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The value of free health insurance schemes in developing countries

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Brazil began the implementation of SUS (Universal Health Insurance) in 1988. To the extent that SUS broke the link between employment contract and health insurance, it may have changed the incentives for individuals to participate in the labor market and in which sector to work (formal or informal). Our goal is to study the labor market impacts of SUS. We do so by structurally estimating a labor market model that allows us to address three main questions (i) How much of the increase in informality in Brazil is due to the introduction of non-contributory health insurance? (ii) How much do individuals value health insurance? and (iii) What are the welfare impacts of increases in the value of non-contributory health insurance? The model is fitted to Brazilian employment data and used to simulate changes in welfare, employment, informality and wages of different non-contributory health insurance policies. Our estimates indicate that the value of the health program to families is *above* the cost incurred by the government: families assign a value of at most 1.9 to each BRL the government directly spends in the program. As a result, when we simulate the introduction of the program, we find that household informality increases by 4.2 p.p. (8%) for low education households. Last, we find quite large and positive welfare impacts, 12%, which is reduced to 4.7% as we take the direct government expenditure with the program into account.

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El valor del seguro de salud gratuito en países en vías de desarrollo

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Brasil comenzó la implementación del SUS (Seguro Universal de Salud) en 1988. En la medida en que el SUS rompió el vínculo entre el contrato de trabajo y el seguro de salud, puede haber cambiado los incentivos para que las personas participen en el mercado laboral y en qué sector trabajar (formal o informal). Nuestro objetivo es estudiar los impactos del SUS en el mercado laboral. Lo hacemos estimando estructuralmente un modelo de mercado laboral que nos permite abordar tres preguntas principales (i) ¿Cuánto del aumento de la informalidad en Brasil se debe a la introducción de un seguro de salud no contributivo? (ii) ¿Cuánto valoran los individuos el seguro de salud? y (iii) ¿Cuáles son los impactos en el bienestar de los aumentos en el valor del seguro de salud no contributivo? El modelo se ajusta a los datos de empleo brasileños y se utiliza para simular cambios en el bienestar, el empleo, la informalidad y los salarios de diferentes pólizas de seguro de salud no contributivas. Nuestras estimaciones indican que el valor del programa de salud para las familias es *mayor* al costo incurrido por el gobierno: las familias asignan un valor de 1.9 como máximo a cada BRL que el gobierno gasta directamente en el programa. Como resultado, cuando simulamos la introducción del programa, encontramos que la informalidad aumenta en 4.2 p.p. (8%) en hogares con baja educación. Finalmente, encontramos impactos en el bienestar bastante grandes y positivos, 12%, que se reducen a 4.7% a medida que tomamos en cuenta el gasto directo del gobierno en el programa.

1 | INTRODUCTION

Universal health coverage is intended to protect individuals against the financial and health consequences of adverse health events. Not all countries offer social health insurance and this is particularly a problem in developing economies, where individuals often do not have resources to purchase essential health care. Many developing countries, such as Mexico, Bolivia, Brazil, Colombia, Peru, India and China, have implemented or expanded access to free medical care in the last decades. Brazil was one of the first countries: it introduced a universal health system in 1988 and implemented the *Programa Saude da Familia* (PSF) in 1994, considered the most important initiative to improve primary health care services in the country; Mexico started piloting *Seguro Popular* in 2002 and rolling it out in 2004.

While the introduction of such free schemes is an important form of social protection, to the extent it breaks the link between the job contract and the provision of health insurance, it may alter the incentives for individuals to participate in the labor market and in which sector to work (formal or informal). This paper aims to study the impact of PSF on the Brazilian labor market, advancing and complementing our related work on Mexico (Conti, Ginja and Narita, 2018; CGN henceforth). We build a model of the Brazilian labor market that allows us to address three main issues: (i) How much of the increase in informality in Brazil is due to the introduction of non-contributory health insurance? (ii) Do individuals value public health insurance?, and (iii) What are the welfare impacts of increases in the value of non-contributory health insurance?

We proceed by first providing some reduced-form evidence to measure the impact of the reform. However, this does not allow the possibility of studying counterfactual scenarios or of performing a welfare analysis. Most importantly, it does not allow retrieving unknown parameters in the data as the value of formal work amenities and the value of free health insurance for families without health insurance. To understand how access to such health programs is valued by households when their members make decisions about the labor market, we develop and estimate a family search model The model considers that each member of a family (couple) is in one of three situations: working in the formal or informal sector, or not working (unemployed or inactive). If one member joins the formal sector, the other member is automatically covered by the health insurance provided by the employer, as well as other social protection benefits treated as public goods in the family. If none of the members work in the formal sector, the family does not have insurance and therefore becomes eligible to the PSF after its implementation. The model captures the key features of an introduction/expansion of free coverage of health services to the uninsured population, as well as existing amenities such as employer-provided health insurance systems and social protection in the formal sector. It is based on Burdett and Mortensen (1998), where workers randomly seek employment while unemployed or employed, with the additional feature of being able to receive offers from formal or informal firms. The unemployed/inactive and informal workers are not entitled to any employment protection benefits, while formal sector workers have access to employer-provided health insurance and other benefits guaranteed by labor legislation (for example: minimum wage and pensions).

The main contribution of our paper is twofold: to develop a family search model with on-the-job search, which provides significant heterogeneity, with two employment sectors that have a one-to-one relationship with the introduction of the free health program which primarily benefits the informal sector workers, and a structure that considers pre-existing amenities in each status or sector of employment; and to apply this dynamic model of the labor market to estimate the value of a free health insurance program, exploring the introduction of Programa Saude da Familia in Brazil.

We also analyze the effects on the labor market of the introduction and expansion of the

Programa Saude da Familia (PSF) in Brazil since 1996. From the structural estimation, we find that the value of PSF for low (high) education households is 15.6% (6%) of the mean wage of husbands in the informal sector, in the expansion period i.e. five years after the program began. The value of the PSF in Brazil appears to be much larger than that found for SP in Mexico (CGN). Based on direct cost estimates, we find that families assign a value of at the most 1.9 to each one BRL the government directly spends in the program, which is very high. Although this is an upper bound for our benefit-cost estimate, this is not outside the range obtained in the literature which is BRL 1.25-3.4, using the value of a statistical life for Brazil and the cost per life saved related to the expansion in total public health expenditure between 1995-2005 (Bhalotra, Rocha and Soares, 2019).

As a result, when we simulate the introduction of the program, we find that household informality increases by 4.2 percentage points (p.p.) (8%) for low education households. Unemployment / inactivity of the spouses in low education households also increase but by less than 1%. The results on informality are consistent with the PSF marking the start of the primary care arm of the Brazilian Unified Health System and having larger improvements in health outcomes as the study by Bhalotra, Rocha and Soares (2019) shows. It can also be related to the program being introduced in Brazil one decade earlier than when Mexico started Seguro Popular, at a worse stage of development from which we should expect larger results. For Brazil, we do find quite large and positive welfare impacts 4.7 to 12%, which is due to the transfer value from the free health insurance schemes and because wages do not go down much. For Mexico, the impact of *Seguro Popular* can be negative, -5%, when the government expenditure with the program is taken into account.

2 | BACKGROUND AND DATA

In this section, we describe the main features of the Programa Saude da Familia (PSF) and the data sources that we use in the reduced-form and model estimation.

2.1 | The Brazilian Health System and the PSF

In the early 1980s, the Brazilian health system was fragmented. The *Instituto Nacional de Assistencia Medica da Previdencia Social* (INAMPS, the medical care arm of the Social Security Institute) provided coverage for curative care to employees of the formal sector, who were mostly based in the urban areas of the country. The Ministry of Health (MOH) mostly focused on public health programs (e.g. immunization campaigns) and managed few hospitals (mostly in Rio de Janeiro); states and larger municipalities operated their own health care facilities, which were mostly targeted to the poor, who could also use the services provided by non-profit institutions. The Ministry of Education also ran a number of university hospitals. This fragmented system left a large share of the population uncovered, in particular unemployed and informal sector workers; and was costly and profoundly inefficient (Couttolenc and Dmytraczenko, 2013).

Health reforms then started in the 1980s, when the universal and free health system became a right to all citizens after the 1988 Federal Constitution. The public health system (SUS) has been regulated ever since to improve health care provision across all regions and municipalities in the country and with a focus on prevention, as many other public systems around the world. One of the first initiatives was to promote decentralization of the health services through the *Programa de Agentes Comunitarios* (PACS) in which agents were recruited at the community level to gather health information about the community and conducts home visits in the area covered by their unit, in order to deal with the main health

problems at the local level. In 1994, the Brazilian Ministry of Health launched the *Programa Saude da Familia* (PSF) that is considered a transition from PACS into a system in which community agents are under direct supervision of nurses and doctors (possibly also dentists, psychologists and social workers) within a health unit. Essentially, the PSF is considered the main arm for primary care improvement at the local level and an improvement for the existing PACS.

Specifically, the PSF is a program in which teams of various professionals promote health and education services, monitor the health status of the population, and recommend a number of families residing in a specific area for specialized consultations. The geographic area in which a team works should cover about 1,000 families. The PSF team consists of a physician, a nurse, a nursing assistant and at least six community agents, who must reside in the area where they work. According to Harris and Haines (2010), the budgetary and logistical responsibility of the program has been transferred to the municipality level, but health expenditure is from the federal government, with contributions from local resources. Therefore, the municipality is considered the place of implementation of health policies.

Despite its start in 1994, the main expansion of the PSF in Brazil occurred after 1998. According to the Brazilian Ministry of Health, in 1998, only 1,134 municipalities were covered by the PSF (42% of the population), but in 2004 the program had been implemented in 87% of the 5,565 municipalities in Brazil, covering about 93% of the national population.[1] According to Rasella et al (2014), the PSF is the largest community-level primary health care program in the world and it also represented a pioneering initiative in the national strategy to reduce cardiovascular diseases.

Earlier papers have shown no effects of PSF on infant mortality. Morsch et al. (2001) analyze whether PSF improved several child health outcomes (mortality, birth weight, vaccination coverage, prenatal care, exclusive breastfeeding and monthly weighting) in the state of Ceara, between 1994 and 1998. They compared the results of two groups of municipalities, the participating communities (municipalities that participated from the beginning in 1994-1995, with coverage of at least 60% of the population) and the nonparticipating communities (municipalities that did not start the program until the end of 1998). The authors do not find any significant difference in infant mortality rates between the two groups, despite declining rates in both. They argue that the absence of significant results may be related to the fact that the implementation of the PSF did not prioritize those municipalities with higher infant mortality rates, but prioritized the municipalities with the largest population.

Recent literature on the effects of PSF has found positive results on health outcomes. Macinko, Guanais and Souza (2006) use a panel of 27 Brazilian states for 1990 to 2002 over three distinct periods: 1990-1994 (pre-PSF), 1995-1998 (initial PSF stage) and 1999-2002 (PSF expansion period). They find that a 10% increase in PSF coverage in the state was associated with a 4.6% reduction in infant mortality. They also show that the effect of PSF is smaller in the more developed regions of the south, southeast and mid-west of Brazil, where infant mortality was lower than in the north and northeast regions. Aquino, Oliveira and Barreto (2009) build a panel of 721 municipalities using administrative data on infant deaths for the period 1996-2004. The authors find significant reductions in infant mortality by 16%, 23% and 32% in municipalities with low, intermediate and high PSF coverage, respectively. They also note that the effect of PSF was higher among municipalities with an above-average infant mortality rate and human development index below the national average at baseline, which closes an important gap in health inequality. Rocha and Soares

[1] Based on own estimates combining the Census data on population weights and the date of implementation of PSF at each municipality from the Department of Primary Care (DAB) of the Brazilian Ministry of Health for the period from 1996 to 2004.

(2010) find that the PSF is associated with reductions in mortality before age 1, between ages 1 and 4, and between ages 15 and 59. Particularly, after eight years into the program a municipality experiences a reduction of 5.4 per 1,000 in infant mortality, as compared to municipalities not covered by the program. Rasella et al. (2014) evaluate the impact of PSF on age-standardised mortality rates of heart and cerebrovascular diseases. From a sample of Brazilian municipalities with administrative vital information from 2000 to 2009, they find that cerebrovascular mortality rate goes down by 14% comparing intermediate PSF coverage to no coverage and by 18% comparing high to intermediate coverage. Their results also show a 21% reduction in heart diseases in municipalities with high program coverage. The authors argue that the effects of PSF have increased over time since its implementation and that the program is a cost-effective strategy for dealing with cardiovascular diseases as well as reducing geographical and financial barriers to access primary and preventive health care.

Bhalotra, Rocha and Soares (2019) is the most recent and comprehensive study evaluating the effects of PSF (access and use of health care) and on health outcomes. Using the exact dates of introduction of the PSF in each municipality and exploring the gradual implementation of the PSF between municipalities, they find that the program increased the population covered by primary care and attended by the teams of general practitioners, nurses and community agents, the proportion of home visits attended by professionals with a university degree and municipal health expenditures. They also show that the PSF is associated with a decline in the number of hospital beds per capita and also fewer specialists in gynecology and pediatrics per capita, which is consistent with the expansion of preventive health coverage. Regarding health outcomes, they show significant reductions in maternal, fetal, neonatal and post-neonatal mortality, where most effects are concentrated among less educated women. However, there is not much evidence that PSF implies healthier children at birth, for example, there is no significant improvement in birth weight and APGAR.

Finally, there is only one study to our knowledge that analyzes the effects of the PSF on the labor market. Rocha and Soares (2010) construct a panel of 316 municipalities in the north and northeast region of Brazil using data from the Brazilian National Household Survey (PNAD) for the years 1995-2004. They show evidence that the PSF program increased labor supply, however they do not look at informality or wages. Hence, the objective of this paper is to study the labor market impacts of PSF based on a complete panel of municipalities from the Brazilian Census data.

2.2 | Data sources

We use data from three main sources. The first data source comes from the Department of Primary Care (DAB) of the Brazilian Ministry of Health for the period from 1996 to 2004. It contains the number of PSF teams which we use to construct coverage, defined as the percentage of the population reached by the teams. Each team is responsible for monitoring a maximum of one thousand families or 3,450 people who reside or work in the territory of the health unit (PSF, 2000). The coverage of the PSF in a municipality is thus given by the number of PSF teams in the municipality $\times$ 3,450 / Population according to IBGE (National Statistics Bureau in Brazil). From figure 1 we observe that the average coverage of the PSF across municipalities was very low in the first two years since PSF implementation, e.g. until 1996, increasing to about 10% in 1998. By 2004, coverage of PSF was nearly 60%.

Figure 2 displays the year of implementation of PSF in each municipality in Brazil between 1994 and 2005. This map shows that there is considerable variation in the timing of adoption of PSF across different regions and municipalities.

Figure 3 shows the spatial distribution of PSF teams across municipalities for two years

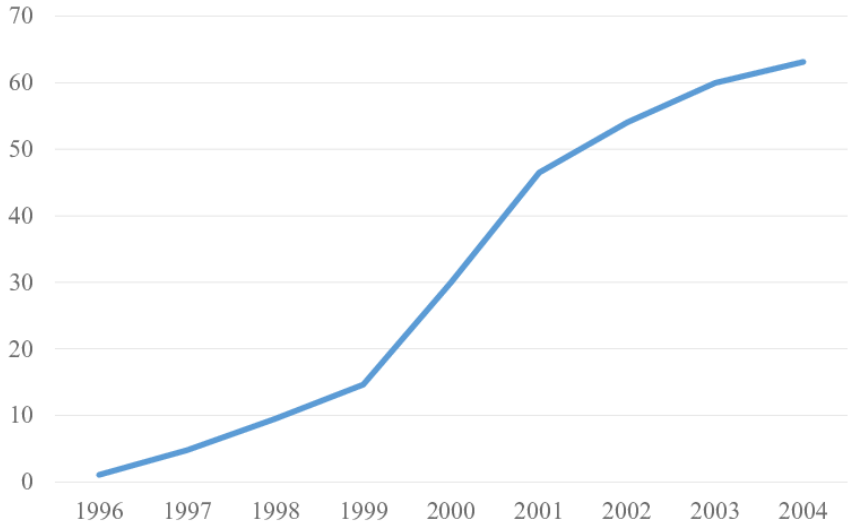

FIGURE 1 Coverage of PSF between 1996 and 2004 (% of population). *Notes:* Data from the Department of Primary Care (DAB in Portuguese) of the Ministry of Health of Brazil and the National Statistics Bureau (IBGE). The coverage of the PSF in a municipality is (the number of PSF teams in the municipality × 3,450) / Population.

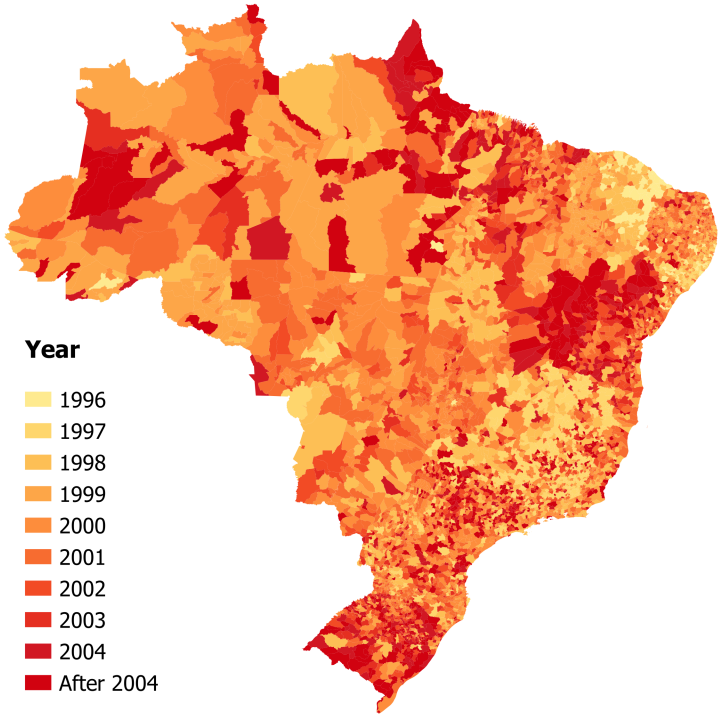

FIGURE 2 Year of implementation of PSF by municipality. *Notes:* Data from the Department of Primary Care (DAB) of the Ministry of Health of Brazil.

1998 and 2004, representing an initial and a later stage of the program implementation. The red color represents the highest incidence (more than 5 teams) and the lightest color, less than one team. In the left figure, we see that very few municipalities had 3-5 or more than 5 PSF teams in 1998. While the figure shows that these municipalities with early implementation of the PSF are located in the poor regions (northeast and north), the program also had begun in some municipalities in the southeast of the country. In 2004, the PSF teams were much more spread across the country where generally most population reside. Figure 4 shows the coverage of PSF in 1998 and 2004. The left plot show that the program began concentrated in some northeast, southeast and midwest of the country. By 2004, most municipalities had above 60% coverage, but there are some areas in the poor regions of the north and northeast, and also in the richer south with less than 18% coverage.

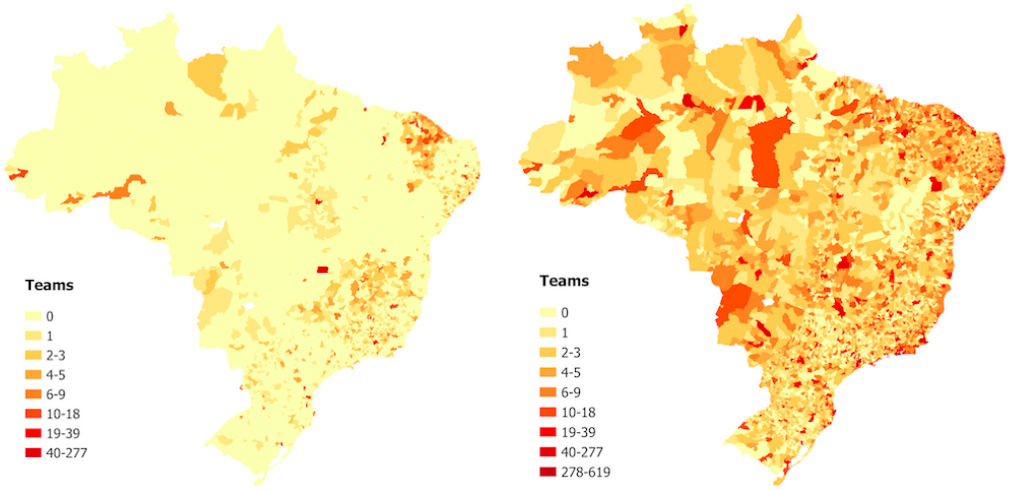

FIGURE 3 Number of PSF teams by municipality in 1998 and 2004. *Source:* Department of Primary Care (DAB) of the Ministry of Health of Brazil for 1998 and 2004.

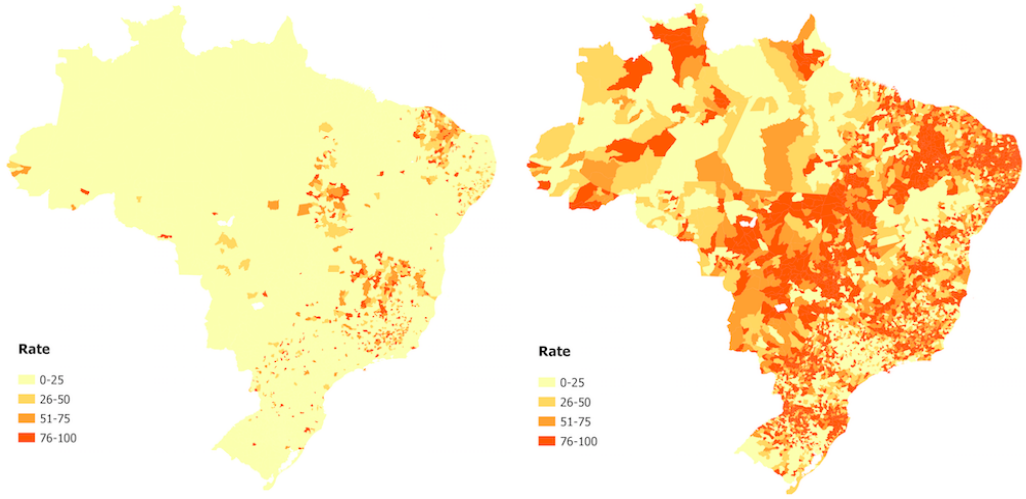

FIGURE 4 PSF Coverage by municipality in 1998 and 2004 (% of population). *Notes:* Per year, the PSF coverage in a municipality is (the number of PSF teams in the municipality x 3,450) / Population. *Source:* Department of Primary Care (DAB) of the Brazilian Ministry of Health for 1998 and 2004, and the National Statistics Bureau (IBGE).

The second data source we use is the Brazilian Census 1991-2004 from the Brazilian National Statistics Bureau for the reduced-form estimation. We pool households living in about 5,565 municipalities across all three Census years with information on employment, sector (formal or informal), wages, education, age and municipality of residence. An individual is defined as an informal worker if he/she does not contribute to social security, which means she is unlikely to have a job contract and the amenities of the regulated sector (formal sector). We do not distinguish between self-employed and informal employees. Table 1 presents basic statistics on the proportion of households by employment type and education, before and after the introduction of PSF; 2004 is the year when the program reached above 87% of municipalities. The table shows that prior to the introduction of PSF about 19%(50.9%) of households in the high(low) education group did not have Social Security coverage. In 2010, while the proportion of households without Social Security coverage remained constant in the low education group, it increased by almost 9 p.p. among the high educated. The table also includes the nine possible types of households according to the labor market situation of each member of the couple (i.e., not working, which includes individuals unemployed or out of the labor force, working in the formal sector or working in the informal sector). Among the low educated, there is an increase in the proportion of households with the spouse working in the informal sector (while the head is formal or informal) or when both are non-employed, and a decrease in the proportion of households where the head is working in the formal or informal sector and the spouse is not working. For the high education households, the proportions change in the same direction except that the fraction of households where the head is working in the informal sector and the spouse is not working is more or less stable, while the share of households with the head working in the formal sector while she is not working reduces by a large proportion, which explains why the fraction of household informality increases for this sample.

Table 2 includes moments from the distribution of wages for the heads and spouses in both formal and informal households, respectively. The mean of the salaries of both heads and spouses are lower in the informal sector than in the formal sector. These differences partly reflect unobserved productivity differences between the individuals who select into either sector within educational groups. Between 1991 and 2010, there is a decrease in salaries of heads and spouses in the high education sample. In the low education sample, salaries increase or remain constant.

As third data source, we use the labor force survey of Brazil, Pesquisa Mensal de Emprego (PME) 1991-2000 for the model estimation. These data have a monthly frequency and are rotating panels at the individual and household level similar to the Current Population Survey in US. The data covers more than 300,000 individuals per month; it has information on the whether the individual contributes to social security, as well as his/her labor income when employed. All monetary values are deflated to 12/2001 using the INPC index from the Brazilian National Statistics Bureau.

We discard the 13% of the workers under a formal contract who earn less than the minimum wage. We restrict the sample to households where the head is married and between 20 (when the chance of returning to full-time education is very low among the low educated) and 59 years old (before age-eligibility for any non-contributory pension program for poor elderly). We then focus on male headed couples with non-missing information on work situation and social security status on the first and second months of the survey. Lastly, we trim the top 5% of wages and we trim also the bottom 5% of informal sector wages. Our final sample includes just over 277,893 couples. We follow individuals between the first and second months they are surveyed. Within this time frame, we obtain the job-to-job, nonemployment-to-job, and job-to-nonemployment transitions for each individual in our sample (i.e., heads and their spouses). The distribution of wages in the formal sector and

TABLE 1 Household employment status

	High Education		Low Education	
	1991	2010	1991	2010
Number of Households	669,083	1,302,332	1,781,657	1,186,799
Share of Households without social security coverage	0.190	0.275	0.509	0.505
Households by type:				
With social security				
Head Formal-Spouse Formal (FF)	0.265	0.329	0.081	0.149
Head Formal-Spouse Informal (FI)	0.066	0.091	0.051	0.081
Head Formal-Spouse Not Working (FN)	0.425	0.226	0.314	0.187
Head Informal-Spouse Formal (IF)	0.041	0.060	0.033	0.059
Head Not Working-Spouse Formal (NF)	0.013	0.019	0.011	0.018
Without social security				
Head Informal-Spouse Informal (II)	0.029	0.093	0.078	0.186
Head Informal-Spouse Not Working (IN)	0.115	0.101	0.365	0.197
Head Not Working-Spouse Informal (NI)	0.005	0.009	0.009	0.015
Head Not Working-Spouse Not Working (NN)	0.040	0.072	0.058	0.108

Notes: Brazilian Census 1991 and 2010, sample of families whose head is 20-59 years old. A household belongs to the 'high education' group if the head has more than complete primary school.

TABLE 2 Wages in the formal and informal sector

	High Education		Low Education	
	1991	2010	1991	2010
Wages: Formal Sector				
Head				
Mean	2943.34	2186.65	1035.36	1032.13
SD	4253.41	4565.05	1939.88	2343.04
Observations	501,412	840,480	789,018	494,007
Spouse				
Mean	1627.28	1403.58	609.63	738.22
SD	2378.10	2860.81	1109.15	1103.49
Observations	209,934	530,495	215,246	266,898
Wages: Informal Sector				
Head				
Mean	1840.38	1363.90	567.63	733.85
SD	3074.92	3566.56	1207.55	1224.38
Observations	122,542	299,512	831,799	444,783
Spouse				
Mean	992.38	769.71	366.82	450.04
SD	1787.55	1660.28	927.45	792.11
Observations	61,712	205,617	193,734	230,979

Notes: Brazilian Census 1991 and 2010, sample of families whose head is 20-59 years old. A household belongs to the 'high education' group if the head has more than complete primary school. Wages are gross and measured in BRL of 08/2010.

incomes in the informal sector are obtained from the first interview.

3 | REDUCED-FORM ANALYSIS

In this section we show reduced-form evidence of the impact on informality of PSF, exploiting the variation in the timing of implementation of the program at the municipality level. The data used are from the Brazilian Census 1991-2010 and the year of implementation of the PSF in a municipality obtained from the Department of Primary Care (DAB), 1996-2010. In order to construct the treatment indicator, we have used the time since the implementation of the PSF in a municipality. We use the variation in this indicator in a difference-in-differences model, where we compare changes in informality for municipalities that introduced PSF in different years between 1996 and 2004 (when above 87% of municipalities had implemented PSF).

As shown in Table 3, PSF implementation is associated with an increase in household informality of 2.6 percentage points (5%) for low education households with 0 to 14 years old children, 10 years after implementation of the program. Differently from the results for Mexico (CGN), the effect is significant for all samples except for high education households with children. These results were obtained through the following regression:

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

where y_{mst} is one of the results analyzed: mean household informality (if no member is in the formal sector), mean share of households in each of the nine types, and mean log wages by spouse and sector; m indicates the municipality, s the state, and t the year. PSF_{mst} is time in years since the implementation of the PSF in the municipality m in which the individual resides in the year t. The controls are for unrestricted municipality effect μ_{ms}, which controls for non-observable characteristics of y_{mst} which are constant at the municipality level and may also be correlated with the PSF; for stae and year unrestricted effects φ_{st} (which considers for example variations in the agreements between federal-state budget). X_{mst} includes basic controls: log of population, the proportion of individuals by education group and by age group. The parameter of interest is β, the PSF effect, which is identified by the residual variation of y_{mst} between households, municipalities and years. We have estimated the reduced form model under several specifications and the results are robust across them. In particular, Table 3 reports the estimates for the most complete model including state-year fixed effects and a linear trend in municipal health expenditure per capita in 1997.

By studying households of different job market status in Panel A.1 (columns 2-10), we further show that the implementation of PSF in a municipality is associated with a significant decrease in the proportion of households where the head works in the formal sector and the spouse is non-employed ("FN" households; 2.3 p.p.), where both work in the informal sector ("II" households; 2.1 p.p.) and where both are non-employed ("NN"households; 1.2 p.p.). In contrast, the program is linked to an increase in the fraction of households where the head is informal and the spouse is non-employed ("IN" households; 5.9 p.p.). The pattern is more or less similar across households with different education and according to the presence of children, as the other Panels A.2, B.1 and B.2 show.

Table 4 tests whether the PSF is associated with higher wages in the formal sector. The idea is that if wages fully adjust to offset the implicit 'tax' then there will be no mobility, i.e. workers do not have an incentive to move from the formal to the informal sector or

TABLE 3 Reduced Form Estimation: Impact of PSF on Informality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Informal Households	FF	FI	IF	FN	NF	II	IN	NI	NN
					Panel A: With Children					
					A.1: Low Education					
PSF x 10	0.026***	-0.001	-0.004	0.002	-0.023***	0.000	-0.021***	0.059***	-0.001	-0.012***
	(0.008)	(0.003)	(0.002)	(0.001)	(0.006)	(0.001)	(0.005)	(0.007)	(0.001)	(0.003)
Mean in 1991	0.517	0.075	0.051	0.033	0.315	0.009	0.080	0.381	0.008	0.048
Observations	12,537									
					A.2: High Education					
PSF x 10	0.002	0.012***	-0.008***	0.005***	-0.012**	0.001*	-0.011***	0.021***	-0.002***	-0.005*
	(0.006)	(0.004)	(0.002)	(0.001)	(0.006)	(0.001)	(0.002)	(0.004)	(0.000)	(0.003)
Mean in 1991	0.185	0.249	0.067	0.039	0.448	0.011	0.029	0.122	0.004	0.030
Observations	12,561									
					Panel B: Without Children					
					B.1: Low Education					
PSF x 10	0.017**	0.001	-0.003	-0.002	-0.013***	0.000	-0.015***	0.047***	-0.001	-0.015***
	(0.007)	(0.004)	(0.003)	(0.002)	(0.005)	(0.001)	(0.004)	(0.007)	(0.001)	(0.003)
Mean in 1991	0.469	0.111	0.052	0.035	0.313	0.021	0.068	0.281	0.012	0.107
Observations	12,572									
					B.2: High Education					
PSF x 10	0.014*	0.010**	-0.006***	-0.001	-0.016**	-0.002	-0.007**	0.029***	-0.002**	-0.007
	(0.007)	(0.004)	(0.002)	(0.002)	(0.007)	(0.001)	(0.003)	(0.005)	(0.001)	(0.004)
Mean in 1991	0.206	0.324	0.061	0.050	0.335	0.024	0.029	0.088	0.007	0.083
Observations	12,096									

Notes: OLS estimates obtained using Brazilian Census data (1991, 2000, 2010) aggregated at the municipality-year level. PSF is the number of years since the program was implemented in the municipality. Controls excluded from table are: the share of households in each municipality-year by education group (incomplete elementary, incomplete primary, complete primary, complete secondary and higher education) and by age of the head (20-29; 30-39; 40-49 and 50-59); log of population, municipality of residence fixed effects, state-year fixed effects, year fixed effects, a linear trend in municipal health expenditure per capita in 1997. Standard errors clustered by municipality. *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Estimates are weighted by the number of observations per cell.

non-employment. This table shows that, differently from what expected in a perfectly competitive environment, wages in the formal sector go down by 3.7 to 9.5% depending on the sample. In a non-competitive equilibrium environment such as in a labor market with search frictions, the effects on wages are not clear. The implied cost of having universal insurance is on the employees and how wage offers change in response to this cost will depend on the relative size of each sector, i.e. on the choice of workers to be in the formal sector, informal sector or non-employed. All estimates in columns 2 and 4 are negative (though not always significant), suggesting that firms in the informal sector tend to adjust wages down due to an inflow of workers to that sector, which is corroborated by the results in Table 3, column 1. If formal sector firms do not react by adjusting wages upwards in order to keep workers, then formal sector wages can even fall due to composition effects. This is likely to be the case if relatively well paid formal sector workers move to the informal sector, as self-employed for example.[2] Finally, the fact that the effects are negative and stronger for formal sector wages are consistent with more households leaving the formal status.

4 | MODEL AND ESTIMATION

The model details are described in CGN, who develop a household search model that incorporates the value of free health care as well as the pre-reform valuation assigned to the amenities in each sector. We build on Burdett and Mortensen (1998) in which workers search randomly on and off the job, with the additional feature that they may receive offers from heterogeneous formal or informal firms. The non-employed and informal sector workers are not entitled to any employment protection benefits, while the formal sector workers have access to employer-provided health insurance and other benefits secured by labor laws (for example, minimum wage and retirement pensions). We also build on Dey and Flinn (2008) as we consider two searching spouses. The main contribution of our model is to combine (i) a household search model with on-the-job search that provides significant heterogeneity, with (ii) two working states that have a one-to-one relationship with the introduction of free health care which mostly benefits the informal workers, and (iii) a structure that accounts for pre-existing amenities across formal and informal/non-employment sectors. Furthermore, we apply this dynamic labor market framework to estimate the value of a free health insurance scheme by exploiting the introduction of the PSF in Brazil.

Based on this framework, we have to estimate: the parameters of the wage offer distribution varying by sector, F, (we assume a non-standard Beta function with minimum and maximum wages varying by sector and spouse obtained from the data), the transition rates, λ, the values of leisure, b, the risk aversion parameter, θ, the relative value of amenities in the formal sector, α, and the value of PSF, γ. The model is estimated on data from Pesquisa Mensal de Emprego (PME) using indirect inference. Specifically, this is done by minimizing the distance between simulated and empirical moments, which are the following. Individual moments: 1) wages by sector: mean, standard deviation, 10th, 25th, 50th, 75th and 90th percentiles (28 moments), 2) transition probabilities: variation in occupation status b/w interviews 1 and 2 (14 moments); Cross (or household) moments: 1) joint employment probabilities (8 moments), 2) conditional transition probabilities, i.e. the probability of head finding a job in the informal sector conditional to the spouse losing a job, and vice-versa (4 moments). As explained in CGN, to recover separately the value of pre-existing amenities in the formal sector relative to that in other states and the value of the new free insurance

[2]There is significant evidence that most movements across formal and informal sectors are among the self-employed in response to a rise in labor inspections (Almeida and Carneiro, 2012) and to a reduction in payroll taxes (Narita, 2019).

TABLE 4 Reduced Form Estimation: Impact of PSF on Wages

	(1)	(2)	(3)	(4)
	Head - formal	Head - informal	Spouse - formal	Spouse - informal
		Panel A: With Children		
		A.1: Low Education		
PSF x 10	-0.037*	-0.016	-0.095***	-0.023
	(0.019)	(0.023)	(0.020)	(0.021)
Observations	12,567			
		A.2: High Education		
PSF x 10	-0.049***	-0.029*	-0.045***	-0.055***
	(0.016)	(0.017)	(0.012)	(0.017)
Observations	12,503			
		Panel B: Without Children		
		B.1: Low Education		
PSF x 10	-0.050**	-0.055*	-0.039**	-0.047
	(0.021)	(0.029)	(0.018)	(0.029)
Observations	12,142			
		B.2: High Education		
PSF x 10	-0.050**	-0.086***	-0.037**	-0.048
	(0.020)	(0.028)	(0.015)	(0.030)
Observations	11,365			

Notes: OLS estimates obtained using Brazilian Census data (1991, 2000, 2010) aggregated at the municipality-year level. PSF is the number of years since the program was implemented in the municipality. Wages are measured per month (in log). Controls excluded from table are: the share of households in each municipality-year by education group (incomplete elementary, incomplete primary, complete primary, complete secondary and higher education) and by age of the head (20-29; 30-39; 40-49 and 50-59); log of population, municipality of residence fixed effects, state-year fixed effects, year fixed effects, a linear trend in municipal health expenditure per capita in 1997. Standard errors clustered by municipality. *** Significant at 1%, ** Significant at 5%, * Significant at 10%. Estimates are weighted by the number of observations per cell.

scheme by PSF, we estimate the model in two steps. First, from data before the PSF introduction (1990-1994), we estimate all but one parameter (γ, the value of PSF), since we know that $\gamma = 0$. We estimate:

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

Then, given the value of the pre-existing amenities and the other structural parameters obtained in the first step, we estimate γ using data after the PSF introduction (1995-1998: early stage, 1999-2000: later stage).

Here we describe the estimation of the first step by the Method of Simulated Moments. Let $m(\Theta)$ denote the vector of moments simulated from the model and $\tilde{m}$ the corresponding sample moments. We define the method of simulated moments by:

$$\hat{\Theta}_{MSM} = \arg\min_{\Theta} (m(\Theta) - \tilde{m})^T W (m(\Theta) - \tilde{m})$$

where $\dim(m(\Theta)) = \dim(\tilde{m}) = 54 > 22$ model parameters. The weighting matrix (W) is derived from data. The diagonal elements are the inverses of the bootstrap variances. Standard errors are obtained by bootstrapping.

5 | RESULTS FROM THE MODEL ESTIMATION

We now present the model estimates. The time period in the model is one month. We set the interest rate to r = 0.04, which corresponds to Brazilian SELIC monthly rate in 12/1994 and τ = 0.358 for employer contributions following Gonzaga (2003). The model is estimated separately for two different types of households: high and low education, with children ages 0-14 years, to account for heterogeneity in health status/shocks. For now, we present the results for low education households only.

Model Fit

Table 5 compares the stocks of households and transitions predicted by the model and observed in the data in the baseline period. The model fits well the largest stocks, i.e. the fraction of households where the head is working and the spouse is not working. The model overestimates the stock of households where the head is not working, but these also have lowest prevalence in the data. Most transitions for males predicted by the model fit well the transitions in the data, except the transitions out of the formal sector and from non-employment to the informal sector, when the spouse loses an informal job. For females, we find a worse prediction of the transitions, despite good fit for the stocks in aggregate. This is because the transition moments for females are more disperse so they receive less weight in our MSM estimation.

Table 6 presents selected moments for the distribution of wages in the data and as predicted by the model. We replicate well the distributions of accepted wages in the data, particularly for men in the formal and informal sectors, for higher percentiles of the females wage distribution in the formal sector and mean wage of females in the informal sector.

For the high education group, Appendix tables A.1 and A.2 show similar results, except that for this sample the fit of the wages is worse for men and the model tends to overestimate the formal sector wages for women.

TABLE 5 Model Fit: Stocks and Transitions

	(1) Data	(2) Model
Employment stocks		
m_{ff}	0.042	0.050
m_{fi}	0.101	0.070
m_{fn}	0.297	0.231
m_{if}	0.030	0.049
m_{nf}	0.013	0.043
m_{ii}	0.129	0.079
m_{in}	0.261	0.295
m_{ni}	0.039	0.071
m_{nn}	0.089	0.112
Transitions: Head		
Nonemployment-Formal	0.027	0.082
Nonemployment-Informal	0.214	0.229
Formal-Nonemployment	0.022	0.114
Formal-Informal	0.053	0.021
Informal-Nonemployment	0.057	0.075
Informal-Formal	0.051	0.063
Nonemp.-Inf., if spouse loses formal job	0.043	0.017
Nonemp.-Inf., if spouse loses informal job	0.041	0.004
Transitions: Spouse		
Nonemployment-Formal	0.003	0.026
Nonemployment-Informal	0.071	0.174
Formal-Nonemployment	0.038	0.387
Formal-Informal	0.072	0.026
Informal-Nonemployment	0.183	0.354
Informal-Formal	0.036	0.195
Nonemp.-Inf., if head loses formal job	0.043	0.011
Nonemp.-Inf., if head loses informal job	0.090	0.012

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

TABLE 6 Model Fit: Log-wages

	(1) Data	(2) Model
Formal wage: head		
P10	5.390	5.307
P25	5.672	5.698
P50	6.063	6.094
P75	6.500	6.529
P90	6.891	6.831
Mean	6.268	6.260
Informal wage: head		
P10	4.895	4.790
P25	5.248	5.131
P50	5.715	5.755
P75	6.190	6.328
P90	6.652	6.805
Mean	6.000	6.015
Formal wage: spouse		
P10	5.138	4.889
P25	5.321	5.098
P50	5.571	5.484
P75	5.941	5.939
P90	6.304	6.280
Mean	5.779	5.674
Informal wage: spouse		
P10	4.223	3.831
P25	4.592	3.831
P50	5.035	4.408
P75	5.505	5.570
P90	5.968	6.311
Mean	5.346	5.317

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

Transition and wage offer distribution parameters

Table 7 shows the parameter estimates for the transition rates. First, the job destruction rates are much higher for the spouse than for the head, regardless of the sector. Second, for both men and women, the destruction rates are also higher in the formal than in the informal sector. Third, the job arrival rates are higher for heads than for spouses. Fourth, women are very unlikely to enter the labor market through formal sector opportunities, as the arrival rates for formal offers for non-employed women are very low. Fifth, on-the-job offers to men are less frequent than to women, suggesting a higher turnover for women in the Brazilian labor market. Also interestingly, search on the informal job seems a more effective way of entry into the formal sector than search while outside any job. Finally, the model estimates show evidence of added-worker effect. Both women and men have a non-neglibible probability to move to the informal sector as a result of the other spouse losing a job in the formal or informal sector.

Table 8 shows the estimates of the wage offer distribution parameters. As we assume a non-standard Beta function, we have to estimate the minimum and maximum wages besides two parameters. We chose to use the minimum and maximum wages from the data for each spouse and sector. Then, as we impose that the two scale parameters do not vary by spouse, we have to estimate four parameters, i.e. (α,β) for each sector.

Tables A.3 and A.4 in the Appendix show the estimates for the high education sample. Differently from the low education sample, the destruction rates are higher in the informal than in the formal sector. The job arrival rates are higher for heads than for spouses but only with the formal sector. Also, on-the-job search seems a more effective way of entry into any sector than searching out of a job. The wage offers distribution parameters from the Beta distribution are consistent with the mean wage offer for high education workers being higher than the mean wage offer of low education workers.

Preference parameters

Table 9 shows the parameter estimates for the value of leisure, formal sector amenities and value of PSF. We estimate the risk aversion of the CARA utility equal to 0.00000048 which is close to have a linear utility function. The value of leisure is slightly higher for females than males. The table shows that the value of leisure is negative, reflecting that job offers from the informal sector arrive more frequently out of than on-the-job.

The fourth and fifth rows of the table include the estimates for a and the marginal willingness to pay (MWP), which is obtained by multiplying a by $\frac{1}{u_I'}$ where I is the mean household income. The MWP gives the value in currency units which we use to compare to income/wages. Note that because risk aversion is very low, the MWP is similar to the utility value. The estimate for MWP shows that, before the introduction of PSF, low education households are willing to forgo a 19% of their earnings to be in the formal sector rather than in the informal sector.

Our main estimate, γ, is calculated using data after the program is implemented for the two stages: early (1995-1998) and later or expansion period (1999-2000). They show that the value-added of PSF is positive, representing 14.7% and 15.6% of the mean wage of husbands in the informal sector. Using information on government expenditures in PSF, we can compare the gain of families with the PSF to the cost of funding the program.[3] Since

[3]In absence of a cost estimate associated with the program, we use the direct cost of maintaining one PSF team, which is around BRL 215,000 to BRL 340,000 in 2000 (Bhalotra, Rocha and Soares, 2019). Since each team covers on average 3,450 individuals or 863 families, the cost per family per month is about BRL 21 to BRL 33 in 2000. Of course, this measure underestimates the real cost per family for at least two reasons: 1) not all families register in the program and 2) it ignores all other health expenditures related with the expansion of the public health system.

TABLE 7 Model Estimates: Transition rates

	Head	Spouse
δ_f	0.134	0.687
	(0.014)	(0.018)
δ_i	0.083	0.589
	(0.011)	(0.016)
λ_{nf}	0.178	0.054
	(0.012)	(0.013)
λ_{ni}	0.857	0.428
	(0.011)	(0.013)
λ_{fi}	0.123	0.505
	(0.012)	(0.017)
λ_{if}	0.296	0.415
	(0.019)	(0.013)
p	0.737	0.605
	(0.015)	(0.013)
q	0.120	0.732
	(0.015)	(0.019)

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

TABLE 8 Model Estimates: Wage offer distributions parameters

α_f	0.847
	(0.095)
α_i	0.167
	(0.022)
β_f	6.958
	(0.149)
β_i	3.535
	(0.160)

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

the government spends at least around BRL 33 per each family per month, these figures are equivalent to saying that the families assign at the most a value of 1.9 to each one BRL the government directly spends in the program, which is very high. Unfortunately we do not have a lower bound for the value/cost estimate, as the information on the total cost of the PSF is not available. But these figures based on a direct cost estimate seem in line with the ones obtained by the literature using the value of a statistical life for Brazil and the cost per life saved related to the expansion in public health expenditure between 1995-2005. Their numbers imply a value in between BRL 1.25 and 3.4 for each one BRL spent in the program (Bhalotra, Rocha and Soares, 2019).

The Appendix Table A.5 shows for the high education sample that the estimate for γ is not so dissimilar from the estimate for low education families, however, in terms of mean salary (around BRL 788), the value of PSF for high education families is at the most 7%, which is half of the estimate for the low education group.

TABLE 9 Model Estimates: value of leisure, of being in the formal sector, and of health insurance in the informal sector

θ	0.00000048
	(0.00000013)
b_1	-165.950
	(21.706)
b_2	-158.779
	(17.260)
α	77.184
	(35.592)
MWP α	77.189
	(35.595)
γ early stage	59.487
	(17.211)
γ later stage	63.208
	(20.402)
MWP γ early stage	59.491
	(17.213)
MWP γ later stage	63.212
	(20.403)

Notes: All parameters estimates presented in the table are obtained using data from the period before the introduction of PSF. The exception is γ, which, conditional on the estimates from the period before PSF, is obtained from the period after the introduction of PSF. The monthly mean household income is BRL 406.26 (in 12/2001). The bootstrap standard errors in parenthesis are computed from 50 replications.

6 | COUNTERFACTUAL SIMULATIONS

We now use the model to simulate the impacts of changing the value of the program, γ, on the share of households according to employment status, wages by spouse and aggregate

welfare. We present the results for the low education sample only which is sufficient to understand the implications of the model. We take as benchmark the estimates from the data in the period prior to the implementation of the program. Since the utility values obtained in stage 1 and 2 of the PSF implementation are very similar (as shown in Table 9) we show the simulation results of changes in the economy with γ equal to the value estimated from the stage 2 of the program implementation only.

The results of the simulations are presented in Table 10, where we consider partial and general equilibrium effects. In the wage posting environment, firms can adjust wages in either sector as workers move in or out. They may increase wages in order to keep workers as on-the-job search allows them to find better options elsewhere. On the other hand, firms can reduce wages if labor supply increases. This is expected to happen in the informal sector, due to an increase in the value of free health insurance. Depending on how these wage adjustments occur we should have important general equilibrium effects.

We first comment on the partial equilibrium results, based on column (1) of Table 10. When the pre-PSF economy is simulated with the estimated value of PSF, we find an increase in household informality of 3.9 p.p. (8%), which is comparable to reduced-form analysis in Section 3 (5%). Non-employment of spouses goes up and of heads falls, which is also in line with the reduced-form analysis, where we find that the combined fractions $\mathrm{FN} + \mathrm{IN} + \mathrm{NN}$ go up whereas $\mathrm{NF} + \mathrm{NI} + \mathrm{NN}$ go down. For women, wages vary very little below 1% and, for men, we observe large variation in both formal and informal sector wages that are consistent with reservation wage changes due to a policy which transfers resources to the informal sector and non-employment and also because of composition. More directly, wages go up in the formal sector since the relatively worse paid male workers in this sector move to informality. Wages go down in the informal sector for males since workers tend to accept lower wage offers in this sector after the introduction of PSF.

We do see some general equilibrium effects. As we consider endogenous wages, column (2) of Table 10 shows that informality still increases despite the decline in the informal wage offers for both men and women.[4] The increase in formal sector wages accepted by all women is due to firms setting higher wages in this sector in order to keep workers. The increase in informal wages for women is because some relatively better paid women in the formal sector move into the informal sector. The bottom line of Table 10 shows that, despite an increase in the informal sector and non-employment of spouses, the welfare increases in all simulations. This is because we simulate an increase in utility due to PSF to households without insurance whose estimated value is about 15.6% of the mean wage, while wages on average decline by 0.5% and 0.7% in the partial and general equilibrium simulations, respectively. Welfare goes up less in the general equilibrium simulation since informal wage offers declined.

We also conduct a revenue neutral simulation in which we introduce a lump-sum tax to all individuals per period to pay for the direct cost of PSF per family (i.e. BRL 33.00). As the lump-sum taxation hits more heavily the informal sector and the non-employed (as they earn less), this reduces their reservation wage to accept a formal sector job. Therefore, wages offers go down in the formal but go up in the informal sector. Wage offers go opposite in relation to the general equilibrium analysis without taxing back individuals. As a result, informality raises a bit more, to 5.8 p.p. (10%) however welfare increases much less than before, by 4.7%. In the Appendix, we show updated results for low education workers from *Seguro Popular* in Mexico to compare with the PSF results for Brazil. Comparing tables 10 and A.6 we see indeed much larger welfare impacts for PSF across all simulations. Importantly, while the impact on welfare of PSF in Brazil is positive, for *Seguro Popular* in Mexico welfare

[4] Mean informal sector wages under the distribution of wage offers drop 1.8% and 1.9% for men and women, respectively.

may even go down by 4.98% when the government is taken into account.

TABLE 10 Counterfactual Experiments: Effects of changing the utility value of having HI outside the formal sector (γ) on stocks, wages and welfare

	Partial Eq.	General Eq.	General Eq. (rev.neutral)
Stocks (p.p)			
m_{ff}	-0.950	-0.790	-1.000
m_{fi}	-0.550	-0.930	-1.200
m_{fn}	-1.620	-2.350	-3.390
m_{if}	0.020	0.480	0.590
m_{nf}	-0.840	-0.610	-0.800
m_{ii}	0.860	1.430	1.910
m_{in}	3.670	3.300	3.640
m_{ni}	-0.150	-0.110	0.160
m_{nn}	-0.440	-0.420	0.090
Household informality (p.p.)	3.940	4.200	5.800
Nonemployment head (p.p.)	-1.430	-1.140	-0.550
Nonemployment spouse (p.p.)	1.610	0.530	0.340
Mean Wage:			
Head: Formal Sector (%)	9.776	9.769	7.885
Head: Informal Sector (%)	-8.249	-11.343	-8.498
Spouse: Formal Sector (%)	-0.807	0.255	3.184
Spouse: Informal Sector (%)	-0.641	1.023	1.052
Welfare workers: total (%)	13.061	11.695	4.738

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

7 | CONCLUSIONS

In this work we have analyzed the effects on the labor market of the introduction and expansion of the Programa Saude da Familia (PSF) in Brazil since 1996, building on the novel household search model developed in CGN for the case of Mexico. We have found much bigger impacts for PSF in Brazil than for SP in Mexico. In particular, while CGN have shown that the implementation of *Seguro Popular* in a municipality is associated with an increase in informality *only* among low-income families with children of 2.8 percentage points (4%), and no impact for high education families, we have shown that PSF is associated with an increase in household informality of 2.6 percentage points (5%), 10 years after implementation of the program; differently from the results for Mexico, the effect is significant in *all* the subsamples, regardless of the educational level and the presence of children. Then, CGN have found a SP utility value of about 4% to 9% of the average family income, respectively, for low and high

education families, indicating that the SP value for households is *below* the government's cost of providing the program, since the utility gain is about 36-56 cents for each Mexican peso spent on the family program.[5] Here, we have found instead that Brazilian families assign at most a value of 1.9 to each one BRL the government directly spends in the PSF program - which is much higher than the SP valuation and *above* the government's cost.

While at present it is not possible to identify what are the drivers of the differences in the labor market impacts and in the valuations of large-scale free health insurance schemes between Mexico and Brazil, we suspect the difference in the timing of implementation (the 1990s for PSF, the 2000s for SP) and the pre-existing infrastructure (for example, the availability of health care for the beneficiaries of *Progresa-Oportunidades* in Mexico) might have played a non-negligible role.

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[5] This is similar to the values found for subsidized health insurance programs in the United States. In particular, families value between 0.5 and 1.2 dollar per each dollar spent on Oregon Medicaid (Finkelstein, Hendren e Luttmer, 2018) and less than 50 cents per dollar spent on CommCare (a subsidized health insurance in Massachusetts also for low-income adults, Finkelstein, Hendren and Shepard (2019)).

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A | ADDITIONAL TABLES

A.1 | High education

TABLE A.1 Model Fit: Stocks and Transitions - High Education

	(1) Data	(2) Model
Employment Stocks		
m_{ff}	0.080	0.040
m_{fi}	0.109	0.106
m_{fn}	0.326	0.327
m_{if}	0.049	0.027
m_{nf}	0.013	0.028
m_{ii}	0.122	0.061
m_{in}	0.219	0.258
m_{ni}	0.024	0.074
m_{nn}	0.058	0.080
Transitions: Head		
Nonemployment-Formal	0.029	0.074
Nonemployment-Informal	0.168	0.289
Formal-Nonemployment	0.014	0.039
Formal-Informal	0.065	0.063
Informal-Nonemployment	0.036	0.152
Informal-Formal	0.076	0.098
Nonemp.-Inf., if spouse loses formal job	0.038	0.032
Nonemp.-Inf., if spouse loses informal job	0.020	0.046
Transitions: Spouse		
Nonemployment-Formal	0.003	0.006
Nonemployment-Informal	0.058	0.186
Formal-Nonemployment	0.022	0.370
Formal-Informal	0.131	0.080
Informal-Nonemployment	0.131	0.372
Informal-Formal	0.065	0.158
Nonemp.-Inf., if head loses formal job	0.067	0.008
Nonemp.-Inf., if head loses informal job	0.025	0.037

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

TABLE A.2 Model Fit: Log-wages - High Education

	(1) Data	(2) Model
Formal wage: head		
P10	5.737	5.585
P25	6.168	6.318
P50	6.704	6.894
P75	7.186	7.257
P90	7.540	7.497
Mean	6.863	6.932
Informal wage: head		
P10	5.388	4.801
P25	5.899	5.391
P50	6.438	6.239
P75	6.999	6.909
P90	7.416	7.273
Mean	6.670	6.483
Formal wage: spouse		
P10	5.383	5.309
P25	5.706	5.840
P50	6.200	6.440
P75	6.735	6.888
P90	7.183	7.169
Mean	6.448	6.556
Informal wage: spouse		
P10	4.584	3.831
P25	5.112	4.785
P50	5.735	5.715
P75	6.370	6.453
P90	6.905	6.873
Mean	6.082	6.033

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

TABLE A.3 Model Estimates: Transition rates - High Education

	Head	Spouse
δ_f	0.055	0.658
	(0.009)	(0.056)
δ_i	0.191	0.671
	(0.030)	(0.059)
λ_{nf}	0.112	0.010
	(0.026)	(0.018)
λ_{ni}	0.318	0.323
	(0.052)	(0.054)
λ_{fi}	0.550	0.614
	(0.047)	(0.041)
λ_{if}	0.305	0.601
	(0.055)	(0.054)
p	0.485	0.490
	(0.069)	(0.052)
q	0.318	0.695
	(0.043)	(0.055)

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

TABLE A.4 Model Estimates: Wage offer distributions parameters - High Education

α_f	0.454
	(0.086)
α_i	0.466
	(0.115)
β_f	1.947
	(0.283)
β_i	2.822
	(0.387)

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

TABLE A.5 Model Estimates: value of leisure, of being in the formal sector, and of health insurance in the informal sector - High Education

θ	7.2455E-08
	(9.10077E-08)
b_1	-348.80
	(74.96)
b_2	-273.45
	(62.70)
α	-15.897
	(59.246)
MWP α	-15.899
	(59.249)
γ early stage	53.961
	(16.048)
γ later stage	49.710
	(18.545)
MWP γ early stage	53.962
	(16.048)
MWP γ later stage	49.711
	(18.546)

Notes: All parameters estimates presented in the table are obtained using data from the period before the introduction of PSF. The exception is γ, which, conditional on the estimates from the period before PSF, is obtained from the period after the introduction of PSF. The monthly mean household income is BRL 788.76 (in 12/2001). The bootstrap standard errors in parenthesis are computed from 50 replications.

A.2 | Simulations for Mexico (*Seguro Popular*) - low education

TABLE A.6 Counterfactual Experiments: Effects of changing the utility value of having HI outside the formal sector (γ) on stocks, wages and welfare (Seguro Popular, Mexico)

	Partial Eq.	General Eq.	General Eq. (rev.neutral)
Stocks (p.p)			
m_{ff}	-0.04	-0.04	0.12
m_{fi}	-1.08	-0.92	-0.80
m_{fn}	-3.29	-2.89	-0.68
m_{if}	-0.30	-0.14	0.11
m_{nf}	-0.27	-0.20	0.08
m_{ii}	2.16	1.02	0.79
m_{in}	2.44	2.73	0.14
m_{ni}	0.17	0.29	0.20
m_{nn}	0.21	0.15	0.04
Household informality (p.p.)	4.98	4.19	1.17
Nonemployment head (p.p.)	0.11	0.24	0.32
Nonemployment spouse (p.p.)	-0.64	-0.01	-0.50
Mean Accepted Wage:			
Head: Formal Sector (%)	0.10	0.07	2.84
Head: Informal Sector (%)	-1.47	-2.00	-0.71
Spouse: Formal Sector (%)	-0.08	0.02	0.51
Spouse: Informal Sector (%)	1.49	0.15	-3.95
Welfare workers: total (%)	1.71	1.09	-4.98

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