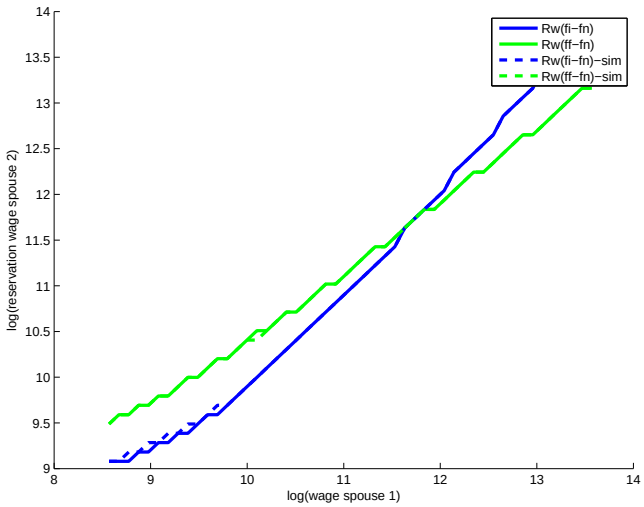


Panel C

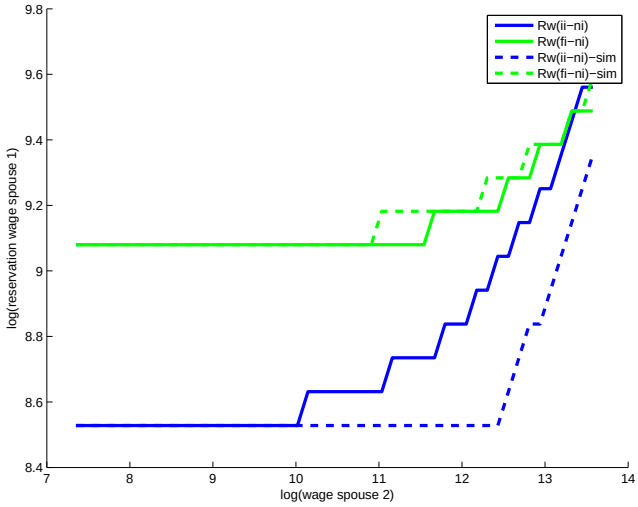
Figure 2: Simulated changes in γ (sample: Northern states, high educated households without children).



Panel A



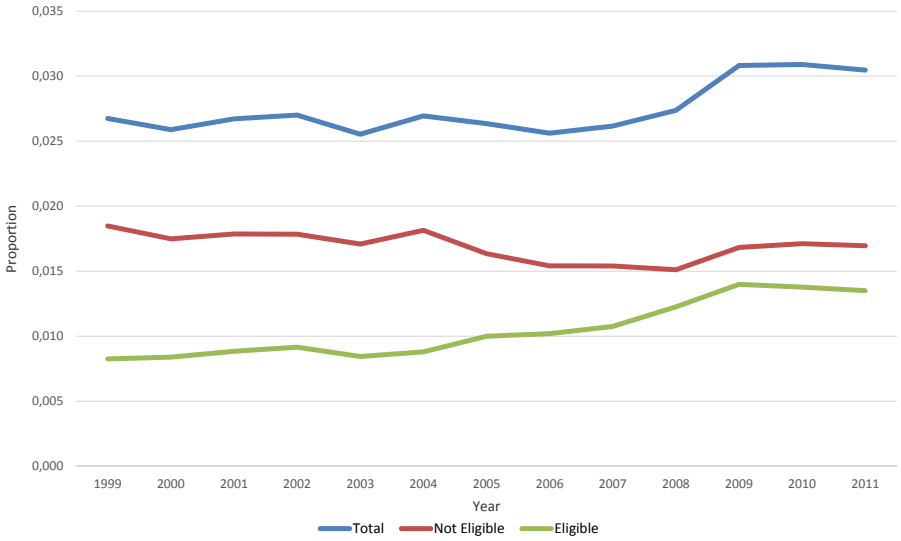
Panel B



Panel C

A Appendix: Figures

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 (*Petrleos 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: Municipalities that implemented SP, per month.

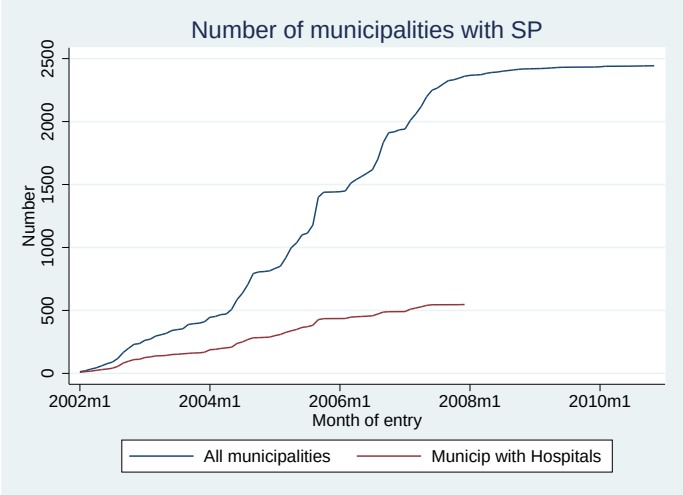


Figure A.3: Year of implementation of SP by municipality.
MAP HERE: REMOVED TO KEEP FILE BELOW 2MB!

B Identification and Estimation Issues

B.1 Flow Conditions

Spouse 1 in formal sector and spouse 2 in informal sector

$$
\begin{aligned}
&m_{fi}G_{fi}(w_1,w_2)[\delta_f^{s_1}+\delta_i^{s_2}+\lambda_{ff}^{s_1}\bar{F}_f^{s_1}(w_1)+\lambda_{ii}^{s_2}\bar{F}_i^{s_2}(w_2)]+\\
&\lambda_{fi}^{s_1}m_{fi}\int^{w_2}\int^{w_1}\bar{F}_i^{s_1}(\hat{w}_{ii-fi}(x,w_2))g_{fi}(x,w_2)dxdw_2+\\
&\lambda_{if}^{s_2}m_{fi}\int^{w_1}\int^{w_2}\bar{F}_f^{s_2}(\min(\hat{w}_{ff-fi}(w_1,x),\hat{w}_{nf-fi}(w_1,x))g_{fi}(w_1,x)dxdw_1=\\
&\lambda_{if}^{s_1}m_{ii}\int^{w_2}\int^{w_1}\max(F_f^{s_1}(w_1)-F_f^{s_1}(\hat{w}_{fi-ii,fi-fn}(x,w_2)),0)g_{ii}(x,w_2)dxdw_2+\\
&\lambda_{fi}^{s_2}m_{ff}\int^{w_1}\int^{w_2}\max(F_i^{s_2}(w_2)-F_i^{s_2}(\hat{w}_{fi-ff}(w_1,x)),0)g_{ff}(w_1,x)dxdw_1+\\
&\lambda_{nf}^{s_1}m_{ni}\int^{w_2}\max(F_f^{s_1}(w_1)-F_f^{s_1}(\hat{w}_{fi-ni,fi-fn}(w_2)),0)g_{ni}(w_2)dw_2+\\
&\lambda_{ni}^{s_2}m_{fn}\int^{w_1}\max(F_i^{s_2}(w_2)-F_i^{s_2}(\hat{w}_{fi-fn}(w_1)),0)g_{fn}(w_1)dw_1.
\end{aligned}
$$

Spouse 1 in formal sector and spouse 2 in nonemployment

$$
\begin{aligned}
&m_{fn}G_{fn}(w_1)[\delta_f^{s_1}+\lambda_{ff}^{s_1}\bar{F}_f^{s_1}(w_1)]+\\
&\lambda_{fi}^{s_1}m_{fn}\int^{w_1}\bar{F}_i^{s_1}(\hat{w}_{in-fn}(x))g_{fn}(x)dx+\\
&\lambda_{nf}^{s_2}m_{fn}\int^{w_1}\bar{F}_f^{s_2}(\min(\hat{w}_{ff-fn}(w_1),\hat{w}_{nf-fn}(w_1))g_{fn}(w_1)dw_1+\\
&\lambda_{ni}^{s_2}m_{fn}\int^{w_1}\bar{F}_i^{s_2}(\hat{w}_{fi-fn}(w_1))g_{fn}(w_1)dw_1=\\
&\delta_f^{s_2}m_{ff}G_{ff}(w_1,\bar{w}_2)+\delta_i^{s_2}m_{fi}G_{fi}(w_1,\bar{w}_2)+\\
&\lambda_{nf}^{s_1}m_{nn}\max(F_f^{s_1}(w_1)-F_f^{s_1}(\hat{w}_{fn-nn}),0)+\\
&\lambda_{nf}^{s_1}m_{ni}\int^{w_2}\max(F_f^{s_1}(w_1)-F_f^{s_1}(\hat{w}_{fi-ni,fi-fn}(w_2)),0)g_{ni}(w_2)dw_2+\\
&\lambda_{nf}^{s_1}m_{nf}\int^{w_2}\max(F_f^{s_1}(w_1)-F_f^{s_1}(\hat{w}_{ff-nf,ff-fn}(w_2)),0)g_{nf}(w_2)dw_2+\\
&\lambda_{if}^{s_1}m_{in}\int^{w_1}\max(F_f^{s_1}(w_1)-F_f^{s_1}(\hat{w}_{fn-in}(x)),0)g_{in}(x)dx.
\end{aligned}
$$

Spouse 1 in nonemployment and spouse 2 in informal sector

$$
\begin{aligned}
&m_{ni}G_{ni}(w_2)[\delta_i^{s_2}+\lambda_{ii}^{s_2}\bar{F}_i^{s_2}(w_2)]+\\
&\lambda_{if}^{s_2}m_{ni}\int^{w_2}\bar{F}_f^{s_2}(\hat{w}_{nf-ni}(x))g_{ni}(x)dx+\\
&\lambda_{nf}^{s_1}m_{ni}\int^{w_2}\bar{F}_f^{s_1}(\min(\hat{w}_{fi-ni}(w_2),\hat{w}_{fn-ni}(w_2)g_{ni}(w_2)dw_2+\\
&\lambda_{ni}^{s_1}m_{ni}\int^{w_2}\bar{F}_i^{s_1}(\hat{w}_{ii-ni}(w_2))g_{ni}(w_2)dw_2=\\
&\delta_f^{s_1}m_{fi}G_{fi}(\bar{w}_1,w_2)+\delta_i^{s_1}m_{ii}G_{ii}(\bar{w}_1,w_2)+\\
&\lambda_{fi}^{s_2}m_{nf}\int^{w_2}\max(F_i^{s_2}(w_2)-F_i^{s_2}(\hat{w}_{ni-nf}(x)),0)g_{nf}(x)dx+\\
&\lambda_{ni}^{s_2}m_{nn}\max(F_i^{s_1}(w_2)-F_i^{s_1}(\hat{w}_{ni-nn}),0)+\\
&\delta_f^{s_1}p_{s_2}m_{fn}\int^{w_1}\max(F_i^{s_2}(w_2)-F_i^{s_2}(\hat{w}_{nn-fn,nn-ni}(w_1)),0)g_{fn}(w_1)dw_1+\\
&\delta_i^{s_1}q_{s_2}m_{in}\int^{w_1}\max(F_i^{s_2}(w_2)-F_i^{s_2}(\hat{w}_{nn-in,nn-ni}(w_1)),0)g_{in}(w_1)dw_1.
\end{aligned}
$$

Spouse 1 in informal sector and spouse 2 in nonemployment

$$
\begin{aligned}
&m_{in}G_{in}(w_1)[\delta_i^{s_1}+\lambda_i i^{s_1}\bar{F}_i^{s_1}(w_1)]+\\
&\lambda_{if}^{s_1}m_{in}\int^{w_1}\bar{F}_f^{s_1}(\hat{w}_{fn-in}(x))g_{in}(x)dx+\\
&\lambda_{nf}^{s_2}m_{in}\int^{w_1}\bar{F}_f^{s_2}(\min(\hat{w}_{if-in}(w_1),\hat{w}_{nf-in}(w_1))g_{in}(w_1)dw_1+\\
&\lambda_{ni}^{s_2}m_{in}\int^{w_1}\bar{F}_i^{s_2}(\hat{w}_{ii-in}(w_1))g_{in}(w_1)dw_1=\\
&\delta_f^{s_2}m_{if}G_{if}(w_1,\bar{w}_2)+\delta_i^{s_2}m_{ii}G_{ii}(w_1,\bar{w}_2)+\\
&\lambda_{ni}^{s_1}m_{nn}\max(F_i^{s_1}(w_1)-F_i^{s_1}(\hat{w}_{in-nn}),0)+\\
&\delta_f^{s_2}p_{s_1}m_{nf}\int^{w_2}\max(F_i^{s_1}(w_1)-F_i^{s_1}(\hat{w}_{nn-nf,nn-in}(w_2)),0)g_{nf}(w_2)dw_2+\\
&\delta_i^{s_2}q_{s_1}m_{ni}\int^{w_2}\max(F_i^{s_1}(w_1)-F_i^{s_1}(\hat{w}_{nn-ni,nn-in}(w_2)),0)g_{ni}(w_2)dw_2+\\
&\lambda_{fi}^{s_1}m_{fn}\int^{w_1}\max(F_i^{s_1}(w_1)-F_i^{s_1}(\hat{w}_{in-fn}(x)),0)g_{fn}(x)dx.
\end{aligned}
$$

Spouse 1 in informal sector and spouse 2 in formal sector

$$
\begin{aligned}
&m_{if}G_{if}(w_1,w_2)[\delta_i^{s_1}+\delta_f^{s_2}+\lambda_{ii}^{s_1}\bar{F}_i^{s_1}(w_1)+\lambda_{ff}^{s_2}\bar{F}_f^{s_2}(w_2)]+\\
&\lambda_{if}^{s_1}m_{if}\int^{w_2}\int^{w_1}\bar{F}_f^{s_1}(\min(\hat{w}_{ff-if}(x,w_2),\hat{w}_{fn-if}(x,w_2)))g_{if}(x,w_2)dxdw_2+\\
&\lambda_{fi}^{s_2}m_{if}\int^{w_1}\int^{w_2}\bar{F}_i^{s_2}(\hat{w}_{ii-if}(w_1,x))g_{if}(w_1,x)dxdw_1=\\
&\lambda_{ni}^{s_1}m_{nf}\int^{w_2}\max(F_i^{s_1}(w_1)-F_i^{s_1}(\hat{w}_{if-nf}(w_2)),0)g_{nf}(w_2)dw_2+\\
&\lambda_{nf}^{s_2}m_{in}\int^{w_1}\max(F_f^{s_2}(w_2)-F_f^{s_2}(\hat{w}_{if-in,if-nf}(w_1)),0)g_{in}(w_1)dw_1+\\
&\lambda_{fi}^{s_1}m_{ff}\int^{w_2}\int^{w_1}\max(F_i^{s_1}(w_1)-F_i^{s_1}(\hat{w}_{if-ff,if-fn}(x,w_2)),0)g_{ff}(x,w_2)dxdw_2+\\
&\lambda_{if}^{s_2}m_{ii}\int^{w_1}\int^{w_2}\max(F_f^{s_2}(w_2)-F_f^{s_2}(\hat{w}_{if-ii,if-nf}(w_1,x)),0)g_{ii}(w_1,x)dxdw_1.
\end{aligned}
$$

Spouse 1 is nonemployed and spouse 2 in formal sector

$$
\begin{aligned}
&m_{nf}G_{nf}(w_2)[\delta_f^{s_2}+\lambda_{ff}^{s_2}\bar{F}_f^{s_2}(w_2)]+\\
&\lambda_{ni}^{s_1}m_{nf}\int^{w_2}\bar{F}_i^{s_1}(\hat{w}_{if-nf}(w_2))g_{nf}(w_2)dw_2+\\
&\lambda_{nf}^{s_1}m_{nf}\int^{w_2}\bar{F}_f^{s_1}(\min(\hat{w}_{ff-nf}(w_2),\hat{w}_{fn-nf}(w_2)))g_{nf}(w_2)dw_2+\\
&\lambda_{fi}^{s_2}m_{nf}\int^{w_2}\bar{F}_i^{s_2}(\hat{w}_{ni-nf}(x))g_{nf}(x)dx=\\
&\delta_f^{s_1}m_{ff}G_{ff}(\bar{w}_1,w_2)+\delta_i^{s_1}m_{if}G_{if}(\bar{w}_1,w_2)+\\
&\lambda_{nf}^{s_2}m_{nn}\max(F_f^{s_2}(w_2)-F_f^{s_2}(\hat{w}_{nf-nn}),0)+\\
&\lambda_{nf}^{s_2}m_{in}\int^{w_1}\max(F_f^{s_2}(w_2)-F_f^{s_2}(\hat{w}_{if-in,if-nf}(w_1)),0)g_{in}(w_1)dw_1+\\
&\lambda_{nf}^{s_2}m_{fn}\int^{w_1}\max(F_f^{s_2}(w_2)-F_f^{s_2}(\hat{w}_{ff-fn,ff-nf}(w_1)),0)g_{fn}(w_1)dw_1+\\
&\lambda_{if}^{s_2}m_{ni}\int^{w_2}\max(F_f^{s_2}(w_2)-F_f^{s_2}(\hat{w}_{nf-ni}(x)),0)g_{ni}(x)dx.
\end{aligned}
$$

B.2 Identification in the Household Model: the value of leisure and the value of being outside the formal sector

From the value functions W_{nn}, W_{ni}, W_{in}, and W_{nf} define:

$$
\begin{aligned}
A = \lambda_{nf}^{s_1} \int \max\left\{W_{fn}(x) - W_{nn}, 0\right\} dF_f^{s_1}(x) + \\
\lambda_{ni}^{s_1} \int \left(W_{in}(x) - W_{nn}\right) dF_i^{s_1}(x) + \\
\lambda_{nf}^{s_2} \int \left(W_{nf}(x) - W_{nn}\right) dF_f^{s_2}(x) + \\
\lambda_{ni}^{s_2} \int \left(W_{ni}(x) - W_{nn}\right) dF_i^{s_2}(x)
\end{aligned}
$$

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

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

$$
\begin{aligned}
D = \delta_f^{s_2} p^{s_1} & \int \left(W_{in}(x) - W_{nf}(\underline{w}_2)\right) dF_i^{s_1}(x) + \\
\lambda_{ff}^{s_2} & \int \left(W_{nf}(x) - W_{nf}(\underline{w}_2)\right) dF_f^{s_2}(x) + \\
\lambda_{fi}^{s_2} & \int \left(W_{ni}(x) - W_{nf}(\underline{w}_2)\right) dF_i^{s_2}(x) + \\
\lambda_{nf}^{s_1} & \int \max\left\{W_{ff}(x, \underline{w}_2) - W_{nf}(\underline{w}_2), W_{fn}(x) - W_{nf}(\underline{w}_2), 0\right\} dF_f^{s_1}(x) + \\
\lambda_{ni}^{s_1} & \int \max\left\{W_{if}(x, \underline{w}_2) - W_{nf}(\underline{w}_2), 0\right\} dF_i^{s_1}(x)
\end{aligned}
$$

Under the restriction $\gamma = 0$, i.e before SP, the parameters b_1, b_2, and a:

$$b_1 = \underline{w}_1^i + C - A$$

$$b_2 = \underline{w}_2^i + B - A$$

$$a = \underline{w}_2^i - \underline{w}_2^f + B - D$$

Given a, γ is obtained using data from a period after the SP implementation:

$$\gamma = a + \underline{w}_2^f - \underline{w}_2^i + D - B$$

B.3 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:

$$\int \max\left\{W_{ni}(x) - W_{fn}(w_1), 0\right\} dF_i^{s_2}(x) = \int_{\hat{w}_{ni-fn}(w_1)}^{\infty} \left(W_{ni}(x) - W_{fn}(w_1)\right) dF_i^{s_2}(x)$$

Then we use the definition of reservation wage so that $W_{ni}(\hat{w}_{ni-fn}(w_1)) = W_{fn}(w_1)$. We also differentiate the value function $W_{ni}(w_2)$ with respect to w_2.

$$W'_{ni}(w_2) = \left(r + \delta_i^{s_2}(1-q^{s_1}) + \delta_i^{s_2} q^{s_1} \overline{F}_i^{s_1}\left(\hat{w}_{in-ni}(w_2)\right) + \lambda_{if}^{s_2} \overline{F}_f^{s_2}\left(\hat{w}_{nf-ni}(w_2)\right) + \right)^{-1}$$

The above integral becomes:

$$\int_{\hat{w}_{ni-fn}(w_1)}^{\infty} \left(W_{ni}(x) - W_{fn}(w_1)\right) dF_i^{s_2}(x) = \int_{\hat{w}_{ni-fn}(w_1)}^{\infty} \overline{F}_i^{s_2}(x)\, W'_{ni}(x) dx$$

Other Emax functions have three elements instead of two. We also solve them in terms of F distributions and the transition parameters. For example:

$$\begin{array}{l}
\int \max\left\{W_{ff}(w_1,x) - W_{fn}(w_1), W_{nf}(x) - W_{fn}(w_1), 0\right\} dF_f^{s_2}(x) = \\
\begin{array}{lll}
\int_{\min\left\{\hat{w}_{ff-fn}(w_1), \hat{w}_{nf-fn}(w_1)\right\}}^{\infty} \overline{F}_f^{s_2}(x)\, W'_{ff}(w_1,x) dx & if & \hat{w}_{ff-nf}(w_1) < \min\left\{\hat{w}_{ff-fn}(w_1), \hat{w}_{nf-fn}(w_1)\right\} \& W_{ff}(w_1,\bar{w}_2) \geq W_{nf}(\bar{w}_2) \\
\int_{\min\left\{\hat{w}_{ff-fn}(w_1), \hat{w}_{nf-fn}(w_1)\right\}}^{\infty} \overline{F}_f^{s_2}(x)\, W'_{nf}(x) dx & if & \hat{w}_{ff-nf}(w_1) < \min\left\{\hat{w}_{ff-fn}(w_1), \hat{w}_{nf-fn}(w_1)\right\} \& W_{ff}(w_1,\bar{w}_2) < W_{nf}(\bar{w}_2) \\
\int_{\min\left\{\hat{w}_{ff-fn}(w_1), \hat{w}_{nf-fn}(w_1)\right\}}^{\hat{w}_{ff-nf}(w_1)} \overline{F}_f^{s_2}(x)\, W'_{nf}(x) dx + \int_{\hat{w}_{ff-nf}(w_1)}^{\infty} \overline{F}_f^{s_2}(x)\, W'_{ff}(w_1,x) dx & if & \hat{w}_{ff-nf}(w_1) \geq \min\left\{\hat{w}_{ff-fn}(w_1), \hat{w}_{nf-fn}(w_1)\right\} \& W_{ff}(w_1,\bar{w}_2) \geq W_{nf}(\bar{w}_2) \\
\int_{\min\left\{\hat{w}_{ff-fn}(w_1), \hat{w}_{nf-fn}(w_1)\right\}}^{\hat{w}_{ff-nf}(w_1)} \overline{F}_f^{s_2}(x)\, W'_{ff}(w_1,x) dx + \int_{\hat{w}_{ff-nf}(w_1)}^{\infty} \overline{F}_f^{s_2}(x)\, W'_{nf}(x) dx & if & \hat{w}_{ff-nf}(w_1) \geq \min\left\{\hat{w}_{ff-fn}(w_1), \hat{w}_{nf-fn}(w_1)\right\} \& W_{ff}(w_1,\bar{w}_2) < W_{nf}(\bar{w}_2) \\
0 & & else
\end{array}
\end{array}$$