FREQUENCY OF BENEFIT PAYMENTS IN SOCIAL TRANSFER PROGRAMS*

Emma Aguila
Sol Price School of Public Policy
University of Southern California
email:eaguilav@price.usc.edu

Arie Kapteyn
Center for Economic and Social Research
University of Southern California
Email: Kapteyn@usc.edu

Francisco Perez-Arce
Center for Economic and Social Research
University of Southern California
Email: Perezarc@usc.edu

FREQUENCY OF BENEFIT PAYMENTS IN SOCIAL TRANSFER PROGRAMS*

Emma Aguila

Arie Kapteyn

Francisco Perez-Arce

Abstract

Since individuals are often unable to smooth consumption, the frequency with which payments are delivered is an important design element of social transfer programs. We hypothesize that programs with more frequent payments will result in smoother consumption and higher consumption levels of food and other personal necessities, while programs with less frequent payments will result in higher consumption of durables and discretionary spending. We derive these hypotheses from a model of intertemporal consumption where individuals are hyperbolic discounters or face saving constraints. We test the hypotheses by comparing the effects of two noncontributory pension programs in Yucatan, Mexico. These programs differed only in the frequency of their payments: monthly or bimonthly. We observe similar food expenditure patterns for both programs at baseline, before the start of the programs, but smoother consumption patterns over time in the monthly program. Recipients of the monthly program also reported greater healthcare use and higher food consumption. Participants in the bimonthly program increased expenditures on durables and discretionary items, compared to the monthly program. For recipients facing barriers to saving, the welfare effect of the payment frequency is ambiguous. Empirically, however, we find that some measures of subjective wellbeing are higher in the monthly program. We also find that a higher frequency of payments is associated with less fear of money being stolen and better relationships with family and other social contacts.

JEL classification: D12, D91, I38

Keywords: Frequency of Payment, Cash Transfer Programs, Consumption Smoothing, Barriers to Saving

*This research was supported by funding from the government of the state of Yucatan, the U.S. National Institute on Aging (NIA) (through grants R01AG035008, P01AG022481, and R21AG033312), the RAND Center for the Study of Aging (with grant P30AG012815 from NIA), RAND Labor and Population, and the RAND Center for Latin American Social Policy (CLASP). We would like to thank Richard Blundell, Leandro Carvalho, Shoshana Grossbard, Cesar Martinelli, James P. Smith, Duncan Thomas, and participants at the NBER Summer Institute, DITE Summer Workshop, APPAM, and LACEA annual meetings for their valuable comments. The expert assistance of Joanna Carroll, Stephany Maqueda, and Jorge Peniche is gratefully acknowledged. An abbreviated version of an earlier draft of this article was presented at the AEA/ASSA conference and appeared in the 2017 AER papers and proceedings issue (Aguila, Kapteyn, and Perez-Arce 2017).

I. INTRODUCTION

The Life Cycle Hypothesis (LCH) is the standard economics framework for analyzing intertemporal consumption decisions. The LCH assumes consumers equalize marginal utility of consumption across periods to maximize utility over their life span. Therefore, predictable changes in income should not affect consumption (e.g. Hall 1978). This theory implies that beneficiaries of transfer programs will smooth consumption across periods, and the frequency of benefits payments will not affect their consumption.

Yet individuals and households with little savings do not smooth their consumption between paychecks. Rather, their consumption tends to peak when the check arrives and then fall until the arrival of the next check. This pattern is evident both for expenditures (Stephens 2003; Stephens 2006) and for caloric intake (Shapiro 2005; Mastrobuoni and Weinberg 2009). This pattern is of interest to both academic and policy research. For academics, this pattern points to hyperbolic discounting (Ainslie 1975; Laibson 1997). For policymakers, it raises concern that food intake among the poor will at times fall below recommended levels. For instance, Mastrobuoni and Weinberg (2009) report that among a sample from an older population without savings, the probability of consuming fewer calories than health officials recommend increases by nearly 15 percent in the final week of the pay period.

In addition to hyperbolic discounting, barriers to saving can also explain the failure to smooth consumption. If people cannot safely retain money for even a short period of time, they will tend to spend (and consume) more in the early part of the payment period. This may be particularly true in developing countries, where poor individuals often face difficulties in saving (for instance, Banerjee and Duflo 2007). Individuals may also be unwilling to hold large sums of money, because family pressures may arise to share the money (Dupas and Robinson 2013, Schaner, 2017). This suggests that saving money from a low-frequency payment stream may be costly and result in strained family relationships.

When people are unable to save, either because of the lack of a conduit or a behavioral barrier, both the cyclicality (i.e., smoothness) and types of consumption may be affected. There is only so much bread or tortilla one can eat on a given day, so if one is unable to save money to later spend on a basic staple, then the rest of the income is likely going to discretionary items or spent on a durable good. In India, a randomized-controlled trial showed that the largest impact of a microcredit program was to allow people to purchase durable goods and reduce consumption of every-day "temptation items" such as tea (Banerjee et al. 2015). A field experiment in Kenya showed that households receiving a one-off lump-sum transfer were likely to spend the money on durable goods, while those that received the transfer over nine monthly installments were more likely to improve food security (Haushofer and Shapiro 2016).

We therefore hypothesize that increasing payment frequency for a social transfer program will have two broad consequences. First, it will smooth consumption. Second, it will affect the type of consumption, particularly by reducing consumption of durable goods and discretionary spending. We formalize these hypotheses through a simple model, where agents maximize an additive intertemporal utility function and income arrives in either monthly or bimonthly installments. Per-period utility depends on consumption of two types of perishable goods: (1) "necessities", yielding concave utility, with marginal utility tending to infinity as consumption tends to zero; and (2) "discretionary items", with bounded marginal utility[1]. We further distinguish between two types of discretionary items: durable goods (i.e., indivisible goods with bounded marginal utility) and others. We show that under geometric discounting and absent credit or savings constraints, a) consumption will be smooth regardless of the frequency of payment; b) the frequency of payment does not affect the mix of consumption between "necessities", "discretionary" and "durable goods".

[1] Note that our definition of necessities deviates from the often-followed convention where a necessity is defined as having an income elasticity of demand smaller than one.

These results do not hold when individuals face savings constraints or when they are hyperbolic discounters. Rather, when individuals are unable to save cheaply (or obtain credit), reducing frequency of payments increases cyclicality of consumption. In addition, when individuals cannot save for later consumption (or borrow at the end of the payment period), they spend more on discretionary and durable goods early in the payment period, when the marginal utility of the necessity drops below that of the discretionary or durable goods. As a result, low frequency of payment results in more discretionary and durable good consumption and less consumption of necessities. In contrast, beneficiaries of programs with high payment frequency may spend less than optimal on some durable goods (because they are unable to accumulate enough money for such goods).

The same pattern is evident for hyperbolic discounting. Decreasing the value of future consumption has effects similar to those of barriers to savings for two reasons. First, because the individual over-consumes upon payment receipt, there is more cyclicality of consumption. Second, because the individual spends more on necessities at the beginning of the period, the marginal utility of the necessities falls below the marginal utility of discretionary or durable goods. This increases discretionary and durable good consumption.

We test our hypotheses through analysis of the introduction of two noncontributory pension programs for an elderly population in Yucatan, Mexico. These programs provided similar benefits but at different payment frequencies. *Reconocer Urbano* is the name of the monthly pension and *70 y Más* is the bimonthly pension. In order to evaluate its impacts, *Reconocer Urbano* was rolled out experimentally: two towns with similar characteristics were chosen for the experiment. One, Valladolid, was randomly selected by the state government for the program. The other, Motul, did not initially receive the program but acted as the control town. We conducted baseline surveys (Wave 1 or W1) in Valladolid and Motul before the launch of the monthly pension program in Valladolid in December 2008, with our first follow-up surveys (Wave 2 or W2) occurring in the summer of 2009. In late July 2009, the federal government extended *70 y Más* to all towns with fewer than

30,000 inhabitants, which included Motul but not Valladolid. As a result, 30 percent of age-eligible households in Motul in W2 reported that they had started to receive *70 y Más*. This provided us an opportunity to understand the effects of the differences in frequency of payments of non-contributory pension programs. Accordingly, in 2010 we conducted another follow-up survey (Wave 3 or W3), when Valladolid was still receiving only the monthly pensions while Motul was receiving the bi-monthly pensions.

After the introduction of the pension programs, pensioners in the bimonthly program did not smooth consumption. Rather, their food and beverage expenditures were larger at the beginning of the cycle than at the end. We observed a similar but much less pronounced pattern in the monthly program. We observed no such cyclicality before the introduction of the pension programs.

Second, we exploit our three waves of data collection to analyze the effects of the noncontributory pension programs on household food expenditure, durable good purchases, health care expenditure, food availability, labor supply, family transfers, and subjective wellbeing. As saving constraints or hyperbolic discounting would predict, we find that the program with higher frequency of payments resulted in more consistent spending on basic needs, such as food staples and health care, and fewer hunger spells (increased food security). The program with lower frequency of payments more strongly affected purchase of durable goods and consumption of discretionary items.

The monthly program also reduced transfers by family members to the older adults more than the bimonthly program did. This is consistent with a pattern of depletion of resources at the early stage of the two-month cycle and subsequent need for in-transfers to cover basic needs at the end of it. Indeed, we observe that in-transfers are more common within the final weeks of the two-month program. By contrast, monthly payments are associated with a reduction of recipients' fears that their money will be taken or stolen. Monthly payments are also associated with increased satisfaction with family and other social relationships, suggesting that holding larger amounts of money is a source of stress for social relationships.

We address some threats to the identification of the differences across program impacts. First, the comparison between the two programs is not exact, because by the third wave of data collection the monthly program had been operating longer than the bimonthly program. Therefore, we interpret results with care. We first focus on outcomes where the effect plausibly will be realized within a short time. We then look at whether effects move in opposite directions between W1 and W2 and between W2 and W3, and formally establish the assumptions required to support our conclusions. A second concern is that the randomization is done at the town-level, so town-level shocks concurrent with the introduction of the programs can confound the effects. We analyze Census data and show that patterns in necessities and durable good consumptions like the ones observe are unlikely to be the results of "macro" shocks or differential trends across the two towns. Third, we conduct standard analyses in the program evaluation literature to assess potential concerns such as differential attrition.

We view our paper as making the following contributions. First, our article contributes to the literature about predictable changes in income and household consumption. Our study complements previous literature that has documented that low-income program recipients do not smooth food consumption, by showing this pattern is also present among poor elderly in a developing country, and showing that this pattern is exacerbated when payments are less frequent. Second, we show that the lack of consumption smoothing implies that the frequency of payment would also matter not only for the timing but also for the types of goods consumed, and find evidence in support of those predictions.

Our results have implications for policy design, and support the idea that seemingly small details in the design and implementation of public programs can strongly influence the outcomes of those programs. Duflo (2017) calls on economists to become "plumbers" and learn how to adjust programs on the ground to help them achieve their desired effect. Our results give guidance to policy-makers and show that an important aspect that needs to be adjusted depending on program goals is the frequency of payments, since higher or lower frequencies of payments will result in different outcomes .

The remainder of the paper is organized as follows. In section II, we present a simple model of intertemporal consumption under the two different payment frequencies and derive the results that motivate the empirical analysis. In section III, we describe the monthly and bimonthly non-contributory pension programs, the experimental design, and the data. In section IV, we explore patterns of consumption smoothing in the two towns, particularly focusing on how expenditures vary with time since last payment. Section V presents difference-in-differences (DID) estimates of the impact of the monthly and bimonthly programs on expenditure and consumption, family transfers, and satisfaction measures. Section VI analyzes the robustness of the DID results using parametric and non-parametric methods. Section VII formally discusses how our interpretation of the results may be affected by the difference in time each program has been operating. Section VIII discusses potential sources of bias including common shocks. Section IX presents our conclusions.

II. MODEL

We present a simple model of intertemporal consumption. Agents maximize an intertemporally additive utility function and receive pension income either monthly or bimonthly. Per-period utility depends on consumption of three types of goods, all of which exhibit decreasing marginal utility if the quantity consumed increases. These three types of goods are (1) necessities n_t, which are non-durable and whose marginal utility tends to infinity when consumption approaches zero; (2) discretionary goods d_t, which are non-durable and whose marginal utility is bounded from above; and (3) durable non-divisible goods D_t, whose marginal utility is bounded from above. We will first consider allocation across periods and then the allocation of spending by period for each of these types of goods. We posit the following per period utility function, where $a,\ b > 0$:

$$u(n_t, d_t, D_t) = \log(n_t) + \log(d_t + b) + \log(D_t + a) \tag{1}$$

Though this is a very specific function, it is simple and allows us to illustrate results of interest for this paper. At each time *t*, individuals choose n_t, d_t, and D_t to maximize the following utility function

(2) $$u(n_t,\ \mathrm{d}_t, D_t)+\beta\sum_{\tau=t+1}^{\infty}\delta^{\tau-t}u(n_\tau, d_\tau, D_\tau), \qquad 0<\beta,\delta<1$$

We will consider different types of constraints and explore their implications:

i. (Intertemporal constraint) $n_t+d_t+(D_t-D_{t-1})+\frac{W_{t+1}}{1+r}\le I_t+W_t$

ii. (Life time constraint with perfect capital markets)

$$\sum_{\tau=t}^{\infty}\frac{1}{(1+r)^{\tau-t}}\left[n_\tau+d_\tau+(D_\tau-D_{\tau-1})\right]=\sum_{\tau=t}^{\infty}\frac{1}{(1+r)^{\tau-t}}I_\tau+W_t$$

iii. (Credit constraints) $W_{t+1}>0$

iv. (Non-divisible and illiquid durable good) $D_t-D_{t-1}\in\{0,\ \kappa,\ 2\kappa,\ldots\}$,

where W_t is net wealth at the beginning of period t; r is the monthly interest rate in a perfect capital market; I_t is the income level at time *t;* κ=per unit value of durable good. The monthly income stream is of the form $\{x,\ x,\ x,\ x, x, x,\ldots.\}$ and the bimonthly stream is of the form $\{2x,\ 0,\ 2x,\ 0,\ 2x,\ 0,\ldots\}$. Ignoring the indivisibility of the durable good, the additivity of the intertemporal utility function implies a two-stage budgeting set-up. Denote total consumption in period t by c_t with corresponding indirect utility function $v(c_t)$.

RESULT A. Under the Life-Cycle Model with geometric discounting (β=1) and perfect financial markets, the permanent income in the bimonthly treatment is higher than in the monthly treatment by a factor of 2(1+r)/(2+r).

This follows trivially from comparison of the income streams under the two treatments. Permanent income is slightly higher under the bimonthly program, because on average the payments arrive earlier. Since r is a monthly interest rate, it is likely to be small, so that the ratio will be very close to one and the consumption streams should be indistinguishable empirically.

RESULT B. If borrowing against future benefits is ruled out and saving across months incurs a penalty, or if preferences are hyperbolic, then in the bimonthly program consumption will be higher in the first month than in the second month.

Consider the case where borrowing is ruled out against future benefits. We are interested in the allocation of consumption over two periods under both treatments. For the allocation of consumption across the two periods, the indirect utility function is of the form

$$v(c_t) + \beta\delta v(c_{t+1}) \tag{3}$$

Obviously in this case there is no distinction between hyperbolic discounting and geometric discounting with strong time preference (Shapiro 2005). For simplicity, assume $W_t = 0$. This does not affect the analysis in any fundamental way, and is empirically relevant for 95% of the households in our samples (see Section IV). For the monthly program, (3) implies that consumption in each month will simply be equal to x as long as $\beta\delta(1+r) < 1$, i.e. as long as the rate of return on saving is insufficient to counteract the strong intertemporal discount factor. The budget constraint under the bimonthly program reads

$$c_t + \frac{c_{t+1}}{1+r} = 2x \tag{4}$$

The first order condition for the intertemporal path of consumption is easily found to be

$$u'(c_t) = \beta\delta(1+r)u'(c_{t+1}) \tag{5}$$

Assuming, once again, that $\beta\delta(1+r)<1$, this implies that consumption will be higher in the first period. This set-up can easily be adjusted to accommodate savings constraints. One interpretation of such constraints is that there is penalty for delaying consumption. This can be incorporated by replacing (4) with

(6) $$c_t + \gamma \frac{c_{t+1}}{1+r} = 2x, \quad \frac{\gamma}{1+r} > 1$$

Thus, a dollar saved in month 1 is worth less than a dollar in month 2. In this case (5) is replaced by

(7) $$u'(c_t) = \frac{\beta\delta(1+r)}{\gamma} u'(c_{t+1})$$

This makes clear that the roles of γ (savings penalty) and $\beta\delta$ (discounting) are interchangeable. It is of interest to explore the nature of the savings penalty. One interpretation could simply be that the pension recipient feels obligated (or is induced to) share some of the payment at the beginning of the two-month period with others, such as family members. This then leaves less money for the second month. It is also possible that the pension recipient actually lends money to others and gets some of the money back in the second month. This is still consistent with (6), as long as the money returned in the second month is less than the money lent in the first month. In the data, one might observe that the pension recipient lends to others as out-transfers in the first month and in-transfers in the second month.

Next consider consumption across periods. In the bimonthly program, consumption is higher in the first month than the second. The additional consumption will likely be spent on both necessities and discretionary goods. The simple model can be used to illustrate. For now, assume that the budget will not be high enough to afford the purchase of a durable good, so we take D_t as given. The maximization problem within a period is then simply

(8) $$\max_{n_t, d_t} \log(n_t) + \log(d_t + b), \text{ s.t. } n_t + d_t = c_t$$

Assuming $c_t > b$, this yields the familiar Linear Expenditure System demand equations

(9) $$n_t = \frac{1}{2}(c_t + b), \; d_t = \frac{1}{2}(c_t - b)$$

In this example spending on both necessities and discretionary goods will be higher in the first period (and lower in the second period). Note, however that the budget share of necessities is equal to $\frac{1}{2}\frac{c_t + b}{c_t}$, which is decreasing in c_t. Because c_t is higher in the first month, more discretionary goods will be purchased in the first month than in the second. It is easy to verify that expenditures on necessities would be maximized if consumption of them were identical in both months. Although this result is derived in the context of our very simple model, it will hold more generally if the expenditure elasticity of the discretionary good is higher than that for the necessity.

RESULT C. Under the bi-monthly program spending on necessities and discretionary goods will be higher in the first month and lower in the second month. Compared to the monthly program, the budget share of discretionary goods will be higher in the first month and over the two months combined.

Now consider the purchase of durable goods. The intuition is similar to that for discretionary goods, but with the extra condition that at a minimum purchase κ the marginal utility of the stock D_t needs to be at least as high as the marginal utility of the necessities and discretionary goods. The simplest case is where the monthly benefit is lower than κ. In that case no durable purchases are possible under the monthly program. Even if $X > \kappa$, a purchase of a durable good is more likely in the bimonthly program, because expenditures in the first period are higher and hence it is more likely that the marginal utility of the durable good at a unit price κ exceeds the marginal utility of the necessities and the discretionary goods.

RESULT D. Durable good purchases are more likely under the bi-monthly program.

III. DATA

Our empirical analyses exploit data arising from a pension program, *Reconocer Urbano*, implemented by the State of Yucatan. *Reconocer Urbano* is a monthly non-contributory pension payment of MXN$550 or US$70.20 at 2013 PPP to any individual at least 70 years old within towns of at least 20,000 inhabitants (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$238.20 at 2013 PPP), and almost equaled the MXN$590 per person poverty line for rural areas (CONEVAL 2015). The program was implemented in phases throughout the state.

To evaluate pension effects, we chose two towns of more than 20,000 inhabitants with similar demographic and economic characteristics. One of these, Valladolid, started receiving the pension in 2008, while the other, Motul, was scheduled to receive it only at a later date and hence served as the control town. During the course of our evaluation however, Motul became eligible for the federal government program, *70 y Más*. *70 y Más* is a national non-contributory pension program similar to *Reconocer Urbano.* It provides a bimonthly cash payment equal to MXN$1,000 or US$127.80 at 2013 PPP to individuals 70 and older. The program 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 30,000 inhabitants. The latter expansion included Motul but not Valladolid. Thus, during the course of our experiment, the control town became eligible for a different non-contributory pension program.

To evaluate the effects of *Reconocer Urbano*, we conducted a number of household surveys in both Motul and Valladolid.[2] The surveys collected detailed community, household, and individual-

[2] Survey items 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 United States, *Oportunidades,* and various family life surveys.

level data at baseline and in two follow-up interviews in both towns.[3] The surveys gathered individual data on health and food security, and household data on food availability, healthcare utilization and out-of-pocket expenditures, financial and in-kind transfers among beneficiaries' children and neighbors, and economic activity of older workers (see Aguila et al. 2014).

We conducted a community survey to understand differences in healthcare infrastructure, economic activity, and government programs, among other characteristics. Both towns had good air quality and adequate public lighting; neither had flooding problems. Both towns had similar coverage of other federal and state government programs. Valladolid is larger and therefore had a larger service infrastructure. The poverty index in Motul was slightly higher at baseline, but both towns experienced similar trends in poverty over time before 2008 (see section VIII).

Wave 1 data collection began in August 2008 for Valladolid and in November 2008 for Motul,[4] just prior to the December 2008 implementation of the monthly pension in Valladolid. Wave 2 data was collected simultaneously in Valladolid and Motul in July and August of 2009. Motul started receiving the bimonthly pension program (*70 y Más*) on July 28, 2009 overlapping with the data collection of W2. As a result, some Motul respondents were interviewed before they received *70 y Más*, while others were interviewed after they started receiving the federal pension.[5] The final round of data collection, W3, was conducted in Valladolid and Motul in the summer of 2010, one and a

[3] Where eligible adults could not be interviewed because of health or language difficulties, the interview was conducted with a proxy respondent within the same household.

[4] To build the sampling frame for this study, we first carried out a complete listing of all households in each town. We then screened them to identify households with age-eligible adults. We entered into a collaborative agreement with INEGI, the National Institute for Statistics and Geography, for maps of the towns selected for each phase of *Reconocer Urbano*, updating these maps as necessary with a cartographer. This created the sampling frame for W1. Overall, we did not find many differences between our listing and the 2005 Census (Aguila et al. 2014)

[5] See online Appendix Table B. We compared W1 characteristics of individuals in Motul who were receiving the federal government program at the time of the interview and those who were not, and found no statistically significant differences among them with the exception that males were more likely to be among the recipients of the Federal program (see online Appendix Table A).

half years after Valladolid started receiving the monthly pension and approximately one year after Motul started receiving the bimonthly pension.

Table I shows descriptive statistics for the samples in Valladolid and Motul at baseline (W1). Among older persons in each town, there are no statistically significant differences at baseline in age, marital status, education, language spoken, proportion living alone, number of household residents, proportion working for pay, and monthly household income. Males made up a larger share of the older population in Motul than in Valladolid (50.9 vs 46.2 percent).

[TABLE I]

Regarding income sources, the greatest source of income for females at W1 was family transfers and social security benefits.[6] For males, it was income from work and social security benefits. We estimated that 83.4 percent of the older population in Valladolid was below the poverty line at W1, as was 77.9 percent of the older population in Motul. Response rates in Valladolid were 91.5 percent at W1, 87.9 percent at W2, and 80.6 percent at W3; in Motul, they were 95.3 percent at W1, 81.9 percent at W2, and 78.5 percent at W3. We conducted an attrition analysis comparing demographic characteristics of the baseline respondents with the panel respondents and did not find statistically significant differences (Aguila, Kapteyn, and Smith 2015). Section eight presents additional analyses of potential sample selection problems due to attrition.

IV. Imperfect Consumption Smoothing

The considerable length of the survey instruments resulted in the survey team staying in each town over an extended time period. 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 (Table B in the online Appendix shows the interview and pension

[6] We deflated income, private transfers, and expenditure variables with the Mexican National Consumer Price Index base year of the last two weeks of December 2010 (INEGI 2015).

disbursement dates). This allows us to test whether expenditures vary with the time elapsed since benefit receipt, as predicted by the model with credit constraints or hyperbolic discounting in RESULT B (discussed in section II). The survey asks about expenditures in the previous seven days, through three separate questions about household expenditures on food eaten at home, expenditures on beverages drank at home, and expenditures on food *and* beverages consumed away from home.

Table II shows estimation results of regressing total food and beverage expenditures (the sum of food and beverages eaten at or away from home) on the number of days elapsed since the most recent pension disbursement and on a number of controls, using data from W2 and W3. See equation (10) below, where Y_{it} is the expenditure variable, α is a constant, D_{it} is the number of days elapsed since the last disbursement date, v_t are dummy variables for each of the waves -W2 and W3-, X_{it} is a vector of individual and family characteristics and ε_{it} is the error term. In some specifications, regressions also include the lagged outcome variable.

$$Y_{it} = \alpha + \beta D_{it} + v_t + \delta X_{it} + \varepsilon_{it} \quad (10)$$

Table II, column 5 shows that each day elapsed since the last payment in the bimonthly program is associated with 4 fewer pesos spent on food and beverages, a statistically significant association. Column 1 does not show such a relationship in the monthly program. Columns 2 and 6 show similar results to columns 1 and 5 when we include a set of background characteristics in the regression, as well as the expenditures in the previous wave. These change the estimates slightly, but qualitatively the conclusions remain the same

[TABLE II]

Expenditure questions ask about expenditures *in the last seven days***.** Therefore, we could have inaccurate estimates for interviews conducted during the first seven days after disbursement. Such recipients will have just received their pension payment and have had fewer days to spend it before our interview. Columns 3 and 4 for the monthly program and columns 7 and 8 for the bimonthly program exclude observations with less than seven days elapsed since last disbursement. The

relationship between food and beverage expenditure and days elapsed since last payment in the monthly program becomes negative when we delete respondents for whom the last disbursement was within the past seven days (but still statistically insignificant and smaller than in the bimonthly program). In the bimonthly program the coefficient of days elapsed becomes less negative, but still remains significant at the 1% level.

Conducting the same regressions for the separate expenditure variables (expenditures on food eaten at home, beverages drank at home, and food and beverages consumed away from home) yields similar results. A negative relationship is observed for each variable in the bimonthly program. The relationships are robust to the set of controls included in the specification, although the magnitude and significance of the effect varies depending on the exact specification and outcome variable (results shown in Table C of the online Appendix). [7] Figure I illustrates how household expenditures on food and beverages vary across the pension payment cycle. The figure shows residuals of a regression similar to equation (10), but excluding $D_{it,}$ on the vertical axis and the number of days elapsed since the last disbursement date on the horizontal axis. The graphs show a clear downward trend in the bimonthly program, but no such pattern in the monthly program.

[FIGURE I]

This pattern is robust to alternative ways of presenting this relationship. For instance, Figure A in the online appendix graphs the coefficients from a regression of food and beverages expenditures on the dummies for every three day period elapsed since the last pension payment. There is a significant negative slope of expenditures and the number of days elapsed in the bimonthly program, but not in the monthly program. Panel B in the same figure shows similar graphs in both towns *before the introduction of the pension programs.* It shows no significant declines in food and beverage expenditures in either town.

[7] We also compared baseline characteristics of respondents who were interviewed the first two weeks after receiving the pension payment with those who were interviewed later in the payment cycle for both the monthly and bimonthly programs. We did not find any statistically significant differences between these two groups.

Online Appendix Figure B shows that the proportion of households whose spending on food is below that of the weekly poverty line. The percentage increases towards the end of the payment cycle in the bimonthly program town. Per RESULT B, the lack of perfect consumption smoothing is predicted by saving constraints or hyperbolic discounting, both of which would also imply very low levels of saving. About 95 percent of households in the monthly and bimonthly program at W1 report not having any monetary savings.

Our results are consistent with Stephens (2003) and Stephens (2006) showing that expenditures peak after receipt of benefits and decline thereafter. Shapiro (2005) and Mastrobuoni and Weinberg (2009) find this cyclicality not only in expenditures but also in consumption. Though we cannot directly test for the cyclicality of consumption because we do not have data on daily food intake, we did analyze expenditures on individual food items, many of which are perishable and so unlikely to be stored for long periods of time. We do not find that such cyclicality is driven by less-perishable goods such as beans and rice. Furthermore, we found that expenditures on some perishable items such as milk and tomatoes, both of which are likely to be consumed soon after purchase, decline significantly during the pension cycle in the bimonthly town (results shown in Table D of the online Appendix).[8]

V. Estimates of the Effects of the Monthly and Bimonthly Pension Programs

In this section, we investigate the differential impacts of the programs with different frequency of disbursements (RESULTS C AND D). First, we analyze the mean difference in the changes between W1 and W3 in Valladolid and Motul. The comparison provides an estimate of the difference across

[8] An alternative potential explanation suggested by Stephens (2003) is that grocery stores may increase their prices in response to higher demand in the days following check receipt. We conducted a cyclicality analysis of respondent-reported information on prices of 12 items (tortilla, beans, rice, eggs, milk, tomato, onion, potato, noodle soup, soft drinks, sweet bread, and French bread) that are commonly consumed in Yucatan. We found no statistically significant changes in prices between paychecks (results available upon request). Changes in prices therefore do not appear to be driving the changes in expenditures.

the programs' impacts subject to the caveat that by W3 the monthly program had operated about six months longer, as earlier discussed. 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 compared to the bimonthly program. However, this would not affect outcomes whose effect is fully realized within one year. We formally discuss the effects of the different timings of the programs in section VII.

Second, we compare the DID of means 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 and before the introduction of the bimonthly program. (For further analysis, see Aguila, Kapteyn, and Smith, 2015.) As noted earlier, in W1 neither town was receiving pensions. By W2, the older adults of Valladolid had been receiving monthly pension payments for approximately six months, while the elderly in Motul had by and large not received any benefits. For our DID analyses, we treat W2 in Motul as not having received any pension benefits (see the next section for a discussion of robustness).[9]

Third, we analyze changes between W2 and W3 to compare the effects of the introduction of the bimonthly program compared to those of the monthly program. The W3-W2 difference in Motul captures the changes occurring after the introduction of the bimonthly program. There was no change in Valladolid, whose elderly had been receiving benefits since W1. To the extent that certain effects of the monthly program take more than six months to realize, the W3-W2 comparison does not fully capture the effects of the bimonthly program. For the W3-W2 difference to accurately capture the impact of the bimonthly program, it is necessary to assume the impacts of the monthly program are fully realized by W2 (we discuss this formally in section VII).

[9] The rollout of the bimonthly program coincided with the later part of the fieldwork in W2, and thus, we conducted robustness analyses by including and excluding individuals in Motul who received the bimonthly pension during W2. We did not find statistically significant differences, likely because the program in Motul was too recent to have an impact already.

We group the outcomes of interest in the following categories: 1) basic needs (healthcare, food consumption); 2) work; 3) durable-goods ownership; 4) discretionary-good expenditures; 5) private transfers to and from family and friends; 6) measures of subjective wellbeing (satisfaction with income and relationships with family members and social contacts, and emotional state). For each category, we created a simple index by averaging standardized versions of each variable in the category. Table III summarizes the indexes and the variables that make up each index.

[TABLE III]

Tables IV.1 to IV.4 present results of our DID analyses for the indexes and each individual outcome. Column 1 of each table shows the mean values of the outcome variables for the monthly program in W1, and column 5 shows them for the bimonthly program. Column 11 shows the DID estimates of the monthly pension program six months after its implementation, using Motul as the comparison. Column 13 shows the DID estimates of the impact of the bimonthly program compared to the monthly program from W2 to W3. Column 9 shows the DID estimates of the impact of the bimonthly program compared to the monthly program using W3 and W1. Columns 2 and 6 show the first differences from W3 to W1, columns 3 and 7 from W1 to W2, and columns 4 and 8 from W2 to W3 for each program. Because we are testing multiple hypotheses in Tables IV.1-IV.4, we apply a Holm-Bonferroni correction (Holm 1979).

V.A. Basic Needs Outcomes

We would expect both the monthly and bimonthly programs to increase expenditures on basic needs, i.e., on healthcare and food consumption. Nevertheless, as per the model in section II, the impact of the monthly pension program may be larger as high-frequency payments lead to more consumption smoothing.

We find evidence consistent with this hypothesis. The effect of the monthly pension program is larger on the indexes for healthcare and food consumption. Its effects are also statistically significant for many individual outcomes. For example, the indicator variable for having visited a doctor

increased in the monthly pension town, Valladolid, from 42.0 percent in W1 to more than 50 percent in W2 and W3 (Table IV.1) but remained fairly steady in Motul. This resulted in a 10 percentage-points increase in the probability of doctor visits in Valladolid compared to Motul (see column 9 in Table IV.1), a statistically significant difference even after accounting for multiple hypotheses testing using the Holm-Bonferroni correction. The change mostly happened between W1 and W2 (0.074 – see column 11), that is, during the introduction of the program. Similarly, the probability that someone had a serious health problem but did not visit a doctor was reduced in Valladolid compared to Motul. The number of interviewees who reported health problems but did not visit a doctor because of lack of money decreased by 9.2 percentage points in Valladolid compared to Motul from W1 to W3 (column 9). The average total number of doctor visits increased by 0.270 from W1 to W3 in Valladolid compared to Motul (column 9; a statistically significant difference both before and after the Holm-Bonferroni correction).

[TABLE IV.1]

Compared to Motul, the self-reported measure on running out of food decreased in Valladolid from W1 to W2. Similarly, the frequency with which respondents reported being hungry because they could not afford food improved in Valladolid compared to Motul from W1 to W3 (on the 1 to 4 scale; column 9). The monthly pension program also had greater effects than the bimonthly program on how often a household member did not eat for a day, and how often respondents received food from charity: the sign of the DID estimates in column 9 are positive for all the food consumption variables.

The improvement in the food consumption variables (as well as most of the health consumption variables[10]) in Valladolid compared to Motul mainly gets realized between W1 and W2, as can be seen by comparing columns 9 and 11.

[10] The only variable where this is not the case is that for "had a serious health problem but no doctor visits because of lack of money". This variable is likely to show delayed effects for two reasons: most people may not have a serious problem in any given six-month period, and health may continue to deteriorate in households with lower food consumption.

V.B. Durable and Discretionary Good Expenditures

Though both programs may increase consumption of durable and discretionary goods by increasing total income, the model with savings constraints or hyperbolic discounting predicts the bimonthly program will have a larger effect. The surveys contained questions on ownership of durable goods such as telephone, cell-phone, and refrigerator, among others. We also created a "no-equipment" variable to indicate households not owning any of the listed durables.

Table IV.2 shows a statistically significant increase in the durable goods index for the bimonthly program compared to the monthly program (-.131, column 9). The difference arose after W2 (column 13), which is consistent with the introduction of the bimonthly program. The W2-W1 DID coefficient is close to zero, suggesting little to no impact on durable-goods ownership for the monthly program.

For some individual goods, we observe a statistically significant increase (after correcting for multiple hypotheses testing) from W1 to W3 in Motul compared to Valladolid. In particular, we observe an increase in Motul in the percentage of older persons owning a cell phone from 14 percent to 24 percent, while the ownership rate decreased in Valladolid from 18 percent to 14.5 percent. The ownership of bicycles decreased in Valladolid from 21 percent to 14 percent, while it stayed flat in Motul.[11] Neither of the programs appears to have had a significant effect on the number of livestock owned.

We also observe a statistically significant increase in the discretionary goods index for the bimonthly program and an insignificant decline in the monthly program. The reported frequency with which pensioners eat non-cereal food items increased in both towns, but increased more in Motul. The differences in effects between the two towns are often insignificant. Compared to *tortilla*

[11] Ownership of durable goods declined in Valladolid over the study period while it remained constant or grew in Motul. Analysis at the individual level shows that, in both towns, the mean ownership rates result both from some older adults acquiring durable goods and some losing them. In Valladolid, few older adults became bicycle and cellphone owners; in Motul, some became owners, offsetting those who lost ownership of these goods.

and other cereals, the consumption of other food-types could be considered consumption of discretionary goods. The DID coefficients in Column 9 of Table IV.2 are negative (indicating a larger increase in Motul) for the consumption of non-cereal food-items (meat, eggs, dairy, and fruit). Valladolid did not see an increase in consumption of these goods from W1 to W2 compared to Motul (coefficients in Column 11 are not statistically significant), whereas Motul saw an increase compared to Valladolid from W2 to W3 and from W1 to W3.

V.C. Work and Private Transfers

We show that both programs affected the prevalence of work by roughly the same amount, but transfers (both to and from pensioners) increased more in the bimonthly program.

V.C.I. Work

We found a decrease in work for pay by the elderly in both towns. As Table IV.3 shows, between W1 and W3 the proportion of elderly working decreased by 52 percent in Valladolid and 43 percent in Motul. The difference in these decreases is not statistically significant, suggesting a similar reduction in work for pay in both programs. The decrease in each town followed the introduction of each program, with work decreasing in Valladolid compared to Motul between W1 and W2 (column 11) and in Motul compared to Valladolid between W2 and W3 (column 13). Consistent with these results, Juarez and Pfutze (2015) found that the federal program *70 y Más* with bimonthly disbursements significantly reduced the labor force participation predominantly for elderly men. Similarly, Kassouf and Rodrigues de Oliveira (2012) found a Brazilian noncontributory pension program with monthly disbursements reduced the probability of work for older beneficiaries.

V.C.II. Private Transfers to and from Family and Friends

One may expect that the pension may crowd-out net-transfers from family members and friends. Such effects have been documented by, among others, Jensen (2004) for South Africa and Juarez (2009) for Mexico City. We may also expect some differences in the effects of each program. If

consumption is smoother with the monthly pension program, it could reduce or eliminate the need for transfers to and from family, social networks, or charities. The inability to smooth consumption under a bimonthly or lower-frequency pension program could result in Motul pension recipients ending the period short of money and in need of assistance from family, friends, or charity. The receipt of a large sum of money at the beginning of the two-month period could also increase transfers from the recipient to family and friends, because it may be more difficult to deny sharing the payment (Dupas and Robinson 2013). If the bimonthly pension is partly transferred to others at the beginning of the period, then later in the period the elderly may require a transfer to cover basic needs. We may therefore expect the monthly pension program to eliminate or reduce transfers to the older population compared to the bimonthly program.

Table IV.3 does indicate a higher reduction in transfers to the elderly in the monthly than in the bimonthly program. We find the monthly pension program reduces both the percentage of the older adults receiving money from others and the total amount of money they receive. From W1 to W3, the percentage of older adults in Valladolid receiving money from others decreased 8.0 percentage points, from 31 per cent to 24 percent; in Motul, it decreased only 3 percentage points, from 22 to 19 percent. Compared to Motul, the reduction between W1 and W3 in the number of recipients who received funds in Valladolid was 4.9 percent. The reduction in Valladolid mainly occurred between W1 and W2 (consistent with the introduction of the program). Furthermore, transfers to the elderly in Motul were more likely to occur towards the end of the bimonthly period. Respondents interviewed toward the end of the payment cycle were more likely to have recently received in-kind transfers than those who were interviewed earlier in the cycle. (Table E in the online appendix).

Similar patterns are evident in transfers *from* the elderly. In the Valladolid monthly program, there is a statistically significant decrease in such transfers; in the Motul bimonthly program, the decrease is small and not statistically significant. Between W1 and W3, the number of elderly who gave out money decreased less in Motul compared to Valladolid. These results suggest the elderly in the bimonthly program are more likely to give money at the beginning of the bimonthly payment

period but to need money near the end of the period. The average amounts given are very modest, however, so these are small effects on average.

V.D. Subjective Wellbeing and Satisfaction with Relationships and Income

In the case of perfect smoothing under the LCH, the frequency of payment is irrelevant. With savings constraints or hyperbolic discounting, the theoretical model presented here cannot unambiguously say which of the two frequencies of payments is better for enhancing welfare. The higher frequency of payments induces more smoothing, but some recipients may benefit more from the low frequency program because it allows them to circumvent savings constraints to purchase durable goods.

Empirically, however, we can test how the different programs affect subjective measures of satisfaction. Table IV.4 shows that between W1 and W3 satisfaction with income changed in both towns by about the same amount (from 3.46 to 3.72 in Valladolid, and from 3.44 to 3.73 in Motul, on a five-point scale where 1 is very dissatisfied and 5 is very satisfied). Satisfaction with income improved (0.092) in Valladolid compared to Motul from W1 to W2, and in Motul compared to Valladolid from W2 to W3 (0.091), consistent with the timing of the introduction of each program.

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 monthly pension might avoid. In fact, one of the often-cited obstacles for savings is the pressure by family members to access liquid funds (Dupas and Robinson 2013; Schaner 2017). Given this, and the transfers observed above, it is possible that the lower frequency of payment in the bimonthly program has detrimental effects on the relationship of the pensioner with family members and other social contacts.

We find recipients' satisfaction with their relationships with family members and social contacts improved less in the Motul bimonthly program than in the Valladolid monthly program. Reported abuse fell in Valladolid compared to Motul. Given that Motul started receiving the pension at the

end of W2, it is particularly remarkable that between W2 and W3 the changes in Valladolid were more favorable than in Motul. Our findings are consistent with the hypothesis that holding sums of disposable income, especially large sums, creates stress in relationships, possibly counteracting an overall positive impact on relationships that having more money can create.[12]

V.E. Heterogeneous Effects

We investigate whether the effects we find are concentrated in certain subgroups, including women and those with particularly low income at baseline. Table V shows the W3-W1 DID analyses conducted separately for women and men as well as for recipients whose income is below or above the official poverty line. For tractability, we present only the results using the indices.

We find that the difference between the programs' impact on food consumption and work for pay is lower for women. On the other hand, the differential effect between the monthly and bimonthly programs on transfers to the elderly is larger for women.

Splitting the sample according to whether a household is above or below the poverty line at baseline, we find that the differential impact of the programs is significantly stronger in reducing transfers both to and from older adults for those below the poverty line. For transfers to older adults, this is not surprising given that the poorest ones were the most likely to receive transfers in the first place (and so there is more potential for an impact).

VI. Robustness of Difference in Difference Estimates

We conducted a series of robustness tests using parametric DID and nonparametric DID methods with propensity score matching to estimate the intention-to-treat effect (ITT). The first robustness test consists of conducting the DID-in-means analysis of section IV in a regression framework where

[12] Although on average satisfaction with relationship with family members improves in both Motul and Valladolid, there were significant proportions for whom satisfaction worsened. In Valladolid, 14 percent of individuals reported a lower level of satisfaction with family members in W3 than in W1, while in Motul 21 percent did.

we control for individual and household characteristics. A second robustness check uses propensity-score matching to correct nonparametrically for differences in baseline characteristics between Valladolid and Motul (Heckman, Ichimura, and Todd 1998). Consider the following equation:

$$(11) \qquad Y_{it} = \alpha_0 + \upsilon_t + \alpha_1 T + \alpha_2 \left(T * B\right) + \delta X_{it} + \varepsilon_{it} \text{ , } t=1, 3$$

where Y_{it} is the outcome of interest for observation i in wave t; υ_t is a time effect, which is equal to zero for W1. The dummy variable T equals 1 when a town is treated, and so for both towns T=1 at W3 and T=0 at W1. The indicator variable B equals 1 for the bimonthly town (Motul) and zero for the monthly town (Valladolid). X_{it} is a vector of individual control variables. The parameter α_2 measures the difference in the treatment effect between the programs from W1 to W3. This coefficient is the regression analog of the differences-in-differences in means discussed in the previous section. Since here we are comparing only waves 1 and 3, the parameters υ_3 and α_1 are not separately identified, but we retain this notation for comparability with later discussions**.**

The propensity score includes the same control variables as in regression equation (11). We impose common support across groups and use Kernel matching. We obtain standard errors with the bootstrap method with 1,000 replications. Online Appendix Table F compares the DID estimates between W1 and W3 with the ITT regressions and propensity-score matching results. Column 1 in these tables reproduces the DID in means from Tables IV.1-IV4.4; column 2 presents the regressions; and column 3 presents propensity score matching results. Overall, the results are very similar across the three methods in terms of sign, magnitude, and statistical significance.

We conducted similar analyses of the changes between W1 and W2, and between W2 and W3. These results are shown in columns 4 to 6 for W1 to W2 and in columns 7 to 9 for W2 to W3. The results including the regression analysis with control variables and the propensity score are again very similar to the DID of the means. As a check, we conducted an analysis that excludes Motul

respondents whose W2 survey happened after the introduction of *70 y Más (*the bimonthly program), and found qualitatively similar results (available from the authors upon request).

VII. Interpreting the Estimates under Alternative Sets of Assumptions

Although we argue that the differences in the frequency of payment are responsible for the different impacts of the programs, the programs differ in other respects as well. In particular, the bimonthly program was introduced later and pays slightly less per month (the monthly equivalent of the bimonthly program payment was MX$500, while the monthly program paid MX$550). Below, we discuss the extent to which these differences may affect our interpretation of the results.

VII.A. Program Duration

We start with an informal discussion and then turn to a formal analysis. First, note that the analysis of W1 to W2 depends only on the standard DID assumptions to capture the short-term impacts of the monthly program. Second, as long as the effects take less than one year to be fully realized, our W1 to W3 comparisons accurately capture the differential effects of the two programs. In addition, if the effects take no more than six months to fully realize, then the W2 to W3 captures the effects of the bimonthly program. On the other hand, if program effects take more than six months to realize, then the W2 to W3 comparison may not accurately identify the effect of the bimonthly program (as the "control" is affected by the changes taking place from the introduction of the monthly program). Further, if effects take more than a year to fully appear, then the W1 to W3 DID presents a biased comparison of the two programs, as the bimonthly program effect is not fully realized by W3.

Nevertheless, even if program effects are not fully realized within a year, we can still make important inferences. 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. that the additional effect in the second year is not higher than that in the first year), we can bound the magnitude of the effects. For instance, whenever we observe a larger W3-W1 increase in Motul than in Valladolid, then the

bimonthly program effect is decidedly larger (since with only one year, its effect was larger than the one and a half years' effect of the monthly program). This is relevant for instance for the durable good results: the fact that the effect is larger in Motul even though the program was in place for only one year (versus one and a half of the comparison program) implies that the effect could be even larger over a longer time period.

Similarly, assuming that the rate of change in the effects of the programs does not increase over time, then 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, we can be certain the effect of the monthly program was larger than of the bimonthly program. Specifically, we assume an effect from month 6 to 18 of the monthly program that was larger than that from month 0 to 12 of the bimonthly program was not a result of effect sizes increasing over time. This is relevant to our analyses of purchases of necessities.

Turning to a formal analysis, 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*).

$$Y_{it}^{m} = \alpha_0 + \upsilon_t + \gamma_{mt} T_{mt} + \varepsilon_{it}^{m},\ t = 1, 2, 2', 3 \tag{12}$$

$$Y_{it}^{b} = \delta_0 + \upsilon_t + \gamma_{bt} T_{bt} + \varepsilon_{it}^{b},\ t = 1, 2, 2', 3 \tag{13}$$

The notation $\mathrm{t} = 1,2,2',3$ 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 υ_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 that their conditional mean is zero. We have omitted individual controls for simplicity of exposition, but these do not affect the basic argument. Notice that equations (12) and (13) are generalizations of equation (11), which only compares W1 and W3. This can be seen as follows. Define

$$Y_{it} \equiv BY_{it}^{b} + (1-B)Y_{it}^{m} \tag{14}$$

$$\varepsilon_{it} \equiv B\varepsilon_{it}^{b} + (1-B)\varepsilon_{it}^{m}$$

Note that $T_{m1} = T_{b1} = 0$ and $T_{m3} = T_{b3} = 1$, so we can replace these treatment variables by one treatment variable *T* equal to zero at W1 and equal to one at W3. Thus (12) and (13) imply:

$$Y_{it} = B\delta_0 + (1-B)\alpha_0 + \upsilon_1 + (B\gamma_{b3} + (1-B)\gamma_{m3})\mathrm{T} + \varepsilon_{it} \tag{15}$$

$$= \alpha_0 + B(\delta_0 - \alpha_0) + \upsilon_1 + \gamma_{m3}\mathrm{T} + (\gamma_{b3} - \gamma_{m3})(\mathrm{T} * B) + \varepsilon_{it}$$

This is equivalent to (11) with $\alpha_1 = \gamma_{m3}$ and $\alpha_2 = \gamma_{b3} - \gamma_{m3}$; the term $B(\delta_0 - \alpha_0)$ would be absorbed in δX_{it} in (11) provided that that X_{it} contains a dummy variable to indicate the bimonthly town. We define:

$$\overline{Y_t^m} \equiv \mathrm{E}[Y_{it}^{m}],\ \overline{Y_t^b} \equiv \mathrm{E}\left[Y_{it}^{b}\right],\ \Delta\overline{Y_t} = \overline{Y_t^m} - \overline{Y_t^b},\ t = 1,2,2',3 \tag{16}$$

So that,

$$\Delta\overline{Y_t} = \alpha_0 - \delta_0 + \gamma_{mt}T_{mt} - \gamma_{bt}T_{bt},\ t = 1,2,2',3 \tag{17}$$

RESULT 1. The 6-month effect of the monthly program, W2-W1, is identified under standard DID assumptions (no additional assumptions needed).

Derivation of Result 1:

For $t = 1$ we have $\Delta\overline{Y}_1 = \alpha_0 - \delta_0$. That implies that the difference between the monthly and bimonthly groups at W1 identifies $\alpha_0 - \delta_0$. For $t = 2$ we have $\Delta\overline{Y}_2 = \alpha_0 - \delta_0 + \gamma_{m2}$. Then, $\Delta\overline{Y}_2 -$

$\Delta\overline{Y}_1 = \gamma_{m2}$, which is the treatment effect of the monthly program six months after the pension program implementation. This is the population equivalent of the DID 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 DID analysis identifies the differential effects of the monthly and bimonthly programs.

Derivation of Result 2:

For $t = 3$ we have $\Delta\overline{Y}_3 = \alpha_0 - \delta_0 + \gamma_{m3} - \gamma_{b3}$. Thus, we identify $\gamma_{m3} - \gamma_{b3}$ by $\gamma_{m3} - \gamma_{b3} = \Delta\overline{Y}_3 - \Delta\overline{Y}_1$. 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 one year to fully realize. In that case we have:

$$\gamma_{m2'} - \gamma_{b3} = \gamma_{m3} - \gamma_{b3} = \Delta\overline{Y}_3 - \Delta\overline{Y}_1 \tag{18}$$

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

RESULT 3. When the effects of the monthly and bimonthly programs take less than six months to be fully realized, 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,

$$(19) \qquad \Delta\overline{Y_3} - \Delta\overline{Y_2} = \gamma_{m3} - \gamma_{b3} - \gamma_{m2} = -\gamma_{b3} = -\gamma_{b2'}$$

We would identify the effects of the bimonthly program by the DID 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 DID 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 the monthly program group, and the difference in that outcome between the monthly and bimonthly program groups DID does 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

$$(20) \qquad 0 \leq \gamma_{m2} \leq \gamma_{m2'} \leq \gamma_{m3} \text{ and } 0 \leq \gamma_{b2'} \leq \gamma_{b3}$$

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

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

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:

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

Since $\gamma_{m2'} \geq \gamma_{m3} - \gamma_{m2}$, equation (22) implies:

RESULT 5. $\gamma_{m2'} \geq \gamma_{m3} - \gamma_{m2} > \gamma_{b3}$.

It is straightforward to verify that under these assumptions our interpretation of the differences between the two programs remains valid, despite the difference in treatment duration. In what follows, we discuss which of the above results are invoked to sustain our main findings.

Necessities (Healthcare and Food Consumption). Under the weakest assumptions, we can conclude that the monthly program increased necessities consumption in the first 6 months (Result 1). Since, for several outcomes, the impact of the monthly program increased between W2 and W3, so that the W3-W1 coefficient (column 9 in Table IV.1) is larger for W2-W1 (column 11), we can invoke Result 5 to conclude, under the assumption of weak monotonicity of program impact (A3), the 1-year effect of the monthly program is larger than that of the bimonthly program. This result applies to healthcare outcomes (the index increased in Valladolid compared to Motul between W1 and W2, and further increased from W2 to W3) and to food consumption (the index increased in Valladolid compared to Motul between W1 and W2, and stayed even between W2 and W3).

If we wanted to establish the impact of the bimonthly program (beyond stating its impact was smaller than that of the monthly program), we would need to use Result 3 by making the stronger assumption that the effect of the monthly program was fully realized within 6 months (A2). This

may not be the case for some of these variables, as suggested by the facts that the number of doctor visits in Valladolid continued increasing between W2 and W3 and that the percentage of respondents who said sometimes they do not have enough to eat continued to decrease. Thus, we do not venture into establishing the impact of the bimonthly program on healthcare and food consumption items beyond stating that its effect is lower than that of the monthly program

Work for Pay. The 6-month impact of the monthly program (*Result 1*) points to a reduction in the number of elderly who work for pay (5.4 percentage points or approximately 31%). Assuming the program effects are fully realized in less than a year (A1), Result 2 allows us to interpret the coefficient of column 9 in Table IV.1 as the difference in the effect between the programs, which was statistically indistinguishable from zero.

Durable and Discretionary Goods. Assuming that the increase in ownership of discretionary and durable goods due to the pension programs is marginally decreasing (the effect may increase over time, but at a non-increasing rate), the effect of the bimonthly program is larger than that of the monthly program, since the W3-W1 comparison favors Motul despite the shorter time it had to affect these outcomes (the coefficients for the indices for durable and discretionary goods in column 9 of Table IV.2 are negative and statistically significant). Under Result 1, we can conclude too that the monthly program had no effect on these outcomes, or that the effect was too small to be detected statistically. Under Result 3, we can estimate statistically significant increases in durable and discretionary good consumption as a result of the bimonthly program.

Transfers. Result 1 allows us to interpret the W2-W1 result as implying that the monthly program crowded out monetary and in-kind transfers to the elderly (see column 11 of Table IV.3). These effects are unchanged at W3. We therefore can use Result 5 to conclude that the monthly program created a larger crowd-out than the bimonthly program.

Satisfaction. The effect on satisfaction with income was not statistically different across programs between W3 and W1. We can conclude that, if the effects take no more than a year to be realized (A1), both programs increase satisfaction with income by comparable amounts (Result 2).

On the other hand, satisfaction with relationships of family members and social contacts increased more in Valladolid than in Motul. The same pattern emerged regarding the feeling of being abused and the fear of money being taken away. Assuming that effects are realized within a year (A2), we can use Result 3 to interpret this as evidence that the monthly program improved these outcomes compared to the bimonthly program. However, it appears that the effects on satisfaction (except for satisfaction with income) are realized slowly. For example, Valladolid pensioners felt a reduction in abuse both from W1 to W2 and from W2 to W3. Thus A1 may not hold, in which case the W3-W2 result would not identify the bimonthly program effect.

VII.B. Payment Amount

The amount of the pension is slightly larger in Valladolid than in Motul (over a two-month period, MX$1,100 versus MX$1,000). One could propose the alternative interpretation that this difference, rather than the frequency of payment, drives the different impacts of the programs. Nevertheless, we argue this cannot explain most of our findings.

First, we note that this difference would strengthen, rather than weaken, the conclusions that the bimonthly program has greater effects on durable-goods ownership and discretionary-goods consumption than the monthly program has. Second, we note that the magnitude of the difference is unlikely to explain some of the other results. For instance, the differential impact we find on the reduction of the total transfers received per month was MX$150, about three times, or two standard errors above, the monthly difference of MX$50 in the pension amount. Third, we note that under Result 3 above (which assumes that effects are realized in six months), we get estimates for the bimonthly program for healthcare that are close to zero, while those of the monthly program are positive. The conclusion that one program had effects while the other one did not is difficult to rationalize by a small difference in the payment amount. We abstain from interpreting small differences in the program effects where the introduction of both programs affected the outcomes (for instance, in the “work-for-pay” variable or on “satisfaction with household income”).

VIII. Potential Sources of Bias

We consider the following potential sources of bias of the DID estimates: attrition, differential trends and macro shocks in Valladolid and Motul, treatment announcement effects, differential implementation of the programs, and changes in living arrangements. Online Appendix B shows that there were no statistically significant differences in attrition across the two towns. Although neither of the programs achieved the intended goal of covering all of the elderly population, both achieved a high takeup, 89% and 93%, after full implementation. Appendix B also describes the results of the field work and explains why it is unlikely that announcement or spillover effects greatly affected the measured impacts of the programs.

Perhaps the most critical issue is whether unobserved factors changed between Valladolid and Motul during the course of the experiment, i.e. whether the assumption of common trends would be violated. This may be of particular concern since the randomization is done across only two-units, we cannot estimate standard errors that are clustered at the level of the randomization. Online Appendix B provides a brief formal discussion of the issue. In Appendix B we also discuss various possible deviations of the common trends assumption (a more extensive discussion is provided by Kapteyn 2010). We found similar trends between monthly and bimonthly municipalities in the Gini index from 1990-2010 (CONEVAL), the marginalization index from 1990-2010 (CONAPO), and the human development index (PNUD 2008; PNUD 2014) from 2000 to 2010 (see online Appendix Figure C). Economic developments in the two towns followed a similar path and no natural disasters have recently affected either.

A major advantage of our design is that everyone in a town receives the same treatment, which makes it likely that the observed effects include spillovers. Also, Valladolid is 95 miles away from Motul. In view of the distance between the two towns, it is unlikely that the spillovers affected the other town. This is important, as any real-world non-contributory pension plan is likely to create spillovers, so it is essential to include these in the measurement of the full effects of a program.

Finally, we note that observed patterns cover a broad domain of outcomes and are consistent with a simple model of behavior. It is hard to think of alternative explanations that would generate the variety of observed outcomes exactly at the time of the interventions. It would be necessary to experience a peculiar combination of shocks that drive the consumption of necessities in one direction and discretionary goods in the other direction.

Appendix B formalizes this intuition, and conducts an exercise with Census data to estimate how often we could expect to find similar results by chance. The exercise analyzes changes in a necessity and a durable good variable in 106 geographic units in Yucatan between 2010 and 2015. It estimates placebo Differences-in-Differences across matched municipalities that are similar at baseline. The exercise shows that, though it is relatively common to observe shocks that change consumption in "placebo treated" towns compared to "placebo controls", it is much less common to observe a town that, compared to the placebo control, increases consumption of one type of good (i.e. the necessity) but decreases the consumption of the other type (i.e. the durable good). The exercise shows that such patterns occur in less than 2% of the cases. Note moreover that these patterns occur over a five-year period. It would be extremely unlikely that such shocks would have happened exactly at the time of the introduction of the programs that we analyze here, and thus it is unlikely that our results arise from having too few randomization units.

IX. CONCLUSIONS

The results of this study confirm, in a developing country setting, the behavioral finding that individuals have trouble smoothing consumption across payments. When the payment period is long, expenditures on food and beverages are significantly higher earlier in the period.

In addition, we demonstrate that the frequency with which individuals receive their income matters not only for the timing of consumption, but also for its composition. We show in a simple model that the same assumptions that would predict a lack of consumption smoothing would also imply that changing the payment frequency would affect the type of consumption. The introduction

of either credit/saving constraints or hyperbolic discounting results in the prediction that a lower frequency of payments would be associated with lower consumption of necessities and higher consumption of discretionary and durable goods.

These predictions are borne out by the data. Both programs lead to increased expenditures on basic needs such as food consumption and healthcare. However, the monthly program increases expenditures on basic needs more than the bimonthly program, while the bimonthly program increases the ownership of durable goods and discretionary expenditures. Another consequence of the lower frequency of payments is that the bimonthly program is less successful in helping beneficiaries avoid situations where they need charity or transfers from family and friends to pay for necessities. The monthly program reduces the total amount of family transfers.

Receipt of the bimonthly pension leads to smaller improvements in satisfaction with family and social relationships than are evident among recipients of the monthly pension. This could be because, for bimonthly pensions, the positive effect of higher income is partially counteracted by increased social pressure to share some of the pension benefit, right after 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 recipients feel verbally or physically abused. Our results make clear that, under imperfect consumption smoothing, the frequency of benefit disbursements is an important design feature for social programs.

Author Affiliations
Emma Aguila, Sol Price School of Public Policy, University of Southern California, 650 Childs Way, Los Angeles, CA 90089; (213) 821-0702; Email: eaguilav@usc.edu. Arie Kapteyn, Center for Economic and Social Research, University of Southern California, 635 Downey Way, Los Angeles, CA90089-3331; Tel: (213) 821-1795; Email: kapteyn@usc.edu. Francisco Perez-Arce, Center for Economic and Social Research, University of Southern California, 1909 K St NW, Suite 530, Washington DC, 20006, Email: perezarc@usc.edu.

X. REFERENCES

Aguila, Emma, Arie Kapteyn, Rosalba Robles, et al. A Noncontributory Pension Program for Older Persons in Yucatan, Mexico: Implementing and Designing the Evaluation of the Program in Valladolid. RAND Corporation, 2014, http://www.rand.org/pubs/technical_reports/TR1288z1.html.

Aguila, Emma, Arie Kapteyn, and Francisco Perez-Arce. "Consumption Smoothing and Frequency of Benefit Payments of Cash Transfer Programs." American Economic Review, vol. 107, no. 5, May 2017, pp. 430–35. CrossRef, doi:10.1257/aer.p20171147.

Aguila, Emma, Arie Kapteyn, and James P. Smith. "Effects of Income Supplementation on Health of the Poor Elderly: The Case of Mexico." Proceedings of the National Academy of Sciences, vol. 112, no. 1, June 2015, pp. 70–75. www.pnas.org, doi:10.1073/pnas.1414453112.

Ainslie, George. "Specious Reward: A Behavioral Theory of Impulsiveness and Impulse Control." Psychological Bulletin, vol. 82, no. 4, 1975, pp. 463–96. APA PsycNET, doi:10.1037/h0076860.

Banerjee, Abhijit, et al. "The Miracle of Microfinance? Evidence from a Randomized Evaluation." American Economic Journal: Applied Economics, vol. 7, no. 1, 2015, pp. 22–53. AEA Web, doi:10.1257/app.20130533.

Banerjee, Abhijit V., and Esther Duflo. "The Economic Lives of the Poor." Journal of Economic Perspectives, vol. 21, no. 1, 2007, pp. 141–68. AEA Web, doi:10.1257/jep.21.1.141.

Consejo Nacional de Evaluación de la Política de Desarrollo Social (CONEVAL). Lineas de Bienestar Mexico. 2015, http://www.coneval.org.mx/Medicion/MP/Paginas/Pobreza_2014.aspx.

Duflo, Esther. "Richard T. Ely Lecture: The Economist as Plumber." American Economic Review, vol. 107, no.5, 2017, pp. 1-26.

Dupas, Pascaline, and Jonathan Robinson. "Why Don't the Poor Save More? Evidence from Health Savings Experiments." American Economic Review, vol. 103, no. 4, 2013, pp. 1138–71. AEA Web, doi:10.1257/aer.103.4.1138.

Hall, Robert E. "Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and Evidence." Journal of Political Economy, vol. 86, no. 6, 1978, pp. 971–87.

Haushofer, Johannes, and Jeremy Shapiro. "The Short-Term Impact of Unconditional Cash Transfers to the Poor: Experimental Evidence from Kenya." The Quarterly Journal of Economics, vol. 131, no. 4, Nov. 2016, pp. 1973–2042. CrossRef, doi:10.1093/qje/qjw025.

Heckman, J. J., et al. "Matching As An Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme." The Review of Economic Studies, vol. 64, no. 4, Oct. 1997, pp. 605–54. CrossRef, doi:10.2307/2971733.

Holm, Sture. "A Simple Sequentially Rejective Multiple Test Procedure." Scandinavian Journal of Statistics, vol. 6, no. 2, Jan. 1979, pp. 65–70.

Jensen, Robert T. “Do Private Transfers ‘Displace’ the Benefits of Public Transfers? Evidence from South Africa.” Journal of Public Economics, vol. 88, no. 1–2, Jan. 2004, pp. 89–112. ScienceDirect, doi:10.1016/S0047-2727(02)00085-3.

Juarez, Laura. “Crowding out of Private Support to the Elderly: Evidence from a Demogrant in Mexico.” Journal of Public Economics, vol. 93, no. 3–4, 2009, pp. 454–63.

Juarez, Laura, and Tobias Pfutze. “The Effects of a Noncontributory Pension Program on Labor Force Participation: The Case of 70 y Más in Mexico.” Economic Development and Cultural Change, vol. 63, no. 4, July 2015, pp. 685–713. CrossRef, doi:10.1086/681668.

Kassouf, Ana Lucia, and Pedro Rodrigues de Oliveira. “Impact Evaluation of the Brazilian Non-Contributory Pension Program Beneffcio De Prestaaao Continuada (BPC) on Family Welfare.” SSRN Electronic Journal, 2012. CrossRef, doi:10.2139/ssrn.2374388.

Laibson, David. “Golden Eggs and Hyperbolic Discounting.” The Quarterly Journal of Economics, vol. 112, no. 2, Jan. 1997, pp. 443–78. qje.oxfordjournals.org, doi:10.1162/003355397555253.

Mastrobuoni, Giovanni, and Matthew Weinberg. “Heterogeneity in Intra-Monthly Consumption Patterns, Self-Control, and Savings at Retirement.” American Economic Journal: Economic Policy, vol. 1, no. 2, 2009, pp. 163–89. AEA Web, doi:10.1257/pol.1.2.163.

PNUD. “Índice de Desarrollo Humano Municipal En México 2000-2005.” México: Producción Creativa, 2008, http://www.cinu.org.mx/prensa/especiales/2008/idh/IDH_Municipal_en_Mexico_2000-2005%5B1%5D.pdf.

---. Índice de Desarrollo Humano Municipal En México: Nueva Metodología. Mar. 2014, p. 104.

Schaner, Simone. "The Cost of Convenience? Transaction Costs, Bargaining Power, and Savings Account Use in Kenya." Journal of Human Resources 52, no. 4, 2017.pp. 919-945.

Shapiro, Jesse M. “Is There a Daily Discount Rate? Evidence from the Food Stamp Nutrition Cycle.” Journal of Public Economics, vol. 89, no. 2–3, Feb. 2005, pp. 303–25. ScienceDirect, doi:10.1016/j.jpubeco.2004.05.003.

Stephens, Melvin. “Paycheque Receipt and the Timing of Consumption*.” The Economic Journal, vol. 116, no. 513, July 2006, pp. 680–701. Wiley Online Library, doi:10.1111/j.1468-0297.2006.01106.x.

Stephens, Melvin, Jr. “‘3rd of Tha Month’: Do Social Security Recipients Smooth Consumption Between Checks?” American Economic Review, vol. 93, no. 1, 2003, pp. 406–22. AEA Web, doi:10.1257/000282803321455386.

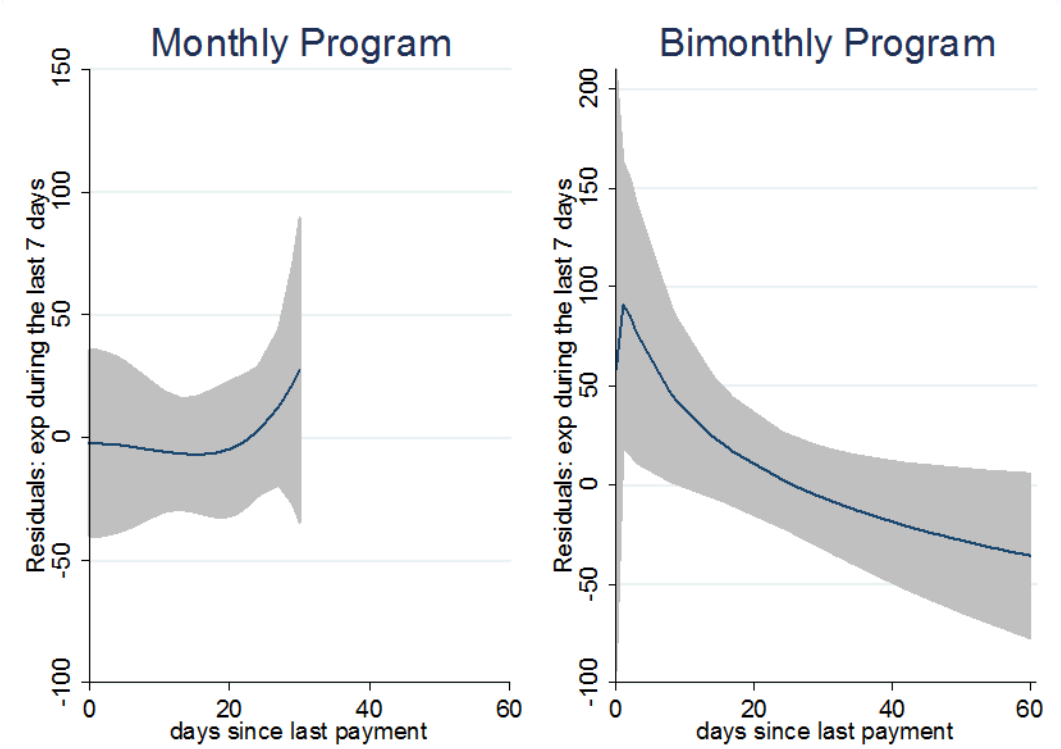

FIGURE I. HOUSEHOLD EXPENDITURES ON FOOD AND BEVERAGES (REGRESSION RESIDUALS)

Notes: Results show expenditures as a function of the number of days elapsed since last disbursement. Polynomial approximations of the relationship between number of days elapsed and the residuals of a regression of expenditures on demographic variables including age, gender, language spoken, and household size.

TABLE I - DESCRIPTIVE STATISTICS BASELINE

	Monthly Program (Valladolid)	**Bimonthly Program** (Motul)	**Difference**
Mean age	77.78	77.34	-0.44
	(0.18)	(0.20)	
Male (%)	46.29	50.92	4.63**
Marital status (%)			
Single/Divorced/Separated	9.08	8.26	-0.82
Couple	52.65	53.79	1.15
Widowed	38.28	37.90	-0.37
Mean years of education	2.21	2.25	0.03
	(0.07)	(0.07)	
Living alone (%)	12.71	12.73	0.02
Mean number of household residents	3.43	3.50	0.07
	(0.06)	(0.07)	
Work for pay (%)	16.65	15.29	-1.37
Monthly household income (MXN$)	1350.37	1420.05	69.69
	(77.07)	(52.50)	
No. Observations	1322	1029	

Notes: Standard deviation in parentheses. * 10 percent, ** 5 percent, and *** 1 percent significance level.

TABLE II- CYCLICALITY OF EXPENDITURES IN MONTHLY AND BIMONTHLY PROGRAMS

TOTAL HOUSEHOLD FOOD AND BEVERAGES EXPENDITURES DURING PREVIOUS WEEK

Variables	**Monthly Program** (Valladolid)				**Bimonthly Program** (Motul)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Number of days since last payment (median recall day)	0.771	0.848	-1.499	-1.261	-4.023***	-3.079***	-3.655***	-2.821***
	(1.022)	(0.976)	(2.222)	(2.086)	(1.252)	(1.188)	(0.930)	(0.816)
Background characteristics	NO	YES	NO	YES	NO	YES	NO	YES
Lagged expenditures	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	2,069	2,068	1,689	1,688	1,166	1,165	1,050	1,050
R-squared	0.003	0.133	0.005	0.128	0.018	0.136	0.021	0.208

Notes: Dependent variable is weekly expenditures on food and beverages in 2010 Mexican Pesos. Standard errors are clustered at the individual level. Standard errors in parentheses. All models are linear regressions and include survey indicators. Background characteristics are age, age squared, gender, an indicator for couples, years of education, an indicator variable for living alone, and household size. Lagged expenditures are expenditures measured in the previous wave. * 10 percent, ** 5 percent, and *** 1 percent significance level.

TABLE III: SUMMARY OF OUTCOME VARIABLES

Basic needs
Health Care Index
Respondent level
Visited a doctor (last 3mo.), no-yes (0-1)
Number of doctor visits (last 3mo.)
Dealt with serious health problem (last 3mo.), no - yes (0-1)
Food Consumption Index
Household level
How much spent on food at home? (last week)
How often run out of food (last 3mo.), always-never (1-4)
Skips or cuts meals (last 3mo.), always-never (1-4)
Often eats less than should (last 3mo.), always-never (1-4)
Often hungry (last 3mo.), always-never (1-4)
Often does not eat for one day (last 3mo.), always-never (1-4)
Received food from charity (last 3mo.), always-never (1-4)
Respondent level
How often do you eat cereals? never-daily (1-4)
Durable Goods Index (Equipment and Investment)
Household level
Owns refrigerator, no-yes (0-1)
Owns telephone, no-yes (0-1)
Owns a cellphone, no-yes (0-1)
Owns a bicycle, no-yes (0-1)
Owns at least one piece of equipment, no-yes (0-1)
Respondent level
How many chickens do you own?
How many pigs do you own?
How many turkeys do you own?

Discretionary Goods Index

Respondent level

How often do you eat fruit and vegetables? never-daily (1-4)

How often do you eat meat? never-daily (1-4)

How often do you eat eggs? never-daily (1-4)

How often do you eat diary? never-daily (1-4)

Household level

How much spent on beverages at home? (last week)

How much spent on food and beverages outside home? (last week)

Other Income

Respondent level

Work for pay (last mo.), no-yes (0-1)

Transfers to Older Adult Index (private)

Respondent level

Receive money (last mo.), no-yes (0-1)

Total money received (last mo.)

Receive in-kind (last mo.), no-yes (0-1)

Total received in-kind (last mo.)

Out of pocket expenses paid by a relative (last 3mo.), no-yes (0-1)

Transfers from Older Adult Index (private)

Respondent level

Give money (last mo.), no-yes (0-1)

Total money given (last mo.)

Give in-kind (last mo.), no-yes (0-1)

Subjective Wellbeing Index

Respondent level

Income

Satisfied with household income, very dissatisfied – very satisfied (1-5)

Family and Social Relationships

Satisfied with relationships with family members, very dissatisfied – very satisfied (1-5)

Satisfied with relationships with social contacts, very dissatisfied – very satisfied (1-5)

Emotional State

How often do you feel abused? always-never (1-4)

How often do you fear money will be taken by someone else? always-never (1-4)

TABLE IV.1 - 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 Dm-Db					
	W1	W3-W1	W2-W1	W3-W2	W1	W3-W1	W2-W1	W3-W2	(W3-W1)	H	(W2–W1)	H	(W3–W2)	H
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Health Care														
Index	-0.093	0.309	0.275	0.043	0.065	0.024	0.095	-0.094	0.285		0.181		0.137	
(mean 0, s.d. 1)	(0.031)	(0.028)**	(0.025)**	(0.023)*	(0.039)	(0.034)	(0.029)**	(0.030)**	(0.044)**	††	(0.038)**	††	(0.038)**	††
Visited a doctor	0.421	0.111	0.104	0.010	0.468	0.010	0.030	-0.026	0.101		0.074		0.035	
no - yes (0-1)	(0.016)	(0.015)**	(0.013)**	(0.013)	(0.019)	(0.017)	(0.015)*	(0.016)	(0.023)**	††	(0.020)**	††	(0.021)	
No. doctor visits	1.089	0.255	0.201	0.104	1.258	-0.015	-0.085	0.017	0.270		0.286		0.088	
	(0.058)	(0.062)**	(0.050)**	(0.051)	(0.096)	(0.081)	(0.062)	(0.062)	(0.102)**	††	(0.080)**	††	(0.080)	
Dealt with health problem	0.824	0.104	0.092	0.007	0.878	0.012	0.060	-0.053	0.092		0.032		0.060	
no - yes (0-1)	(0.012)	(0.010)**	(0.009)**	(0.008)	(0.013)	(0.012)	(0.010)**	(0.010)**	(0.016)**	††	(0.014)**	††	(0.013)**	††
Food Consumption														
Index	-0.089	0.489	0.264	0.166	0.015	0.373	0.174	0.160	0.116		0.089		0.006	
(mean 0, s.d. 1)	(0.035)	(0.026)**	(0.025)**	(0.019)**	(0.034)	(0.027)**	(0.024)**	(0.020)**	(0.037)**	††	(0.034)**	††	(0.027)	
Food at home	146.626	14.692	7.811	6.069	134.520	7.934	11.041	-5.620	6.757		-3.230		11.688	
(MXN$)	(5.100)	(4.251)**	(3.594)*	(3.093)	(4.028)	(3.336)*	(3.843)**	(3.953)	(5.404)		(5.261)		(5.019)	
Run out of food	3.496	0.336	0.141	0.170	3.555	0.240	0.065	0.171	0.096		0.076		-0.001	
always-never (1-4)	(0.030)	(0.022)**	(0.023)**	(0.017)**	(0.029)	(0.024)**	(0.022)**	(0.020)**	(0.032)**	††	(0.032)	†	(0.026)	

Skips or cuts meals	3.553	0.313	0.134	0.131	3.553	0.315	0.126	0.174	-0.002		0.009		-0.043			
always-never (1-4)	(0.029)	(0.021)**	(0.022)**	(0.017)**	(0.030)	(0.024)**	(0.023)**	(0.017)**	(0.032)		(0.032)		(0.024)			
Eat less than should	3.595	0.275	0.132	0.112	3.596	0.269	0.122	0.126	0.006		0.009		-0.014			
always-never (1-4)	(0.028)	(0.020)**	(0.021)**	(0.016)**	(0.027)	(0.023)**	(0.019)**	(0.017)**	(0.030)		(0.029)		(0.023)			
Often hungry	3.696	0.244	0.173	0.046	3.777	0.156	0.104	0.048	0.088		0.069		-0.002			
always-never (1-4)	(0.024)	(0.017)**	(0.017)**	(0.011)**	(0.022)	(0.017)**	(0.015)**	(0.011)**	(0.024)**	††	(0.023)**	††	(0.015)			
Not eat for one day	3.808	0.155	0.127	0.011	3.872	0.098	0.057	0.032	0.057		0.070		-0.022			
always-never (1-4)	(0.018)	(0.013)**	(0.012)**	(0.008)	(0.016)	(0.013)**	(0.012)**	(0.009)**	(0.019)**	††	(0.017)**	††	(0.013)			
Food from charity	3.904	0.055	0.049	-0.002	3.955	0.015	-0.024	0.021	0.040		0.073		-0.023			
always-never (1-4)	(0.013)	(0.010)**	(0.010)**	(0.006)	(0.009)	(0.008)	(0.008)**	(0.008)**	(0.013)**	††	(0.012)**	††	(0.010)			
Eat cereal	3.678	0.297	0.095	0.138	3.831	0.099	0.072	0.015	0.198		0.023		0.123			
never-daily (1-4)	(0.035)	(0.026)**	(0.029)**	(0.019)**	(0.031)	(0.026)**	(0.024)**	(0.018)	(0.036)**	††	(0.038)		(0.027)**	††		

Notes: * 10 percent, ** 5 percent, and *** 1 percent significance level. † indicates significance at 10% and †† indicates significance at 5% when using the Holm-Bonferroni correction for multiple hypothesis testing. Standard errors in parentheses.

TABLE IV.2 -DIFFERENTIAL EFFECTS OF THE MONTHLY AND BIMONTHLY PROGRAMS ON DURABLE AND DISCRETIONARY GOODS

Variable	Monthly Program (m) (Valladolid)				Bimonthly Program (b) (Motul)				Diff-in-Diff in means Dm-Db					
	W1	W3-W1	W2-W1	W3-W2	W1	W3-W1	W2-W1	W3-W2	(W3-W1)	H	(W2–W1)	H	(W3–W2)	H
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Durable Goods														
Index	-0.033	-0.122	-0.012	-0.126	0.025	0.009	0.005	0.003	-0.131		-0.017		-0.128	
(mean 0, s.d. 1)	(0.033)	(0.022)**	(0.02)	(0.021)**	(0.039)	(0.027)	(0.024)	(0.022)	(0.035)**	††	(0.031)		(0.031)**	††
Refrigerator	0.635	0.019	0.028	-0.011	0.646	0.011	0.003	0.004	0.009		0.026		-0.015	
no - yes (0-1)	(0.016)	(0.01)	(0.009)**	(0.009)	(0.019)	(0.011)	(0.011)	(0.011)	(0.015)		(0.014)		(0.014)	
Telephone	0.192	-0.005	-0.01	-0.002	0.192	-0.009	-0.018	0.013	0.005		0.008		-0.015	
no - yes (0-1)	(0.013)	(0.007)	(0.006)	(0.006)	(0.015)	(0.008)	(0.008)	(0.007)	(0.011)		(0.01)		(0.009)	
Cellphone	0.18	-0.044	0.01	-0.059	0.139	0.104	0.061	0.032	-0.148		-0.051		-0.09	
no - yes (0-1)	(0.013)	(0.011)**	(0.01)	(0.010)**	(0.013)	(0.013)**	(0.011)**	(0.012)*	(0.017)**	††	(0.015)**	††	(0.016)**	††
Bicycle	0.206	-0.07	-0.027	-0.044	0.337	-0.003	-0.01	-0.004	-0.067		-0.018		-0.04	
no - yes (0-1)	(0.013)	(0.009)**	(0.008)**	(0.008)**	(0.018)	(0.012)	(0.011)	(0.012)	(0.015)**	††	(0.013)		(0.014)**	††
Any equipment	0.699	0.002	0.032	-0.032	0.766	0.023	-0.009	0.028	-0.02		0.041		-0.059	
no - yes (0-1)	(0.015)	(0.011)	(0.009)**	(0.010)**	(0.016)	(0.011)	(0.011)	(0.011)*	(0.016)		(0.015)**	††	(0.015)**	††
No. of chickens	2.939	-0.81	-0.447	-0.27	2.494	-0.489	-0.32	-0.075	-0.321		-0.128		-0.195	
	(0.216)	(0.154)**	(0.125)**	(0.135)	(0.216)	(0.158)**	(0.134)	-(0.112)	(0.221)		(0.183)		(0.175)	
No. of pigs	0.059	-0.031	-0.017	-0.021	0.039	-0.012	0.001	-0.012	-0.018		-0.018		-0.009	
	(0.013)	(0.011)**	(0.01)	(0.012)	(0.011)	(0.012)	(0.008)	(0.009)	(0.016)		(0.013)		(0.015)	
No. of turkeys	0.344	-0.115	-0.002	-0.139	0.676	-0.261	-0.086	-0.13	0.145		0.085		-0.009	

	(0.046)	(0.036)**	(0.044)	(0.048)**	(0.167)	(0.119)	(0.104)	(0.050)*	(0.124)		(0.113)		(0.07)	
Discretionary Goods														
Index	0.045	-0.005	-0.059	0.047	-0.118	0.173	-0.055	0.233	-0.178		-0.003		-0.186	
(mean 0, s.d. 1)	(0.036)	(0.026)	(0.024)**	(0.020)**	(0.032)	(0.025)**	(0.024)*	(0.020)**	(0.036)**	††	(0.034)		(0.028)**	††
Fruit and vegetables	2.885	0.114	0.012	0.073	2.914	0.224	-0.004	0.217	-0.11		0.016		-0.144	
never-daily (1-4)	(0.027)	(0.022)**	(0.021)	(0.019)**	(0.031)	(0.024)**	(0.023)	(0.021)**	(0.033)**	††	(0.031)		(0.028)**	††
Meat	2.772	0.037	-0.014	0.031	2.786	0.134	-0.029	0.164	-0.097		0.015		-0.133	
never-daily (1-4)	(0.023)	(0.02)	(0.017)	(0.016)	(0.023)	(0.019)**	(0.019)	(0.018)**	(0.028)**	††	(0.026)		(0.024)**	††
Eggs	3.099	-0.009	-0.095	0.081	3	0.044	-0.092	0.145	-0.053		-0.003		-0.064	
never-daily (1-4)	(0.024)	(0.02)	(0.019)**	(0.017)**	(0.025)	(0.021)**	(0.021)**	(0.017)**	(0.029)		(0.028)		(0.024)**	††
Dairy	2.612	0.139	0.105	0.05	2.49	0.266	0.055	0.218	-0.127		0.05		-0.168	
never-daily (1-4)	(0.032)	(0.025)**	(0.022)**	(0.024)	(0.037)	(0.031)**	(0.026)	(0.027)**	(0.040)**	††	(0.034)		(0.036)**	††
Beverages at home	32.464	-5.6	-2.855	-1.371	26.777	-6.297	-4.092	-2.676	0.697		1.237		1.305	
(MXN$)	(1.401)	(1.188)**	(1.029)**	(1.018)	(1.426)	(1.193)**	(1.129)**	(0.964)**	(1.683)		(1.528)		(1.402)	
Food/beverages out home	29.551	-18.653	-8.49	-10.053	13.163	-9.052	2.709	-11.036	-9.601		-11.2		0.982	
(MXN$)	(4.118)	(3.154)**	(3.066)**	(2.264)**	(1.473)	(1.118)**	(1.456)	(1.329)**	(3.347)**	††	(3.394)**	††	(2.625)	

Notes: * 10 percent, ** 5 percent, and *** 1 percent significance level. † indicates significance at 10% and †† indicates significance at 5% when using the Holm-Bonferroni correction for multiple hypothesis testing. Standard errors in parentheses.

TABLE IV.3 -DIFFERENTIAL EFFECTS OF THE MONTHLY AND BIMONTHLY PROGRAMS ON INCOME AND PRIVATE TRANSFERS (FROM/TO OLDER ADULT)

Variable	**Monthly Program (m) (Valladolid)**				**Bimonthly Program (b) (Motul)**				**Diff-in-Diff in means Dm-Db**					
	W1	**W3-W1**	**W2-W1**	**W3-W2**	**W1**	**W3-W1**	**W2-W1**	**W3-W2**	**(W3-W1)**	**H**	**(W2–W1)**	**H**	**(W3–W2)**	**H**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**

Other Income														
Work for pay	0.177	-0.092	-0.007	-0.065	0.164	-0.071	0.047	-0.125	-0.021		-0.054		0.060	
no - yes (0-1)	(0.012)	(0.008)***	(0.008)	(0.008)***	(0.014)	(0.010)***	(0.009)***	(0.010)***	(0.013)	NA	(0.011)***	NA	(0.013)***	NA
In-transfers to Older Adult														
Index	0.150	-0.392	-0.228	-0.142	-0.227	-0.093	0.036	-0.106	-0.299		-0.264		-0.037	
(mean 0, s.d. 1)	(0.032)	(0.025)**	(0.024)**	(0.022)**	(0.031)	(0.025)**	(0.026)	(0.025)**	(0.035)**	††	(0.036)**	††	(0.033)	
Received money	0.312	-0.076	-0.065	-0.014	0.218	-0.028	-0.010	-0.005	-0.049		-0.056		-0.009	
no - yes (0-1)	(0.015)	(0.013)**	(0.011)**	(0.011)	(0.016)	(0.013)*	(0.012)	(0.012)	(0.018)**	††	(0.017)**	††	(0.017)	
Amount money	330.518	-189.011	-37.923	-120.987	220.984	-57.655	10.933	-62.849	-131.356		-48.856		-58.138	
(MXN$)	(27.061)	(19.724)**	(21.488)	(18.771)**	(29.297)	(21.888)**	(27.604)	(25.082)*	(29.465)**	††	(34.981)		(31.328)	
Receive in-kind	118.229	-86.255	-36.183	-41.721	49.546	-21.642	3.616	-18.945	-64.613		-39.798		-22.776	
no - yes (0-1)	(12.914)	(9.497)**	(11.443)**	(7.846)**	(8.408)	(6.597)**	(10.075)	(15.609)	(11.564)**	††	(15.246)**	††	(17.470)	
Amount in-kind	118.229	-86.255	-36.183	-41.721	49.546	-21.642	3.616	-18.945	-64.613		-39.798		-22.776	
(MXN$)	(12.914)	(9.497)**	(11.443)**	(7.846)**	(8.408)	(6.597)**	(10.075)	(15.609)	(11.564)**	††	(15.246)**	††	(17.470)	
Relative paid	0.269	-0.124	-0.120	0.005	0.147	-0.031	-0.001	-0.032	-0.094		-0.119		0.037	
oop no - yes (0-1)	(0.014)	(0.011)**	(0.011)**	(0.009)	(0.014)	(0.011)**	(0.012)	(0.011)**	(0.016)**	††	(0.016)**	††	(0.014)*	††
Out-Transfer from Older Adult														
Index	0.028	-0.189	-0.123	-0.091	-0.069	-0.023	-0.013	-0.003	-0.165		-0.111		-0.088	
(mean 0, s.d. 1)	(0.031)	(0.023)**	(0.028)**	(0.019)**	(0.028)	(0.025)	(0.025)	(0.022)	(0.034)**	††	(0.037)**	††	(0.029)**	††
Give money	0.030	-0.023	-0.009	-0.019	0.028	-0.006	-0.007	0.005	-0.017		-0.002		-0.024	
no - yes (0-1)	(0.006)	(0.004)**	(0.005)*	(0.004)**	(0.006)	(0.006)	(0.005)	(0.005)	(0.007)**	††	(0.007)		(0.006)**	††
Amount money	136.445	-106.228	-146.926	15.280	48.727	-32.745	-29.546	7.059	-73.483		-117.380		8.220	

(MXN$)	(41.214)	(31.448)**	(47.350)**	(18.870)	(21.183)	(15.641)	(13.031)*	(7.116)	(35.123)**	††	(49.111)**	††	(20.167)
Give in-kind	0.020	-0.019	-0.011	-0.008	0.006	0.001	0.005	-0.005	-0.020		-0.016		-0.003
no - yes (0-1)	(0.005)	(0.003)**	(0.003)**	(0.003)**	(0.003)	(0.003)	(0.004)	(0.003)	(0.005)**	††	(0.005)**	††	(0.004)

Notes: * 10 percent, ** 5 percent, and *** 1 percent significance level. † indicates significance at 10% and †† indicates significance at 5% when using the Holm-Bonferroni correction for multiple hypothesis testing. Standard errors in parentheses. NA refers to no correction for multiple-hypothesis needed becausework for pay is the sole variable under "Other Income".

TABLE IV.4 - 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 Dm-Db					
	W1	W3-W1	W2-W1	W3-W2	W1	W3-W1	W2-W1	W3-W2	(W3-W1)	H	(W2–W1)	H	(W3–W2)	H
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Subjective Wellbeing														
Index	0.016	0.408	0.182	0.259	0.043	0.229	0.167	0.002	0.179		0.014		0.257	
(mean 0, s.d. 1)	(0.038)	(0.030)**	(0.030)**	(0.027)**	(0.043)	(0.036)**	(0.031)**	(0.034)	(0.047)**	††	(0.043)		(0.043)**	††
Satisfaction very dissatisfied–very satisfied (1-5)														
Household	3.460	0.255	0.253	0.013	3.437	0.291	0.161	0.103	-0.036		0.092		-0.091	
income	(0.032)	(0.027)**	(0.025)**	(0.025)	(0.036)	(0.029)**	(0.029)**	(0.025)**	(0.040)		(0.038)*	†	(0.035)**	††
Family members	3.942	0.153	0.031	0.177	3.869	0.086	0.074	-0.041	0.067		-0.043		0.218	
	(0.026)	(0.023)**	(0.020)	(0.021)**	(0.028)	(0.024)**	(0.021)**	(0.021)	(0.033)*	†	(0.029)		(0.029)**	††
Social contacts	3.766	0.178	0.052	0.130	3.769	0.064	0.059	0.002	0.114		-0.007		0.128	
	(0.027)	(0.022)**	(0.020)**	(0.020)**	(0.029)	(0.023)**	(0.023)**	(0.022)	(0.032)**	††	(0.031)		(0.030)**	††
Emotional State always-never (1-4)														
Feel abused	3.865	0.069	0.019	0.054	3.902	-0.010	0.002	-0.034	0.079		0.017		0.089	
	(0.018)	(0.015)**	(0.015)	(0.013)**	(0.018)	(0.017)	(0.014)	(0.016)	(0.023)**	††	(0.021)		(0.020)**	††
Feel fear money	3.741	0.129	0.030	0.087	3.807	0.072	0.053	0.022	0.057		-0.023		0.064	
taken away	(0.024)	(0.019)**	(0.019)	(0.016)**	(0.023)	(0.020)**	(0.018)**	(0.018)	(0.028)		(0.026)		(0.024)**	††

Notes: * 10 percent, ** 5 percent, and *** 1 percent significance level. † indicates significance at 10% and †† indicates significance at 5% when using the Holm-Bonferroni correction for multiple hypothesis testing. Standard errors in parentheses.

TABLE V. DIFFERENTIAL EFFECTS OF THE MONTHLY AND BIMONTHLY PROGRAMS BY GENDER AND BASELINE POVERTY STATUS (DID W3-W1, VALLADOLID MINUS MOTUL)

	Effects for Males	Effects for Females	Difference	Lowest Income (Below Poverty Line)	Higher Income (Above poverty line)	Difference
Health Care Index	0.305	0.276		0.215	0.334	
Food Consumption Index	0.152	0.071	**	0.024	0.125	
Durable Goods Index	-0.162	-0.099		-0.276	-0.108	*
Discretionary Goods Index	-0.142	-0.155		-0.215	-0.123	
Work for Pay	-0.058	0.014	***	-0.046	-0.015	
Transfers to Older Adult Index	-0.245	-0.347	**	-0.606	-0.178	***
Transfers from Older Adult Index	-0.149	-0.154		-0.325	-0.122	***
Subjective Wellbeing Index	0.221	0.164		0.158	0.192	

Notes: * 10 percent, ** 5 percent, and *** 1 percent significance level.