Consumption Smoothing, Frequency of Benefit Payments, and Effectiveness of Social Programs

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Abstract

We study the effect of differences in payment frequencies (monthly and bimonthly) across two noncontributory pension programs in Yucatan, Mexico. Compared to the bimonthly program, the monthly program increased doctor visits, reduced the incidence of hunger spells and lessened the need for support from charities. Under the bimonthly program expenditures on food and beverages significantly decreased near the end of the pay-cycle, while in comparison with the monthly program expenditures on more expensive non-cereal food as well as ownership of durable goods are higher. In general the monthly program appears to more effective in improving the welfare of poor elderly.

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I. Introduction

Various studies have documented that individuals or households with little savings do not smooth their consumption between paychecks (or social security checks). Rather, consumption tends to peak when the check arrives and then falls until the arrival of the next check. This pattern is found both for expenditures (Stephens, 2003, 2006) and for caloric intake (Shapiro, 2005; Mastrobuoni and Weinberg, 2009). The same pattern is found among Japanese pensioners (Stephens and Takashi, 2008). From an academic viewpoint, these findings are of interest, since they may point towards hyperbolic discounting (Ainslie, 1975; Laibson, 1997).[1] From a policy viewpoint, a concern is that toward the end of the pay period people will reduce their food intake until it falls below recommended levels. For instance, Mastrobuoni and Weinberg (2009) report that in a sample from an older population without savings, the probability of consuming less than the USDA recommended consumption level for total calories increased by nearly 15 percent in the final week of the pay period.

In this paper we analyze the extent of consumption smoothing among elderly households in the state of Yucatan, Mexico. Not only will it be of interest to see if similar patterns of consumption are found among an older population in a very different setting, but given that many of the persons 70 years old or older in Mexico and other developing countries suffer from inadequate food availability, reporting not having enough money to eat, making sure that the caloric intake for older populations is sufficient during the whole pay period is of obvious importance. Under imperfect consumption smoothing, we would expect that higher frequency of payments would be associated with more consistent spending

[1] One has to be careful in distinguishing consumption from expenditures. For instance expenditures tend to have a strongly cyclical component, due to regularly recurring bills (e.g. monthly rent or mortgage payments; cf. Gelman et al., 2014). Thus, observing cyclicality in expenditures by itself does not necessarily imply that consumption is not smoothed.

on basic needs, such as food staples and doctor visits, and a reduction of hunger spells (increased food security).

On the other hand, receiving funds in a single larger payment instead of more frequent smaller amounts may allow individuals to take on large investments, such as house improvements or durable goods purchases. A large literature shows that poor individuals in developing countries often face difficulties in saving even for moderate goals (for instance, Banerjee and Duflo, 2007). Also, previous literature has found that individuals are unwilling to maintain large amounts of money because family pressures may arise when a family member keeps a substantial amount of money (Dupas and Robinson, 2013). In fact, randomized-controlled trial evaluations of microcredit programs have shown that the largest impact of microcredit is to allow individuals to purchase durable goods, and reduce consumption of every-day "temptation items" such as tea in India (Banerjee, et al 2015). This can be explained by a lack of financial services that would allow for safely accumulating wealth or by self-control problems. Thus, a potential positive aspect of lower-frequency of payments is that it may allow individuals to take on investments, some of which may be health improving.

Thus, we would expect higher frequency of payment to be associated with higher spending on basic needs while low frequency could be associated with more durable good purchases. In fact, in a field-experiment Haushofer and Shapiro (2013) compare the impact on consumption of either giving rural households in Rarieda, Kenya a one-off cash transfer or dividing the transfer into nine smaller monthly amounts. They find that households receiving monthly transfers are more likely to improve food security, while households receiving lump-sum transfers are more likely to spend the money on durable goods.

This paper exploits the introduction of two very similar permanent non-contributory pension programs in the State of Yucatan, Mexico, which have as the

key difference between them, the frequency of the payments: *Reconocer Urbano* (monthly pension or high frequency) and *70 y Más* (bimonthly[2] pension or low frequency). In order to evaluate its impacts, *Reconocer Urbano* was rolled out experimentally: first, two towns with similar characteristics were chosen; second, one of them (Valladolid) was randomly selected by the government of the State to receive the program in 2008. The control town, Motul, did not receive the program. We conducted baseline surveys (Wave 1 or W1) in Valladolid and Motul before the roll-out of the monthly pension program in Valladolid in December 2008. Towards the end of the first follow-up surveys (Wave 2 or W2), in the summer of 2009, the Federal government began extending *70 y Más*, which originally targeted towns with less than 20,000 inhabitants, to towns with less than 30,000 inhabitants. As a result, on July 28 of 2009, households in Motul became eligible for the federal bimonthly pensions but not households in Valladolid because it had more than 30,000 inhabitants. In the first follow-up around 30 percent of the age eligible individuals in Motul report that they just started receiving *70 y Más.* In order to understand the effects of the differences in frequency of payments of non-contributory pension programs, we decided to conduct a second follow-up survey in 2010 (Wave 3 or W3) in both Valladolid and Motul. By that time Valladolid was still only eligible to receive the monthly pensions.

We analyze the changes experienced by the elderly in Valladolid and Motul between Waves 1 and 3 (W1 to W3) to shed light on the differential impacts of the high and low frequency programs. Between W1 and W3, we observe larger increases in expenditures on necessities (such as food and doctor visits) in the monthly program town (Valladolid) than in the bimonthly program town (Motul), as well as a reduction of cases in which families run out of food,

[2] To avoid ambiguity: we use the term bimonthly as synonymous to "every two months".

reports of being hungry, or having a medical emergency and being unable to go to the doctor. On the other hand, the ownership of cell phones increased in Motul relative to Valladolid, while the ownership of bicycles fell in Valladolid and stayed constant in Motul. We also observe changes within the shorter time intervals (W1 to W2 and W2 and W3) and confirm that the timing of the changes is consistent with the timing of the introduction of each program.

The monthly program led to a larger reduction in net-transfers to the elderly by their family members. In addition, there is some evidence that the monthly pension program reduces older persons' fear that their money will be taken by someone they know and increases their satisfaction with their relationship with family members and other social contacts. No such effects appear to emerge with the bimonthly program.

The reader may note that the comparison between the two programs is not exact, since by the third survey wave the high frequency program had been operating longer than the low frequency program. Therefore, we interpret results with care. First, we focus on outcomes where the effect plausibly will be realized within a short time (such as expenditures). Second, we look at whether effects are going in different directions between W1 and W2, and between W2 and W3. Third, we do not try to interpret small differences between W1 and W3.

The remainder of the paper is organized as follows. In Section two, we describe the monthly and bimonthly non-contributory pension programs, the evaluation design, and the data. In Section three, we explore patterns of consumption smoothing in the two towns, particularly focusing on how expenditures vary with the time since last payment. Section four presents difference-in-differences (diff-in-diff) estimates of the impact of the monthly and bimonthly programs on a series of expenditure and consumption variables, family transfers and satisfaction measures. Section five analyzes the robustness of the diff-in-diff results using parametric and non-parametric methods and discusses

potential sources of bias. Section six provides a discussion of remaining methodological concerns and Section seven concludes.

II. Background, Experimental Design, and Data

The social security program being implemented by the State of Yucatan is called *Reconocer Urbano,* a non-contributory, universal pension program aimed at elderly in towns with more than 20,000 inhabitants. The program was designed to provide a non-contributory pension payment of MXN$550 or US$70.2 at 2013 PPP per month to any individual 70 or older in semi-urban and urban areas (see Aguila, et al., 2014). The monthly benefit is equal to almost one third of the monthly minimum wage in Yucatan (MXN$1,865.95 in January 2013 or US$238.2 at 2013 PPP).[3] The program was implemented in phases throughout the state.

To be able to evaluate the effect of the provision of the old age pension, we chose two towns of more than 20,000 inhabitants with similar demographic and economic characteristics, one of which would receive the pension, while the other would be the control town and only receive the pension at a later stage. Valladolid was randomly chosen to start receiving the pension in 2008, while Motul was chosen as a control town.

The federal government program *70 y Más* is a national non-contributory pension program similar to *Reconocer Urbano.* The program provides a bimonthly cash payment equal to MXN$1,000 or US$127.80 at 2013 PPP to individuals 70 and older. The program is run by the Ministry of Social Development (Secretaría de Desarrollo Social or SEDESOL) and was introduced in 2007 to rural localities with less than 2,500 inhabitants. In 2008, *70 y Más* was extended to towns with up to 20,000 inhabitants and in 2009 to towns of up to

[3] We denote Mexican pesos as MXN$. The 2013 PPP exchange rate from Mexican pesos to U.S. dollars is taken from Organisation for Economic Co-operation and Development [OECD], undated [a].

30,000 inhabitants. In 2012, the program *70 y Más* was extended to the whole country for individuals 70 years old or older without other social security benefits, covering almost 80,000 localities across Mexico and more than 3.5 million beneficiaries.

Motul became eligible for *70 y Más* after the 2009 changes in the eligibility criteria. In July 2009, individuals aged 70 or over in Motul began receiving the non-contributory pension from *70 y Más*. Valladolid remained ineligible for the federal government program until 2012.

To evaluate the effects of the introduction of *Reconocer Urbano*, we conducted a number of surveys in both the control town and the treatment town. Items included in the survey instrument were taken or adapted from other longitudinal studies including the Mexican Health and Aging Study, the U.S. Health and Retirement Study, the New Immigrant Study in the U.S., *Oportunidades,* as well as from various family life surveys.

The surveys collected detailed community, household, and individual-level data at baseline (before the program was announced or implemented) and in two follow up interviews in both treatment and control towns. In those cases where eligible adults could not be interviewed, due to health issues or language difficulties, the interview was conducted with a proxy respondent within the same household.[4] Both baseline and follow up surveys collect self-reported data on health, depression, chronic conditions, activities of daily living (ADLs), instrumental activities of daily living (IADLs), physical functioning, anthropometric measurements, a number of biomarkers, food security, and household-level data on availability of food, health care utilization and out-of pocket expenditures, financial and in-kind transfers among beneficiaries' children

[4] The questionnaire used for proxy respondents is a selection of the full survey and does not include any physical or anthropometric measurements. The interviews completed by proxy respondents are counted in the total, but not used for the response rate calculations.

and neighbors, and on the economic activity of older workers, among other topics (see Aguila et al., 2014).

To build the sampling frame for this study, we first carried out a complete listing of all households in each town and screened them in order to identify households with age-eligible adults. We entered into a collaborative agreement with INEGI, the National Institute for Statistics and Geography (the federal agency in Mexico responsible for conducting the population census in addition to many other surveys) whereby they provided us with maps of the towns selected for each phase of *Reconocer Urbano*, while updating these maps as necessary (a cartographer accompanied our data collection team and updated the maps as households were being listed). The listing of households in Valladolid and Motul was conducted during June and July 2008. This created the sampling frame for the baseline survey of the evaluation study. We compared the sample information (total number of households, number of households with age-eligible individuals and age-eligible individuals in the households) collected during the listing in Valladolid and Motul with the information of the Mexican Census 2005. Overall, the number of observations is very similar between our listing and the Census 2005, with small differences, mainly as a result of the different years of data collection (2005 vs. 2008) (Aguila et al., 2014).

Table 1 shows the dates of pension disbursements and survey dates for both towns.

[TABLE 1]

The baseline data collection (W1) started in August 2008 for Valladolid and in November 2008 for Motul. After the collection of baseline data, the monthly pension program was implemented in Valladolid in December 2008. The first follow-up interview (W2) in both Valladolid and Motul was conducted simultaneously in July, August, and September 2009. Motul, started receiving the bimonthly pension program (*70 y Más*) on July 28, 2009 overlapping with the

data collection of our follow-up survey in Motul, which was conducted between July 1 and August 31, 2009. We compared baseline characteristics of individuals in Motul with and without the federal government program and found no statistically significant differences between groups (results available upon request). Both the monthly and bimonthly programs' disbursements of benefits occurred in a period of 2 days within each town, whereas the survey was conducted over a period of about two months. This resulted in variation in the time gap between the last disbursement and the date of survey. We exploit this variation to study the effect of the two programs on consumption smoothing (Section 3).

The second follow-up survey (W3) in Valladolid and Motul was conducted in June, July, and August 2010, one and a half years after Valladolid started receiving the monthly pension and approximately one year after elderly in Motul started receiving the bimonthly pension program.

Table 2 shows descriptive statistics for the samples in Valladolid and Motul at baseline (W1). The t-tests for the differences between the two towns show that they have similar characteristics in terms of age, marital status, education, speaks Mayan, the proportion of elderly living alone, number of household residents, proportion working for pay and monthly household income. Respondents in Motul are more likely to be able to read and write a message in Spanish (65.8% vs. 55.0%). Motul has a larger share of males 70 and older than Valladolid (50.4% vs 46.1%).

[TABLE 2]

The response rates at baseline were 91.4% in Valladolid and 95.2% in Motul; in the first follow-up survey response rates were 87.9% and 81.9%; and in the second follow-up the response rates were 80.6% and 78.5%, respectively. [5]

[5] The response rate reported is AAPOR RR2, defined as the number of complete interviews (including proxy interviews) divided by the number of interviews (complete plus partial) plus the

From the original sample interviewed at baseline in Valladolid of 1,346 individuals, 69 persons died, 19 changed address, 30 could not be contacted and 66 refused to be interviewed between baseline and first follow-up. The baseline sample in Motul comprised 1,073 respondents. Between baseline and first follow-up 64 persons died, and 17 changed address, 35 could not be contacted, and 101 refused to be interviewed. Between first and second follow-up surveys, 70 persons died, 23 changed address, 65 could not be contacted, and 114 refused to be interviewed in Valladolid and 59 persons died, 28 changed address, 46 were unable to be contacted, and 98 refused to be interviewed in Motul. We conducted an attrition analysis comparing demographic characteristics of the baseline respondents with the panel respondents and we did not find statistically significant differences (Aguila et al, 2015).

III. Imperfect Consumption Smoothing

The considerable length of the survey instruments resulted in the survey team staying in each town over an extended time period. Thus the dates of the interviews vary substantially, even within wave and town, and hence for different respondents the time elapsed since the most recent benefit receipt varies substantially as well. This allows us to study whether expenditures vary with the time elapsed since benefit receipt. In particular, the survey asks about expenditures on food and drinks at home and outside the home. The questionnaire included the following questions:

- *How much did the household spend last week on food eaten at home?*
- *How much did the household spend last week on beverages that you drank at home?*

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number of non-interviews (refusal and break-off plus non-contacts plus others) plus all cases of unknown eligibility following the guidelines of the American Association for Public Opinion Research (AAPOR, 2011) for calculating non-response rates.

– *How much did the household spend last week on food and beverages consumed out of the home?*

Table 3 shows estimation results of regressing total food and beverage expenditures (the sum of the three items asked in the questions above) both inside and outside the home during the previous week on the number of days elapsed since the most recent pension disbursement using W2 and W3. Column 5 shows that in Motul each elapsed days is statistically significantly associated with about 2.1 fewer pesos spent on food. In Valladolid, on the other hand, column 1 does not show a statistically significant association among these variables. Columns 2 and 6 show results when we include a set of background characteristics in the regression. This changes the estimates somewhat, but qualitatively the conclusions remain the same.

[TABLE 3]

The lack of statistical significance in the monthly program does not necessarily mean a lack of relationship, but perhaps reflects a lower power due to a lower potential number of days. In fact, when we restrict the sample to observations that are at most one month after benefit receipt, results for the bimonthly program group are also statistically insignificant (results available upon request).

Also note that the question asks how much was spent in the last week**.** Therefore, during the first 7 days after payment, we would have inaccurate estimates regarding consumption smoothing after receiving the monthly or bimonthly pension. On the one hand, they just received the pension payment, while on the other hand they have had fewer days to spend it. In the extreme, when they have just received the pension, they may have not have had time to spend it at all. In fact, columns 3 and 4 for the monthly program and columns 7 and 8 for the bimonthly program of Table 3 show that the negative relationship

becomes slightly stronger when we delete observations where the time since last disbursement is less than 7 days.

Conducting the same regressions for the separate expenditure variables (expenditures on food at home, beverages at home, and food and beverages outside of home), yields qualitatively similar results. A negative relationship is observed for each of those variables, and is robust to the set of controls included in the specification, although the magnitude of the effect does vary somewhat depending on the exact specification (See Table Appendix A, Panels A1 and A2).

Figure 1 shows the implied time paths of the different expenditure categories, using a fractional polynomial approximation of the data. The grey bands are 95% confidence bands. In each panel, the left side figures graph expenditures in the bimonthly pension town (Motul), whereas the right side figures do the same for the monthly program (Valladolid). For total expenditures and each expenditure category (food at home; beverages at home; food and beverages outside the home) we observe a peak right after the disbursement of the benefit in the bimonthly program and then a steep decline. It is interesting to note that for food at home the data actually suggest a rise in expenditures in the first few days of the payment cycle. This is consistent with the fact that recipients in this situation have had only a few days to spend the extra income.

[FIGURE 1]

Figure 1 shows mean expenditures only. Another way to look at this is by looking at the proportion of households spending less than certain amounts. Figure 2 shows the relationship between "days since payment" and the proportion of households who spent less than MXN$400. The proportion of households in the bimonthly program spending less than MXN$400 increases in the later part of the cycle.

[FIGURE 2]

This relationship does not depend on the specific threshold chosen to conduct this analysis. Figure Appendix B, Panels B.1 to B.5 show the same graphs when the thresholds are, respectively, MXN$100, MXN$200, MXN$300, MXN$400, and MXN$500. These results are consistent with studies such as Stephens (2003) and Stephens (2006) showing that expenditures peak after receipt of social-security benefits in the US and the UK, and decline thereafter. Other studies (Shapiro, 2005; Mastrobuoni and Weinberg, 2009) find this cyclicality not only in expenditures but also in consumption. Unfortunately, we cannot directly test for the cyclicality of consumption since we do not have data on daily consumption. In the following section, we examine the impact of the monthly and the bimonthly pension programs on a variety of other outcome measures.

IV. Diff-in-diff Estimates of the Effects of the Monthly and Bimonthly Pension Programs

Given that the two towns are similar in terms of their location in the same geographic region of the State of Yucatan− and their socioeconomic and demographic characteristics− we would expect the introduction of the pension programs to have similar effects if the programs had been exactly the same. Therefore, we attribute the differences in the outcome variables to the difference in the design of these two programs: namely, the periodicity of the payments (monthly and bimonthly).

First, we analyze the mean difference in the changes between W1 and W3 between the two groups. The comparison is subject to the caveat that by W3 the monthly program had operated for longer because the monthly program started in 2008 and the bimonthly program started in 2009. To the extent that some recipients take a long time to adapt their behavior, the W1-W3 comparison would tend to overestimate the impact of the monthly program in comparison to the

bimonthly program. This would not affect outcomes whose effect is fully realized within one year. We discuss this more in Section 6 and formally in Appendix D.

Second, we compare the changes in outcomes that occurred between W1 and W2. By comparing W1 and W2, we analyze short-term changes following the introduction of the monthly pension program. While in W1 none of the towns were receiving pensions, by W2 the elderly of Valladolid had been receiving monthly pension payments for approximately six months, while the elderly in Motul during the collection of W2 started receiving the bimonthly program. We assume negligible effects of the bimonthly program for elderly in Motul who started receiving the pension while we were collecting W2. We conducted robustness analysis by including and excluding individuals in Motul who received the bimonthly pension in W2 and we did not find statistically significant differences (results upon request of the authors).

Third, we analyze changes between W2 and W3 to compare the effects of the introduction of the bimonthly program in comparison with the monthly program. It is important to note here that, to the extent that certain effects of the monthly program take more than six months to fully realize, the W3-W2 comparison does not fully capture the effects of the bimonthly program, i.e. Valladolid is an imperfect control group for the introduction of the bimonthly program in Motul.

We group the outcomes of interest in four categories including: 1) basic needs: health care, food consumption, and other income 2) expenditures: durable and luxury goods, 3) private transfers: to and from family and friends, and 4) measures of subjective wellbeing: satisfaction with income and relationships with family members and social contacts, and emotional state. Table 4 summarizes the variables.

[TABLE 4]

Empirical results are presented in Tables 5.1 through 5.5. The tables show the average values of the outcome variables in Valladolid and Motul for W1, W2, and W3. Column 7 of each table shows the diff-in-diff estimates of the monthly pension program six months after its implementation using Motul as comparison group. Column 8 of each table shows the diff-in-diff estimates of the impact of the bimonthly program in comparison to the monthly program using W3 and W2. Column 9 of each table shows the diff-in-diff estimates of the impact of the bimonthly program in comparison to the monthly program using W3 and W1. Since we are testing multiple hypotheses at the same time, we apply a Holm-Bonferroni correction (Holm, 1979).

A. *Program Participation Effects*

The monthly and bimonthly pension programs are universal and voluntary, but none of the programs achieved 100 percent coverage, Table 5.1, shows that both programs significantly increased the proportion of older persons receiving any support. The surveys included a series of questions about program receipt. Ninety-four percent of Valladolid respondents in W2 reported receiving the monthly pension.

[TABLE 5.1]

In all waves, a negligible number of respondents in Valladolid report receiving benefits from the bimonthly pension program. These answers most likely reflect measurement error, as this program has not been implemented in Valladolid. A negligible number of respondents also report receiving the bimonthly pension in the baseline survey in Motul, increasing to 38 percent in W2 and 89 percent in W3.

One possible concern is that the access to other public programs or their take-up might have changed as a result of the introduction of the monthly or the bimonthly pension programs, causing a "crowding-out" effect of other existing

public programs. We do in fact find a slight reduction in W2 and W3 in the proportion of older persons reporting receiving other public programs. For example, the percentage of older persons in Valladolid who reported receiving *Oportunidades*[6] decreased by 2.2 percentage points more than in Motul between W1 and W2 (see column 7 in Table 5.1). Similarly, between W2 and W3 the percentage that reported receiving *Oportunidades* in Motul decreased by 4.7 percentage points more than in Valladolid (column 8). Similar but smaller effects can be observed for the program *PROCAMPO*.[7]

Those effects are small compared with the changes in the proportion of older persons who started receiving the monthly and bimonthly pension benefits.

B. *Expenditures on basic needs*

We would expect both the monthly and bimonthly programs to affect expenditures on basic needs. However, one might expect the impact of the monthly pension program to be larger when high-frequency payments lead to more consumption smoothing; while receiving less-frequent but higher payments may lead to expenditures on larger investment goods or splurging.

We find evidence consistent with these hypotheses. First of all, we note that the effect of the monthly pension program seems to be larger for many of the basic expenditures. For example, the indicator variable for having visited a doctor increased in the monthly pension town, Valladolid, from slightly over 40 percent in W1 to over 50 percent in W2 and W3 (Table 5.2); while it remained fairly constant over the period in Motul. Overall, there is a 10 percentage point increase in the probability of having visited a doctor between W1 and W3 in Valladolid relative to Motul (see last column in Table 5.2). The change mostly happened

[6] *Oportunidades* offers a cash transfer and a food assistance transfer for elderly adults living in eligible households, conditional on attending nutrition and health training sessions.
[7] PROCAMPO is an agricultural support program with the aim of improving the wellbeing of growers by increasing and stabilizing their income. The program provides flat-rate payments to help farmers overcome financial constraints.

between W1 and W2 (0.070 – see column 7). Similarly, the average total number of doctor visits increased between W1 and W3 by 0.287 in Valladolid compared to Motul (p-value is 0.03, but this difference is not significant at the 5% level once we adjust significance levels for multiple hypothesis testing).

[TABLE 5.2]

Several other expenditures on basic needs also increased more between W1 and W3 in Valladolid compared to Motul; the number of interviewees who responded they had health problems but did not go to the doctor because of lack of money was reduced between W1 and W3 in Valladolid compared to Motul by almost 10 percentage points.

Compared to Motul, the frequency of running out of food reported by respondents in Valladolid decreased by 0.169 between W1 and W2 (on a 1 to 4 scale, where 1 is never and 4 is always). Similarly, the frequency with which Valladolid respondents reported to be hungry because they could not afford food also declined in comparison to Motul between W1 and W3 (the 1 to 4 scale declined by 0.314 points). The proportion of individuals reporting receiving food from charity also declined more in Valladolid than Motul. The effect on several variables including "sometimes we do not have enough to eat"; "how often hungry because can't afford food"; "how often someone in the household does not eat for 1 day"; "how frequently received food from charity" had a larger positive effect in all specifications for the monthly pension program than for the bimonthly pension program. This is clear from Column 9, where the sign of these diff-in-diff estimates is negative. Overall, both programs seem to have reduced the incidence of hunger in the families' households, but generally more in Valladolid. We should note however, that in a number of instances the baseline situation in Motul appears to have been better than in Valladolid, so that the improvements in Valladolid brought the elderly in that town closer to the elderly in Motul.

C. *Durable and Luxury Good Expenditures*

The increased pension income should allow older persons and their households to buy durable goods and perhaps also consume more of non-basic or "luxury" consumption goods. The surveys contained questions on household ownership of several such items: telephone, cell-phone, refrigerator, bicycle, etc. In addition, we created one variable: "no-equipment" which is an indicator of the household owning none of the listed durables. Though both programs may have an impact on the durable and luxury good variables, one could expect the effect of the bimonthly pension program to be larger, since right after benefit receipt the recipients have more liquidity to spend on big ticket items

Table 5.3 shows indeed an increase in the ownership of several goods in Motul relative to Valladolid. For some of the goods, we observe a statistically significant increase from W1 to W3 in Motul relative to Valladolid, despite the fact that the bimonthly program was rolled out later. In particular we observe an increase in Motul in the percentage of older persons owning a cell phone from 14.0 percent to 20.6 percent, while the ownership rate decreased in Valladolid from 17.9 percent to 14.5 percent. The ownership of bicycles decreased in Valladolid from 20.4 percent to 13.0 percent, while it stayed flat in Motul.

[TABLE 5.3]

Neither of the programs seems to have had a significant effect on the number of livestock owned. The reported frequency with which pensioners eat non-cereal food items increased in both towns, but the bimonthly pension program appears to have the largest effect. The differences in effects between the two towns are however often insignificant. Compared to *tortilla*, and other cereals, the consumption of these other food-types could be considered as luxury goods. The diff-in-diff coefficients in Column 9 of Table 5.3 are negative (indicating a larger increase in Motul) for the consumption of non-cereal food-items (dairy, eggs, meat, and fruit). Valladolid did not see an increase between

W1 and W2 (coefficients in Column 7 are not statistically significant), whereas there was an increase in Motul relative to Valladolid between W2 and W3, and overall between W1 and W3 (although the latter differences are not always statistically significant). Similarly, there was an increase in expenditures on beverages in Motul compared to Valladolid between W2 and W3, again suggesting that the bimonthly program had a larger effect on the consumption of non-necessities.

D. *The Impact of the Pension Programs on Transfers to and from the Population 70 Years Old or Older*

One may expect that the increase of income of the older population may reduce the net-transfers they receive from family members and friends. A "crowding-out" effect of private transfers as a result of the introduction of a non-contributory pension program has been documented by Jensen (2004) for the South African case and by Juarez (2009) for Mexico City.

Although we would expect both the monthly and bimonthly pension programs to affect net-transfers, we may also expect some differences in the effects of each program. If recipients are able to smooth consumption, the frequency of payment of the pension program should not affect within-family and social network allocation of monetary resources. The inability to smooth consumption under a low-frequency pension program could result in pension recipients in Motul ending the period without cash and in need of assistance from family, friends and/or charity. The receipt of a large pot of money in the bimonthly pension program could also increase transfers from the recipient to family and friends right after the receipt of payment, because it may be more difficult to deny sharing the cash from the pension while receiving a large amount. If the bimonthly pension is partly transferred to others, then later in the two-month period just before receiving the next pension payment, the older

person may require a transfer to smooth consumption. Thus, we would expect the monthly pension program to reduce or eliminate the transfers to the older population, while the bimonthly pension program could be less successful in doing so and possibly increase the transfers from the recipients to family and friends.

We find evidence for these mechanisms in the results presented in Table 5.4. The monthly pension program reduces both the percentage of the older population receiving money from others and the total amount of money received by them. At baseline, 31 percent of individuals 70+ in Valladolid received money, while only 23 percent did so at the second follow-up (W3). The percentage that received money in Motul was reduced only from 22 to 19 percent in the same period. Compared to Motul, the reduction between waves 1 and 3 in the number of recipients who received funds in Valladolid is 5.0 percentage points (or about 18 percent of the baseline level). The reduction in Valladolid mainly occurred between W1 and W2, but it continued between W2 and W3. Similarly, Valladolid showed a reduction, compared to Motul, in the total amount of money received, the percentage of the older population receiving in-kind transfers, total in-kind transfers received, and the frequency with which family or friends pay for expenses including out of pocket.

[TABLE 5.4]

E. *The Impact of the Pension Programs on Satisfaction with Relationships and Income*

Table 5.5 shows that between W1 and W3 satisfaction with income changed in both towns by about the same amount so that the difference in the changes is indistinguishable from zero (from 3.435 to 3.713 in Valladolid, and from 3.421 to 3.738 in Motul, on a five point scale where 1 is very dissatisfied and 5 is very satisfied). However, satisfaction with income improved (0.047) in

Valladolid relative to Motul from W1 to W2, and (-0.094) in Motul relative to Valladolid from W2 to W3, consistent with the timing of the introduction of each program.

[TABLE 5.5]

That satisfaction with income improves after the introduction of a pension program is no surprise. However, the sporadic possession of relatively large sums of money by the older persons could create tensions within the family that a higher-frequency pension might avoid. In fact, one of the often cited obstacles for savings is the pressure by family members to get access to those funds (Dupas and Robinson, 2013). In view of this and the effects on the direction of transfers observed in the previous subsection, it is possible that the lower-frequency pension program has some detrimental effects on the relationship of the pensioner with family members and other social contacts.

Satisfaction with the relationship with family members improved less in the bimonthly program (Motul) than in the monthly program (Valladolid). This is also the case with regards to the relationship with social contacts; how often the respondent feels abused and feel that their money will be taken by someone else. However, these results lose significance at the 5% level once we apply the Holt-Bonferroni correction for multiple hypothesis testing. Given that Motul started receiving the pension around the second interview, it is remarkable that between W2 and W3 the changes in Valladolid were more favorable than in Motul: satisfaction with family relations and social contacts increased more and the frequency with which one feels abused fell. Yet, over the whole period (W1 to W3) no effects are statistically significantly different between the two towns at the 5% level, but some would be at the 10% level. Satisfaction with relationships with family members and satisfaction with social contacts both improved more in Valladolid than in Motul. Both types of satisfaction improved marginally in Motul, but quite substantially in Valladolid. This is consistent with the hypothesis

that holding sums of disposable income creates stress in relationships, especially so when the sum of the pension is large (which may counteract an overall positive impact on relationships of having more money).[8] It suggests that smaller sums with higher frequency may be better in terms of reducing or avoiding increased frictions with social contacts.

V. Robustness of Difference in Difference Estimates and Potential Sources of Bias

Robustness of Diff-in-diff Estimates

The first robustness test consists of conducting the diff-in-diff analysis of Section 4 in a regression framework where we control for other conditions and individual and household characteristics. The equation estimated to analyze the impact of the monthly and bimonthly programs between waves 1 and 3 is as follows:

$$Y_{it} = \alpha_0 + \beta_1 W_t + \beta_2 T_{it} + \beta_3 (T_{it} * W_t) + \delta X_{it} + \varepsilon_{it}, t = 1,3 \qquad (1)$$

where Y_{it} is the outcome of interest for observation i in wave t; W_t is a wave dummy equal to 1 for W3 and zero for W1; the dummy variable T_{it} equals 1 for the monthly pension program group and zero for the bimonthly pension program; the indicator variable $(T_{it} * W_t)$ equals 1 for an observation from the monthly pension program group at W3, and zero otherwise. The parameter β_3 measures the difference in effect between the monthly and the bimonthly pension program. This coefficient is the regression analog of the coefficients reported in columns 9 in Tables 5.1 through 5.5; X_{it} is a vector of individual controls. Since, not all households take up the monthly and bimonthly pension benefits, the estimated effects are Intent to Treat (ITT) estimates.

[8] Although on average satisfaction with relationship with family members improve in both Motul and Valladolid, there were significant proportions for whom satisfaction went down. In Valladolid, only 14% of individuals reported a lower level of satisfaction with family members in W3 than in W1, whereas 21% of Motul expressed a lower level in the final wave.

A second robustness check uses propensity score matching, to correct for differences in sample composition across Valladolid and Motul. In these cases, matches in Motul are found for each observation in Valladolid based on the characteristics included as controls in the regression of equation (1).

Table Appendix C, provides comparisons of the Diff-in-Diff estimates in Panels C.1 to C.5 between W1 and W3 with the ITT regressions and the results based on propensity score matching. Overall, the results are very similar across the three methods both in terms of effect sizes and in terms of accuracy. The propensity score matching results tend to have somewhat larger standard errors.

We conducted similar analyses of the changes between W1 and W2, and between W2 and W3. For these cases, we added one additional specification that excludes Motul respondents whose W2 survey happened after the *70 y Más* program started the rollout. These results are available as Web-Appendices D and E[9]. We find qualitatively similar results across specifications and similar to the diff-in-diff in means results reported in section 4.

Potential Sources of Bias

In this section we discuss potential sources of bias of the diff-in-diff estimates. Some of these are differential macro shocks, treatment announcement effects, differential implementation of the government programs in the treatment and control towns, and differences in pre-treatment trends. We also discuss the validity of the estimates and potential bias due to cluster effects.

Announcement Effects in Treatment Group

We have designed the rollout schedule of the program and the timing of public information campaigns in close cooperation with the State government of Yucatan. This level of input into the design of the program is allowing us to limit

[9] Here will go the web address for the online appendix

anticipatory effects that have been observed in other programs and spillover effects that could occur from the program being implemented in treatment and control groups that are geographically proximate.

Differential Implementation of Government Programs in Treatment and Control Groups

The State of Yucatan agreed to ensure there would be no differential implementation of other public programs in these towns.

Differences in Pre-treatment Trends for Treatment and Control Groups

According to the Mexican Census 2005, Valladolid had a total of 45,868 inhabitants and Motul 21,508 inhabitants. The Census 2005, also reports that 10.95 percent of the population 15 years old or above are illiterate in Valladolid and in Motul this figure is 11.23 percent. Valladolid is categorized according to the Census 2005 as having a low level of poverty and Motul has a medium level. However, it should be noted that the poverty index between Valladolid and Motul is not that different: they are both at the margin between low and medium level of poverty. Motul has a higher proportion of households without sewage or toilet and piped water than Valladolid. All other indicators are similar between the treatment and the control town.

We conducted a community survey to understand in more detail the differences between the two cities in terms of healthcare infrastructure, economic activity, government programs, among others. None of the towns have flooding problems, they have enough public light systems, and the air quality is good. Both towns have similar federal government programs and state government programs. In terms of health infrastructure both towns have clinics of the Mexican Social Security Institute (IMSS), and the Ministry of health of the Government of the

State of Yucatan. Valladolid has 6 clinics of the Ministry of health and Motul has only one. Also Valladolid has 4 private hospitals and Motul has none. All other health infrastructure is similar. The economic activity in both towns includes manufacturing industry (textile, automotive, wood, plastic, etc.), assembly plants, construction, wholesale and retail commerce, restaurants, and hotels. In addition, Valladolid has some agricultural employment. The most important economic activities in Motul are the assembly plant, construction, and services (commerce, restaurants, and hotels). For Valladolid the most important activities are services, manufacturing, and agriculture.

In sum, Valladolid has more inhabitants; therefore there is a larger infrastructure of services. The poverty index in Motul is slightly higher. They receive similar federal and state government programs. In terms of economic activity, they overlap in most of them but Valladolid has also agriculture.

Differential Macro Shocks in Treatment and Control Groups

In the community survey, we also collect information about aggregate changes in the treatment and control towns. None of the two cities has experienced floods, earthquakes, fires, landslides, hurricanes or plagues since the beginning of the social security program. However, both towns have had droughts (April and May 2009). In Valladolid, officials reported that the drought affected 22 persons and Motul did not report any effects. This suggests only small differences in aggregate effects between the two towns. Since one of Valladolid's economic activities is agriculture, we would expect that if anything aggregate effects have been more severe in Valladolid.

VI. Discussion

Although we argue that the differences in the frequency of payment are responsible for the different impacts of the programs, it is important to

acknowledge that there could be alternative explanations for these differences. In particular, the bimonthly program was introduced somewhat later so that some of the differences may reflect less than full impact of the bimonthly program.

To guard against this problem, we have limited our analysis to outcomes that we expect to be affected in the short-run, such as expenditures. However, it is still possible that the comparison between the programs is affected by the difference in duration to the extent that the elderly and their families take a long time to adjust their behavior. In Appendix D, we discuss more formally the assumptions we need to make in order for our interpretation of the results to be accurate. Here, however, we present the main points.

First of all we note that, as long as the effects take less than six months to be fully realized, our W1 to W3 comparisons accurately capture the differential effects of the monthly versus the bimonthly program. In addition, in that case, our W1 to W2 analysis fully captures the effect of the monthly program, and the W2 to W3 captures the effects of the bimonthly program.

Second, if we are willing to assume that an effect of the program takes less than one year to be realized, then the W1 to W3 comparison still identifies the differential effect of the programs, but the W2 to W3 comparison does not identify the sole effect of the bimonthly program (as it is affected by the changes taking place in Valladolid as a result of the introduction of the monthly program). In all cases, the analysis of W1 to W2 comparisons depends only on the standard diff-in-diff assumptions (though it may only capture the short-term effect).

However, even when we are not comfortable with the assumption that the effects are fully realized within a year, we can still make important inferences. As is shown in Appendix D, as long as we are willing to assume that the effects are monotonically increasing or decreasing with time, and at a non-increasing rate (i.e. the additional effect in the second year would not be higher than the effect in the first year), we can bound effects in certain cases. For instance, whenever we

observe a larger W3-W1 increase in Motul than in Valladolid, then the *70 y Más* effect is decidedly larger (since with only one year, its effect was larger than the one and a half years effect of *Reconocer).* This is relevant for instance for the durable-good effects: the fact that the effect is larger there even though the program was in place for only one year (versus one and a half of the comparison program) suggests that the effect could be even larger over a longer time period.

Similarly, under the monotonicity assumption, when we observe an increase in the W2-W1 outcome in Valladolid, and the difference in that outcome between Valladolid and Motul did not decrease between W3 and W2 (as for some of the necessities outcomes), we can be certain the effect of *Reconocer* was larger than of *70 y Más* (since, in that case, the effect from month 6 to 18 of Reconocer was larger than the month 0 to 12 of *70 y Más* and we are assuming marginally decreasing effects).

Another potential problem would arise if the pension affects household composition. If that were the case, the variables representing household outcomes would not be comparable. Fortunately for our purposes, this does not seem to be the case.

VII. Conclusions

The results of this study confirm the behavioral finding from previous studies that individuals do not smooth consumption perfectly. The frequency with which individuals receive their income matters for the type and time path of expenditures. Particularly when the period is long, expenditures on food and beverages are significantly higher the closer the survey date is to the last receipt of the pension payment.

This lack of consumption smoothing translates into different effects of two non-contributory pension programs that are similar to each other except for the frequency of payment. Both programs lead to an increase in expenditures on basic

goods and reduce the likelihood of hunger spells in the households. However, the impact of the monthly program is larger than of the bimonthly program. In particular, the monthly program increases doctor visits and reduces the chances that an older person does not visit a doctor due to lack of money. The higher frequency program reduces the hunger spells more strongly while the lower frequency program increases the consumption of more expensive non-cereal food items. In addition, it appears that the bimonthly program increases the ownership of durable goods: in particular cell phones and bicycles.

The monthly program reduces the total amount of family transfers to the benefit recipient. As expected, both pension programs increase satisfaction with income. The receipt of the lower frequency pension is associated with a smaller improvement in satisfaction with family and social relationships. This could be because, in the bimonthly pension case, the positive effect of higher income is partially counteracted with increased social pressure to share some of the pension receipt. Consistent with this, receiving the bimonthly instead of monthly pension increases the fear of recipients that someone will take their money and increases the frequency with which they feel verbally or physically abused.

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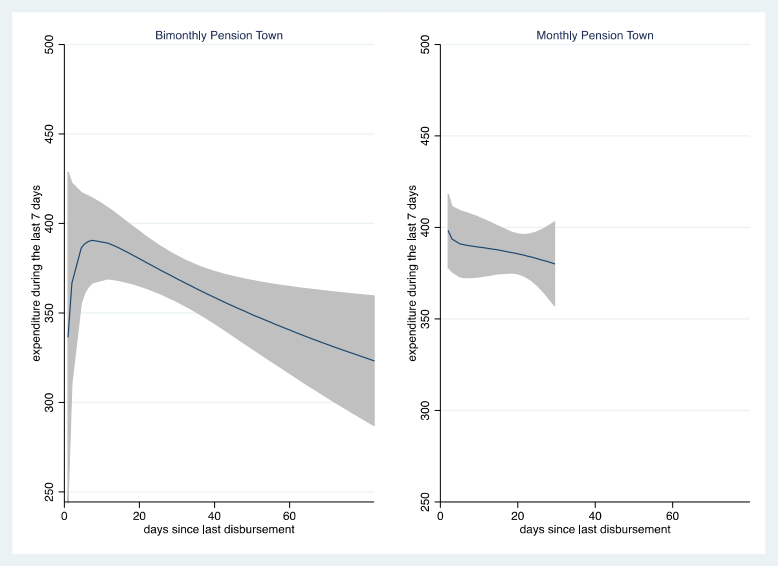
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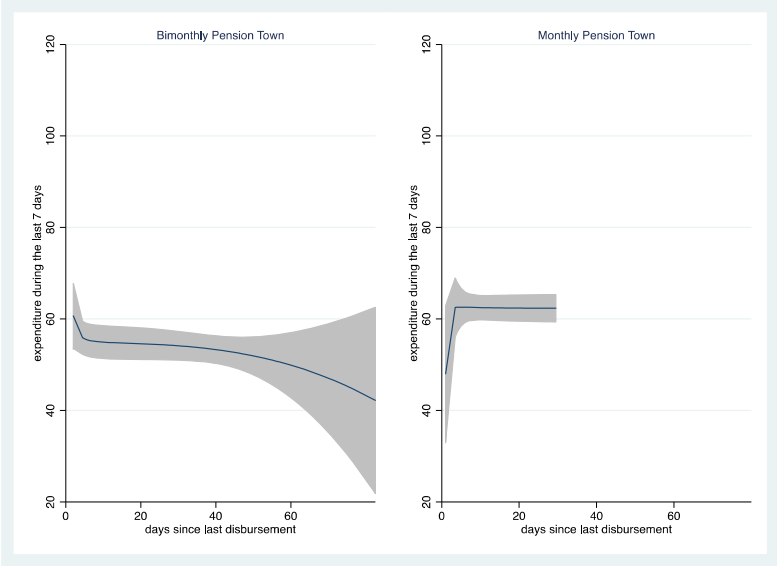
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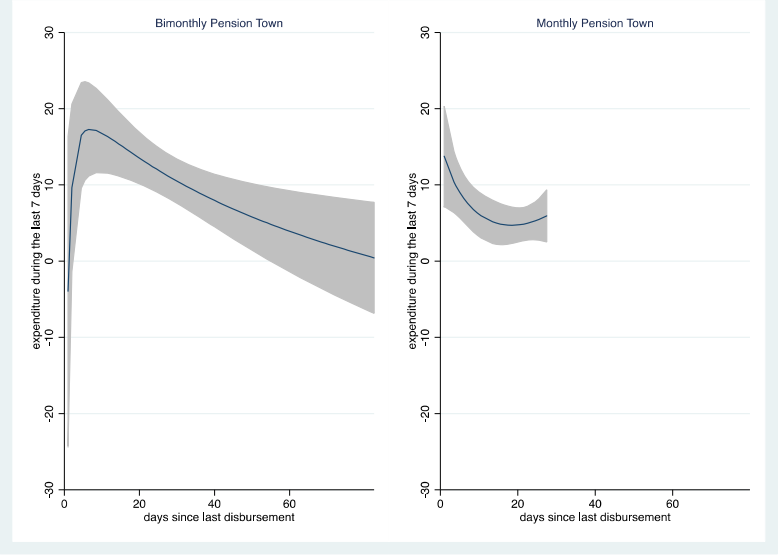
PANEL A. EXPENDITURES ON FOOD AT HOME



PANEL B. BEVERAGES AT HOME



PANEL C. FOOD AND BEVERAGE OUTSIDE OF HOME



PANEL D. TOTAL EXPENDITURES

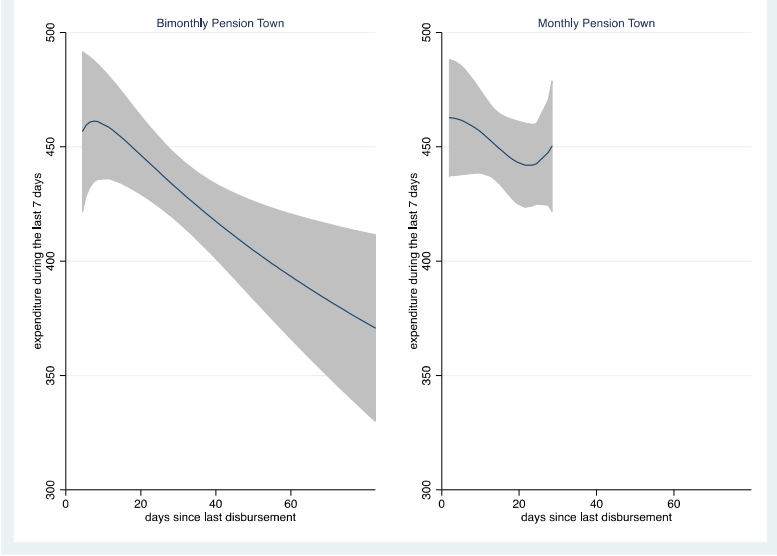


FIGURE 1. HOUSEHOLD EXPENDITURES AS A FUNCTION OF TIME ELAPSED SINCE LAST PENSION PAYMENT

Source: Authors' calculations.

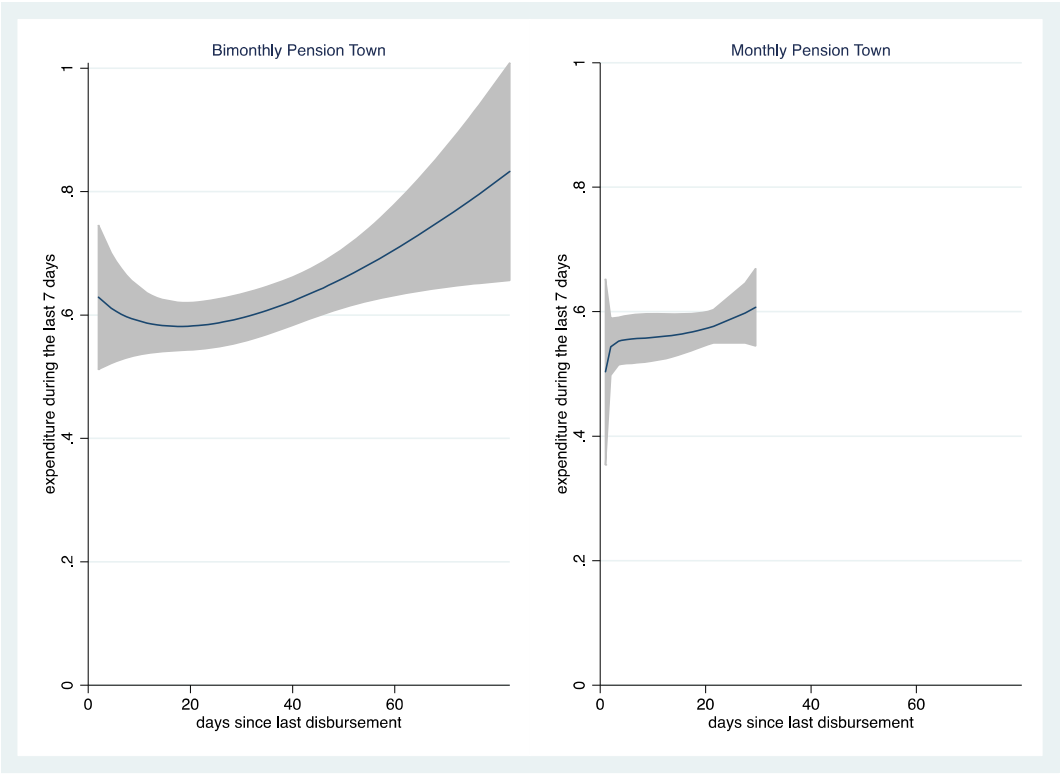


FIGURE 2. FRACTION OF HOUSEHOLDS SPENDING LESS THAN MXN400 AS A FUNCTION OF TIME ELAPSED SINCE LAST PENSION PAYMENT

Source: Authors' calculations.

TABLE 1 - PENSION DISBURSEMENTS AND SURVEY DATES

Period Program		Monthly Program (Valladolid)			Bimonthly Program (Motul)		
		Pension Disbursement Dates	Survey	Survey Dates	Pension Disbursement Dates	Survey	Survey Dates
2008	August		W1	11-31			
	September		W1	1-21			
	October						
	November					W1	3-28
	December	16					
2009	January	22					
	February	20					
	March	20					
	April	24					
	May	25					
	June	24					
	July	24	W2	7-31	28-29	W2	1-31
	August	21	W2	3-27		W2	3-31
	September	25	W2	3-9	29-30		
	October	23					
	November	23			26-27		
	December	15					
2010	January	29					
	February	26			04-05		
	March	29					
	April	28			01-02		
	May	26			27-28		
	June	28	W3	15-30		W3	14-30
	July	28	W3	1-28	28-29	W3	1-30
	August	25				W3	2-13
	September	27			29-30		
	October	27					
	November	24					
	December	15					

Source: RECONOCER, and 70 y Más programs' administrative information 2008, 2009, and 2010.

TABLE 2 - DESCRIPTIVE STATISTICS BASELINE

	Monthly Program (Valladolid)	**Bimonthly Program** (Motul)	**Difference**
Mean age	77.87	77.49	-0.38
Male (%)	46.10	50.42	4.32**
Marital status (%)			
Single/Divorced/Separated	9.21	8.20	-1.01
Couple	52.67	53.31	0.64
Widowed	38.11	38.40	0.28
Missing	0.00	0.19	0.19
Mean years of Education	1.80	1.93	0.13
Speaks Mayan (%)	76.15	78.10	1.95
Read and write a message in Spanish (%)	55.05	65.80	10.74***
Living alone (%)	12.85	13.79	0.94
Mean number of household residents	3.45	3.45	0.00
Work for pay (%)	16.73	14.75	-1.98
Monthly household income (MXN$)	1223.27	1253.90	30.63
No. Observations	1346	1073	

Notes:

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Source: Authors' calculations.

Table 3 - Cyclicality of Expenditures in Monthly and Bimonthly Programs

Total Expenditures by household during previous week

Variables	Monthly Program (Valladolid)				Bimonthly Program (Motul)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Change in food expenditure per day since last disbursement (MXN$)	-0.557 (0.745)	-0.835 (0.676)	-1.352 (1.156)	-1.506 (1.050)	-2.08 (0.517)***	-1.61 (0.481)***	-2.145 (0.536)***	-1.871 (0.500)***
Background Characteristics	NO	YES	NO	YES	NO	YES	NO	YES
Excludes observations with less than seven days elapsed since last disbursement	NO	NO	YES	YES	NO	NO	YES	YES
Observations	1,410	1,409	1,170	1,169	995	995	933	933
R-squared	0.004	0.198	0.005	0.195	0.017	0.175	0.018	0.175

Notes: All models are linear regressions and include survey indicators. Background characteristics are age, age squared, gender, an indicator variable for living alone, household size, dummy variables for highest education level achieved, marital status, and language spoken.

*** Significant at the 1 percent level.

** Significant at the 5 percent level.

* Significant at the 10 percent level.

Source: Authors' calculations.

Table 4: Summary of Outcome Variables

Basic needs
Health care
Visited a Doctor
Number of doctor visits
Had a serious health problem but no doctor visits because of money
Food consumption
Sometimes do not have enough to eat
Often run out of food
Someone in household skips or cuts meals
Often eats less than should
Often hungry because cannot afford food
Often in last 3 months someone in the household did not eat for 1 day
Received food from charity
Eats cereal daily
Other Income
Work for pay
Expenditure
Durable goods (equipment and investment)
Owning refrigerator
Owning telephone
Owning a cellphone
Owning a bicycle
Owns no piece of equipment
Number of chicken you own
Number of pigs you own
Number of turkeys you own
Luxury goods
How often does one eat food items (non-cereal): meat, fruit, eggs, diary?
How much spent on beverages at home?
How much spent on food and beverages out of home?
Private transfers (from/to family and friends)
In-Transfers to the elder:
Receive money
Total Money Received
Receive in-kind
Total received in-kind
Out of Pocket Expenses paid by a relative
Family or friends pay for Expenses
Out-Transfer from the elder
Give money
Total money given
Give in-kind
Subjective Wellbeing
Income
Satisfied with household income
Family and social relationships
Satisfied with relationships with family members
Satisfied with relationships with social contacts
Emotional State
How often do you feel abused?
How often do you fear money will be taken by someone else?

.

TABLE 5.1 - PROGRAM PARTICIPATION RATES

Variable	Monthly Program (m) (Valladolid)			Bimonthly Program (b) (Motul)			Diff-in-Diff in means Δm–Δb		
	W1	W2	W3	W1	W2	W3	Δ=(W2–W1)	Δ=(W3–W2)	Δ=(W3–W1)
	1	2	3	4	5	6	7	8	9
Receives *Reconocer*	0.000	0.936	0.924	0.000	0.000	0.000	0.936	-0.013	0.924
	(0.000)	(0.008)	(0.009)	(0.000)	(0.000)	(0.000)	(0.008)**	(0.011)**	(0.009)**
Receives *70 y Más*	0.012	0.024	0.009	0.032	0.377	0.892	-0.333	-0.531	-0.864
	(0.004)	(0.005)	(0.003)	(0.007)	(0.018)	(0.012)	(0.020)**	(0.021)**	(0.014)**
Receives *Oportunidades*	0.121	0.089	0.082	0.203	0.193	0.138	-0.022	0.047	0.026
	(0.011)	(0.009)	(0.009)	(0.015)	(0.015)	(0.013)	(0.015)	(0.015)**	(0.016)
Receives *Atención a Adultos Mayores*	0.021	0.011	0.002	0.017	0.007	0.001	-0.001	-0.003	-0.003
	(0.005)	(0.003)	(0.002)	(0.005)	(0.003)	(0.001)	(0.008)	(0.005)	(0.007)
Receives *PROCAMPO*	0.003	0.002	0.003	0.017	0.019	0.004	-0.003	0.015	0.013
	(0.002)	(0.002)	(0.002)	(0.005)	(0.005)	(0.003)	(0.007)	(0.006)**	(0.005)
Receives *any other program*	0.004	0.004	0.016	0.003	0.001	0.000	0.001	0.013	0.015
	(0.002)	(0.002)	(0.004)	(0.002)	(0.001)	(0.000)	(0.004)	(0.005)**	(0.005)**
Receives *no-program*	0.846	0.036	0.043	0.750	0.471	0.078	-0.531	0.400	-0.131
	(0.012)	(0.006)	(0.007)	(0.016)	(0.019)	(0.010)	(0.024)**	(0.021)**	(0.023)**

Notes: ** indicates significance at 5%, when using the Holt-Bonferroni correction for multiple hypothesis testing. Standard Error in parentheses. The total may sum to more than 1 since individuals might get benefits from more than one program. *Reconocer* is a poverty alleviation program for adults 70 and older program in certain locations in the state of Yucatan. *70 y Más* is the federal poverty alleviation program for adults 70 years and older. *Oportunidades* is a poverty alleviation program for urban and rural households in extreme poverty. *Atención a Adultos Mayores* is a poverty alleviation program for older adults 60 years and older in food poverty living in high and very high marginalization areas that are not covered by other poverty alleviation programs. *PROCAMPO* is an income supplement program for agricultural workers. *Any other program* refers to programs different from those previously stated.
Source: Authors' calculations.

Table 5.2 - Differential Effects of the Monthly and Bimonthly Programs on Basic Needs

Variable	Monthly Program (m) (Valladolid)			Bimonthly Program (b) (Motul)			Diff-in-Diff in means Δm–Δb		
	W1	W2	W3	W1	W2	W3	Δ=(W2–W1)	Δ=(W3–W2)	Δ=(W3–W1)
	1	2	3	4	5	6	7	8	9
Health Care									
Visited a Doctor	0.417	0.532	0.535	0.470	0.515	0.485	0.070	0.032	0.103
	(0.016)	(0.016)	(0.016)	(0.019)	(0.019)	(0.019)	(0.031)	(0.031)	(0.032)
Number of doctor visits	1.089	1.234	1.363	1.269	1.189	1.262	0.227	0.053	0.287
	(0.058)	(0.048)	(0.073)	(0.096)	(0.055)	(0.076)	(0.120)	(0.116)	(0.145)
Had a serious health problem but no doctor visits	0.177	0.084	0.071	0.124	0.062	0.114	-0.031	-0.065	-0.095
because of money	(0.012)	(0.009)	(0.008)	(0.013)	(0.009)	(0.012)	(0.021)	(0.019)**	(0.022)**
Food Consumption									
Sometimes do not have enough to eat	0.289	0.269	0.162	0.347	0.355	0.237	-0.029	0.011	-0.018
	(0.015)	(0.014)	(0.012)	(0.018)	(0.018)	(0.016)	(0.030)	(0.029)	(0.030)
Often run out of food	1.595	1.387	1.187	1.468	1.427	1.219	-0.169	-0.011	-0.159
never-always (1-4)	(0.029)	(0.024)	(0.016)	(0.027)	(0.026)	(0.019)	(0.049)**	(0.039)	(0.045)**
Someone in household skips or cuts meals	1.674	1.448	1.700	1.579	1.454	1.535	-0.104	0.209	-0.184
never-always (1-4)	(0.028)	(0.024)	(0.049)	(0.028)	(0.026)	(0.051)	(0.048)	(0.105)	(0.110)
Often Eat less than should	1.622	1.378	1.678	1.529	1.389	1.569	-0.103	0.115	-0.142
never-always (1-4)	(0.027)	(0.021)	(0.052)	(0.026)	(0.023)	(0.056)	(0.044)	(0.104)	(0.102)
Often hungry because cannot afford food	1.416	1.178	1.361	1.292	1.167	1.299	-0.121	0.057	-0.314
never-always (1-4)	(0.024)	(0.015)	(0.048)	(0.022)	(0.016)	(0.046)	(0.036)**	(0.083)	(0.093)**
Someone in household often does not eat for 1 day	1.262	1.074	1.206	1.146	1.100	1.132	-0.150	0.093	-0.320
never-always (1-4)	(0.018)	(0.010)	(0.040)	(0.015)	(0.013)	(0.034)	(0.028)**	(0.069)	(0.080)**
Received food from charity	1.094	1.039	1.040	1.042	1.057	1.036	-0.071	0.021	-0.050
never-always (1-4)	(0.013)	(0.007)	(0.007)	(0.009)	(0.010)	(0.007)	(0.019)**	(0.016)	(0.019)**
Eats cereal daily	0.924	0.956	0.474	0.960	0.981	0.521	0.010	-0.022	-0.010
	(0.009)	(0.007)	(0.016)	(0.008)	(0.005)	(0.019)	(0.014)	(0.026)	(0.027)
Other Income									
Work for pay	0.175	0.124	0.086	0.162	0.168	0.091	-0.057	0.040	-0.018
	(0.012)	(0.011)	(0.009)	(0.014)	(0.014)	(0.011)	(0.018)**	(0.017)	(0.018)

Notes: ** indicates significance at 5%, when using the Holt-Bonferroni correction for multiple hypothesis testing. Standard errors in parentheses.
Source: Authors' calculations.

Table 5.3 - Differential Effects of the Monthly and Bimonthly Programs on Expenditure

Variable	Monthly Program (m) (Valladolid)			Bimonthly Program (b) (Motul)			Diff-in-Diff in means Δm–Δb		
	W1	W2	W3	W1	W2	W3	Δ=(W2–W1)	Δ=(W3–W2)	Δ=(W3–W1)
	1	2	3	4	5	6	7	8	9
Durable Goods (Equipment and Investment)									
Owning Refrigerator	0.633	0.669	0.661	0.645	0.662	0.661	0.021	-0.015	0.008
	(0.016)	(0.016)	(0.016)	(0.019)	(0.018)	(0.018)	(0.021)	(0.021)	(0.022)
Owning Telephone	0.193	0.184	0.186	0.187	0.168	0.186	0.017	-0.021	-0.003
	(0.013)	(0.013)	(0.013)	(0.015)	(0.014)	(0.015)	(0.015)	(0.013)	(0.015)
Owning Cellphone	0.179	0.195	0.145	0.140	0.206	0.240	-0.047	-0.088	-0.146
	(0.013)	(0.013)	(0.012)	(0.013)	(0.015)	(0.016)	(0.024)**	(0.024)**	(0.023)**
Owning Bicycle	0.204	0.178	0.136	0.338	0.337	0.340	-0.025	-0.045	-0.070
	(0.013)	(0.013)	(0.011)	(0.018)	(0.018)	(0.018)	(0.021)	(0.021)**	(0.021)**
Owning No Piece of Equipment	0.305	0.262	0.293	0.231	0.219	0.199	-0.028	0.057	0.025
	(0.016)	(0.015)	(0.015)	(0.016)	(0.016)	(0.015)	(0.023)	(0.022)**	(0.023)
Number of chickens you own	2.910	2.402	2.163	2.441	2.076	2.000	-0.113	-0.161	-0.351
	(0.216)	(0.190)	(0.182)	(0.214)	(0.155)	(0.152)	(0.285)	(0.258)	(0.314)
Number of pigs do you own	0.059	0.044	0.026	0.039	0.032	0.022	-0.013	-0.008	-0.013
	(0.013)	(0.016)	(0.009)	(0.011)	(0.010)	(0.010)	(0.020)	(0.022)	(0.022)
Number of turkeys do you own	0.344	0.350	0.220	0.658	0.510	0.397	0.119	-0.005	0.132
	(0.046)	(0.063)	(0.036)	(0.165)	(0.082)	(0.060)	(0.183)	(0.100)	(0.175)
Luxury Goods									
How often do you eat meat?	3.488	3.554	3.806	3.513	3.507	3.928	0.074	-0.169	-0.098
never-once a day – (1-5)	(0.036)	(0.031)	(0.017)	(0.039)	(0.036)	(0.018)	(0.065)	(0.051)**	(0.055)
How often do you eat eggs?	3.932	3.884	3.766	3.836	3.719	3.740	0.065	-0.139	-0.069
never-once a day – (1-5)	(0.035)	(0.029)	(0.021)	(0.036)	(0.034)	(0.024)	(0.063)	(0.051)**	(0.056)
How often do you eat dairy?	3.126	3.303	3.744	2.938	3.068	3.764	0.046	-0.254	-0.208
never-once a day – (1-5)	(0.047)	(0.045)	(0.035)	(0.053)	(0.053)	(0.037)	(0.079)	(0.069)**	(0.072)**
How often do you eat fruit?	3.599	3.706	4.001	3.624	3.671	4.127	0.061	-0.161	-0.102
never-once a day – (1-5)	(0.039)	(0.035)	(0.021)	(0.045)	(0.042)	(0.024)	(0.070)	(0.057)**	(0.062)
How much spent on beverages at home? (MXN$)	61.395	63.615	60.418	55.504	49.786	53.782	5.558	-5.570	-3.805
	(1.993)	(1.946)	(1.811)	(2.035)	(1.976)	(1.941)	(3.885)	(3.584)**	(3.810)
How much spent on food and beverages out of home? (MXN$)	15.797	6.755	5.690	15.471	15.083	8.171	-7.346	6.043	0.582
	(2.298)	(1.258)	(1.396)	(2.453)	(2.338)	(1.645)	(4.488)	(3.465)**	(4.158)

Notes: ** indicates significance at 5%, when using the Holt-Bonferroni correction for multiple hypothesis testing. Standard errors in parentheses.

Source: Authors' calculations.

Table 5.4 - Differential Effects of the Monthly and Bimonthly Programs on Private Transfers (from/to Family and Friends)

Variable	Monthly Program (m) (Valladolid)			Bimonthly Program (b) (Motul)			Diff-in-Diff in means Δm–Δb		
	W1	W2	W3	W1	W2	W3	Δ=(W2–W1)	Δ=(W3–W2)	Δ=(W3–W1)
	1	2	3	4	5	6	7	8	9
In-transfers to the elder									
Received Money	0.310	0.250	0.230	0.215	0.205	0.191	-0.053	-0.006	-0.058
	(0.015)	(0.014)	(0.014)	(0.016)	(0.015)	(0.015)	(0.026)	(0.025)	(0.026)
Total money received (MXN$)	260.678	187.293	114.666	150.144	187.813	155.295	-111.054	-40.109	-151.163
	(48.801)	(21.270)	(11.835)	(23.465)	(35.692)	(17.876)	(65.275)	(42.479)	(56.060)**
Receive in-kind	0.187	0.123	0.074	0.092	0.110	0.065	-0.081	-0.004	-0.086
	(0.013)	(0.011)	(0.009)	(0.011)	(0.012)	(0.009)	(0.022)**	(0.020)	(0.021)**
Total received in-kind (MXN$)	56.379	38.898	11.144	21.676	35.496	12.648	-31.301	-4.905	-36.206
	(9.872)	(10.245)	(2.351)	(5.303)	(11.381)	(3.180)	(18.588)	(15.780)	(11.465)**
Out of Pocket expenses paid by a relative	0.266	0.138	0.144	0.146	0.148	0.122	-0.130	0.034	-0.099
	(0.014)	(0.011)	(0.011)	(0.013)	(0.014)	(0.012)	(0.024)**	(0.021)	(0.023)**
Family or friends pay for expenses never - always (1-4)	2.173	2.156	2.257	2.025	2.059	1.872	-0.046	0.284	0.236
	(0.040)	(0.039)	(0.038)	(0.045)	(0.044)	(0.039)	(0.068)	(0.067)**	(0.066)**
Out-Transfer from the elder									
Give money	0.030	0.024	0.007	0.026	0.016	0.023	0.005	-0.024	-0.019
	(0.006)	(0.005)	(0.003)	(0.006)	(0.005)	(0.006)	(0.010)	(0.009)	(0.010)
Total money given (MXN$)	19.958	11.674	1.764	12.547	8.173	14.302	-3.910	-16.040	-19.949
	(8.211)	(3.451)	(0.807)	(5.103)	(4.056)	(6.052)	(10.907)	(8.124)	(11.404)
Give in-kind	0.019	0.009	0.001	0.006	0.013	0.007	-0.018	-0.002	-0.020
	(0.005)	(0.003)	(0.001)	(0.003)	(0.004)	(0.003)	(0.007)	(0.006)	(0.006)**

Notes: ** indicates significance at 5%, when using the Holt-Bonferroni correction for multiple hypothesis testing. Standard errors in parentheses.
Source: Authors' calculations.

TABLE 5.5 - DIFFERENTIAL EFFECTS OF THE MONTHLY AND BIMONTHLY PROGRAMS ON SUBJECTIVE WELLBEING

Variable	Monthly Program (m) (Valladolid)			Bimonthly Program (b) (Motul)			Diff-in-Diff in means Δm–Δb		
	W1	W2	W3	W1	W2	W3	Δ=(W2–W1)	Δ=(W3–W2)	Δ=(W3–W1)
	1	2	3	4	5	6	7	8	9
Income									
Satisfied with household income	3.435	3.658	3.713	3.421	3.627	3.738	0.047	-0.094	-0.039
very dissatisfied – very satisfied (1-5)	(0.029)	(0.025)	(0.026)	(0.034)	(0.030)	(0.025)	(0.057)	(0.053)	(0.057)
Family and Social Relationships									
Satisfied with relationship with family members	3.903	3.905	4.094	3.879	3.974	3.933	-0.085	0.211	0.082
very dissatisfied – very satisfied (1-5)	(0.023)	(0.023)	(0.023)	(0.026)	(0.025)	(0.026)	(0.044)	(0.044)**	(0.046)
Satisfied with relationship with social contact	3.743	3.784	3.931	3.740	3.839	3.815	-0.030	0.156	0.117
very dissatisfied – very satisfied (1-5)	(0.024)	(0.022)	(0.019)	(0.028)	(0.026)	(0.024)	(0.047)	(0.044)**	(0.045)
Emotional State									
How often do you feel abused?	1.124	1.115	1.064	1.102	1.102	1.113	-0.003	-0.074	-0.076
never-always (1-4)	(0.015)	(0.015)	(0.011)	(0.017)	(0.018)	(0.016)	(0.032)	(0.030)**	(0.032)
How often do you fear money will be taken by someone else?	1.257	1.219	1.130	1.170	1.161	1.125	-0.016	-0.055	-0.089
never-always (1-4)	(0.022)	(0.020)	(0.016)	(0.020)	(0.022)	(0.016)	(0.041)	(0.037)	(0.039)

Notes: ** indicates significance at 5%, when using the Holt-Bonferroni correction for multiple hypothesis testing. Standard errors in parentheses.
Source: Authors' calculations.

APPENDIX

TABLE APPENDIX A - CYCLICALITY OF EXPENDITURES

Variable	Food at Home				Beverages at Home				Food and Beverages Outside of Home			
	1	2	3	4	5	6	7	8	9	10	11	12
Panel A1. Monthly Pension (Valladolid)												
Number of days since last disbursement	-0.61	-0.865	-1.329	-1.475	0.093	0.091	-0.285	-0.266	-0.182	-0.18	0.096	0.102
	(0.656)	(0.598)	(1.021)	(0.931)	(0.159)	(0.152)	(0.25)	(0.239)	(0.113)	(0.114)	(0.155)	(0.156)
Background Characteristics	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Includes Observations with less than seven days elapsed since last disbursement	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
Observations	1,410	1,409	1,170	1,169	1,542	1,540	1,260	1,259	1,599	1,597	1,313	1,312
R-squared	0.007	0.192	0.008	0.191	0.001	0.105	0.004	0.106	0.002	0.011	0.003	0.009
Panel A2. Bimonthly Pension (Motul)												
Number of days since last disbursement	-1.735***	-1.293***	-1.762***	-1.488***	-0.212*	-0.153	-0.194	-0.152	-0.141	-0.161	-0.193*	-0.214*
	(0.459)	(0.425)	(0.477)	(0.442)	(0.114)	(0.112)	(0.119)	(0.117)	(0.104)	(0.105)	(0.111)	(0.111)
Background Characteristics	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES	NO	YES
Includes Observations with less than seven days elapsed since last disbursement	NO	NO	YES	YES	NO	NO	YES	YES	NO	NO	YES	YES
Observations	995	995	933	933	1,073	1,073	1,006	1,006	1,085	1,085	1,014	1,014
R-squared	0.016	0.182	0.017	0.181	0.003	0.074	0.003	0.071	0.006	0.029	0.008	0.0338

Notes: Standard errors in parentheses

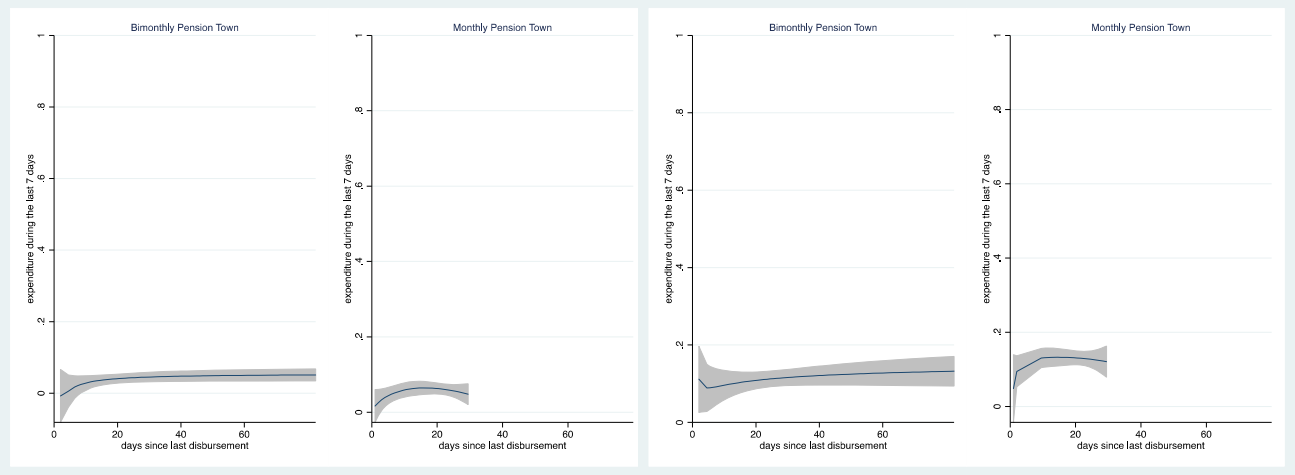
*** Significant at the 1 percent level.

** Significant at the 5 percent level.

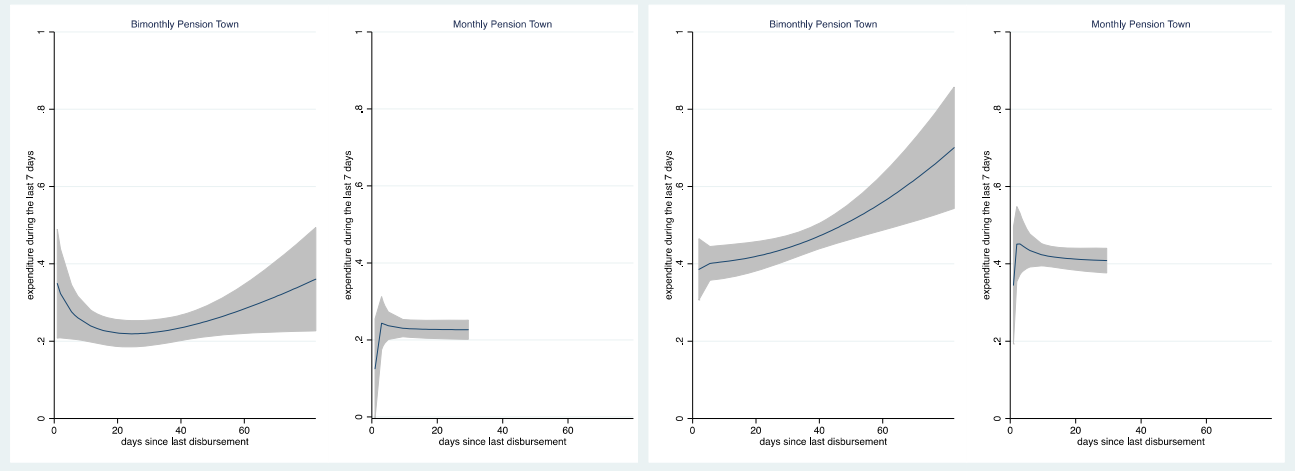
* Significant at the 10 percent level.

Source: Authors' calculations, ENCAHEY 2009 and 2010.

PANEL B1 - EXPENDITURE LESS THAN MXN$100 **PANEL B2 - EXPENDITURE LESS THAN MXN$200**



PANEL B3 - EXPENDITURE LESS THAN MXN$300 **PANEL B4 - EXPENDITURE LESS THAN MXN$400**



PANEL B5 - EXPENDITURE LESS THAN MXN$500

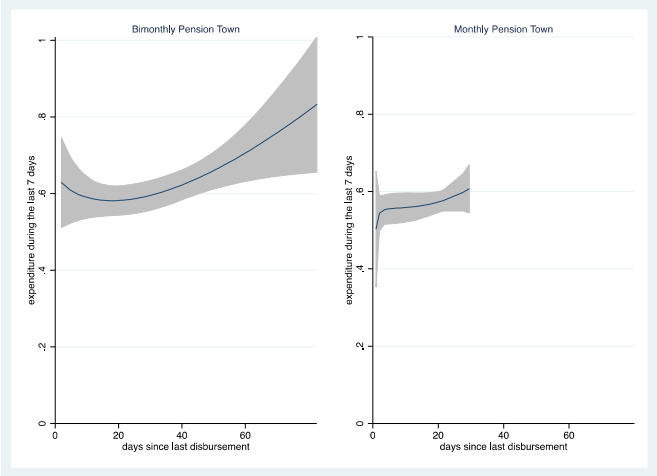


FIGURE APPENDIX B. FRACTION OF HOUSEHOLDS SPENDING BELOW CERTAIN CEILINGS AS A FUNCTION OF TIME ELAPSED SINCE LAST PENSION PAYMENT

Source: Authors' calculations.

TABLE APPENDIX C - IMPACT OF MONTHLY PROGRAM (VALLADOLID) VERSUS BIMONTHLY PROGRAM (MOTUL) (W3-W1)

Variable Verbal scale (numeric codes)	Diff-in-Diff Means	 Regressions	 Propensity Score Matching
Panel C1 - Program Participation Rates			
Receives *Reconocer*	0.924	0.924	0.924
	(0.009)	(0.009)	(0.009)
Receives *70 y Más*	-0.864	-0.864	-0.861
	(0.014)	(0.015)	(0.017)
Receives *Oportunidades*	0.026	0.026	0.046
	(0.016)	(0.017)	(0.020)
Receives *Atención a Adultos Mayores*	-0.003	-0.003	0.001
	(0.007)	(0.007)	(0.008)
Receives *PROCAMPO*	0.013	0.013	0.013
	(0.005)	(0.005)	(0.005)
Receives *any other program*	0.015	0.015	0.014
	(0.005)	(0.005)	(0.005)
Receives *no-program*	-0.131	-0.131	-0.178
	(0.023)	(0.025)	(0.025)
Panel C2 - Basic Needs Outcomes			
Health Care			
Visited doctor	0.103	0.103	0.138
	(0.031)	(0.033)	(0.036)
Number of doctor visits	0.287	0.280	0.392
	(0.145)	(0.150)	(0.148)
Had a serious health problem but no doctor visits because of money	-0.095	-0.095	-0.087
	(0.022)	(0.023)	(0.025)
Food Consumption			
Sometimes do not have enough to eat	-0.018	-0.018	-0.008
	(0.030)	(0.035)	(0.034)
Often run out of food	-0.159	-0.160	-0.125
never-always (1-4)	(0.045)	(0.051)	(0.049)
Someone in household skips or cuts meals	-0.184	0.071	-0.147
never-always (1-4)	(0.110)	(0.090)	(0.121)
Often Eat less than should	-0.142	0.016	-0.118
never-always (1-4)	(0.102)	(0.093)	(0.107)
Often hungry because cannot afford food	-0.314	-0.062	-0.310
never-always (1-4)	(0.093)	(0.085)	(0.101)
Someone in household often does not eat for 1 day	-0.320	-0.043	-0.307
never-always (1-4)	(0.080)	(0.065)	(0.082)
Received food from charity	-0.050	-0.049	-0.046
never-always (1-4)	(0.019)	(0.021)	(0.020)
Eats cereal daily	-0.010	-0.011	0.025
	(0.027)	(0.029)	(0.029)
Other Income			
Work for pay	-0.018	-0.018	-0.025
	(0.018)	(0.018)	(0.020)

(Cont.)

TABLE APPENDIX C - IMPACT OF MONTHLY PROGRAM (VALLADOLID) VERSUS BIMONTHLY PROGRAM (MOTUL) (W3-W1)

Variable Verbal scale (numeric codes)	Means	Diff-in-Diff Regressions	 Propensity Score Matching
Panel C3 - Expenditure Outcomes			
Durable Goods (Equipment and Investment)			
Owning Refrigerator	0.008	0.012	0.002
	(0.022)	(0.025)	(0.023)
Owning Telephone	-0.003	-0.007	-0.006
	(0.015)	(0.018)	(0.015)
Owning Cellphone	-0.146	-0.134	-0.134
	(0.024)	(0.027)	(0.024)
Owning Bicycle	-0.070	-0.070	-0.085
	(0.022)	(0.024)	(0.023)
Owning No Piece of Equipment	0.025	0.020	0.037
	(0.023)	(0.026)	(0.026)
Number of chickens you own	-0.351	-0.307	-0.380
	(0.314)	(0.354)	(0.318)
Number of pigs do you own	-0.013	-0.016	0.007
	(0.022)	(0.023)	(0.029)
Number of turkeys do you own	0.132	0.138	-0.003
	(0.175)	(0.180)	(0.134)
Luxury Goods			
How often do you eat meat?	-0.098	-0.097	-0.115
never - once a day (1-5)	(0.055)	(0.059)	(0.062)
How often do you eat eggs?	-0.069	-0.070	-0.056
never - once a day (1-5)	(0.056)	(0.059)	(0.058)
How often do you eat dairy?	-0.208	-0.209	-0.230
never - once a day (1-5)	(0.072)	(0.076)	(0.079)
How often do you eat fruit?	-0.102	-0.100	-0.140
never - once a day (1-5)	(0.062)	(0.067)	(0.064)
How much spent on beverages at home? (MXN$)	-3.805	0.745	-3.996
	(3.810)	(4.204)	(4.109)
How much spent on food and beverages out of home? (MXN$)	0.582	-2.806	1.995
	(4.158)	(4.608)	(4.465)
Panel C4 - Private transfers Outcomes			
In-transfers to the elder			
Receive Money	-0.058	-0.056	-0.030
	(0.026)	(0.027)	(0.028)
Total money received (MXN$)	-151.163	-151.163	-140.897
	(56.060)	(72.579)	(53.159)
Receive in-kind	-0.086	-0.085	-0.096
	(0.021)	(0.021)	(0.022)
Total received in-kind (MXN$)	-36.206	-36.206	-36.561
	(11.465)	(11.812)	(12.153)
Out of Pocket expenses paid by a relative	-0.099	-0.099	-0.102
	(0.023)	(0.023)	(0.026)
Family of friends pays for expenses	0.236	0.237	0.251
never - always (1-4)	(0.066)	(0.070)	(0.070)
Out-Transfer from the elder to the rest of the family			
Give money (MXN$)	-0.019	-0.019	-0.016
	(0.010)	(0.010)	(0.010)
Total money given (MXN$)	-19.949	-19.949	-15.846
	(11.404)	(11.397)	(11.372)
Give in-kind	-0.020	-0.020	-0.019
	(0.006)	(0.007)	(0.007)

(Cont.)

TABLE APPENDIX C - IMPACT OF MONTHLY PROGRAM (VALLADOLID) VERSUS BIMONTHLY PROGRAM (MOTUL) (W3-W1)

Variable Verbal scale (numeric codes)	Means	Diff-in-Diff Regressions	 Propensity Score Matching
Panel C5 - Satisfaction Outcomes			
Income			
Satisfied with household income	-0.039	-0.039	-0.027
very dissatisfied – very satisfied (1-5)	(0.057)	(0.056)	(0.066)
Family and Social Relationships			
Satisfied with relationship with family members	0.082	0.138	0.070
very dissatisfied – very satisfied (1-5)	(0.046)	(0.046)	(0.051)
Satisfied with relationship with social contacts	0.117	0.112	0.123
very dissatisfied – very satisfied (1-5)	(0.045)	(0.045)	(0.051)
How often do you feel abused?	-0.076	-0.070	-0.082
never-always (1-4)	(0.032)	(0.029)	(0.033)
How often do you fear money will be taken by someone else?	-0.089	-0.081	-0.098
never-always (1-4)	(0.039)	(0.037)	(0.042)

Notes: Standard Errors in parenthesis

APPENDIX D: INTERPRETING THE DIFF-IN-DIFF ESTIMATES UNDER ALTERNATIVE SETS OF ASSUMPTIONS.

In this appendix, we lay out several assumptions under which the interpretation of the outcomes is justified.

Consider the following two equations, the first one for the *monthly* program group (*m*) and the second one for the *bimonthly* program group (*b*).

$$Y_{it}^{m} = \alpha_0 + \beta_t W_t + \gamma_{mt} T_{mt} + \varepsilon_{it}^{m}, t = 1,2,2',3 \qquad (1)$$

$$Y_{it}^{b} = \delta_0 + \beta_t W_t + \gamma_{bt} T_{bt} + \varepsilon_{it}^{b}, t = 1,2,2',3 \qquad (2)$$

The notation $t = 1,2,2',3$ indicates that for ease of interpretation we distinguish four waves (W1, W2, W2', and W3) with 6 months between each wave, although we only collected data in waves W1, W2, and W3. T_{mt} and T_{bt} are dummies indicating the *monthly* (*m*) or *bimonthly* (*b*) treatment. T_{m1} is zero and T_{m2}, $T_{m2'}$, and T_{m3} are equal to one, indicating that the *monthly* treatment was implemented after W1 and continued in subsequent periods. Similarly, T_{b1} and T_{b2} are zero and $T_{b2'}$, and T_{b3} are equal to one, indicating that the *bimonthly* treatment was implemented after W2. Notice that β_t is the same in both equations, which represents the common trends assumption. The error terms ε_{it}^{m} and ε_{it}^{b}, satisfy the classical assumptions with conditional mean zero. We define:

$$\overline{Y_t^m} \equiv \mathrm{E}[Y_{it}^{m}], \overline{Y_t^b} \equiv \mathrm{E}\left[Y_{it}^{b}\right], \Delta\overline{Y_t} = \overline{Y_t^m} - \overline{Y_t^b}, t = 1,2,2',3 \qquad (3)$$

So that

$$\Delta\overline{Y_t} = \alpha_0 - \delta_0 + \gamma_{mt} T_{mt} - \gamma_{bt} T_{bt}, \ t = 1,2,2',3 \qquad (4)$$

Result 1. The 6 months effect of the *monthly* program, W2-W1, is identified under standard diff-in-diff assumptions (no additional assumptions needed).

Derivation of Result 1:

For $t = 1$ we have

$$\Delta\overline{Y}_1 = \alpha_0 - \delta_0 \qquad (5)$$

That implies that the difference between the *monthly* and *bimonthly* groups at W1 identifies $\alpha_0 - \delta_0$.

For $t = 2$ we have

$$\Delta\overline{Y_2} = \alpha_0 - \delta_0 + \gamma_{m2} \qquad (6)$$

Then, $\Delta\overline{Y_2} - \Delta\overline{Y_1} = \gamma_{m2}$ (7)

where γ_{m2} is the treatment effect of the *monthly* program six months after the pension program implementation. This is the population equivalent of the diff-in-diff estimator between W2 and W1 (referred as W2-W1).

Result 2. When the effects take less than one year to be fully realized, then the W3-W1 diff-in-diff analysis identifies the differential effects of the *monthly* and *bimonthly* programs.

Derivation of Result 2:

For $t = 3$ we have

$$\Delta\overline{Y}_3 = \alpha_0 - \delta_0 + \gamma_{m3} - \gamma_{b3}, \quad (8)$$

Thus, we identify $\gamma_{m3} - \gamma_{b3}$ by

$$\gamma_{m3} - \gamma_{b3} = \Delta\overline{Y}_3 - \Delta\overline{Y}_1 \quad (9)$$

Ideally, we would compare treatments in the *monthly* and *bimonthly* programs of the same duration. So we would like to compare $\gamma_{m2'} - \gamma_{b3}$, the effect of *monthly* program one year after the pension implementation ($\gamma_{m2'}$) and the effect of the *bimonthly* program one year after the pension implementation (γ_{b3}) .

Assumption 1: $\gamma_{m2'} = \gamma_{b3}$. That is, the effect in the *monthly* program group takes at most 1 year to fully realize. In that case we have

$$\gamma_{m2'} - \gamma_{b3} = \gamma_{m3} - \gamma_{b3} = \Delta\overline{Y}_3 - \Delta\overline{Y}_1 \quad (10)$$

We would identify the differential effects of the programs, by the diff-in-diff between W3 and W1 (referred as W3-W1).

Result 3. When the effects of the *monthly* and *bimonthly* programs take less than six months to be fully realized then, the effect of the *bimonthly* program is identified through the W3-W2 comparison.

Derivation of Result 3:

Assumption 2: $\gamma_{m3} = \gamma_{m2'} = \gamma_{m2}$ and $\gamma_{b3} = \gamma_{b2'}$, i.e. the effects of the *monthly* and *bimonthly* programs take at most six months to be fully realized.

Then, $\Delta\overline{Y}_3 - \Delta\overline{Y}_2 = \gamma_{m3} - \gamma_{b3} - \gamma_{m2} = -\gamma_{b3} = -\gamma_{b2'}$ (11)

We would identify the effects of the *bimonthly program* by the diff-in-diff between W2 and W3 (W3-W2).

However, if we are not willing to assume that the effects take a given time to fully realize, but we assume that all effects are either monotonically non-decreasing with time (the first derivative is non-negative everywhere) or monotonically non-increasing with time (the first derivative is non-positive

everywhere) and if moreover the rate of change of an effect is not increasing over time (the second derivative is non-positive everywhere), then we obtain Results 4 and 5.

Result 4. If the W3-W1 DIFF-IN-DIFF estimate is larger in the *bimonthly* program group for a given outcome, then the impact of the *bimonthly program* is larger for that outcome.

Result 5. If we observe an increase in the outcome between W1 and W2 in *monthly* program group, and the difference in that outcome between the *monthly* and bimonthly program groups diff-in-diff not decrease between W2 and W3 (as for some of the necessities outcomes), we can be certain the effect of the *monthly* program was larger than of the *bimonthly* program (since, in that case, the effect from months 6 to 18 of the monthly program was larger than the months 0 to 12 of the *bimonthly program* and we are assuming non-positive second derivatives).

Derivation of Results 4 and 5:

Assumption 3: Effects of each program are either monotonically non-decreasing or non-increasing with time; the second derivative is non-positive everywhere.

Without loss of generality, assume all impacts are non-negative (we can always redefine outcomes so that this is the case). This implies

$$0 \leq \gamma_{m2} \leq \gamma_{m2'} \leq \gamma_{m3} \text{ and } 0 \leq \gamma_{b2'} \leq \gamma_{b3} \qquad (12)$$

Case 1: The *bimonthly* program overall impact (W3-W1) is larger (effects in the *bimonthly* program group are stronger than in the *monthly* program group). Then we have

Result 4. $\gamma_{m3} - \gamma_{b3} < 0 \rightarrow \gamma_{m2'} \leq \gamma_{m3} < \gamma_{b3}$ (13)

In other words, the *bimonthly* program effect is larger.

Case 2: The difference between the *monthly* and *bimonthly program* increased between W2 and W3. In other words:

$$\Delta\overline{Y_3} - \Delta\overline{Y_2} = \gamma_{m3} - \gamma_{b3} - \gamma_{m2} > 0 \qquad (14)$$

Since $\gamma_{m2'} \geq \gamma_{m3} - \gamma_{m2}$, (14)implies:

Result 5. $\gamma_{m2'} \geq \gamma_{m3} - \gamma_{m2} > \gamma_{b3}$ (15)