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Evidence from a Nationwide Quasi Experiment in Brazil

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Nudging the self-employed into contributing to Social Security: Evidence from a nationwide quasi experiment in Brazil

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Abstract: This paper studies the first large scale effort by the Brazilian government to increase the social security compliance of self-employed workers using behavioral interventions. In 2014, the Brazilian Ministry of Social Security gradually delivered by postal mail a booklet reminding nearly 3 million self-employed workers their obligation to contribute to social security. We find that, sending the booklet increased payments by 15 percent and compliance rates by 7 percentage points. This increase is concentrated around the month the booklet was delivered and disappears three months after the intervention, a pattern known as action and backsliding. The relatively brief increase in payments outweighs the cost of sending the booklet by at least a factor of 2. Our results suggest that active behavioral interventions could be used as policy instruments that are orders of magnitude more cost-effective than subsidies to increase social security contributions in developing countries, particularly for the self-employed.

JEL codes: D03, H26, H55, O17

Key Words: Behavioral interventions, Tax evasion, Informal Sector, Social Security and Pensions.

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I Introduction

The self-employed constitute around one third of all the workers in the world and nearly half of the workers in low and middle income countries (World Bank, 2014). However, this group of workers remains largely detached from social security institutions and tax authorities, and constitutes public finance gaps around the world. For example, in 19 Latin American countries where micro data on contributions are available, only 16 percent of self-employed contribute to social security systems, compared to 66 percent of their salaried counterparts (Bosch et al., 2013). The evasion or under-reporting of social security contributions by the self-employed are also prevalent in high income countries. For instance, in Japan in 2002, only 62 percent of contributions expected from self-employed were collected, versus more than 97 percent from salaried workers (Choi, 2009).

At least three sets of explanations have been put forward to rationalize this disconnect between the self-employed and the social security systems. First, from an institutional point of view, social security systems in their conception were only designed for salaried workers (Levy and Kaplan, 2014 and Auerbach et al., 2005). In fact, still today in many countries the self-employed are, by design, either completely excluded from social security (e.g. Pakistan) or only required to contribute to pension systems on a voluntary basis (Mexico, Indonesia, Thailand, Bangladesh, Ghana, Kenya, South Africa, Tanzania and Tunisia, among others). Furthermore, enforcement remains a challenge in countries where the self-employed are required to make contributions. Second, the self-employed are, on average, poorer than salaried workers (Cunningham and Maloney, 2001), and, in an environment of low enforcement and institutional capacity, the self-employed are less able to make regular payments to social security.² Finally, another explanation highlights the fact that the self-employed lack the appropriate behavioral channels that make social security systems work effectively

² For instance, in Latin America, around 49 percent of all self-employed report incomes below the minimum wage. A related explanation is that due to lack of enforceability, individuals who have low preference for social insurance programs self-select into self-employment activities.

for salaried workers (Bodie and Prast, 2012); in particular, the lack of third party defaults that allow firms to collect social security contributions from salaried workers. Since the self-employed are both the firm and the worker, they have to make proactive decisions to contribute regularly. This fact makes them particularly prone to problems of self-control, limited attention and procrastination underlined by the behavioral literature (Banerjee and Mullainathan, 2010, 2008; Fudenberg and Levine, 2006; Laibson, 1997).

This paper documents a large scale behavioral intervention in which the Brazilian authorities sent an informational booklet to self-employed workers already affiliated with social security with the aim of increasing compliance rates. Taking advantage of the quasi natural experiment that resulted from the staggered implementation of the intervention across Brazilian states, we find that sending the booklet increased payments by 15 percent and the compliance rate by 7 percentage points (from 40% to 47%). There is a clear pattern of “action and backsliding”; affiliates increase contributions markedly in the month they receive the booklet, but these immediate gains decrease rapidly. Nevertheless, the relatively brief increase in contributions during a period of six months outweighs the cost of sending the booklet by at least a factor of two, increasing social security contributions (net of costs) by US\$ 3.1 million. We compare our results with a previous intervention in 2011 that slashed contribution rates for the self-employed by more than 50 percent, with an estimated gain in contributors of around 8.5 percent (Rocha et al., 2014), and a net loss for social security revenues of US\$ 27.8 million within a six month window.

Unfortunately, the behavioral intervention was not designed for evaluation purposes and, hence, it is difficult to understand the mechanisms behind the outcomes we observe. However, at least two potential mechanisms are evident. First, the booklet acts as a cue that draws the attention of the affiliate to several facts; the obligation to contribute every month, the short term and long term

benefits of social security, and the active monitoring of affiliates by social security and tax authorities. Second, the booklet simplifies the way contributions are made by providing twelve vouchers (one per month) that could be used at any bank to process social security contributions. The increase in contributions and the pattern of action and backsliding that we observe are consistent with both mechanisms. On the one hand, the intervention is an exogenous cue which increases the marginal utility of contributing to social security. As the cue is removed, affiliates return to their un-cued level. On the other hand, the simplification mechanism could generate similar patterns. Social security contributions can be paid in advance using the vouchers. For instance, consider the case where some affiliates are affected by the reduction in costs of paying into social security through the provision of the vouchers. These affiliates could have been prepaying the rest of the year using all the vouchers, hence explaining the sharp increase in contributions and the rapid decrease afterwards. Which of these two mechanisms and what pieces of information are driving our results are unclear and deserve further research to improve interventions.

This paper is related to two strands of literature. First, it builds on extensive literature that show that behavioral interventions have proven to produce significant impacts on outcomes in a wide range of environments (Thaler and Sunstein, 2008). In particular, a large number of studies have shown how interventions can dramatically increase savings for retirement (and other purposes). The evidence suggests that, by far, the most effective method to increase participation in saving schemes is some kind of automatic enrollment that locks the individual into a saving default (Madrian, 2012). Studies at the firm level report large increases, up to 50 percentage points, in the participation in savings scheme due to automatic enrollment (Choi et al., 2001; Dupas and Robinson, 2013; Madrian and Shea, 2001). Other studies document positive effects of commitment products (Ashraf et al., 2006; Dupas and Robinson, 2013; Gugerty, 2007), or simplification mechanisms (Carroll et al., 2009). Perhaps closer to this paper, a number of recent studies show that reminders can have a significant

impact on saving decisions (Kast et al., 2012; Cadena and Schoar, 2011; Akbas et al., 2014). In particular, a significant impact takes place when those reminders focus on both a particular future goal set by the individual and on the means toward achieving that goal (Karlan et al., 2010). Furthermore, the pattern of action and backsliding is also reminiscent of a series of studies that document this outcome in response to home energy reports (Allcott and Rogers, 2014), flood insurance (Gallagher, 2014), electricity and running water bills (Gilbert and Zivin, 2013; Szabo and Ujhelyi, 2014).

Second, it resonates with the literature that analyzes how to increase social security and tax compliance in developing countries, with large segments of firms and workers either openly eluding compliance (Busso et al., 2012; Perry et al., 2007; Schneider, 2014) or underreporting wages (Kumler et al., 2013). Evidence from Turkey (Betcherman et al., 2010), Colombia (Kugler and Kugler, 2009) and Brazil (Rocha et al., 2014) suggest that high contributions are in part responsible for the low levels of compliance, and that reductions in social security contributions or tax rates can actually increase the share of complying workers (albeit never enough to increase total revenue). Others, however, show decreases in social security contributions are passed on to workers in full as higher wages, without any effect on compliance rates (Cruces et al., 2010; Gruber, 1997). Similarly, a study in Uruguay found that improving health benefits for certain groups of workers led to an increase in compliance rates, even as contribution rates increased (Bérgolo and Cruces, 2011). Finally, a series of papers show how improved monitoring, via increases in labor inspections, can increase compliance levels (Andrade et al., 2014; Almeida and Carneiro, 2012).

The results of this paper contribute to the literature in two distinct ways. First, we show how behavioral interventions employed at scale can be cost-effective instruments to increase social security and tax compliance rates. This intervention is several orders of magnitude more effective

than price incentives, (i.e. contribution subsidies), even in a context of low enforceability and lack of defaults. Second, despite being cost effective in the short run, our results show clear signs of decreasing impacts of a single treatment. This raises crucial questions as to whether reminders, simplifications or other behavioral interventions can affect compliance rates for long periods of time (15 or 20 years is the average time to qualify for pensions in many defined benefit programs). Given the promising (although limited) results, there is plenty of scope to experiment with different messages as well as time spans to evaluate the long term feasibility of these interventions.

The paper proceeds as follows. Section 2 describes the institutional setting around the MEI program and its policy changes that led to the implementation of the booklet intervention. Section 3 presents the data and our identification strategy. Section 4 shows the results and Section 5 presents our conclusions.

II Institutional Setting: The Brazilian Social Security System and the Self-employed

The MEI program

During the last decade, Brazil implemented a series of initiatives to increase social security coverage and tax compliance for self-employed. In 2009, the Brazilian Ministry of Social Security (*Ministerio da Previdencia Social*) implemented a program, the *Individual Microentrepreneur* (MEI in its Portuguese acronym), to affiliate the self-employed.³ The MEI substantially reduced the cost of compliance with tax and social security authorities for the self-employed, decreasing the total cost from 20 percent of net income to 11 percent of the minimum wage (around 7 percent of average net income

³ The entrepreneurs eligible to join the program were those (i) whose business revenues were under R\$ 36,000 a year (around US\$ 13,000); (ii) who had one employee with a monthly salary equal to the minimum wage (R\$ 724, around US\$ 270); and (iii) were not owners of nor partners in other businesses. According to the PNAD, in 2009 there were 9 million self-employed that fulfilled those characteristics, or around 45 percent of all self-employed (Rocha et al, 2014).

of self-employed). It also significantly simplified compliance by collapsing into a single payment all social security contributions and municipal, state and federal taxes.

However, in 2011, two years after the implementation of the program, only 2 of the potential 9 million self-employed were affiliated with MEI. Furthermore, of those affiliated, only around 45% were regularly complying. Brazilian authorities speculated that both the low affiliation and compliance rates were a result of still high contribution rates for the low income, informal self-employed (Globo, 2011; Senado Federal, 2011). Following this conjecture, in April 2011, the contribution rates were reduced from 11 to 5 percent of the minimum wage (US\$ 13) with the specific objective of increasing the number of contributors by 500,000 by the end of the year. Within a month of implementation, revenues from the MEI decreased from R\$30 million in April 2011 to R\$12 million in May 2011. Rocha et al (2014) evaluate this early stage of the introduction of MEI and the decrease in the contribution rate taking advantage of the variation in eligibility of MEI at the industry level and the technical problems that emerged with the online registration platform that generated some variation among states at the early stages of the program. According to their estimates, the reduction in contribution rates in 2011 increased the number of contributions by 8.5 percent with an implied elasticity of 0.16 (for each 10 percent reduction in contribution rates there was a 1.6 percent increase in the number of contributors). This estimate implies that the reduction in contribution rates caused an increase in net contributors of 60,000 by December 2011, well below the government's target of 500,000. In subsequent years, affiliation steadily increased to reach 3 million affiliates by mid-2013. However, despite the sharp reductions in contribution rates, the share of affiliates contributing to the system never increased above 55%.

The booklet intervention and its behavioral components

The consensus within the Ministry of Social Security was that further reductions in the contribution rates would be ineffective (and highly undesirable from a fiscal point of view). In order to increase compliance levels, in 2014 the Brazilian Ministry of Social Security pushed forward a new initiative. The focus in this case was not necessarily to bring new affiliates to the program, but “nudging” those already affiliated to contribute. For that purpose, the Ministry of Social Security sent a booklet reminding the affiliate of the need to contribute and facilitate payment procedures to all self-employed already affiliated with MEI (around 3 million at the end of 2013). Given some logistical restrictions, the booklets were sent gradually across states during a four month period, starting in February 2014 (see appendix for a copy of the booklet). Our identification strategy relies on this staggered implementation.

The booklet intervention could be understood as a composite of at least two behavioral interventions. On the one hand, the booklet is a *reminder* that draws the attention of the individual and highlights several facts related to compliance with social security and tax authorities. First, it reminds the affiliate of the obligation to contribute, something that not all affiliates were aware of. In a survey conducted in 2013 by the administrator of the program, 20% of the affiliates responded that they were not aware that registration to the MEI implied monthly contributions. Second, it highlighted the importance of the contribution as a means to become eligible for a series of benefits; the text in the booklet reads “*Keeping up with the monthly payments, you are protected in case of an accident, entitled to an old age pension, a disability pension, maternity leave (in case of pregnant women and adoptions) after a minimum number of contributions. Your family will have the right of survivorship pension and prison-grant.*” Finally, the booklet could have been perceived as a monitoring tool as it contained both the seal of the Ministry of Finance (*Ministerio da Fazenda*) and the Ministry of Social Security. In fact, the lack of contributions constituted a debt with the Ministry of Social Security, although this was probably

unknown to affiliates (they were not informed in the booklet) and not enforced by the Ministry of Social Security.

On the other hand, it is a *simplification tool*. In order to pay for the contributions, all MEI beneficiaries had to go online and either make the payment through the online banking system or print a voucher (*boleto bancário*), a Brazilian print payment instruction that is accepted by all banks. The booklet contained 12 vouchers (*boletos bancários*) for all monthly installments of the year.

On a side note, the booklet asked the affiliates not to make payments without obtaining information on preventing fraud, something that in principle could confound the main objective of the booklet, which was to raise contributions.

III Data and Identification strategy

To estimate the impact of the booklet intervention on the performance of the MEI contributions, we use administrative data from the Ministry of Finance and the Ministry of Social Security. We have access to municipality-level monthly data on the number of affiliates since 2012 (since 2011 at the state level). We obtained the municipal reports on the number of affiliates and the number of contributions in the month of reference. The nature of these data make it highly reliable due to the absence of typical measurements errors found in household surveys.

Several features of the data are worth noting. First, the number of affiliates reflects the number of people registered in the program either through the program's web page or through different registration campaigns that were carried out across the country to attract new self-employed workers. Surveys carried out by the institution to supervise the MEI, SEBRAE, show that around 83 percent of those registered workers were actually conducting an entrepreneurial activity. The rest were either at a salaried job or unemployed and had never reported their new status to the MEI

administrator. The latter is relevant as the official rate of non-compliance could be overestimated.⁴ Second, the data on payments refer to the number of “contributions” paid in a particular month in a state or municipality. This does not necessarily mean that the number of individuals that contributed in that month is equivalent to the number of contributors. An individual can pay up to 12 installments in a particular month, paying forward in January the contributions for the entire year (anecdotal evidence suggests that this is the case for high income self-employed). This could explain the hike in the number of payments we observe taking place every January.

Therefore, our final sample is composed of 5,396 municipalities out of 5,570 municipalities in Brazil. We ruled out those municipalities with zero affiliates or zero payments to obtain a balanced panel dataset. Our balanced panel starts in February 2012 and ends in September 2014 with 172,640 observations. Table 1 below describes the available data for this study. It is worth noting that the breakdown of the number of observations indicates that a large portion of the sample corresponds to the pre-booklet intervention status.

⁴ This demonstrated that the program lacked the ability to identify and remove from the program the entrepreneurs that no longer worked as micro entrepreneurs. Accounting for dropouts, it would imply that the compliance rate would be around 51 percent.

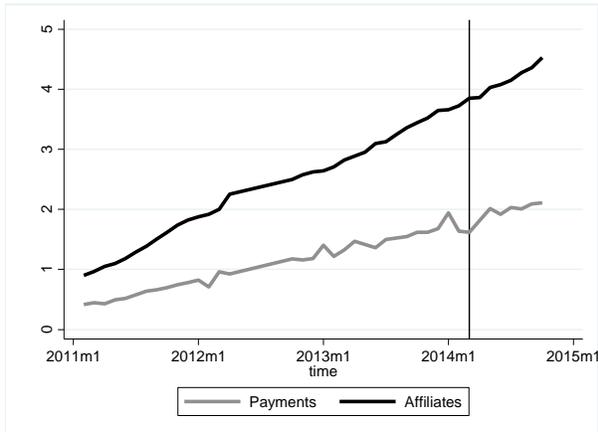
Table 1: Descriptive statistics (averages).

Variable(s)	Pre-intervention	Post-intervention	Total
<i>Outcomes</i>			
Compliance rate	0.584 [0.200]	0.578 [0.170]	0.583 [0.195]
Log(Registration)	4.720 [1.475]	5.126 [1.394]	4.789 [1.470]
Log(Payment)	4.093 [1.473]	4.514 [1.381]	4.165 [1.466]
<i>Control variables</i>			
Population	30,030 [208,012]	28,647 [190,066]	29,758 [204,608]
GDP per capita	9.639 [10.38]	9.263 [10.20]	9.565 [10.35]
Observations	143,028	29,612	172,640

Source: administrative data from the Ministry of Social Security. Notes: (1) Standard deviations in brackets.

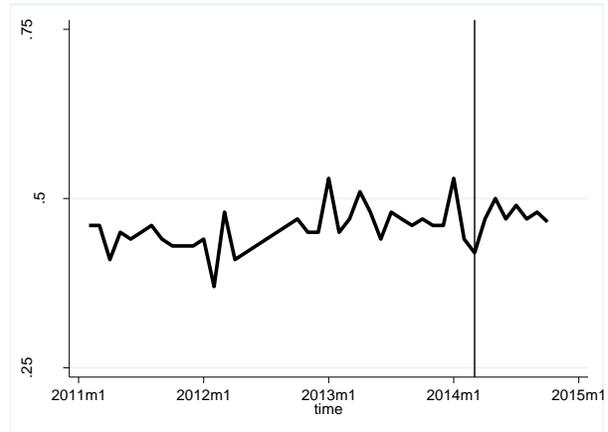
Figures 1 and 2 below show the number of affiliates to the MEI program and the payment rate since January 2011 (aggregate data availability dates back to 2011, whereas municipal level data is only available since February 2012). Several facts merit attention. First, the number of affiliates during this period has increased fourfold from roughly 1 million in 2011 to more than 4.5 million by September 2014. Similarly, the number of monthly contributions increased from 0.5 million to 2 million in the same period, with an average compliance rate slightly below 45 percent. Second, neither the decrease in contribution after April 2011 rates nor the booklet intervention seem to manifest a significant break in trend of affiliation or contributions in 2014.

Figure 1. Affiliates



Source: administrative data from the Ministry of Social Security.

Figure 2. Compliance rate



Source: administrative data from the Ministry of Social Security.

Difference in differences approach

We take advantage of the natural quasi-experiment that resulted from rolling out the booklet intervention in the period February - July 2014, which was introduced gradually by groups of states. In particular, each month Brazilian authorities targeted different groups of states due to logistical restrictions on sending the booklets. These restrictions resulted in the staggered rolling out of the intervention during a 4 month period. The booklet was sent to all affiliates in a particular group of states (see Table 2 below), regardless of their date of entry into the program.

Although all the treatment variations that we exploit take place at the state level, our econometric approach focuses on the municipal level. We thus control for specific municipal trends and explore heterogeneity of the effects also at the municipality level. The program implementation followed the schedule shown in Table 2 below:

Table 2. Rolling out the booklet strategy 2014.

Wave	Feb-Mar	N	Mar-Apr	N	Apr-May	N	May-Jul	N
	Acre	20	Alagoas	100	Distrito Federal	1	Sao Paulo	642
	Amazonas	56	Bahia	415	Goias	243		
	Amapa	15	Ceara	184	Mato Grosso	139		
					Mato Grosso do			
	Para	140	Espirito Santo	78	S.	78		
	Roraima	13	Maranhao	197	Parana	394		
			Minas Gerais	841	Rio de Janeiro	92		
					Rio Grande do			
			Paraiba	213	Sul	479		
			Pernambuco	184	Santa Catarina	292		
			Piaui	168				
			Rio Grande do					
			Norte	158				
			Rondonia	52				
			Sergipe	69				
			Tocatins	133				
Total		244		2,792		1,718		642

Source: administrative information from the Ministry of Social Security. N corresponds to the number of municipalities in that state.

Crucial to our estimation of the identification strategy is the way the roll out was engineered. The roll out was not random. Brazilian authorities argued that a geographical criterion was followed. It started with the relatively poor North and ended with the relatively rich South, in the State of Sao Paulo, which comprises around a quarter of all affiliates to MEI. Based on the information from Table 2 above, we first estimate a difference in differences (DiD) model that captures the effect of the intervention for different sets of treatment and comparison groups according to the following equation:

$$Y_{it} = \beta_0 + \beta_1 D_i + \beta_2 X_i + \gamma_i + \gamma_t + e_{it} \quad (1)$$

Where Y_{it} is the outcome variable of interest for each municipality i in month t . D_i the treatment indicator which takes values of 1 when the municipality is treated (the month the municipality is schedule to receive the booklet and thereafter) and 0 when untreated. We obtain the DiD estimator from the coefficient β_1 for the whole treated sample. We also control for pre-trends derived from

the potential non-random assignment of treatment, X_i . In particular, we allow the four treatment groups in Table 2 to have different time trends. Furthermore, we allow different trends for quintiles of municipalities depending on their GDP per capita level and seven groups of population levels (as of 2011). The parameters γ_i and γ_t denote individual (municipal) and time (monthly) fixed effects.

Second, we take advantage of the nature of our data by estimating the gradual effects of the booklet intervention several months before and after its introduction in 2014. This also helps us assess our identification strategy, which is based on the absence of pre-treatment trends that can be correlated with the (gradual) introduction of the booklet intervention. Similarly, this approach allows us to understand the effects of the intervention according to different lengths of exposure. Here we focus on the following specification:

$$Y_{it} = \beta_0 + \sum_{t=-3}^3 \beta_{1t} D_{it} + \beta_3 X_i + \gamma_i + \gamma_t + e_{it} \quad (2)$$

Where t_0 indicates the month in which the intervention starts at each municipality, B_{it} are binary variables indicating the treatment status prior to the intervention, specifically, three months before the intervention ($t_0 - 3$), A_{it} are binary variables over three months after the intervention starts at each municipality.

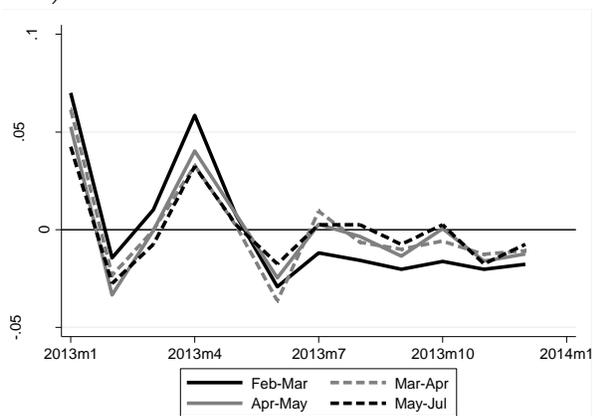
We estimate (1) and (2) taking into consideration the fact that the residuals could be serially correlated. To tackle this, we rely on a non-parametric approach for the estimation of our standard errors by running a block-bootstrap at the state level as suggested by Bertrand et al. (2004).

IV Results

We focus on three potential outcomes of the program, namely, compliance rates, the log of number of payments and the log of number of affiliates. Our identification strategy relies on the assumption

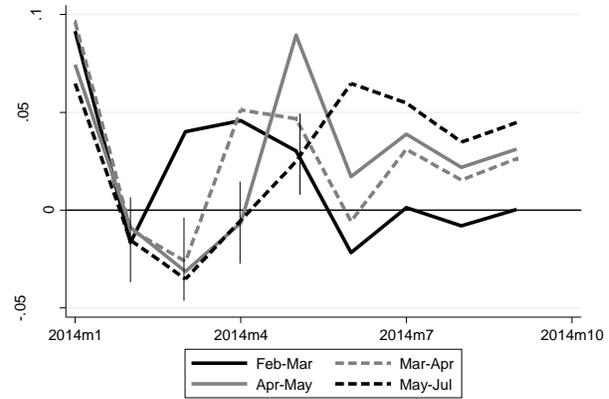
that the four groups of states would have followed similar trends in the absence of the booklet program. To illustrate the identification strategy, Figures 3 and 4 below show the payment rate (standardized to the yearly average in each group of states) month to month for 2013 (the pre-treatment year) and 2014 for the four groups of states depending on the month they received the booklet (see appendix for other outcomes). It is apparent from Figure 3 that the payment rate behaves similarly among the four groups of states in each implementation wave during 2013, albeit with minor differences. In contrast, Figure 4 shows clear evidence that the month a group of states starts receiving the booklet presents a notable hike in overall payment rates. In particular, for each month of the intervention, the states that received the booklet intervention show a compliance rate increase by around 5 percentage points above the other groups, indicating a clear effect of the program.

Figure 3. Pre-treatment compliance rates trends (in 2013).



Source: administrative data from the Ministry of Social Security.

Figure 4. Post-treatment compliance rates trends (in 2014).



Source: administrative data from the Ministry of Social Security.

Table 3 below provides the estimations of equation (1) for each selected outcome for different groups of municipalities. It can be seen from the table below that the booklet intervention had a positive and significant effect on the payment rate and number of payments. In fact, the intervention increased compliance rates by 6.8 percentage points for the overall sample. Similarly, it increased the

number of payments by 15.3 percent. Furthermore, we detected no effects on the number of affiliates to the MEI, which is reassuring as the booklet should have no impact on increasing coverage of the MEI and that the impact is focused on existing affiliates. Our results are robust to changes in weights and the inclusion or not of group trends. We test whether the non-random groups of states resulting from the rollout of the program could contaminate our results. We run a placebo regression “as if” the booklet program had been implemented in the same way (using the four groups of states) but during 2013 instead of 2014. We find no impact in any of our variables, suggesting that there were no systematic differences in the trends of those groups that could explain our results.

Table 3. DiD estimates

Group / Dep. Var.	Payment rate	Log(Registration)	Log(Payment)	Obs.
Overall	0.0680*** (0.006)	0.0185 (0.020)	0.1534*** (0.015)	172,640
Overall - Placebo ^a	0.0020 (0.004)	-0.0001 (0.004)	0.0046 (0.011)	172,640
Overall - no weights	0.0673*** (0.006)	0.0027 (0.002)	0.1274*** (0.012)	172,640
Overall - robust SE	0.0680*** (0.005)	0.0185 (0.019)	0.1534*** (0.015)	172,640
Overall - no covariates	0.0668*** (0.006)	0.0191 (0.019)	0.1524*** (0.016)	172,640

Source: administrative data from the Ministry of Social Security. Notes: (1) Coefficients are estimated by linear regression with municipal fixed effects; (2) Block-bootstrapped standard errors at the municipal level with 200 replications in parenthesis; (3) The covariates are population and GDP per capita trends; (4) ^a Placebo is the estimation of the effects as if the program had been implemented in 2013; (5) *** p<0.01, ** p<0.05, * p<0.1

Table 4 below shows the results for different groups for municipalities. In all of our subsamples we find significant effects in compliance rates and number of payments with no effects in the number of affiliates. We do not observe any remarkable differences of the effect of the booklet across income or size of the municipality. The increases in the compliance rates range from 5.87 percentage points in medium size municipalities to 7.6 pp in small municipalities. The differences across income

per capita are even smaller ranging from, 6.73 percentage points in the highest quintile to 7.55 percentage points in the fourth quintile.

Table 4. DiD estimates

Group / Dep. Var.	Payment rate	Log(Registration)	Log(Payment)	Obs.
Population 0 - 5,000	0.0760*** (0.008)	0.0030 (0.004)	0.1375*** (0.016)	70,880
Population 5,001 - 10,000	0.0635*** (0.008)	0.0009 (0.003)	0.1201*** (0.019)	37,344
Population 10,001 - 20,000	0.0634*** (0.006)	0.0012 (0.003)	0.1229*** (0.012)	29,408
Population 20,001 - 50,000	0.0587*** (0.007)	0.0037 (0.005)	0.1152*** (0.013)	19,776
Population 50,001 - 100,000	0.0592*** (0.008)	0.0049 (0.006)	0.1258*** (0.017)	7,232
Population 100,001 - 500,000	0.0695*** (0.006)	0.0162 (0.015)	0.1622*** (0.017)	6,848
Population + 500,000	0.0755*** (0.006)	0.0581 (0.059)	0.1879*** (0.022)	1,152
GDP per capita Q1	0.0676*** (0.008)	0.0023 (0.004)	0.1597*** (0.024)	34,240
GDP per capita Q2	0.0656*** (0.005)	0.0618 (0.056)	0.1489*** (0.012)	34,784
GDP per capita Q3	0.0697*** (0.005)	0.0021 (0.008)	0.1501*** (0.015)	34,656
GDP per capita Q4	0.0775*** (0.009)	-0.0024 (0.002)	0.1707*** (0.025)	34,560
GDP per capita Q5	0.0673*** (0.006)	0.0027 (0.002)	0.1274*** (0.012)	34,560

Source: administrative data from the Ministry of Social Security. Notes: (1) Coefficients are estimated by linear regression with municipal fixed effects; (2) Block-bootstrapped standard errors at the municipal level with 200 replications in parenthesis; (3) The covariates are population and GDP per capita trends; (4); (5) *** p<0.01, ** p<0.05, * p<0.1

Table 5 below presents the results of the estimation of (2) for payment rates, log of number of affiliates and log of number of payments. As expected, we find strong effects in compliance rates (7

percentage points) and number of payments (15 percent) the month the booklet was delivered, with no significant effects on the number of affiliates to MEI. The effects, however, seem to become non-significant three months after implementation, suggesting just a temporary effect of the booklet intervention. We also find some pre-implementation effects suggesting some systematic differences between implementing states, perhaps due to the vast differences in the characteristics of municipalities across Brazil.

Table 5. DiD estimates for (2).

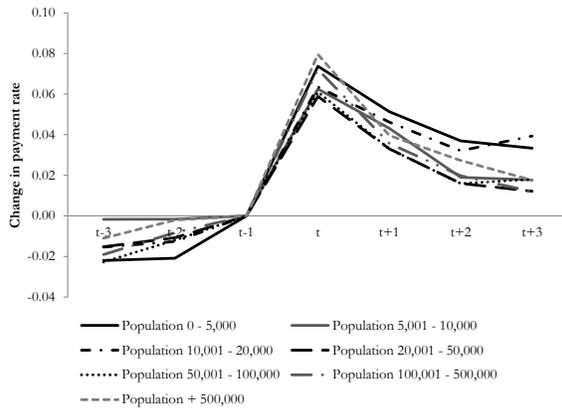
Group / Dep. Var.	Payment rates	Log(Affiliates)	Log(Payments)	Obs.
<i>Overall</i>				172,640
$t - 3$	-0.0167** (0.007)	-0.0445 (0.051)	-0.0462** (0.019)	
$t - 2$	-0.0077** (0.003)	-0.0211 (0.023)	-0.0175* (0.010)	
t_0	0.0703*** (0.005)	0.0217 (0.026)	0.1582*** (0.015)	
$t + 1$	0.0364*** (0.010)	0.0460 (0.052)	0.0903*** (0.024)	
$t + 2$	0.0208* (0.012)	0.0691 (0.078)	0.0588** (0.027)	
$t + 3$	0.0144 (0.015)	0.1058 (0.115)	0.0432 (0.029)	

Source: administrative data from the Ministry of Social Security. Notes: (1) Coefficients are estimated by linear regression with municipal fixed effects; (2) Block-bootstrapped standard errors at the municipal level with 200 replications in parenthesis; (3) The covariates are population and GDP per capita trends; (4) *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

We explore this hypothesis by running the same specification separately for groups of municipalities according to their GDP per capita and population levels. Figures 6-9 show the coefficients of the event study for all subsamples (see appendix for estimation tables). Two facts merit attention. First, most of the pre-implementation trends disappear in this set of regressions, particularly when we divide the sample across municipalities with similar income levels (only municipalities in the fourth quintile show pre-treatment significant effects). Second, all samples show the same time pattern (regardless of the size or income level of the municipalities), with a large spike in the month the booklet is delivered, ranging from an increase in compliance rates (number of payments) between 6

percentage points and 8 percentage points (11 and 20 percent in the number of payments) and a steady decline after that. Although the effects are still positive three months after the delivery of the booklet, only in a few samples are the effects significant at the conventional levels, suggesting very clear decreasing impacts of these kinds of measures. In none of the samples do we find any effects on affiliation, as expected.

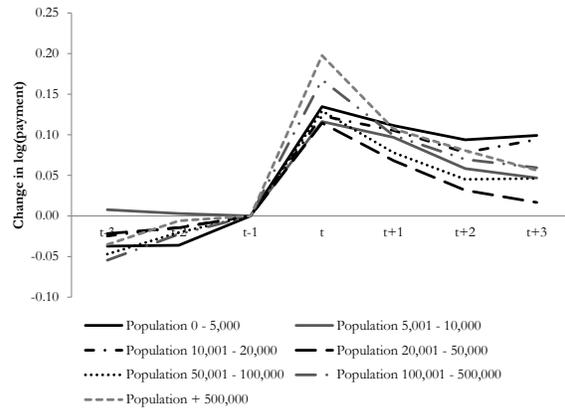
Figure 6. Estimated coefficients for compliance rates by population size.



Source: Authors based on administrative data from the Ministry of Social Security.

Note: see appendix for full estimations.

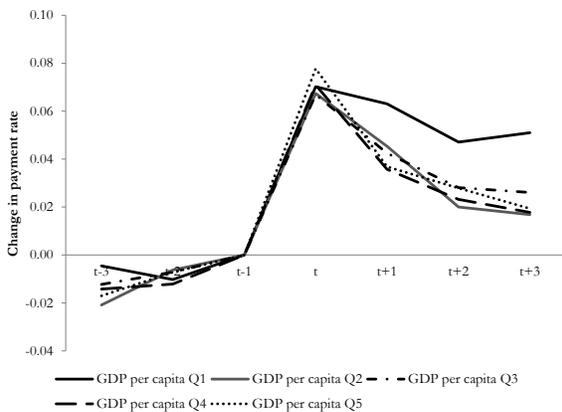
Figure 7. Estimated coefficients for log(payment) by population size.



Source: Authors based on administrative data from the Ministry of Social Security.

Note: see appendix for full estimations.

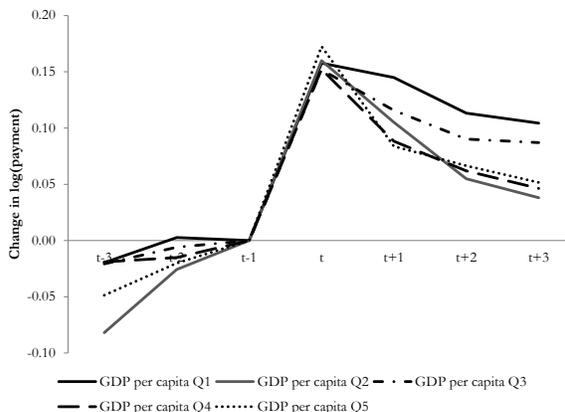
Figure 8. Estimated coefficients for compliance rate by income.



Source: Authors based on administrative data from the Ministry of Social Security.

Note: see appendix for full estimations.

Figure 9. Estimated coefficients for log(payment) by income.



Source: Authors based on administrative data from the Ministry of Social Security.

Note: see appendix for full estimations.

V Behavioral interventions vs price incentives

The MEI experience since 2009 offers a unique window to explore an experiment at scale on the cost-effectiveness of prices versus behavioral interventions to increase social security. This section presents the short run fiscal impact in Brazil of the booklet intervention, and compares it to the previous reduction in contribution rates implemented in 2011. In order to do this we create two counterfactual series of contributors (and the implied revenues); one that had resulted in the absence of the reduction in contributions using estimates from Rocha et al (2014) and one that would have resulted in the absence of the booklet intervention, using the estimates from the previous section.

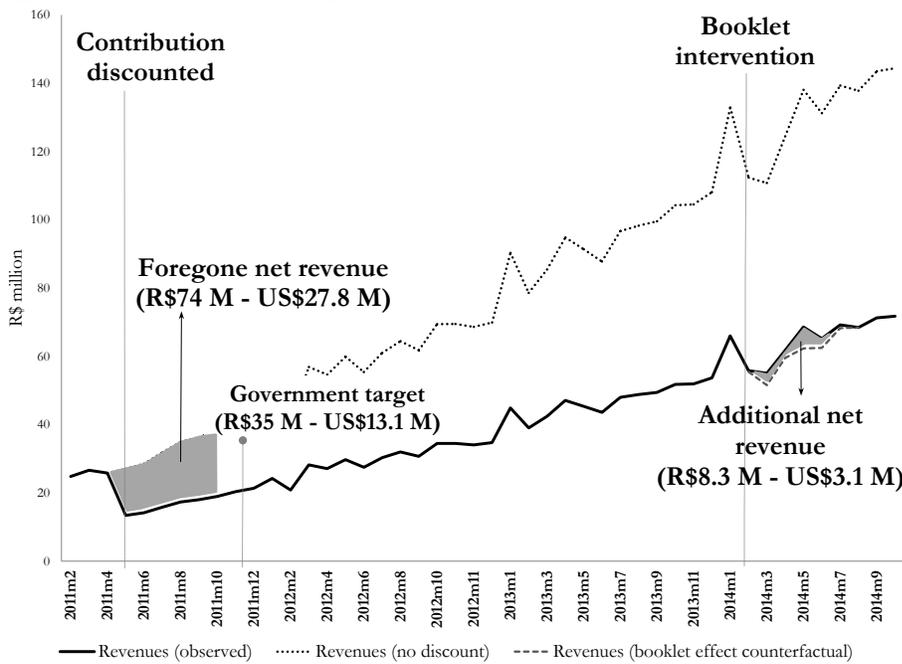
According to Rocha et al. (2014), the reduction contribution rate from 11 to 5 percent in 2011 generated an increase in the number of payments of around 8.5 percent. Although it is not tested in that paper, we assume this increase to be permanent and constant over time. We assume that logistical and operational cost of implementing the reduction in contribution rates is negligible, although one could take into account the cost of informing affiliates of the new contribution rates, printing new forms and changing the MEI web page, among other costs. On the other hand, in a conservative interpretation of our results, we assume that the booklet intervention increased the number of payments by 15.8, 9 and 5.9 percent in the first, second and third months post intervention, respectively, with no permanent effects afterwards. According to the Brazilian authorities, the cost of producing and sending the booklet was R\$ 7.7 million (US\$2.9 million).

Figure 10 below shows the actual revenues from the MEI program, the counterfactual revenues of MEI in the absence of the 2011 reduction in contribution rates, and the counterfactual revenues that would be observed if the booklet intervention had not been implemented (derived from the estimates of our regression). We also include implied revenues of the target level of contributors by December 2012.⁵ Several points merit attention. First, the reduction in contribution rates dramatically reduced revenues in the MEI program. For the sake of comparability with the booklet intervention, we highlight the loss of revenue in a six month period after the drop in contributions. Even taking into account an immediate and permanent increase of 8.5 percent in contributions

⁵ It is difficult to know whether Brazilian authorities were talking in counterfactual terms. We assume that they were, that is, that by December 2011, they were expecting 500,000 more affiliates than would have been in the absence of the reduction in contribution rates.

during a 6 month period, we calculate a net loss for the social security fund of R\$ 74 million (or US\$ 27.8 million).⁶ Indeed, the reduction in contribution rates can only be fiscally neutral (in the short run) with an elasticity of number of contributors to contribution rates of 1. The implied elasticity in Rocha et al (2014) is 0.16. Hence, only an increase in the number of contributors of 220 percent (instead of 8.5 percent) would have compensated for the loss of revenue. It is also apparent that the objective of the government was not to increase revenue directly. Even if the objective of 500,000 thousand additional contributors in the MEI program had been met by December 2011, revenues in that month (R\$ 35 million) would still have been 37.5 percent lower than in the absence of the policy (R\$ 56.6 million).

Figure 10. Social security revenues with effect trends.



Source: Authors based on administrative data from the Ministry of Social Security and Rocha et al. (2014).

Second, the gradual delivery of the booklet is cost effective in the short run. According to our estimates, the brief increase in contributions generated 470,000 additional MEI payments to social security within six months, the period in which the effects are significant according the results showed in table 5. The booklet intervention increased revenues by R\$ 16 million (US\$ 6 million), an

⁶ Note that the loss of funds continues endlessly due to the large decreases in contribution rates that are not compensated by the increase in the number of contributors.

increase that outweighs the costs (R\$ 7.7 million or US\$2.9 million) by a factor of 2. The net revenues from this intervention are estimated as R\$ 8.3 million (US\$ 3.1 million) at 2011 prices.

The results of this comparison suggest that, in this context, behavioral interventions seem to be several orders of magnitude more effective in increasing contributions than reductions in contribution rates. In fact, the reduction of the contribution rate demonstrated that the relation between the compliance rate and the contribution rate is highly inelastic and ended in a net loss of funds. Contrarily, a nudge like the booklet intervention generated positive effects and positive net revenues for the social security fund, given the relatively small cost of the intervention.

Several caveats should be noted in this exercise. First, there could be some policy complementarities between the reduction in contribution rates and the booklet intervention. Or, in other words, the effect of the booklet intervention could have been influenced by the previous reduction in contribution rates. However, given the small cost of the intervention, a very modest increase in contributions could have financed the cost of sending the booklet. Second, the long run fiscal effects of these interventions could be very different. The MEI program operates as a defined benefit program, with a pension benefit of 100 percent of the minimum wage after 30 years of contributions. Given the small contributions demanded from the self-employed, this implies a subsidy of more than 90 percent of the final pension. Therefore, large increases in the number of contributors triggered by behavioral interventions could generate short run fiscal revenues with long run fiscal deficits. Hence, understanding the full fiscal impact of behavioral interventions in social security contexts should take into account the full actuarial implications. Third, if the policy objective is to increase the number of contributors, reduction in contribution rates could have a permanent impact. It remains to be seen whether behavioral interventions, such as continuous

reminders of simplified procedures, can have permanent effects on the association of self-employed to social security institutions.

VI Conclusions

This paper documents a large scale effort by the Brazilian government to use behavioral interventions to increase social security compliance among self-employed workers. Taking advantage of a gradual delivery of a booklet that simplified the payment procedures and reminded self-employed workers to contribute, we find an increase in compliance by 15 percent in the month that the booklet was received. This effect, however, disappears rapidly over time (mostly disappears by the third month). The relatively low cost of the intervention makes it self-financeable in spite of the limited increase in contributions to the MEI (at least in the short run). We compare this intervention with a previous reduction in contribution rates, also aimed at increasing the number of contributors, implemented three years earlier. We find the booklet intervention to be several orders of magnitude more cost effective than the reduction in contribution rates, at least in the short run.

The empirical findings in this study provide a better understanding of the behavioral responses of nudges aimed at increasing the formalization of workers. Since the underlying defaults that characterize the implementation of social security system designs are not consistent with the self-employment of workers, we have provided evidence of alternative interventions that can help policy makers increase the coverage of the system. To the best of our knowledge, this is the first counterfactual evidence of the effects of a behavioral intervention in the labor market on a large scale in a middle income country.

Our results suggest that behavioral interventions can be powerful, low-cost instruments to connect the self-employed with social security institutions and tax authorities in developing countries. However, it remains to be seen whether this type of intervention can generate permanent

attachment to these institutions. Therefore, a key policy priority should be to carefully study the impact of the use of nudges or reminders instead of reducing the contribution rate to social security on its own. Our results shed light on these effects at a countrywide intervention and not on a small sample of states or municipalities.

Unfortunately, the results of this paper do not explain which of the elements contained in the booklet has a higher potential of increasing contributions, and whether the relatively large effects on contributions can be maintained over time with additional interventions. Future avenues of research should focus on testing which of those elements is behind the large (but brief) increase in contributions. Relatively straightforward experimental designs could be implemented at a very low cost to disentangle these different hypotheses. Furthermore, in the context of social security and savings for retirement, it is crucial to understand if any of those elements have a long run impact on contributions and/or savings. In particular, if the effect of maintaining behavioral nudges over long periods of time is required to ensure self-employed qualify for a pension.

VII References

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Appendix

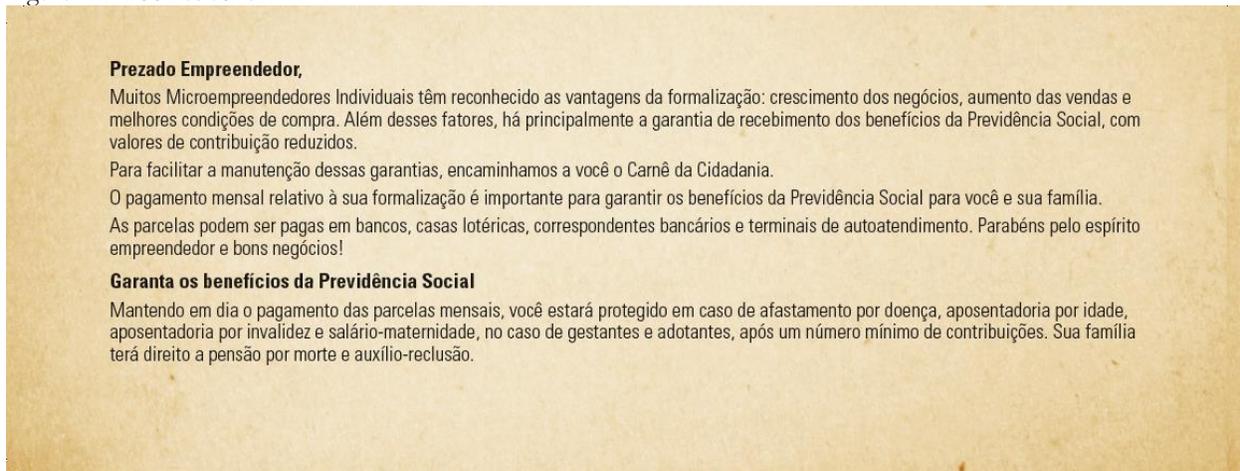
Figure A1. Booklet cover.



Source: SEBRAE.

Note: translates into “MEI identification card”

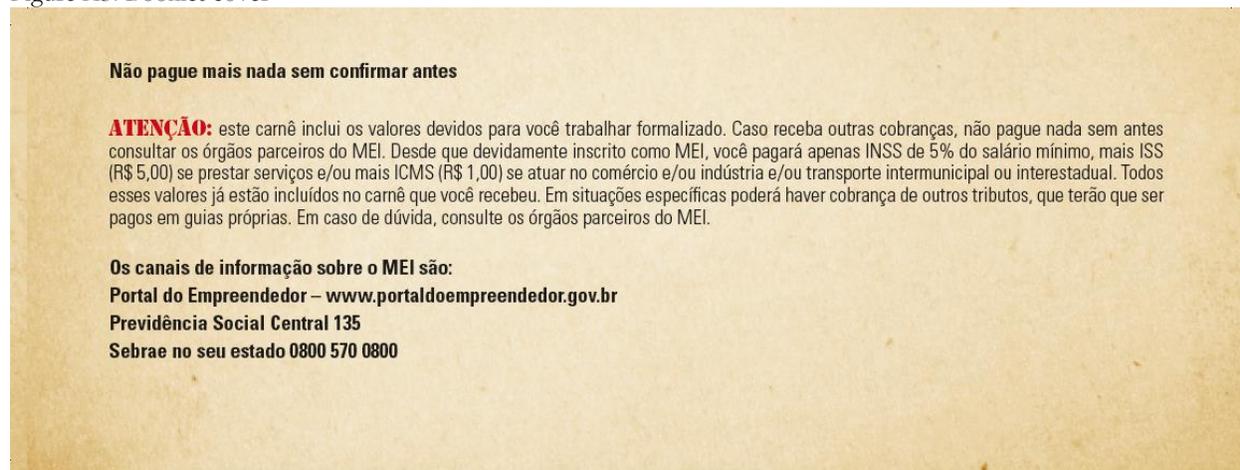
Figure A2. Booklet cover



Source: SEBRAE.

Note: translates into “Dear entrepreneur, many individual micro-entrepreneurs know the advantages of labor formalization: business growth, increase in sales and better purchasing conditions. In addition to these, you can count on the benefits from social security with reduced contribution rates. To facilitate the continuation of those benefits, we are sending the MEI identification card to you. The monthly payment of your formalization is important to guarantee the benefits from social security for you and your family. The payment slips can be taken to bank branches, lottery houses, banking correspondents and self-service terminals. Congratulations for your entrepreneurial spirit and good luck in your business!”

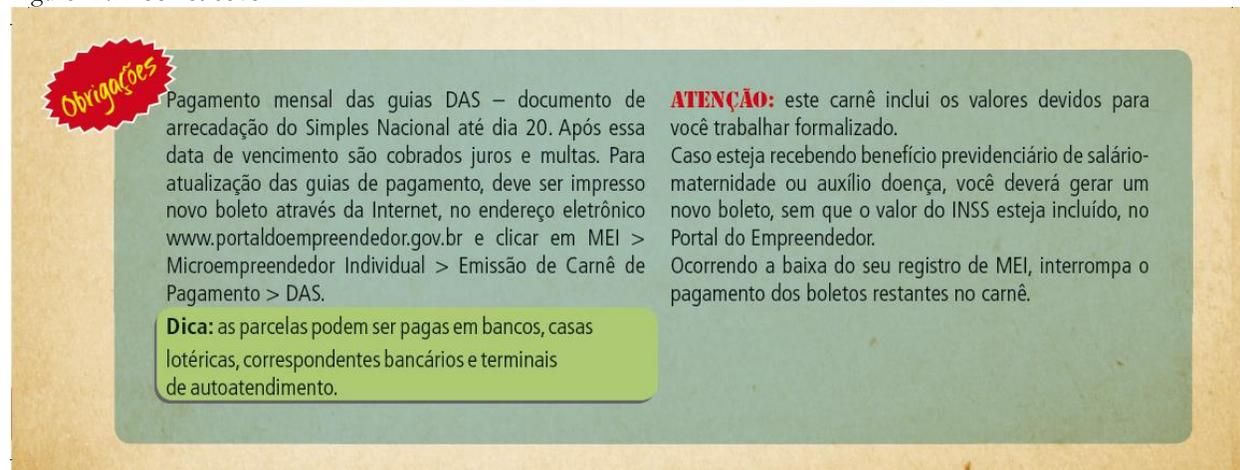
Figure A3. Booklet cover



Source: SEBRAE.

Note: translates into “Do not pay for more without previous confirmation. ATTENTION: this card includes the contribution values you owe to work in a formalized manner. In case you receive other charges do not pay until you confirm with our partner agencies. If you are correctly registered as MEI, you will pay for a contribution to social security equivalent to 5% of the minimum wage, plus R\$ 5.00 if you supply services and/or plus R\$ 1.00 if you work in the trade, manufacturing or transportation sectors. All these payments are included in the card that you just received. In some specific situations other tax charges may apply and will need to be paid with specific forms. Should you have any question, please contact MEI’s partner agencies”

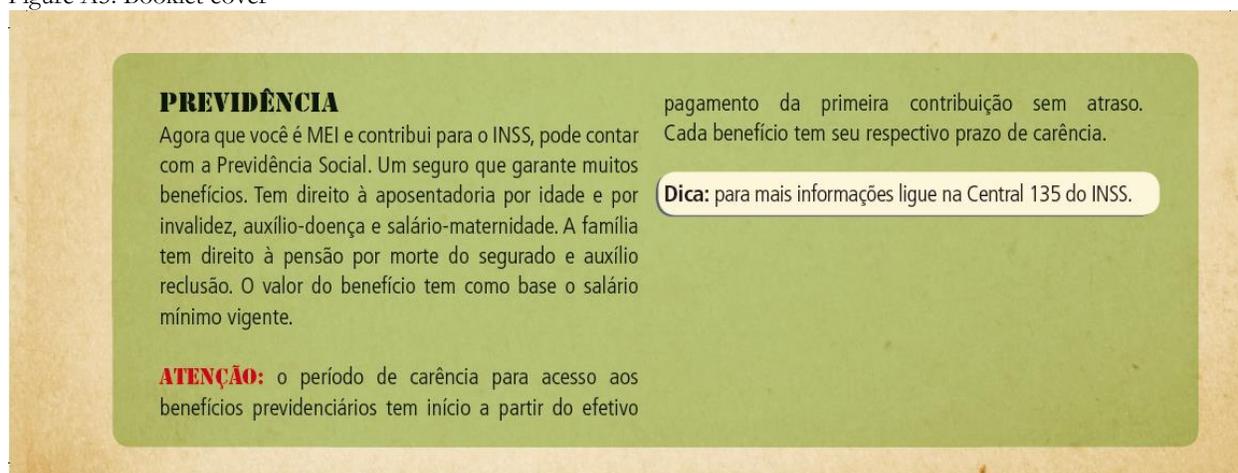
Figure A4. Booklet cover



Source: SEBRAE.

Note: translates into “Obligations. Monthly payment of DAS form (document for the national simplified tax collection until the 20th of each month). After that due date charges for interests and penalties apply. To update the payment slip a new form must be printed from the internet at www.portaldoempreendedor.gov.br and click on MEI > Microempreendedor Individual > Emissão de Carnê de Pagamento > DAS. Tip: the instalments can be paid at banks, lottery houses, banking correspondents and self-service terminals. ATTENTION: this card includes the values you owe to work as a formalized worker. In case you are receiving maternity or sick leave benefits you will have to generate a new ticket without the contribution value for social security at the Entrepreneur Portal. If you are dropped from the MEI, stop the contributions of the remaining payment slips.”

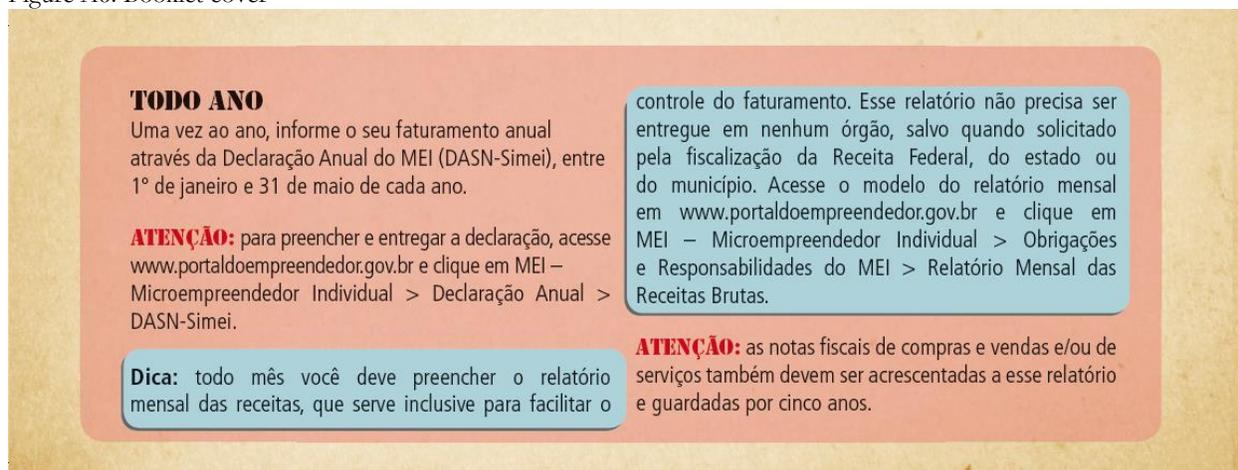
Figure A5. Booklet cover



Source: SEBRAE.

Note: translates into “SOCIAL SECURITY. As you are now a MEI and contribute to social security, you can count on certain benefits. You have the right to pension coverage either for old age or disabilities, maternity and sick leave. Your family has the right to either the pension in case the insured dies or is imprisoned. The value of the benefit depends on the minimum wage. ATTENTION: the coverage period for the social security benefits starts after the first contribution without delays. Each benefit has its own validity period. Tip: for more information call the Central INSS by dialing 135.”

Figure A6. Booklet cover



Source: SEBRAE.

Note: translates into “EVERY YEAR. Once a year inform your annual billing activity through the annual MEI declaration (DASN-Simei), between 1st January and 31st May, every year. ATTENTION: To fill and submit the declaration go to www.portaldoempreendedor.gov.br and click on MEI – Individual Micro-entrepreneur > Annual Declaration > DASN-SIMEI. Tip: every month you have to fill out the monthly revenue form that serves to facilitate billing control. This registration form does not need to be submitted at any agency, unless under request for investigation by the Federal Revenue Service, from the state or municipality. Obtain a sample monthly from at www.portaldoempreendedor.gov.br and click on MEI – Individual Micro-Entrepreneur > MEI obligations and responsibilities > Monthly registration of gross revenues.”

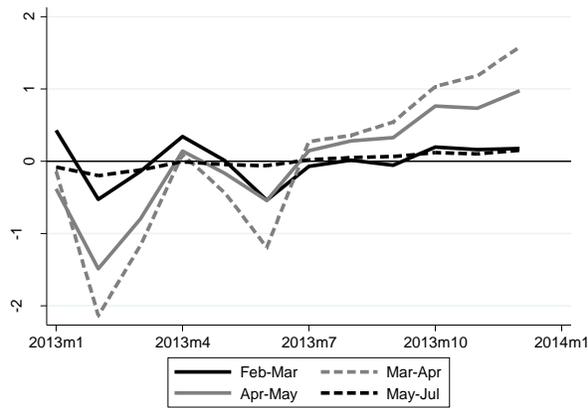
Figure A7. Booklet cover



Source: SEBRAE.

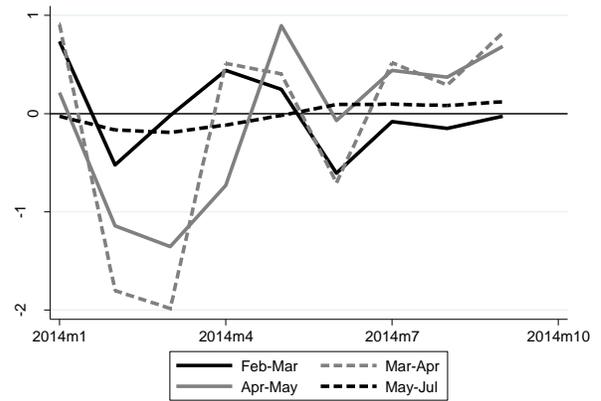
Note: translates into “HELP. The SEBRAE is your partner at all hours. Therefore, SEBRAE created different training courses that can take advantage of more opportunities and to improve your business. SEBRAE offers free training sessions to support the development of your business. We offer face-to-face sessions that can be booked at customer centers or long distance through www.ead.sebrae.com.br. ATTENTION: remember, should you need any assistance, call SEBRAE at 0800 570 0800. Tip: each year SEBRAE carries out a MEI week, that occurs simultaneously in every state capital and, in 2015, it will be held between 13th – 18th April. You will have the opportunity to clarify all your doubts, pay for your debts, fill out the DASN –annual billing declaration, participate in different workshops and training and obtain orientation. Call SEBRAE at 0800 571 0800 and obtain information or go to www.sebrae.com.br/mei and keep up to date.”

Figure A8. Pre-treatment log of payments trends (in 2013).



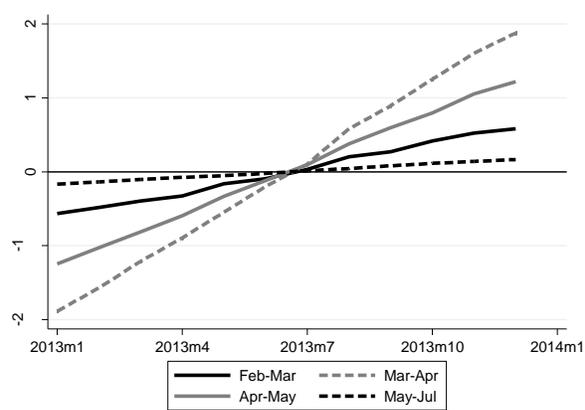
Source: administrative data from the Ministry of Social Security.

Figure A9. Post-treatment log of payments trends (in 2013).



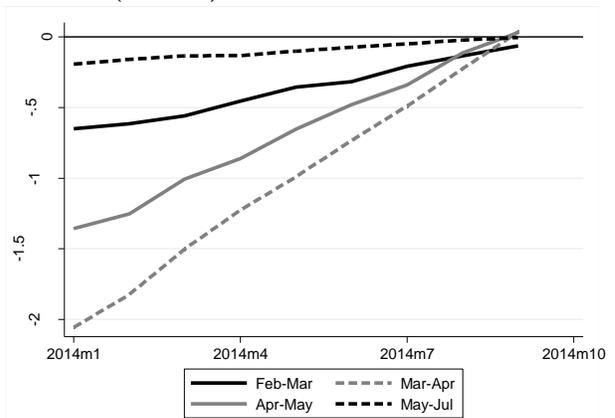
Source: administrative data from the Ministry of Social Security.

Figure A10. Pre-treatment log of affiliates trends (in 2013).



Source: administrative data from the Ministry of Social Security.

Figure A11. Post-treatment log of payments affiliates (in 2013).



Source: administrative data from the Ministry of Social Security.

Table A1. Estimation results for payment rate and population groups.

Payment rate	Population 0 - 5,000	Population 5,001 - 10,000	Population 10,001 - 20,000	Population 20,001 - 50,000	Population 50,001 - 100,000	Population 100,001 - 500,000	Population 500,000+
t-3	-0.0220 (0.014)	-0.0017 (0.012)	-0.0154 (0.012)	-0.0152 (0.013)	-0.0227** (0.011)	-0.0191*** (0.007)	-0.0111 (0.008)
t-2	-0.0209*** (0.008)	-0.0016 (0.008)	-0.0127** (0.005)	-0.0108*** (0.004)	-0.0120** (0.005)	-0.0082** (0.004)	-0.0020 (0.004)
t	0.0738*** (0.009)	0.0625*** (0.007)	0.0635*** (0.005)	0.0589*** (0.006)	0.0610*** (0.007)	0.0722*** (0.007)	0.0795*** (0.006)
t+1	0.0513*** (0.015)	0.0431*** (0.016)	0.0462*** (0.008)	0.0330** (0.013)	0.0330** (0.015)	0.0356*** (0.013)	0.0396*** (0.010)
t+2	0.0369** (0.017)	0.0190 (0.019)	0.0321*** (0.010)	0.0160 (0.014)	0.0159 (0.017)	0.0197 (0.016)	0.0273** (0.013)
t+3	0.0333 (0.022)	0.0177 (0.021)	0.0393*** (0.013)	0.0121 (0.017)	0.0180 (0.022)	0.0120 (0.019)	0.0175 (0.015)
No. of observations	70,880	37,344	29,408	19,776	7,232	6,848	1,152

Source: administrative data from the Ministry of Social Security. Notes: (1) Coefficients are estimated by linear regression with municipal fixed effects; (2) Block-bootstrapped standard errors at the state level with 200 replications in parenthesis; (3) The covariates are population and GDP per capita trends; (4) *** p<0.01, ** p<0.05, * p<0.1

Table A2. Estimation results for Log(Payment) and population groups.

Log(Payment)	Population 0 - 5,000	Population 5,001 - 10,000	Population 10,001 - 20,000	Population 20,001 - 50,000	Population 50,001 - 100,000	Population 100,001 - 500,000	Population 500,000+
t-3	-0.0379* (0.021)	0.0040 (0.017)	-0.0247 (0.022)	-0.0209 (0.021)	-0.0489** (0.022)	-0.0541*** (0.018)	-0.0345 (0.022)
t-2	-0.0365*** (0.011)	0.0015 (0.014)	-0.0142 (0.012)	-0.0141* (0.008)	-0.0211** (0.011)	-0.0224** (0.009)	-0.0056 (0.013)
t	0.1346*** (0.014)	0.1177*** (0.016)	0.1233*** (0.012)	0.1139*** (0.012)	0.1301*** (0.019)	0.1677*** (0.016)	0.1968*** (0.017)
t+1	0.1111*** (0.023)	0.0998*** (0.032)	0.1052*** (0.020)	0.0667*** (0.023)	0.0796* (0.041)	0.0994*** (0.032)	0.1055*** (0.030)
t+2	0.0935*** (0.027)	0.0629* (0.037)	0.0780*** (0.022)	0.0294 (0.025)	0.0476 (0.046)	0.0702* (0.042)	0.0776** (0.036)
t+3	0.0985*** (0.033)	0.0530 (0.037)	0.0933*** (0.025)	0.0133 (0.027)	0.0496 (0.054)	0.0606 (0.041)	0.0513 (0.040)
No. of observations	70,880	37,344	29,408	19,776	7,232	6,848	1,152

Source: administrative data from the Ministry of Social Security. Notes: (1) Coefficients are estimated by linear regression with municipal fixed effects; (2) Block-bootstrapped standard errors at the state level with 200 replications in parenthesis; (3) The covariates are population and GDP per capita trends; (4) *** p<0.01, ** p<0.05, * p<0.1

Table A3. Estimation results for payment rate and GDP per capita quintiles.

Payment rate	GDP per capita Q1	GDP per capita Q2	GDP per capita Q3	GDP per capita Q4	GDP per capita Q5
t-3	-0.0045 (0.015)	-0.0209* (0.011)	-0.0123 (0.008)	-0.0142** (0.006)	-0.0170 (0.020)
t-2	-0.0102 (0.008)	-0.0063 (0.005)	-0.0071 (0.005)	-0.0121*** (0.003)	-0.0072 (0.010)
t	0.0702*** (0.011)	0.0674*** (0.008)	0.0669*** (0.004)	0.0709*** (0.004)	0.0777*** (0.009)
t+1	0.0630*** (0.022)	0.0453*** (0.016)	0.0425*** (0.011)	0.0358*** (0.010)	0.0368*** (0.013)
t+2	0.0471* (0.028)	0.0200 (0.020)	0.0281* (0.015)	0.0232* (0.013)	0.0279* (0.015)
t+3	0.0510 (0.032)	0.0168 (0.025)	0.0261 (0.017)	0.0178 (0.017)	0.0194 (0.020)
No. of observations	34,240	34,784	34,656	34,560	34,656

Source: administrative data from the Ministry of Social Security. Notes: (1) Coefficients are estimated by linear regression with municipal fixed effects; (2) Block-bootstrapped standard errors at the state level with 200 replications in parenthesis; (3) The covariates are population and GDP per capita trends; (4) *** p<0.01, ** p<0.05, * p<0.1

Table A4. Estimation results for Log(Payment) and GDP per capita quintiles.

Log(Payment)	GDP per capita Q1	GDP per capita Q2	GDP per capita Q3	GDP per capita Q4	GDP per capita Q5
t-3	-0.0197 (0.034)	-0.0819** (0.039)	-0.0208 (0.021)	-0.0190 (0.018)	-0.0486 (0.046)
t-2	0.0026 (0.016)	-0.0257 (0.017)	-0.0059 (0.013)	-0.0151 (0.018)	-0.0201 (0.025)
t	0.1578*** (0.023)	0.1599*** (0.024)	0.1518*** (0.011)	0.1522*** (0.018)	0.1725*** (0.026)
t+1	0.1449*** (0.045)	0.1051*** (0.034)	0.1157*** (0.032)	0.0883*** (0.032)	0.0837** (0.038)
t+2	0.1132** (0.055)	0.0549 (0.041)	0.0902** (0.041)	0.0620* (0.037)	0.0665 (0.045)
t+3	0.1043* (0.060)	0.0381 (0.047)	0.0871** (0.038)	0.0464 (0.037)	0.0517 (0.057)
No. of observations	34,240	34,784	34,656	34,560	34,656

Source: administrative data from the Ministry of Social Security. Notes: (1) Coefficients are estimated by linear regression with municipal fixed effects; (2) Block-bootstrapped standard errors at the state level with 200 replications in parenthesis; (3) The covariates are population and GDP per capita trends; (4) *** p<0.01, ** p<0.05, * p<0.1