Are Informal Workers Compensated for the Lack of Fringe Benefits?
Free Health Care as an Instrument for Formality

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Abstract

I estimate the compensating wage differential for the bundle of fringe benefits that Mexican Social Security provides to low-educated female salaried workers in the private sector. I use the exogenous availability of free health care implemented in 2001 in the Distrito Federal (DF) part of Mexico City to overcome the endogeneity that typically contaminates estimates. This policy provides valid instruments because eligibility is not correlated with individual unobserved characteristics affecting wages or benefits. In contrast with previous studies for Mexico and other countries, my results show that IMSS coverage decreases wages by 23 percent, which supports the compensating differentials theory.

1 Introduction

In developing countries, a substantial fraction of workers have informal jobs, i. e., jobs not covered by health insurance or other fringe benefits mandated by law. The compensating differentials theory predicts that if workers value these benefits then informal workers should get a higher wage than workers in formal or covered jobs to compensate for the lack of benefits (Rosen, 1986). In practice, estimating the tradeoff between wages and benefits typically suffers from endogeneity bias because unobserved worker characteristics are likely to be correlated with both variables. A positive bias would arise if more able workers demand higher wages together with higher fringe benefits. In fact, many studies for the U.S. find positive or insignificant effects of health insurance coverage on wages using both cross section and panel data methods.[1] For the same reason, the empirical literature on the wage differentials

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[1] Currie and Madrian (1999) survey the literature on the tradeoff between employer-provided health insurance and wages.

between formal and informal sectors in developing countries finds evidence of a positive formality premium (Funkhouser, 1999; Gong and Van Soest; 2002)[2], even if in some studies this premium is not statistically significant (Pratap and Quintin, 2006)

A potential strategy for estimating the compensating differentials for fringe benefits consistently is to find valid instruments for having those benefits. Olson (2002) estimates the wages foregone for employer-provided health insurance using husband's firm size and union status as variables that influence whether wives working full-time accept or decline health insurance coverage through their own jobs. The author does find evidence of a wage-benefits tradeoff but, as he also discusses, assortative mating could still bias his results.

This paper estimates the effect of formality, defined as social security coverage, on the wages of female salaried workers with at most high school education in the private sector. To overcome endogeneity, I use the Free Health Care and Prescription Drugs Program (PSMMG), implemented in 2001 in the part of Mexico City that belongs to the state of Distrito Federal (DF), as an exogenous expansion in the health benefits available to informal workers. Mexican law requires employers in the private sector to register their salaried employees with the Mexican Institute of Social Security (IMSS). Both employer and employee are required to pay contributions to the system, and in return the employee gets a bundle of fringe benefits, including access to public health care and retirement saving, among others. Thus, I am not able to estimate the compensating differential for a single benefit, but rather for the package of benefits provided by IMSS. Nevertheless, health care is a substantial component of this bundle, so the availability of state free health care should decrease the incentives to contribute to the system and make informal or uncovered jobs more attractive to some workers, affecting their choice of coverage. The PSMMG provides valid instruments for IMSS coverage because the only requirements to participate are to be at least 18 years old, which is the legal working age in Mexico, to have at least 3 years of residence in the state and to lack health insurance coverage. Thus, eligibility for the program is not correlated with individual unobserved characteristics that affect wages or benefits choice.

I use a sample of female salaried workers with at most high school education from the Mexican Urban Employment Survey (ENEU) for Mexico City, Guadalajara and Monterrey, which are the three largest cities in Mexico. Female workers with relatively low education are more likely to respond to free health care availability by changing their IMSS coverage, because they have a higher risk of not accumulating the minimum time in the system required

[2]Studies that do find a negative formal premium usually compare self-employed workers with salaried workers or use a definition of informality based on firm size. These studies classify self-employed, family and domestic workers, as well as salaried workers in firms with five or fewer workers as informal. Independent professionals and salaried workers in firms with more than five employees are considered formal. (Marcoullier et al, 1997). Comparing the earnings of the self-employed, classified as informal, with those of salaried workers is misleading because they could include returns to risk, capital and entrepreneurship. On the other hand, even though firm size and compliance are positively correlated, a definition of informality based on firm size might be picking up the effect of the firm size on wages rather than the effect of informality per se. The positive effect of firm size on wages is well documented in the works of Brown and Medoff (1989), Schmidt and Zimmerman (1991) and Rebitzer and Robinson (1991), among others.

to receive some of the IMSS benefits, so they might value them less. It is also easier for workers with low education to find jobs with similar characteristics in both sectors. My data cover the period 2000-2004, before and after the policy change. After 2001, free health care was available only to DF residents, and not to individuals living in Guadalajara, Monterrey or the part of Mexico City that belongs to the State of Mexico. Given that my data cover the first three years of the program, my estimates reflect the short-run effects of free health care access on workers' IMSS coverage choices and wages.

For the instrumental variables procedure used in this paper, I estimate a probit for the probability of having a job covered by IMSS using interactions of DF residence with year dummies as instruments, and calculate the predicted probability of being formal for each observation. Then, I estimate the wage equation by two-stage least squares using this predicted probability as an instrument for IMSS coverage.

My results show that being a DF resident after the PSMMG was implemented has a negative and statistically significant effect on the probability that a female salaried worker with at most high school education has IMSS coverage in her current job. Such a worker is about 4 percentage points less likely to have a formal job in DF in 2003 and 2004. I find no statistically significant effects of being in DF in 2001 and 2002 for these workers, right after the policy change, which is consistent with a slow initial enrollment in the program. The effects of being in DF after 2001 for female salaried workers with more than high school education, and for low and highly educated men are mostly small and not statistically significant. These findings confirm that low-educated women are the most responsive to the policy, as argued above, so I focus on this sample for the estimation of compensating wage differentials. However, the negative effects estimated for highly educated women, statistically significant only in 2004, suggest that other workers might respond more to the policy in the longer term. I also find negative and statistically significant effects of the DF program on IMSS coverage for a subsample of low-educated women who are not covered as IMSS dependents, but not for those covered as dependents, which is reasonable because women in the latter group are already covered by IMSS, regardless of their own job choice, and so they are not affected by the program. Including workers paid with commissions reinforces the negative effects of the DF policy on IMSS coverage, as would be expected, given that these workers are sometimes informal salaried workers in disguise.

Regarding wages, not controlling for the endogeneity of IMSS coverage gives rise to a positive formal premium, as in other studies for developing countries. In contrast, my instrumental variables results show that low-educated female salaried workers in formal jobs earn around 23 percent less than similar workers in informal jobs, which is slightly less than the 27 percent that total IMSS contributions represent of the mean wage in my sample. Compared to the estimates of 10-20 percent of wages for private health insurance reported by Olson (2002), my estimate is low, even if IMSS provides public and not private health care, given that the IMSS bundle includes other fringes. However, the quality of services and other failures might

contribute to workers' low valuation of IMSS coverage, as argued extensively in Levy (2008). Also note that my estimates reflect the compensating differential after the implementation of free health care in DF, and so they might also be lower than the ones in the absence of the policy if free health care affected wages directly. However, I expect wage adjustments to be small in the first three years of the program, especially because enrollment took off slowly.

Given that the PSMMG induces only a fraction of eligible workers in DF to switch IMSS coverage in the early years of the program, my estimated compensated differential reflects the valuation of those workers, who are presumably at the margin, and not the average valuation of the IMSS bundle among all female salaried workers with low education. The fraction of switchers is likely to increase with time as workers change their industry, occupation or firm size in response to the availability of contribution-free health care in their state. In addition, after 2004 the federal government has implemented similar universal access programs that provide substitutes for some of the benefits in the IMSS bundle, like health care, child care and retirement, further increasing the incentives for dropping IMSS coverage. So, as the benefits available to informal workers continue to increase, the compensating wage differential would likely decrease.

Additional empirical checks show that the decrease in the probability of having a formal job found for low-educated female salaried workers in DF after the PSMMG cannot be attributed to different trends in economic activity, or in female labor force participation, between cities. In addition, using the Employment and Social Security Supplement (ENESS) to the ENEU data, I find that being in DF in 2004, after free health care was implemented, has a positive and statistically significant effect of 19 percentage points on the probability that a female salaried worker with at most high school education used health care at least once in the previous 12 months. Conditioned on having used health services at least once, being in DF in 2004 has a negative effect of 8.9 percentage points, significant at 10 percent, on the probability of having used IMSS health services at least once and a negative and statistically significant effect of 11 percentage points on having used IMSS most frequently during the previous year. Being in DF in 2004 has a positive and statistically significant effect of 7 percentage points on the probability of having used other public health care at least once, and a positive, but small and not statistically significant, effect on the probability of having used other public health care most frequently in the previous year. This evidence is consistent with these workers substituting IMSS health care with the free state health care provided in DF.

The main contribution of this paper is showing that properly controlling for the endogeneity of fringe benefits gives rise to a negative formal premium, which supports the compensating differentials theory. In the Mexican context, this implies that informal salaried workers with low education are not necessarily worse off than their counterparts in the formal sector because they are being compensated for the lack of fringe benefits, which would contradict the view of the informal sector as a "waiting" or relatively disadvantaged sector. My results also add to the evidence on worker mobility and transition patterns between sectors, which suggest

that the labor market in Mexico is relatively competitive (Maloney, 1998, 1999; Levy, 2008).

However, if individuals underestimate the probability of becoming disabled or if they are myopic when making intertemporal decisions, withdrawing from the current social security system could have negative consequences on their welfare in the future. As Levy (2008) points out, transitions between formal and informal employment imply, for example, that individuals are forced to save for retirement only part of their working lives, which undermines the government social objectives. So, even though universal access to health care could have positive effects on health outcomes, especially for individuals not participating in the labor market, my findings also suggest that weakening the link between contributions and benefits could go against the efforts to increase tax compliance in Mexico.

This paper is organized as follows. Section 2 describes the Mexican social security system and the DF program used to obtain instruments for the choice of sector. Section 3 summarizes the theory of compensating differentials by Rosen (1986) and discusses the underlying assumptions. Section 4 presents the empirical strategy for estimating the effect of formality on wages and the instrumental variables procedure used in this paper. Section 5 describes the data and variables used in the estimation. Section 6 discusses the results. Section 7 presents some additional empirical checks and section 8 concludes.

2 Background: the Mexican Social Security System and the Free Health Care and Prescription Drugs Program

According to Mexican labor law, employers in the private sector must register their salaried employees with the Mexican Institute of Social Security (IMSS).[3] Both employer and employee are required to pay contributions to the system, and in return the employee gets a blundle of fringe benefits, including access to public health care, maternity benefits, disability, life and workers' compensation insurance, retirement saving, child care and housing loans. The health benefits provided by IMSS also cover the worker's spouse and children.[4] Federal employees, which will be excluded from my estimations, are covered by a similar but separate system called Health and Social Security Institute for Government Employees (ISSSTE). Finally, a small proportion of salaried workers in the private sector get, in addition to IMSS benefits, other fringes, like private health insurance. As a large literature on informality documents, an important fraction of eligible private sector workers is not covered by IMSS (40 percent in

[3] According to the Federal Labor Law, workers must be registered with IMSS if they perform "subordinated work" for an employer and are paid a wage in exchange. Unpaid family workers and non-salaried workers, like independent professionals, the self-employed and workers who are have a profit-sharing agreement with a firm or are paid with commissions, are not legally required to register with IMSS. Levy (2008, ch.1) provides a broader discussion on the Mexican labor regulations and their implications for social security compliance.

[4] Mexican law does not allow a salaried worker in the private sector to legally drop IMSS coverage if she is already covered through her spouse's job. So, a formal worker is required to pay IMSS contributions in full regardless of her marital status and her spouse's coverage.

my data).[5]

The first panel of Table 1 shows IMSS contributions required by law as a percentage of salary for each of the benefits included in the bundle. If a worker is registered with IMSS, she and her employer must pay all the contributions listed, so neither she nor her employer can choose to pay only for a subset of them. Adding up rows A to E in Table 1, shows that contributions required equally from all workers are roughly 17 percent of wages, and that the law requires employers to pay for the largest part (14.65 percent). The contribution for workers' compensation insurance varies from 0.5 to 15 percent of wages depending on the risk of injury in each firm and job, so I in row G report the average contribution paid by employers in 2004 according to the IMSS Financial and Actuarial Report of that year, which was 1.93 percent of wages. Adding this to row F yields 18.96 percent of wages. Row H shows that the health and maternity contribution has an additional part that varies with earnings. For workers earning up to 3 times the DF legal minimum wage (DFMW), employers must pay a fixed contribution of 20.4 percent of the DFMW, which is used in the law as a reference wage, regardless of the worker's place of residence. For workers earning more than 3 times the DFMW, employers must pay the same fixed contribution stated above, plus 1.1 percent of exceeding earnings, and workers must also pay an additional 0.4 percent on exceeding earnings. This non-linearity in the health and maternity contribution causes the total health contribution to decrease with earnings. The last column of Table 1 reports the total contributions that must be paid for a worker earning 2.3 times the DFMW, approximately the mean earnings for the female salaried workers in my sample in 2000. The total IMSS contribution for such a worker is 1118 pesos, which represents 27.8 percent of earnings. The largest part of the health contribution is that conditioned on earnings, which is 356.4 pesos. Adding both the unconditioned and conditioned health contributions gives a total of 451.82 Mexican pesos, which represents 11.2 percent of earnings and 40 percent of the total contributions paid.

The Free Health Care and Prescription Drugs Program (PSMMG) is a state program that provides free health care and medications to the population not covered by any type of health insurance in the DF part of Mexico City.[6] The program was created in June 2001. To qualify, an individual must be at least 18 years old, must have at least 3 years of residence in DF, and must not be covered by IMSS, ISSSTE or any other type of health insurance. Individuals must enroll voluntarily to receive benefits and they can do so in any state hospital. No fee is paid for either enrollment or any of the medical services, regardless of the applicant's individual or household income. The program covers also the beneficiary's dependents, like her spouse or partner and her children. The only ways of losing the benefits from PSMMG are by providing

[5] Noncompliance with IMSS and other labor regulations is relatively large for a number of reasons. First, noncompliance is easier for smaller firms. Second, firms can to some extent disguise some of their employees as contractors or commission workers to avoid paying for their IMSS contributions. Third, if a firm has not registered a given worker with IMSS, enforcement of IMSS and other benefits typically happens when the worker files a lawsuit after she leaves that employer, which is costly given the complexity and poor functioning of the legal system.

[6] Proper Mexico City is called Distrito Federal (DF), which for government purposes is a state, but the metropolitan area of the city also includes some municipalities belonging to State of Mexico.

false information or getting a job covered by either IMSS or ISSSTE.

The benefits from this program are quite generous. The health services provided for free include vaccines, doctor visits, surgeries and hospitalization, mental health services, lab services, dental and vision care, among others, and they must be provided in hospitals under the administration of the DF government. The program also provides the prescription drugs required by treatment at no cost to the beneficiary and explicitly includes those for the treatment of HIV.

Above, I showed that the health contribution represents around 40 percent of total IMSS contributions for the mean worker. Table 2 reports IMSS expenditures by benefit in 2000 in billion pesos. Of the total 241.3 billion pesos spent on providing benefits in 2000, 43 percent were spent in the provision of health benefits. Even though an actual conversion of the different IMSS benefits into monetary equivalents would be most informative, these two figures show that health care is a substantial component of the benefits linked to the employee's and employer's contributions to IMSS. Given this, the availability of free health care in DF should decrease the incentives to contribute to the social security system, thus decreasing the probability that a given worker has a formal job. I expect PSMMG to have a negative effect on formality, even if IMSS hospitals and clinics are usually better equipped and have better doctors than state ones, because before the program an important fraction of workers was already willing to go without health benefits in order to avoid paying contributions.[7] Furthermore, PSMMG provides valid instruments because eligibility for the program is not correlated with individual unobserved characteristics that affect both wages and the choice of sector.

3 Theoretical discussion

This section follows closely the theory of equalizing differences as presented in Rosen (1986) and applies it to informality in Mexico. Let D be a binary variable indicating whether a job is covered by IMSS ($D = 0$) or not ($D = 1$). So, jobs of type 1 have the disamenity of not providing IMSS benefits. Each worker has a utility function $u(C, D)$, defined over the consumption that can be bought with money (C) and the job disamenity (D). In this model, workers differ in their preferences for the IMSS bundle of benefits, but are homogeneous in productivity. In my data, no productivity measure is available, but I focus on a sample of low-educated women, which potentially reduces the actual heterogeneity in productivity. In addition, the policy change I use to generate instruments for sector choice is not correlated with unobserved worker productivity.

In the model, it is also assumed that for a given value of C, $u(C, 0) \geq u(C, 1)$ so that, keeping consumption constant, $D = 1$ is never preferred to $D = 0$. This assumption is

[7] Before PSMMG, some health services were provided to the uninsured population by the state hospitals, but they were restricted to emergency care and other 14 basic medical procedures. The patients would pay for medications and for any additional care.

reasonable in the period covered by my data (2000-2004), even after the introduction of PSMMG, because this program provides free health services and medications to workers in informal jobs, but not the other benefits included in the IMSS bundle (see Table 1).[8] So, if C_0 is market consumption when $D = 0$ and C^* is such that $u(C_0, 0) = u(C^*, 1)$, then $C^* \geq C_0$. Thus, the additional compensation that a worker needs to be indifferent between having a formal or informal job is $Z = C^* - C_0 \geq 0$.

Each job can be described as a combination (w, D) of wages (w) and IMSS coverage (D). Formal jobs offer $(w_0, 0)$ and informal jobs offer $(w_1, 1)$. The labor market is assumed to be competitive, so each worker takes these options as given. In Mexico, this is more likely to hold for my sample of low-educated workers, because these workers are relatively abundant.[9] Let $\Delta W = (w_1 - w_0)$ be the market compensating differential for not having IMSS coverage. A utility-maximizing worker will choose to have an informal job if $u(\Delta W + C_0, 1) > u(C_0, 0)$, or equivalently if $\Delta W > Z$. The heterogeneity in workers' valuations of IMSS benefits is described by the probability density function $g(Z)$. Then, for a given value of ΔW, the fraction of workers who apply for an informal job is $G(\Delta W)$, where $G(\cdot)$is the cumulative density function of Z. The PSMMG program provides health benefits to workers without charging any contributions, so the program decreases Z, the subjective reservation price for an informal job, for some workers inducing them to switch coverage if ΔW remains constant. The assumption that the PSMMG does not affect wages directly is also necessary for this program to be a valid instrument for formality, so the instruments can be properly excluded from the wage equation. Given that I use data for the first three years of the program, I argue that this is a reasonable assumption when estimating the short-run effects on coverage choice.

Firms choose whether to offer formal or informal jobs by comparing the cost of offering IMSS coverage, which is paying the required contributions, with the corresponding wage savings of doing so. If wage savings exceed the contributions that must be paid, a firm will choose to offer formal jobs. In the case of IMSS contributions, an additional cost of being informal is the expected penalty for not complying with the social security regulations, which by law is entirely borne by the firm and not by the worker. Modifying the model in Rosen (1986) slightly, assume firms have a linear technology described by $x = a_1 L - pKL$ when $D = 1$ and $x = a_0 L$ when $D = 0$, where L is labor, p is the probability the firm is caught by IMSS, and K is the penalty paid per unit of L. Let $B = a_1 - a_0 - pK$. A firm will choose to offer an informal job if the benefit of being informal exceeds the cost $B > \Delta W$. In Mexico, smaller firms are less likely to be detected by IMSS, so they are more likely to offer informal

[8] Recently, the federal government has implemented and expanded a number of non-contributory programs that provide health, child care, housing and retirement benefits to the population not covered by IMSS or ISSSTE, increasing the benefits that informal workers have access to. However, most of this expansion took place after 2004, so this assumption remains valid for the period and cities covered by my data.

[9] Using my sample of female salaried workers with at most high school education from ENEU, I calculated the median hourly wage and the interquartile range within industry, occupation, firm size, city, quarter and year cells. The median interquartile range was 2.75 pesos, which is 16 percent of the median wage (16.80 pesos). Given that I cannot identify individuals working in the same firm, I take this as evidence of low wage dispersion suggesting that room for individual bargaining for these workers is small.

jobs. If $f(B)$ is the pdf of B, the fraction of informal jobs offered to the market is equal to $F(\Delta W)$ where $F(\cdot)$is the cdf of B. After the implementation of PSMMG, firms are still required by law to register their employees with IMSS, to pay contributions, and they still face the same penalties for not doing so. Thus, the program did not change the expected costs of offering informal jobs for firms.

In equilibrium, workers and firms are sorted and matched according to the workers' preferences for the IMSS bundle of benefits and the firms' cost of providing it. So, workers in informal jobs have relatively low valuations of IMSS benefits and firms offering informal jobs have relatively low costs of avoiding the payment of IMSS contributions. The market compensating differential makes the marginal worker indifferent between the two types of jobs, but due to the sorting, it might differ from the average reservation price of workers in each type of job. The PSMMG likely changes Z for those who at the current wage differential are close to the margin of choice, making them switch. Those at the extremes of the tastes distribution are unlikely to be affected by the program, especially if they place a high value on IMSS benefits other than health services.

4 Estimating the effect of formality on wages

To measure the effect of IMSS coverage on the wages of salaried workers, one could estimate the following equation:

$$\log wage_{it} = c_i + \alpha_1 formal_{it} + X_{it}\beta_1 + u_{it} \tag{1}$$

where the dependent variable is the logarithm of the hourly wage for worker i in period t, $formal_{it}$ is a dummy variable equal to one if the worker has IMSS coverage in her current job, X_{it} is a vector of individual characteristics and c_i is an individual effect that captures unobserved heterogeneity. By assumption, the error term u_{it} has zero mean and it is not correlated with X_{it}. However, estimating α_1 consistently with pooled OLS is problematic because c_i is potentially correlated with $formal_{it}$. Workers choose whether to have a formal job, with the bundle of fringe benefits associated with it, according to their unobserved characteristics, like ability. In fact, if ability is positively correlated with formal, i.e. more able workers earn higher wages and also choose jobs covered by IMSS, then OLS would tend to overestimate the effect of formality on wages. Most previous work, both on compensating differentials and on the effect of formality on wages, suffers from this endogeneity, because in many cases the information on the covariates needed to make the ignorability assumption credible is not available, or because it is very difficult to find instruments that affect the choice of sector or benefits, but not wages directly.

Let $\Delta y_{it} \equiv y_{it} - y_{i,t-1}$ for a given variable y_{it}. With panel data, taking first differences of equation (1) eliminates the individual effect c_i and results in the following equation:

$$\Delta \log wage_{it} = \alpha_1 \Delta formal_{it} + \Delta X_{it}\beta_1 + \Delta u_{it} \tag{2}$$

which yields consistent estimates of α_1 if $E(\Delta formal_{it}\Delta u_{it}) = 0$. Taking first differences solves the endogeneity due to the correlation between the time-invariant individual effect and the formal dummy, but only if $formal_{is}$ is uncorrelated with u_{it} for all s and t. If employers learn gradually about a worker's productivity and reward past positive productivity shocks with both a wage increase and IMSS coverage, then taking first differences would not completely solved the heterogeneity bias.

My preferred approach is to use the following instrumental variables procedure.[10] Suppose z_{it} contains valid instruments for $formal_{it}$, that is, z_{it} can be properly excluded from equation (1), it is partially correlated with having a formal job in period t and it is not correlated with c_i. I estimate the probability of having a formal job with a probit :

$$\Pr ob(formal_{it} = 1|X_{it}, z_{it}) = \Phi(\delta + X_{it}\beta_2 + z_{it}\gamma) \tag{3}$$

and then I estimate equation (1) by two-stage least squares (2SLS) using the fitted probability from (3) for each observation as an instrument for $formal_{it}$. This IV estimator is consistent and asymptotically normal, and it does not require the probit to be the correct specification for equation (3). The 2SLS standard errors and test statistics are asymptotically valid, and they can be corrected for heteroskedasticity and serial correlation. Without valid instruments that are actually excluded from equation (1), identification would rest entirely on the nonlinearity of the probit model. As discussed in the section 2, I use the exogenous availability of free health care in DF after 2001 to generate instruments for $formal_{it}$.

5 Data and empirical specification

I use quarterly data from Mexico's National Urban Employment Survey (ENEU), which is a panel covering 44 cities in the country. Each individual is followed for a maximum of five quarters and the information collected refers to the previous week. I use a sample of female salaried workers 18 to 60 years old in the three largest cities in Mexico: Mexico City, Guadalajara and Monterrey. The ENEU survey explicitly asks the worker to classify herself as employer, self-employed, piece-rate or commission worker, wage or salaried worker, coop member or unpaid worker. I keep only those who report being wage or salaried workers and exclude all others, because salaried workers are those to which the IMSS obligation applies. However, it is not entirely clear whether piece-rate or commission workers qualify for IMSS benefits, because some employers disguise their employees as commission workers to avoid paying their contributions. So, even though workers paid with commissions are excluded from my main results, I check whether including them in the sample makes a difference.

[10] The description of the procedure is taken from Wooldridge (2002).

Government workers are also excluded from the analysis. My data cover the period 2000-2004. After the second semester of 2001, informal workers in DF were eligible for free health care and prescriptions drugs, whereas informal workers in Guadalajara, Monterrey and the part of Mexico City that belongs to State of Mexico were not. Observations in Guadalajara and Monterrey act as controls because they are in cities similar to DF, but in the northern part of Mexico, and observations in State of Mexico, but still within the metro area of Mexico City, would ideally control for any specific regional effects. However, as I show below, some State of Mexico residents might have access to PSMMG services, even though they are not supposed to, making them unsuitable as control group.

Female workers with relatively low education are more likely to respond to PSMMG by changing their IMSS coverage for several reasons. First, some of IMSS benefits depend on the accumulated time of enrollment in the system. Women have a higher risk of leaving both formal employment and the labor force due to family reasons, so they have a higher risk of not accumulating enough time to receive these benefits, so they might value them less. Second, workers with high education might not respond to the policy change because for them it is difficult to find suitable jobs in the informal sector, whereas workers with lower educational levels might actually find jobs with similar characteristics in both sectors. In addition, workers with high education can also afford private health insurance, and they might not be willing to substitute between private and public care. Using administrative IMSS records, Levy (2008) finds that low-wage workers enter and exit the formal sector more often than high-wage workers. These administrative data have no information on the education of the worker, but given the positive correlation between education and wages, this is indirect evidence of the higher willingness to switch IMSS coverage of low-educated workers, even in the absence of free health care.[11]

Figure 1A shows the fraction of female salaried workers with 12 or less years of education who have jobs covered by IMSS in DF and in Guadalajara, Monterrey and the State of Mexico part of Mexico City during the period 2000-2004. Before PSMMG, Guadalajara and Monterrey have similar trends, which are different from those of DF and State of Mexico, particularly in the 6 months before the program. However, despite the difference in quarter-to-quarter fluctuactions, formality rates for Guadalajara are similar to those for DF, and they both oscillate between 60 to 65 percent until the end of 2002. After 2002, one and a half years after PSMMG was implemented in DF, the proportion of formal workers in DF falls sharply, whereas in Guadalajara it continues to move slightly around 60 percent. In Monterrey, the formality rate fluctuates between 70 and 75 percent throughout the period, and no drop comparable to that of 10 percentage points in DF is observed. This preliminary evidence suggests that free health care availability in DF might have decreased the fraction of female workers with IMSS coverage. However, Figure 1A shows that the formality rate in the part of Mexico City that belong to State of Mexico also falls sharply after 2002. In fact,

[11] Levy (2008) also finds the evidence on worker transitions from IMSS administrative records to be broadly consistent with similar evidence from the ENEU data.

both DF and State of Mexico follow similar trends during the whole period, except after the third quarter of 2001, shortly after PSMMG had just started, in which formality decreases in State of Mexico and stays constant at a lower level until the third quarter of 2002, whereas formality in DF increases slightly. According to the rules of the program, individuals living in State of Mexico do not qualify for PSMMG, but I show that some of them are getting health care from the program given their proximity to DF.[12]

Figure 1B shows formality rates for DF and for Guadalajara and Monterrey grouped as Not DF. State of Mexico observations are excluded from the graph and from my main results, but I check how including them as part of the treatment and control groups affects estimates. Even though the trends in and outside of DF are not exactly the same, formality rates in DF oscillate between 60 and 65 percent until the end of 2002 and those outside of DF fluctuate slightly around 65 and 70 percent throughout the period. Again, after 2002, formality decreases sharply in DF. Figure 1 suggests that the response to PSMMG in DF was not immediate, probably because individuals wait to see how the program actually works before deciding to switch coverage.[13] In fact, as shown below, data for health services provided in DF state hospitals are consistent with this delay in program take-up.

Figure 2 shows annual hospital discharges in DF state hospitals by patient residence between 2000 and 2004, as reported by the Health Information Office of the DF State Ministry of Health (SSDF). Panel A shows that between 2000 and 2001, discharges of patients residing in DF increased by 7 percent (4,835), whereas Panel B shows that between the same years discharges of patients residing in State of Mexico increased by 45 percent (6,417), they continue to grow steadily till 2002, reaching 25,000 per year, and remain roughly constant after that. Panel C shows that the fraction of total discharges represented by State of Mexico patients grew from 16 to 22 percent between 2000 and 2001, and it oscillates between 22 and 24 percent in 2003 and 2004. This suggests that some State of Mexico residents are getting services from the DF program, and they started doing so early, even though they are not supposed to. So, for my estimations I exclude them from the group of control cities, but I also check how including them as part of the control and treatment groups affects my results.

Figure 2A also shows that the largest increase in discharges of DF patients occurred between 2001 and 2002, and not between 2000 and 2001, right after the implementation of the program. After 2002, discharges of DF patients continue to grow, but at a lower rate. Figure 3 shows total patient days in DF state hospitals in the period 1999-2004, also reported by the DF Ministry of Health. Patient days remained constant between 1999 and 2000, increased by 5.7 percent between 2000 and 2001, by 15.5 percent between 2001 and 2002, and continue to grow after 2002 but at a much lower rate. Both figures suggest that enrollment of DF residents in PSMMG grew slowly between 2000 and 2001, really took off between 2001

[12] To verify DF residence, the program asks for a water, electricity or telephone bill with a DF address on it, but it does not have to be addressed to the applicant.

[13] In Mexico, switching between a formal and informal job not necessarily means changing employer. An individual could continue working in her same job, but just drop out of IMSS, as pointed out also by Levy (2008). In my data, I can identify whether workers changed their coverage, but not whether they changed jobs.

and 2002, and continued to grow slowly after 2002. These patterns in hospital discharges and patient days are consistent with the observed delay in the decrease of formality rates in DF, which, as shown in Figure 1, took place not right after the second quarter of 2001, when PSMMG started, but only after 2002. So, I can convincingly attribute the drop in formality in DF to PSMMG, and not to some other confounding factor. I also present additional evidence of substitution between IMSS health care and other public health care in section 7.

For my estimations, I calculate real hourly wages in 2002 pesos as monthly labor earnings, divided by the monthly hours worked and the average consumer price index for the corresponding quarter. The independent variables included in the probit and logwage equations are age, years of schooling, number of children younger than 5 years old, children 5-12 years old, number of adults age 12 and older and number of adults age 70 and older in the household; dummies for married, head of household, firm size, occupation, industry, state and year. The key independent variable in the logwage regression is $formal$, a dummy equal to one if the individual has IMSS coverage in her current job. The instruments are the interactions of the DF dummy with the year dummies (for instance, $DF \times 2001$). Monterrey and Guadalajara observations are grouped together as the excluded category.

Table A1 in the appendix shows the mean and standard errors of the variables used in the estimation for female salaried workers in DF, State of Mexico, Guadalajara and Monterrey, before the policy change. Table 3 presents the results of differences-in-means tests for selected variables and my sample of female workers with at most high school education in DF and outside of DF, which includes only Guadalajara and Monterrey, before the policy change. In DF, about 60 percent of workers have IMSS coverage before 2001, whereas outside of DF 68 percent of similar workers do. The mean hourly wage in DF is 15.97 pesos, which is lower than the mean wage in the control cities (17.24 pesos). Female workers in DF are on average 33.3 years old, 2.6 years older than their counterparts outside of DF. Women in both groups have about 9 years of schooling which corresponds to having completed secondary education, but female workers in DF are slightly more educated. About 36 percent of female salaried workers in DF are in firms with 5 employees or less, compared to only 30 percent of women outside of DF. Although all the differences are statistically significant, those for the hourly wage, age and education are small. Thus, female salaried workers in control cities are not very different, at least in those observed characteristics, from those living in DF. In any case, as described before, I explicitly control for these and other characteristics, and for state dummies, in all my estimations.

6 Results

6.1 The effect of PSMMG on the probability of having a job covered by IMSS

Tables 4 to 6 report the mean probit effects of the year and DF dummies, and also those of the DF-year interactions, which capture the effects of PSMMG on the probability of having a formal job for different samples. In all three tables, the reported standard errors are clustered at the state level, as suggested by Bertrand, Duflo and Mullainathan (2004). This clustering matters only for assessing the significance of the program effects, but it will not matter for the estimation as a whole, because the probit for the formal dummy is used to calculate the predicted probability for each observation, and then used in a two-stage least squares procedure.[14]

Table 4 reports the mean probit effects of PSMMG on the probability of having a formal job for salaried workers by education and gender. Column 1 shows that for female salaried workers with at most high school education being a DF resident in 2001 and 2002 has no statistically significant effect on the probability of having a formal job, which is consistent with the delay shown in Figure 1. However, for these workers, being in DF in 2003 and 2004 decreases the probability of having a formal job by 4.6 and 4.2 percentage points, respectively, and both effects are significant at 1 percent. Column 2 shows that for female salaried workers with more than high school education, only the effect of being in DF in 2004 is statistically significant and slightly smaller than for low-educated women. For highly-educated women, the effects of being in DF in 2001 and 2002 are negative, but very small and not statistically significant, and the effect of being in DF in 2003 is roughly half the size of the effect for low educated women and also not statistically significant. These results indicate that among female workers, those with lower education are more likely to switch coverage after PSMMG, as argued before. Columns 3 and 4 present the results for low and highly educated men. For men with at most high school education, all DF-year interactions are negative, but close to zero and not statistically significant. Column 4 shows that for highly educated men, only the effects of being in DF in 2002 and 2004 are statistically significant, but positive and small. Thus, of the four groups of salaried workers, the availability of free health care in DF effectively decreased the probability of having a job covered by IMSS only for low-educated women in the early years of the program. So, the rest of my estimations focus only on this sample. The negative and significant effect observed for highly educated women in 2004 suggest that, over time, these workers might also respond to PSMMG by dropping IMSS coverage. For all groups, the estimated coefficient for the DF dummy is negative and statistically significant, which means that being in DF has a negative effect on the probability that a given worker has IMSS coverage. In all columns, the estimated coefficients for the year dummies are all

[14] Wooldridge (2002) shows that the conditions required to ignore the estimation of the parameters in the probit stage hold.

close to zero and mostly not statistically significant suggesting that workers in Guadalajara and Monterrey did not experience a particular trend in the probability of having a formal job over the period.

Table 5 shows how including the observations in the State of Mexico part of Mexico City changes the estimated effects of PSMMG on the probability of having a formal job only for female salaried workers with at most high school education. Column 2 reproduces the results from column 1 in Table 4, excluding State of Mexico observations from the estimation. In column 1 of Table 5, State of Mexico observations are included as part of the control group, and the interactions of the DF dummy with the 2003 and 2004 dummies are still negative, smaller in absolute value than those in column 2, but statistically significant. So, including State of Mexico as part of the control cities only weakens the estimated effects of PSMMG on IMSS coverage. The estimated coefficients for the year dummies in column 1 are negative, larger in magnitude than those in column 2, and statistically significant for 2002 and 2003, consistent with the decrease in IMSS coverage, and the increase in the use of DF health services, observed for State of Mexico in the same years. In column 3, the treatment group is the metropolitan area of Mexico City, including both DF and State of Mexico observations, and the estimated effects are closer to those in column 2. The DF-year interactions for 2003 and 2004 are negative, slightly smaller than those in column 2, but statistically significant. Female salaried workers in the metropolitan area of Mexico City are about 3 percentage points less likely to have IMSS coverage in 2003 and 2004. Column 4 includes only State of Mexico observations in the control group and none of the effects of the DF-year interactions is statistically significant. Overall, I cannot rule out that these results are due to some State of Mexico residents cheating and participating in the PSMMG, even though they are not eligible for it, especially given the evidence in Figure 2.

Table 6 presents mean probit effects for the probability of having IMSS coverage for two subsamples: for female salaried workers with 12 or less years of education who are already covered by IMSS as dependents, either as the spouse or child of the head of household who has a job covered by IMSS, and for those who are not. Women who are IMSS dependents should not respond to PSMMG, because they are covered regardless of whether they have a formal or informal job, so their decision likely depends on other characteristics of the job, but not on IMSS coverage. Column 1 shows the results for all dependents and column 2 only for those dependents who are covered as spouses. In both columns, the effects of the DF-year interactions are negative in 2001 and positive for 2002, 2003 and 2004, but only the effect of being in DF in 2004 for all dependents is significant at 5 percent. So, for IMSS dependents, being in DF after the program started has a positive, but small and mostly not significant effect on whether they have IMSS coverage through their own jobs. Column 3 presents the results for not dependents, that is, for women who are themselves the head of their household, or who are children or spouses of the head, who does not have a job covered by IMSS. The results in this column are consistent with those in column 1 of Table 4. The

DF-year interactions are all negative, but larger and statistically significant only in 2003 and 2004. For not dependents, being in DF in 2003 and 2004 decreases the probability of having a formal job by 4 and 2.8 percentage points, respectively. The effect of -1.2 percentage points in 2001, right after PSMMG was implemented, is significant at 10 percent only. Column 4 further restricts the sample of not dependents to those women who are heads of household, which strengthens the negative effects of PSMMG on formality. For these women, being in DF has a negative effect on the probability of having a formal job in all years after 2000, but only the negative effects of 4.9 and 7.8 percentage points in 2003 and 2004 are statistically significant and larger in absolute value than for the whole sample and for the sample of not dependents.

The last column in Table 6 adds those female workers with at most high school education who report being paid with commissions to my original sample. These workers are excluded from my main results because strictly speaking they would not, in most cases, qualify for IMSS benefits, and because their earnings, which are mostly based on performance, might not be comparable to those of salaried employees receiving a fixed wage. However, as mentioned before, some firms and workers use this category to disguise salaried employment and avoid paying IMSS contributions, so in practice labor courts sometimes rule in favor of these workers against firms that fail to register them with IMSS. Column 6 shows that including commission workers reinforces the negative effects of PSMMG on IMSS coverage, as would be expected if some of these workers are actually informal salaried employees. Being in DF decreases the probability of having a formal job between 1.5 and 6.2 percentage points after the program started. These negative effects are all significant at 5 percent, even in 2001 right after the program started, they become stronger over time, and they are larger in absolute value than those for the sample of only female salaried workers.

In summary, the results in Table 4-6 confirm that PSMMG induced some female salaried workers with at most high school education to drop IMSS coverage in the early years of the program. These negative effects are statistically significant, particularly after 2002, which is consistent with the evidence in Figures 1 and 2, and they are larger for women who are not IMSS dependents and also when commission workers are included in the estimation, as would be expected. PSMMG has almost no effect on the coverage of highly educated women and of men, which suggests that my results are not due to a state-specific trend not associated with the policy. In addition, given that no decrease in coverage is observed for low-educated female salaried workers who are IMSS dependents, I can reasonably conclude that my results are not due either to other confounding factors affecting the labor market conditions for low-educated women in DF. Thus, in the next subsection I use the predicted probability for each worker from these probit estimations as an instrument for the formal dummy to calculate the wage compensating differential for the IMSS bundle of benefits.

6.2 The effect of IMSS coverage on wages

Table 7 shows the complete first-stage results. Columns 1 to 3 exclude observations from State of Mexico and show results for the sample of female salaried workers with at most high school education, for a sample that adds similar workers paid with commissions, and for a subsample of female salaried workers who are not IMSS dependents. Column 4 defines Mexico City, including observations from both DF and State of Mexico, as the group affected by PSMMG, and column 5 includes State of Mexico as part of the control groip. As expected, the fitted probability has a positive partial correlation with the endogenous variable and it is significant at 1 percent in all columns. Age, schooling and the married dummy have small, but statistically significant effects on the formal dummy, whereas the other control variables have small, and mostly not statistically significant, effects after conditioning on the predicted probability, but they must be included in this stage as part of the econometric procedure.

The bottom part of Table 7 presents some test statistics obtained by estimating the wage equation with 2SLS, including the DF-year interactions directly as instruments for the formal dummy in the first stage. In all columns, the results of the overidentification test do not reject the null that the instruments are valid, i.e. uncorrelated with the error term in the wage equation and properly excluded from it. The results for the Anderson underidentification test reject the null that the equation is underidentified at 5 percent in all columns, so the parameters are identified when using the DF-year interactions as instruments. The last row shows the Cragg-Donald F-statistic, which I compare to the critical values in Stock and Yogo (2002) to test the null that the instruments are weak for the case of one endogenous regressor and four instruments. In all estimations, except the one in column 3, I reject at 5 percent the hypothesis that instruments are weak if the maximum relative bias of the IV estimator I am willing to tolerate is 20 percent, but not if it is only 10 percent. This is probably because of the four DF-year interactions, only those for 2003 and 2004 are statistically significant, as shown in Tables 4-6. However, including only those instruments that turn out to be relevant could potentially yield the IV estimates inconsistent (Hall et al., 1996). In addition, these tests are informative, but my main results use only the predicted probability, which is statistically significant in all estimations are discussed above, as the single instrument for the formal variable.

Table 8 shows the effect of IMSS coverage on wages estimated by pooled OLS (panel A), first-differences (panel B) and instrumental variables (panel C) for the same samples in Table 7. In all the estimations in Table 8, the reported standard errors are clustered at the individual level to account for the panel structure of the data. Standard errors are not clustered at the state level in these estimations, because the pooled OLS and first-differences estimates do not incorporate DF-year effects, and the instrumental variables estimates use the predicted probability of having a formal job for each worker, which is a continuous variable, as an instrument for the formal dummy in a 2SLS procedure.

Panels A and B of Table 8 do not control for the endogeneity of coverage choice and show

that, as obtained by previous work, workers in jobs covered by IMSS earn about 9-10 percent more than workers in uncovered jobs. This would contradict the compensating differentials theory because it implies that formal workers receive both higher fringe benefits and higher wages. The pooled OLS and first-differences estimates are remarkably similar across samples, even if the second ones control for worker fixed effects and do not use the workers who do not appear at least twice in the data.[15]

Panel C of Table 8 presents the effects of IMSS coverage estimated with instrumental variables, which in contrast to the results in panels A and B, are all negative and mostly statistically significant. Column 1 shows that IMSS coverage decreases wages by 23.5 percent for female salaried workers with at most high school education. This estimated wage differential is slightly smaller to the total IMSS contributions paid by a worker earning 2.3 times the DFMW, the mean earnings for these workers in DF in 2000, as shown in Table 1. The fraction of earnings that total IMSS contributions represent decreases with earnings due to the part of the health contribution that is conditioned on earnings, so for workers earning less than 2.3 times the DFMW, which are about 70% of the sample in DF before PSMMG, total IMSS contributions are likely to exceed the estimated differential. Column 2 shows that adding workers paid with commissions to the sample yields the same compensating wage differential, but due to a larger standard error, it is significant at 10 percent only. As mentioned before, this might reflect that the earnings of commission workers, mostly tied to performance, are not comparable to those of salaried workers. In column 3, IMSS coverage decreases wages by 6.1 percent for the subsample of female salaried workers who are not IMSS dependents, and this effect is not statistically significant. The smaller estimated differential for not dependents might reflect a lower valuation of IMSS coverage for the marginal worker in this subsample or a larger bias in the direction of OLS, given the low value of the Cragg-Donald statistic for this subsample in Table 7. Column 4 shows that including female salaried workers who live in the State of Mexico, either as part of the treatment or control group, yields compensating differentials of about 14 percent, which are negative, as in the other columns, and statistically significant.

My findings show that pooled OLS and first-differences suffer from positive endogeneity bias, as would be expected if ability is positively correlated with wages and IMSS coverage. Once the endogeneity is controlled for, I find that female salaried workers with at most high school education in formal jobs earn less than similar workers in uncovered or informal jobs, as the compensating differentials theory predicts. My IV estimates reflect the effect of formality for those workers induced to drop IMSS coverage by PSMMG, who are only a fraction of eligible workers. These women would earn 23 percent more by switching to an informal job. According to my probit estimates, about 5 percent of eligible workers drop coverage in the initial years of the program. This is a small fraction, but it is likely to grow in the longer term as workers adjust their behavior more in response to the program, by changing jobs or even

[15] Pooled OLS and and first-differences estimates differ more when industry, occupation or firm size dummies are excluded from the estimation. These results are not shown, but they are available upon request.

their industry and occupation. In addition, universal access programs for several benefits have been expanding in Mexico, in particular in the period after 2004, increasing the incentives for dropping IMSS coverage.[16]

My IV estimates are comparable in magnitude to those found by Olson (2002), who estimates that married women in the U.S. forego approximately between 10 and 20 percent of wages in exchange for employer-provided health insurance. However, my estimated wage-benefits tradeoff might seem low given that I cannot separate health care from the other benefits that formal workers receive by contributing to IMSS. The actual quality of benefits, most of which are provided directly by the government, and other provision-related problems, discussed extensively by Levy (2008), could lower some workers' valuation of the whole bundle.

Note also that my estimates reflect the compensating wage differential after PSMMG was implemented. The program might decrease wages in informal jobs, because it makes informal jobs more attractive than before, compared to formal jobs, and increases the number of applicants for informal jobs, decreasing the compensating wage differential in equilibrium. In this case, the compensating differential in the absence of PSMMG would be higher than my estimates. Given that I am estimating the effects in the first few years of the program and that program participation took off only after 2002, the wage adjustment due to the effect of the program is most likely small, but can be substantial over time.

Another implication of my results is that female salaried workers with relatively low education are not necessarily worse off in the informal sector than their counterparts in the formal sector, because they are being compensated for the lack of fringe benefits. However, leaving the quality of benefits aside for a moment, informal workers are not being forced to save for retirement and they are also not protected against certain risks, at least not through their jobs. If individuals underestimate the probability of becoming disabled or if they are myopic when making intertemporal decisions, withdrawing from the current social security system could have negative consequences on their welfare in the future.

7 Additional Empirical Checks

First, I check whether different trends in economic activity or female labor force participation between the control cities and DF could explain the sharp decrease in formality observed in DF after 2001. Figure 4 plots the quarterly open unemployment rate for women age 12 and older, calculated by the National Institute of Statistics (INEGI, Mexico) using the ENEU survey for Mexico City and the control cities from the first quarter of 1999 to the last quarter

[16] Seguro Popular started in 2002 in some states, but had its largest expansion during 2004. Universal Insurance for the First Generation provides health services to all babies born after December of 2006. Starting in 2007, a new and large federal program provides child care services for working mothers without social security. Also in 2007, the federal government started a cash transfer program for the rural elderly that is conditioned exclusively on reaching the age of 70. All of these programs provide imperfect substitutes of IMSS benefits for some workes, but the key is that benefits are unbundled, not linked to individual contributions, and that enrollment in each program is voluntary and conditioned on not being covered by social security.

of 2004. The rate is calculated as the total number of women age 12 and older who did not work, but actively looked for a job, in the previous week divided by the total number of women age 12 and older. Mx City includes observations in the State of Mexico, but within the metropolitan area of Mexico City. Guadalajara and Monterrey are grouped together under the Not Mx City category.

Before PSMMG, the unemployment rate is larger in Mexico City than in the group of control cities, and it does not follow the same trend before 2000. Between the third quarter of 1999 and the second quarter of 2000, female unemployment in DF stayed constant at about 3 percent, whereas it decreased in the control cities throughout 1999 and then started to increase at the beginning of 2000. However, after the second quarter of 2000, one year before the start of PSMMG, the trends in unemployment move together for Mexico City and the control cities. After PSMMG, the unemployment rate in the control cities catches up with that in Mexico City and they stay close together up to the last quarter of 2002. Starting in 2003, both unemployment rates increase and after the first quarter of 2004, female unemployment in Mexico City increases further and remains higher than in the control cities, even though quarter-to-quarter movements follow the same direction. If the decrease in formality that I observe in DF were due to relatively worse economic conditions in Mexico City, then it would only be significant in 2004, which is the year in which clearly the increase in female unemployment was larger in Mexico City, and not starting in 2003, as shown in my results. Note that the unemployment rates in Figure 4 are not conditioned on education. Worse economic conditions in Mexico City would likely affect all women, even if not evenly. However, I find that the decrease in formality is concentrated and significant only for low-educated women, and not for highly educated women or for men. If worse economic conditions are affecting low-educated women in particular, they would also affect female salaried employees who are already covered as IMSS dependents, but I find no evidence of this in Table 6. Below, I present more evidence on the trends in females labor force participation and on the substitution of IMSS health care for other public health care.

Figure 5 shows the labor force participation for women 18-60 years old with at most high school education in and outside of DF, calculated with my data, from the first quarter of 2000 to the third quarter of 2004. In 2000, female labor force participation outside of DF stayed roughly constant, whereas in DF it experienced first an increase and then a decrease. The labor force participation of women starts increasing in DF again one quarter before PSMMG was implemented, while it decreased very slightly in the control cities. After PSMMG the female labor force participation of both groups moves roughly together over time and no drastic change in DF is observed. Both working and non-working women are eligible for PSMMG, because it is not conditioned on employment, so the program makes non-working and informal jobs relatively more attractive than formal jobs. For my sample of low-educated women this does not seem to have changed their labor participation decision.

Together, Figures 4 and 5 suggest that the sharp decrease in the fraction of female salaried

workers in formal jobs after 2001 cannot be fully explained by differences in the economic activity or female labor force participation between cities.

It is worth mentioning that in 2002 the federal government started Seguro Popular, a program that provides low-cost health care access to the population not insured through their jobs. Unlike PSMMG, this federal program is supposed to charge an annual family fee that increases with household income[17] and, for it to be implemented in a given state, the local government must sign an agreement with the federal government. This parallel program does not contaminate my results because it had not started operating in the states where my control cities are located for most of the period covered by my data.[18] In addition, Seguro Popular had not started operating in DF by 2004, because the state government rejected it[19], even though that would allow covering some of the health expenses with additional federal money[20] and providing services in federal hospitals as well.

To provide evidence on health care use, I use the Employment and Social Security Supplement (ENESS) to the ENEU data, collected as separate cross sections in 2000 and 2004. This survey has a few more detailed questions on social security coverage and health care use during the previous year.

Using ENESS, I estimate probits for having used health care at least once in the previous year, for the type of health care used at least once and for the type used most frequently, conditional on having used health services at least once. Health care services are classified as private, IMSS and other public health care, which excludes ISSSTE, because government employees are not part of my sample, but includes Pemex[21], military and state health services. PSMMG should have a positive effect on the probability that a given woman in DF uses health care services at least once during the previous year and, if the program effectively decreased the probability of having IMSS coverage, as shown in the previous section, it should also decrease the probability of using IMSS health services and increase the use of state health services. In these data, I cannot separate the use of state health services from the other public health services that are grouped together under this category. Table 9 reports the mean probit marginal effects and their standard errors, clustered at the state level. The first column shows that female salaried workers in DF in 2004, 3 years after the policy started, are 19.5 percentage points more likely to have used health care services at least once in the

[17] Households in the first two income deciles are not required to pay. The premiums paid by households in higher income deciles range from 64 to 1000 USD per year.

[18] Those states are Jalisco (Guadalajara), State of Mexico and Nuevo Leon (Monterrey). According to the 2004 Seguro Popular Report, Jalisco signed the agreement in December 2003, State of Mexico in January 2004 and Nuevo Leon in June 2004. An early trial of the program was conducted in five states in 2002 and Jalisco is among them, but only few municipalities participated and none of them belongs to the metropolitan area of Guadalajara (see *Diario Oficial de la Federacion*, March 15th 2002).

[19] The DF government rejected Seguro Popular because the PSMMG was already operating and also because it did not agree on charging any premiums or fees for the provision of health services.

[20] The PSMMG is financed with local tax revenues and some resources from Item 33 (Ramo 33) of the Federal Budget, which are transfers to state goverments for expenditures on education, health, infrastructure and public safety.

[21] Pemex is the national government-owned oil company, which directly provides its employees with health services in hospitals administered by the company.

previous 12 months, compared to similar workers in Guadalajara and Monterrey. Columns 2 and 3 show that being in DF in 2004 has a negative but not statistically significant effect of 5.6 percentage points on the probability of having used private health care at least once during the previous year, and also a negative effect of 8.9 percentage points on having used IMSS health care at least once, significant only at 10 percent. Column 4 shows that being in DF in 2004 has a positive and statistically significant effect of 7 percentage points on the probability of having used other public health care at least once in previous year. These results confirm that the policy indeed decreased the use of IMSS and increased the use of other public health care in DF, as would be expected. For the type of health care most frequently used, the evidence is more modest, but broadly consistent. In columns 5 and 6, being in DF in 2004 has a negative and statistically significant effect of 11 percentage points on the use of IMSS health services and a positive and statistically significant effect of 6.9 percentage points on the use of private health care. In the last column, the DF-2004 interaction is positive, but not statistically significant for the frequent use of other public health care.

8 Conclusions

This paper estimates the compensating wage differential for the bundle of benefits that IMSS provides to female salaried workers in the Mexican private sector. I overcome the endogeneity that typically contaminates estimates by using the exogenous availability of free health care and prescription drugs due to the implementation of PSMMG in 2001 in DF. My results show that being a DF resident after free health care was implemented has a negative and statistically significant effect of about 4-4.6 percentage points on the probability that a female salaried worker has IMSS coverage in her current job. Additional empirical checks show that these effects cannot be attributed to differences in the economic activity or labor force participation trends between DF and other cities unaffected by the policy, and that female workers with low education are substituting IMSS with state health care in DF.

Regarding wages, not controlling for the endogeneity of social security coverage gives rise to a positive formal premium as in other studies for developing countries. In contrast, my instrumental variables results show that female salaried workers in the formal sector earn 23 percent less than female workers in jobs not covered by IMSS. My estimates reflect the effect of formality for those workers induced to drop IMSS coverage by PSMMG, who are only a fraction of eligible workers, and not the valuation of the average female salaried worker with low education.

The main contribution of this paper is showing that workers who receive higher fringe benefits are paid a lower wage, which supports the compensating differentials theory. In the Mexican context, my results also imply that informal salaried workers are not necessarily worse off than their counterparts in the formal sector, because they are being compensated for the lack of fringe benefits.

The PSMMG is among the first universal social programs implemented in Mexico. As these programs continue to expand at the national level, as has been the case after 2004, both the benefits available to informal workers and the incentives for dropping IMSS coverage increase, which would likely reduce the compensating wage differential for the IMSS bundle. However, opting out of IMSS could make informal workers worse off in the future if some of the benefits in the IMSS bundle are not substituted by fair-quality universal access programs. More broadly, my results point out to the potential incompatibility of the current contribution-based social security system with a contribution-free social benefits system.

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Table 1: IMSS Contributions

	According to the Social Security Law (% of salary)			For earnings = 2.3 times DFMW
	Employer	Employee	Total	Total in pesos
A. Disability and life insurance	1.75	0.625	2.375	95.43
B. Retirement	5.15	1.125	6.275	252.14
C. Child care and other benefits	1.00	0	1.00	40.18
D. Housing (Infonavit)	5.00		5.00	200.91
E. Health and maternity (all workers)	1.75	0.625	2.375	95.43
F. A+B+C+D+E	14.65	2.375	17.025	
G. Workers' compensation insurance	0.5 to 15	0	1.93*	77.55
H. Health and Maternity				
Workers earning up to 3 times DFMW	Fixed contribution of 20.4% of the DFMW	0		356.388
Workers earning more than 3 times DFMW	Fixed contribution of 20.4% of the DFMW + 1.1% of earnings exceeding 3 DFMW	0.4% of earnings exceeding 3 DFMW		
I. Health total (E+G)				451.82
J. Total (A+B+C+D+E+F+G)				1118.02

*Average contribution paid by employers in 2004 from IMSS Financial and Actuarial Report 2004.

NOTE.- The last column reports author's calculations based on the Social Security Law for a worker earning $4018 pesos per month in 2000, which is 2.3 times the DF minimum wage (DFMW). Values in the last column are in 2000 Mexican pesos.

Table 2: IMSS Expenditures in 2000

	In billion pesos	As a % of total expenditures
Health	103.8	43.0
Disability and life insurance	18.3	7.6
Retirement	57.8	24.0
Workers' compensation insurance	14.9	6.2
Day care and recreational services	7.4	3.1
Housing	39.1	16.2
Total	241.3	100.0

NOTE.- Author's calculations based on Levy (2008, p.294). Real values in 2007 pesos are reported.

Table 3: Tests for Differences in Means Before PSMMG

	Not DF	DF	Difference
Formal	0.685	0.606	0.079***
	(0.005)	(0.009)	(0.010)
Hourly wage	17.248	15.986	1.261***
	(0.258)	(0.265)	(0.466)
Age	30.732	33.329	-2.597***
	(0.119)	(0.208)	(0.238)
Years of schooling	8.970	9.134	-0.165***
	(0.031)	(0.057)	(0.062)
Firm less than 5 employees	0.296	0.356	-0.060***
	(0.005)	(0.009)	(0.010)
Number of observations	7,731	2,680	

NOTE.- Standard errors in parentheses. Sample: Female salaried workers with at most high school education (12 years of schooling) from ENEU. The period before the implementation of PSMMG in DF is from the 2nd quarter of 2000 to the 2nd quarter of 2001. Women in Guadalajara and Monterrey are grouped together in the "Not DF" category. A woman is considered a formal worker if her job is covered by IMSS.

Table 4: Effect of PSMMG on the Probability of Having a Formal Job by Gender and Education

	Women with HS or less	Women HS+	Men with HS or less	Men HS+
	(1)	(2)	(3)	(4)
2001	0.002	-0.011	0.004*	0.006
	(0.007)	(0.011)	(0.002)	(0.007)
2002	-0.005	-0.010	0.003	-0.014***
	(0.011)	(0.012)	(0.008)	(0.002)
2003	-0.008	0.005	0.005*	0.002
	(0.006)	(0.022)	(0.003)	(0.005)
2004	0.010	-0.010	0.009**	-0.012
	(0.008)	(0.011)	(0.004)	(0.013)
DF	-0.030***	-0.048***	-0.129***	-0.083***
	(0.005)	(0.014)	(0.004)	(0.004)
DF x 2001	0.003	-0.002	-0.006***	-0.003
	(0.006)	(0.008)	(0.002)	(0.008)
DF x 2002	0.001	-0.014	0.008	0.014***
	(0.011)	(0.011)	(0.008)	(0.001)
DF x 2003	-0.046***	-0.025	-0.001	0.004
	(0.007)	(0.022)	(0.003)	(0.005)
DF x 2004	-0.042***	-0.039***	-0.004	0.028***
	(0.011)	(0.010)	(0.004)	(0.010)
Sample mean of formal before PSMMG	0.606	0.814	0.585	0.772
Individual-quarter observations	34232	9082	57166	15537
Individual observations	16956	4594	25730	7749
Log likelihood	-11824	-3338	-19260	-4886
Pseudo-R2	0.466	0.248	0.427	0.279

NOTE.- Probit mean marginal effects with errors clustered at the state level in parentheses. Sample: Salaried workers from ENEU. A worker is considered a formal if her job is covered by IMSS. All estimations control for age, education, number of children of different ages in the household, number of individuals at least 12 years old in the household, number of individuals at least 70 years old in the household and dummies for married, head of the household, state, industry, occupation and firm size. The control group includes the cities of Guadalajara and Monterrey and the base year is 2000.
* Significant at 10%
** Significant at 5%
***Significant at 1%

Table 5: Effect of PSMMG on the Probability of Having a Formal Job Using Different Control Cities

	Cities in control group			
	Guadalajara, Monterrey, State of Mx (1)	Guadalajara, Monterrey (2)	Guadalajara, Monterrey (3)	State of Mx (4)
2001	-0.004	0.002	-0.003	-0.009
	(0.006)	(0.007)	(0.009)	(0.013)
2002	-0.015**	-0.005	-0.007	-0.021
	(0.006)	(0.011)	(0.008)	(0.014)
2003	-0.013**	-0.008	-0.008	-0.036***
	(0.007)	(0.006)	(0.005)	(0.014)
2004	-0.005	0.010	0.001	-0.028*
	(0.009)	(0.008)	(0.007)	(0.016)
DF	-0.045***	-0.030***		0.011
	(0.006)	(0.005)		(0.014)
DF x 2001	0.009	0.003		0.011
	(0.006)	(0.006)		(0.014)
DF x 2002	0.012*	0.001		0.009
	(0.007)	(0.011)		(0.017)
DF x 2003	-0.039***	-0.046***		0.017
	(0.009)	(0.007)		(0.018)
DF x 2004	-0.025**	-0.042***		-0.013
	(0.011)	(0.011)		(0.018)
Mexico City (includes DF &State of Mx)			-0.052***	
			(0.010)	
Mx City x 2001			0.002	
			(0.009)	
Mx City x 2002			0.003	
			(0.010)	
Mx City x 2003			-0.035***	
			(0.010)	
Mx City x 2004			-0.030***	
			(0.009)	
Individual-quarter observations	40928	34232	40928	15700
Individual observations	20786	16956	20786	8603
Log likelihood	-14297	-11824	-14209	-6091
Pseudo-R2	0.468	0.466	0.471	0.429

NOTE.- Probit mean marginal effects with errors clustered at the state level in parentheses. Sample: Female salaried workers with at most high school education (12 years of schooling) from ENEU. A woman is considered a formal worker if her job is covered by IMSS. All estimations control for age, education, number of children of different ages in the household, number of individuals at least 12 years old in the household, number of individuals at least 70 years old in the household and dummies for married, head of the household, industry, firm size and occupation. State of Mexico observations are within the metropolitan area of Mexico City. The base year is 2000.

* Significant at 10%

** Significant at 5%

***Significant at 1%

Table 6: Effect of PSMMG on the Probability of Having a Formal Job by IMSS Dependent Status and Including Workers Paid With Commissions

	Covered as IMSS dependent (spouse or child) (1)	Covered as IMSS dependent (only spouses) (2)	Not covered as IMSS dependents (3)	Heads of household (4)	Including workers paid with commissions (5)
2001	-0.012*	-0.008	0.008	0.024	0.013*
	(0.007)	(0.012)	(0.007)	(0.027)	(0.008)
2002	-0.016	-0.005	0.001	0.047*	0.012**
	(0.021)	(0.027)	(0.016)	(0.029)	(0.005)
2003	-0.040***	-0.030***	0.004	0.023*	-0.003
	(0.009)	(0.010)	(0.008)	(0.014)	(0.009)
2004	-0.013	0.007	0.016***	0.066***	0.020***
	(0.014)	(0.021)	(0.005)	(0.011)	(0.006)
DF	-0.070***	-0.050***	-0.078***	-0.045***	-0.045***
	(0.008)	(0.006)	(0.007)	(0.014)	(0.008)
DF x 2001	-0.004	-0.01	-0.012*	-0.016	-0.015**
	(0.005)	(0.012)	(0.007)	(0.028)	(0.007)
DF x 2002	0.028	0.029	-0.003	-0.049	-0.018***
	(0.020)	(0.024)	(0.017)	(0.032)	(0.006)
DF x 2003	0.025*	0.031	-0.039***	-0.049***	-0.047***
	(0.015)	(0.021)	(0.009)	(0.017)	(0.011)
DF x 2004	0.027**	0.033*	-0.028***	-0.078***	-0.062***
	(0.012)	(0.018)	(0.008)	(0.018)	(0.009)
Individual-quarter observations	8144	4948	21321	5054	36603
Individual observations	4543	2863	11008	2399	18213
Log likelihood	-2257	-1337	-6985	-1627	-14598
Pseudo-R2	0.525	0.569	0.500	0.515	0.400

NOTE.-Probit mean marginal effects with errors clustered at the state level in parentheses. Sample: Female salaried workers with at most high school education from ENEU. A worker is considered a formal if her job is covered by IMSS, and she is covered as an IMSS dependent if the head of her household has a formal job and she is the head's child or spouse. Column 4 adds workers who report being paid with commissions to the original sample of salaried workers. All estimations control for age, education, number of children of different ages in the household, number of individuals at least 12 years old in the household, number of individuals at least 70 years old in the household and dummies for married, head of the household, industry, occupation and firm size. The reference group includes the cities of Guadalajara and Monterrey and the base year is 2000.

* Significant at 10%

** Significant at 5%

***Significant at 1%

Table 7: 2SLS First-stage using predicted probability of being formal as an instrument

	Excluding State of Mexico from control group			Mexico City (DF and State of Mexico) as treated	Including State of Mexico in control group
	Only salaried workers (1)	Salaried workers + workers paid with comissions (2)	Only salaried who are not IMSS dependents (3)	Only salaried workers (4)	Only salaried workers (5)
Age	-0.002***	0.001	-0.003***	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Years of schooling	-0.002*	0.002*	-0.002**	-0.002***	-0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Married dummy	0.010**	-0.011**	0.006	0.013***	0.012***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)
Head dummy	0.004	0.001	-0.003	0.007	0.006
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
Number of children 0-3 years old	-0.001	-0.001	0.002	0.001	0.001
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
Number of children 4-5 years old	0.003	-0.005	0.005	0.007*	0.006*
	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
Number of children 6-12 years old	0.003	-0.004	0.002	0.005**	0.005**
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Number of adults 70+	-0.002	0.003	0.001	-0.004	-0.003
	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)
Number of individuals 12+	-0.001	0.001	0.001	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
2001	-0.002	0.001	0.001	-0.001	-0.001
	(0.006)	(0.005)	(0.006)	(0.005)	(0.005)
2002	-0.001	0.001	0.004	0.002	0.003
	(0.006)	(0.006)	(0.007)	(0.006)	(0.006)
2003	0.005	-0.004	0.006	0.009*	0.009*
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)
2004	-0.001	0.002	0.002	0.003	0.003
	(0.007)	(0.007)	(0.008)	(0.006)	(0.006)
Guadalajara	0.005	-0.016***	0.004	0.006	0.006
	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)
State of Mexico					0.030***
					(0.006)
DF	0.009*	-0.026***	0.027***		0.019***
	(0.005)	(0.006)	(0.008)	.	(0.005)
Mexico City (DF& State of Mexico)				0.021***	
				(0.005)	
Predicted Prob(formal=1|X,Z)	1.264***	0.645***	1.338***	1.429***	1.426***
	(0.051)	(0.051)	(0.054)	(0.046)	(0.045)
Constant	-0.069	-0.029	0.146	0.065	0.015
	(0.103)	(0.090)	(0.115)	(0.088)	(0.098)
Individual-quarter observations	34243	36603	21321	40928	40928
Individual observations	16956	18213	11008	20786	20786
Tests using 2SLS with DF x year as instruments in LPM first-stage					
Over-identification test	1.572	5.71	1.942	7.27	2.672
Anderson under-identification test	32.39	28.98	9.89	28.35	30.349
Cragg-Donald F-stat	8.239	6.340	2.47	7.08	7.54

NOTE.- The table reports the first stage of the 2SLS procedure, in which for each worker the fitted probability from a probit on the probability of having a formal job is used as an instrument for the formal dummy. Sample: Female workers with at most high school education (12 years of schooling) from ENEU. A woman is considered a formal worker if her job is covered by IMSS. The reference group includes the cities of Guadalajara and Monterrey and the base year is 2000.

*** p<0.01, ** p<0.05, * p<0.1

Table 8: Effect of Formality on Wages for Different Subsamples of Female Salaried Workers with at Most High School Education

	Excluding State of Mexico			Mexico City (DF and State of Mexico) as treated	Including State of Mexico in control group
	Only salaried workers (1)	Salaried workers + workers paid with comissions (2)	Only salaried who are not IMSS dependents (3)	Only salaried workers (4)	Only salaried workers (5)
A. Pooled OLS					
Formal	0.101***	0.101***	0.104***	0.107***	0.104***
	(0.008)	(0.009)	(0.011)	(0.007)	(0.007)
Individual-quarter observations	34243	36603	21321	40952	40952
Individual observations	16956	18213	11008	20784	20784
B. First-Differences					
Formal	0.092***	0.100***	0.095***	0.093***	0.093***
	(0.010)	(0.010)	(0.014)	(0.009)	(0.009)
Individual-quarter observations	15618	16641	9109	18204	18204
Individual observations	8547	9119	5252	10200	10200
C. IV estimates					
Formal	-0.235***	-0.235*	-0.061	-0.145***	-0.135***
	(0.064)	(0.121)	(0.067)	(0.052)	(0.051)
Individual-quarter observations	34243	36603	21321	40928	40928
Individual observations	16956	18213	11008	20786	20786

NOTE.- Standard errors clustered at the individual level are reported in parentheses. Formal is a dummy variable equal to 1 if the woman has a job covered by IMSS. All estimations control for age education, number of children of different ages in the household, number of individuals at least 12 years old in the household, number of individuals at least 70 years old in the household and dummies for married, head of the household, state, occupation, industry, firm size, DF and years. For the IV estimation, fitted probabilities from a probit on the probability of having a formal job are used as an instrument for the formal dummy in a 2SLS procedure.
* Significant at 10%
** Significant at 5%
*** Significant at 1%

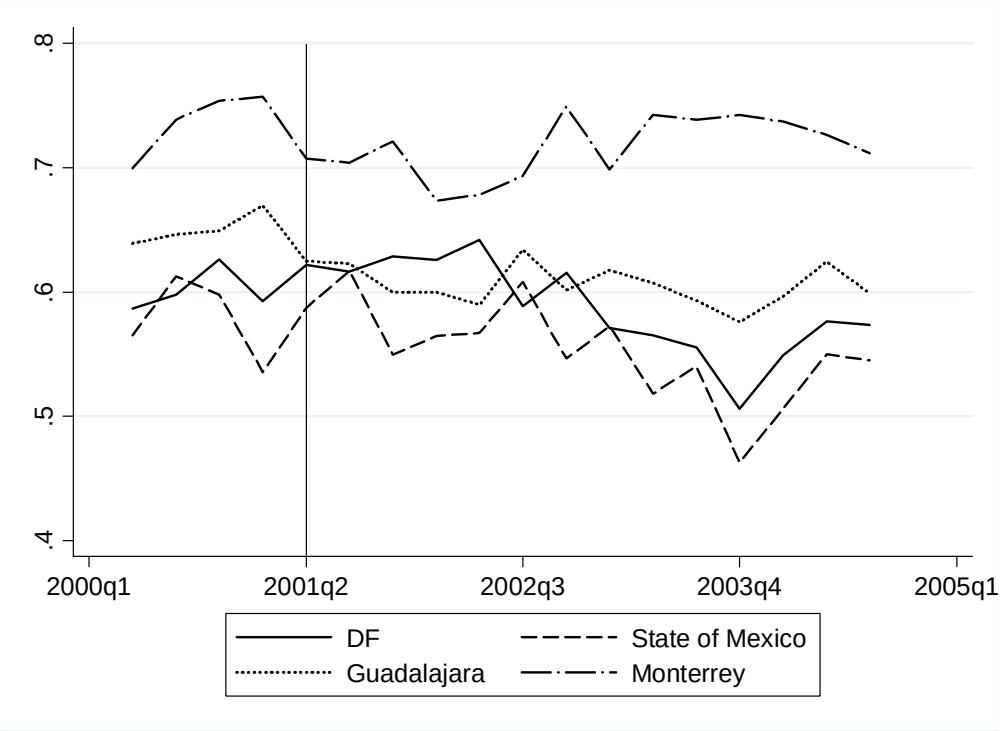
Table 9: Probit Estimations for the Use of Health Care Services

		Type of health care used at least once in past 12 months			Type of health care most frequently used in past 12 months		
	Used health care at least once in past 12 months	Private	IMSS	Other public health care	Private	IMSS	Other public health care
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
2004	-0.115**	0.500***	0.058	-0.021***	-0.109***	0.047	-0.004
	(0.051)	(0.023)	(0.061)	(0.006)	(0.012)	(0.036)	(0.023)
DF	-0.134***	0.054***	-0.053	-0.054***	0.005	-0.088***	-0.029***
	(0.013)	(0.004)	(0.057)	(0.001)	(0.009)	(0.004)	(0.005)
DF x 2004	0.195***	-0.056	-0.089*	0.070***	0.069***	-0.110***	0.032
	(0.038)	(0.041)	(0.054)	(0.016)	(0.006)	(0.039)	(0.037)
Observations	1199	811	811	811	811	811	811
Log likelihood	-731.7	-423.9	-630.1	-348.6	-617.9	-642.4	-344.0
Pseudo-R2	0.0306	0.279	0.0252	0.0871	0.0146	0.0164	0.0815

NOTE.- Probit mean marginal effects are reported. Standard errors clustered at the state level are reported in parentheses. Sample: Female salaried workers with at most high school education from ENESS supplement for 2000 and 2004. All estimations control for age, education, number of children of different ages in the household, number of individuals at least 12 years old in the household, number of individuals at least 70 years old in the household and dummies for married, head of the household and state. Control cities are Guadalajara and Monterrey and the base year is 2000.

*** p<0.01, ** p<0.05, * p<0.1

A. All Cities



B. DF versus Not DF

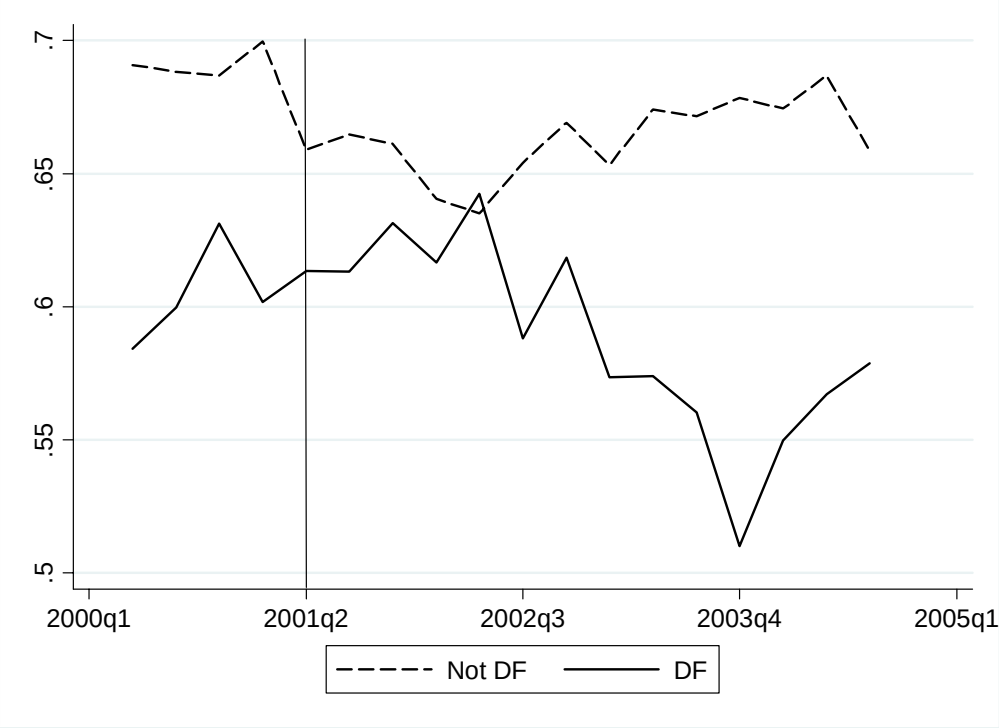
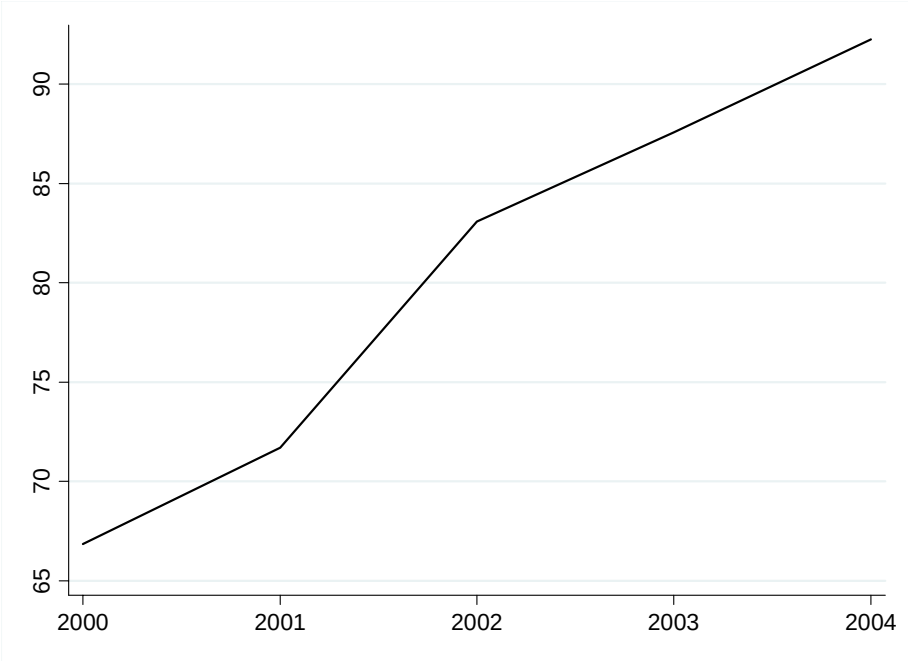
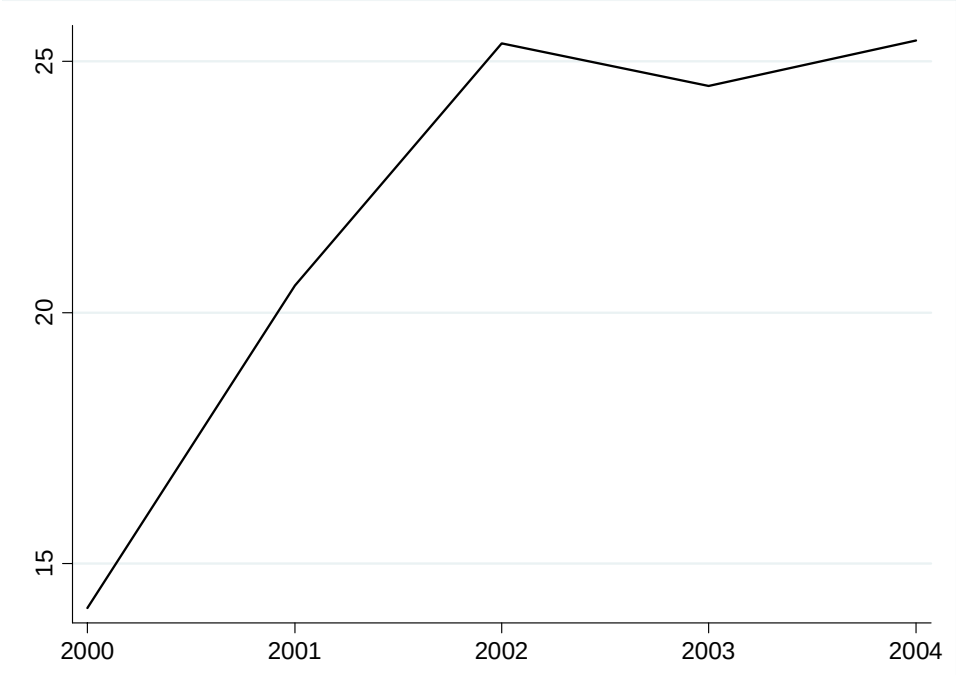


FIG. 1.- Fraction of female salaried workers with at most high school education who are covered by IMSS in their current job in each quarter. Panel A shows the trends for DF and the three control cities. State of Mexico observations are within the metropolitan area of Mexico City. Panel B shows the same trends with Guadalajara and Monterrey grouped together as Not DF, and excluding State of Mexico observations. Data come from the ENEU survey.

A. Patients residing in DF



B. Patients residing in State of Mexico



C. Patients residing in State of Mexico as a proportion of total discharges.

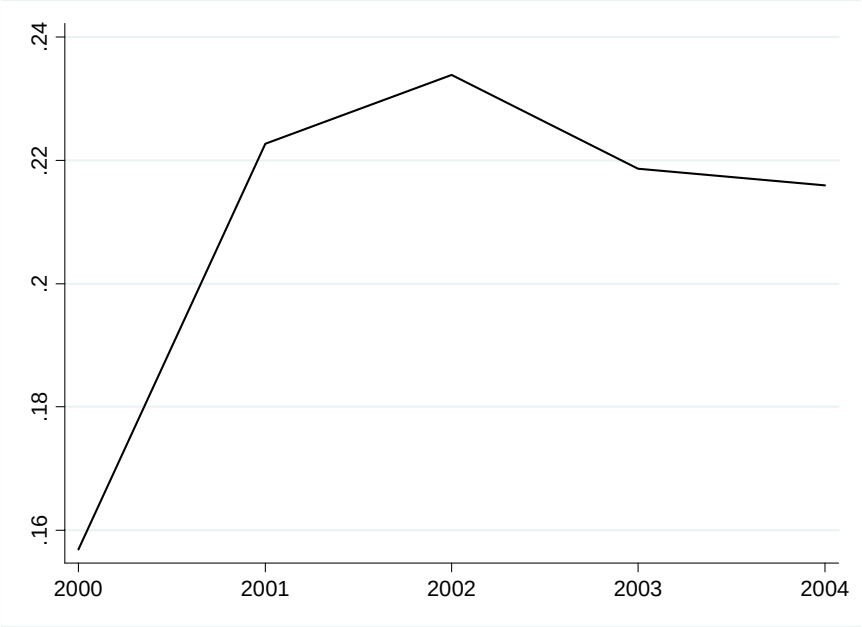


FIG. 2.- Hospital discharges in DF state hospitals by patient residence. Panel A and B are in thousands per year. Panel C reports the fraction of total hospital discharges in DF state hospitals represented by patients who reside in the State of Mexico. The data come from the Health Information Office of the DF State Ministry of Health (SSDF).

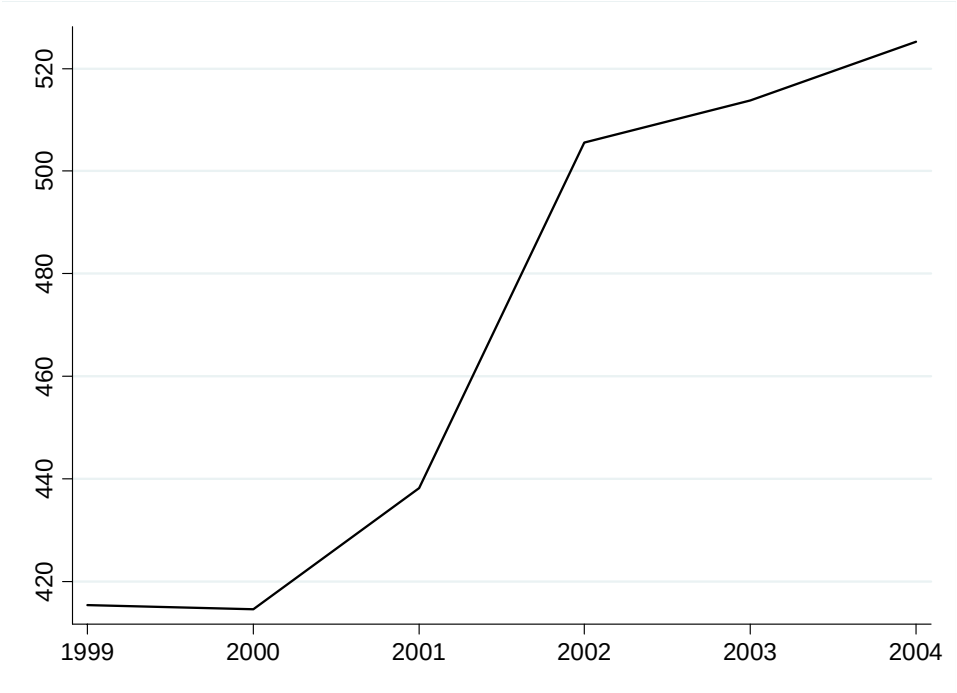


FIG. 3.- Total patient days in DF state hospitals in thousands per year. The data come from the Health Information Office of the DF State Ministry of Health (SSDF).

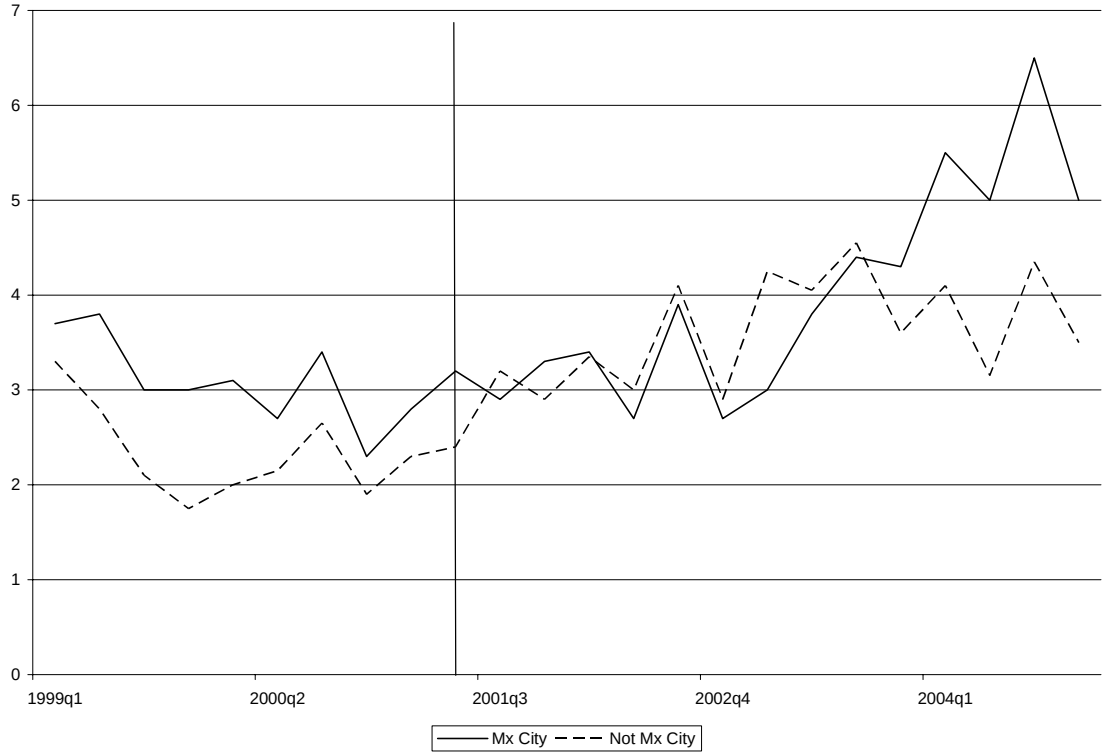


FIG 4.- Quarterly open unemployment rate for women age 12 and older calculated by the National Institute of Statistics (INEGI, Mexico) using the ENEU survey. The rate is calculated as the total number of women age 12 and older who did not work, but actively looked for a job in the previous week divided by the total number of women age 12 and older. Mx City, includes observations in the State of Mexico, but within the metropolitan area of Mexico City. Guadalajara and Monterrey are grouped together under the Not Mx City.

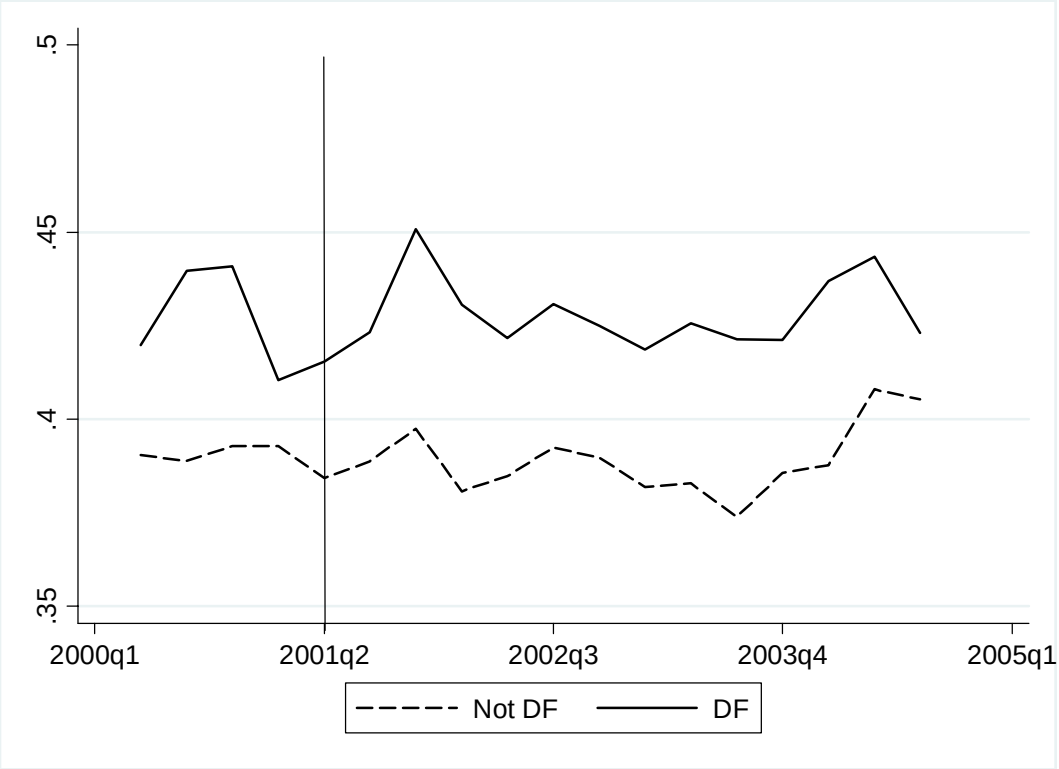


FIG 5.- Labor force participation of women 18-60 years old with at most high school education, calculated by the author using the ENEU survey. Guadalajara and Monterrey are grouped together under the Not DF category.