# THE EFFECTS OF BENEFIT TIMING AND INCOME FUNGIBILITY ON FOOD PURCHASING DECISIONS AMONG SUPPLEMENTAL NUTRITION ASSISTANCE PROGRAM HOUSEHOLDS

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The Supplemental Nutrition Assistance Program (SNAP) is the largest nutritional safety net in the United States. Prior research has found that participants have higher consumption shortly after receiving their benefits, followed by lower consumption towards the end of the benefit month. Known as the "SNAP benefit cycle," this consumption pattern has been found to have negative effects on beneficiaries. We hypothesize two behavioral responses of SNAP participants may work in tandem to drive much of the cycle: (1) short-run impatience—a higher preference to consume today, and (2) fungibility of income—the degree of substitutability between a SNAP dollar and a cash dollar. Using data from the National Food Acquisition and Purchase Survey (FoodAPS), a newly developed nationally representative survey of daily food acquisitions by SNAP households, we find evidence of both behavioral responses. However, the degree of short-run impatience and fungibility of income is found to differ significantly across poverty levels and use of grocery lists to plan food purchases. SNAP households could gain from food purchase planning education.

*Key words*: Fungibility of income, SNAP benefit cycle, time-inconsistent preferences.

*JEL codes*: D12, I38.

The Supplemental Nutrition Assistance Program (SNAP) is the nation's largest food assistance program providing over 45 million low-income Americans a monthly benefit. Although SNAP has been found to improve food security, birth-weight outcomes, and child health (see Bitler (2014) and citations within), potential negative effects of the monthly nature of benefit provision have been raised. Administrative records reveal that more than 80% of SNAP benefits are redeemed within the first two weeks of issuance (Castner and Henke 2011), a consumption pattern known as the "SNAP benefit cycle." This cycle of rapid depletion of SNAP benefits early in the month has been linked to potentially negative consequences for participants. For example, studies find that SNAP beneficiaries consume fewer calories toward the end of the benefit cycle, suggesting potential increased risk of food insecurity (Shapiro 2005; Todd 2015; Wilde and Ranney 2000). While not explicitly focused on SNAP, Seligman et al. (2014) finds that there is a 27% increase in hospital admissions due to hypoglycemia among low-income individuals at the end of

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the benefit month, with no observed increase in higher income populations.

The behavioral mechanism most frequently attributed to payment benefit cycles is time-inconsistent preferences (e.g., Shapiro 2005; Mastrobuoni and Weinberg 2009). Rooted in Laibson's (1997, 1998) theory of hyperbolic discounting, a time-inconsistent household exhibits short-run impatience and therefore has a higher preference for today's consumption. Intuitively, an impatient household has a higher tendency to spend when resources are flush; this tendency is *inconsistent* with the household's preference to spend at the end of the month. As a result, households may put themselves at a higher risk to negative income shocks and food insecurity later in the month.

We explore whether a second behavioral phenomenon could be exacerbating the degree of the cycle: income fungibility, which refers to the degree of substitutability between different sources of income.[1] Economic theory predicts that inframarginal SNAP households (i.e., those who receive benefit income less than their food budget) should not treat SNAP differently than non-SNAP income (Southworth 1945). Yet previous literature has found that SNAP households exhibit a higher marginal propensity to spend (MPS) on food when using benefit income rather than cash income (Fraker, Martini, and Ohls 1995; Levedahl 1995; Breunig and Dasgupta 2002, 2005). In other words, a one-dollar increase in SNAP benefits generates more spending on food than an equal increase in cash income; in other words, households appear to budget SNAP benefits differently than non-SNAP income.

How is income fungibility related to time-inconsistent preferences? Laibson (1998) shows that the monthly consumption path of an impatient household is a function of its propensity to spend out of available resources. Specifically, an impatient SNAP household will spend relatively more upon receiving benefits, and the higher MPS out of SNAP can increase this effect. This raises the possibility that part of the observed SNAP benefit cycle is being driven by income fungibility and cannot be completely attributed to time-inconsistent preferences. Understanding the roles of time-inconsistent preferences *and* income fungibility can help guide the development of policy prescriptions to reduce the SNAP benefit cycle.

To empirically examine how time inconsistency and income fungibility affect SNAP-spending patterns in a unified framework, we estimate food Engel curves using data from the National Food Acquisition and Purchase Survey (FoodAPS). The survey is a newly developed nationally representative measure of daily food acquisitions by SNAP households. To test for time-inconsistent preferences, we rely on the random administration of the survey throughout the benefit month. This allows us to test the direct effect of days since benefit receipt on budget shares via an intercept shift and an indirect effect via its interaction with total expenditure.

Most importantly, FoodAPS respondents report daily food spending by venue (i.e., at home and away from home), as well as the type of income used to make the purchase (i.e., SNAP and non-SNAP income). This allows for a test for income fungibility, where we specify total food expenditure to be a function of SNAP and non-SNAP payments (Moffitt 1989; Levedahl 1995; Breunig and Dasgupta 2002, 2005). The fully specified model allows us to test for any compounding effects of fungibility and impatience.

The results of our empirical analyses advance our understanding of the daily food spending patterns of SNAP beneficiaries on several dimensions. First, we find significant evidence of time-inconsistent spending profiles; households spend roughly 96 cents of every food dollar (regardless of its income source) on food at home the day that benefits are issued. This propensity to spend on food at home falls by 10 cents in the three days that follow. By the end of the month, households are spending just over three-quarters of their food budget on food at home.

Second, we find SNAP households have a consistently higher propensity to spend on food at home out of SNAP benefits than out of non-SNAP expenditures, regardless of the time of month. Specifically, an increase in the food budget due to SNAP benefits will generate 5.2% more in food-at-home spending than an equal increase due to non-SNAP income. The higher propensity to spend out of SNAP benefits for inframarginal households implies a lack of fungibility, or substitutability, with other budgeted categories.

[1] Income fungibility, or the idea that "money in one mental account is not a perfect substitute for money in another account" (Thaler 1980), has also been investigated as a 'cash-out effect' (e.g., Moffitt 1989) and a 'labeling effect' (e.g., Kooreman 2000).

Importantly, we find evidence that time-inconsistent preferences and the fungibility of income work in tandem. SNAP households spend 9.3% more on food at home out of SNAP than out of non-SNAP on the day of benefit arrival. Over the subsequent three days this difference drops to 6.3% before leveling off just under the sample average (5.2%). We attribute this finding to a persistent lack of perfect fungibility between SNAP and non-SNAP resources throughout the benefit month.

Finally, we investigate the degree of heterogeneity of our results within the SNAP population. First, we examine differences in monthly spending patterns for households that frequently utilize grocery lists compared to those that do not. We view grocery lists as a type of self-commitment mechanism. Second, we explore how severe resource constraints impact purchasing decisions. We find strong evidence that households who plan more frequently, as well as those who are less resource constrained, have smoother propensities to spend on food at home throughout the month. In both cases our results suggest that small measures to facilitate household food planning could be an effective way to mitigate the SNAP benefit cycle.

The remainder of this article is organized as follows. First we formally outline our theoretical underpinnings. We then describe our data set and present graphical evidence. The next section outlines our empirical strategy to test our hypotheses. The results are followed by a discussion about policy implications.

## Conceptual Framework

Standard economic theory states that as long as the total value of food assistance is less than the household's food budget (i.e., inframarginal), the manner in which benefits are transferred should not alter food expenditures (Southworth 1945). In this case, SNAP and non-SNAP incomes are perfectly fungible. Moreover, the traditional view of intertemporal choice assumes households are perfectly patient throughout the benefit month (i.e., exponential discounters). Together, these assumptions imply: (1) an equal propensity to spend SNAP and non-SNAP income on food at home, and (2) a smooth redemption schedule of SNAP benefits throughout the month. We discuss each in turn and the potential for compounding effects.

### *Income Fungibility and Mental Accounting*

Two components of mental accounting suggest that households may not treat SNAP and non-SNAP income as perfectly fungible.[2] First is how households assign income to specific mental accounts based on its usage (i.e., they budget by expenditure category). For example, a household may have an account for purchasing food and a separate account for paying utility bills. Thus, the type of income (e.g., cash or government assistance) can dictate the overall assignment of income to each account. SNAP must be spent on food for at-home consumption (e.g., grocery store purchases), whereas cash income can clearly be spent on any type of food (e.g., restaurant dining). As a result, the two sources of income may not be perceived as being perfectly substitutable and SNAP benefits may be assigned differently than an equal value of cash.

The second component of mental accounting that may impact income fungibility is "transaction utility." Thaler (1985, 1999) describes the utility derived from a purchase transaction as the value of the "deal," although in the present context it is more appropriate to think of this as the shadow price of the income source. Levedahl (1995) provides a theoretical framework in which food purchased with cash enters the household utility function separately from food purchased with SNAP benefits. This allows for the possibility of imperfect substitution between two otherwise identical bundles of food.

To see this, consider a household utility function $U(\cdot)$ that is weakly separable in food $C$ and all other goods $Q$ so that $U(C,Q) = U[u(C), v(Q)]$.[3] Suppose $C_I$ is food bought with non-SNAP income and $C_S$ is food bought with SNAP, so that $C = C_I + C_S$. The household has total resources $X$ devoted to food purchases, which is the sum of non-SNAP income $I$ and SNAP benefits $S$. The household maximizes $\mathcal{L} = u(C_I, C_S) +$

[2] See Thaler (1980, 1985, 1990, 1999) for a more complete treatment of mental accounting.

[3] It is without loss of generality that the function $U(\cdot)$ is weakly separable. See Levedahl (1995) for the nonseparable case. We use this framework here since it corresponds to our assumptions used in the empirical section.

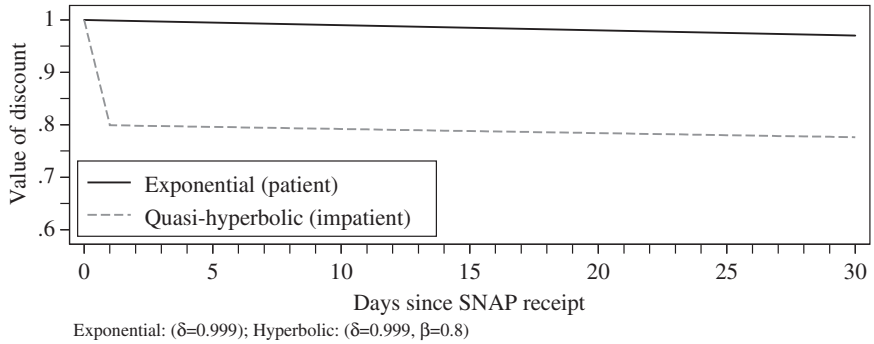


**Figure 1. Hypothetical consumption paths for patient and impatient households**

$\lambda_I(I - C_I) + \lambda_S(S - C_S)$, where $\lambda_I$ and $\lambda_S$ are the shadow prices of non-SNAP and SNAP income, respectively. In equilibrium, the total demand for food will be a function of $\lambda_S/\lambda_I$. If $\lambda_S/\lambda_I$ is equal to 1, then non-SNAP and SNAP income are perfectly fungible. However, if the marginal utility of non-SNAP and SNAP income is different, this implies that they are not fungible.[4]

*Hyperbolic Preferences*

If households are perfectly patient throughout the benefit month, we can characterize their equilibrium path of food consumption $C$ using the familiar Euler equation,

$$u'(C_t) = E_t \delta u'(C_{t+1}) \tag{1}$$

where $E_t$ is the expectation operator for time $t$, $\delta$ is the daily exponential discount factor, $u(\cdot)$ is a suitable utility function defined over food consumption $C$, and $u'$ is the marginal utility from consumption. Intuitively, this condition states that households smooth consumption over the benefit month according to $\delta$.

Laibson (1998) incorporates the idea that households are not perfectly patient exponential discounters and instead exhibit hyperbolic preferences. The idea is intuitive in the present context; upon receiving benefits at $t = 0$, SNAP households discount tomorrow's food consumption at a much higher rate than consumption between two far-off days, $s$ and $s + 1$. This higher discount *rate* implies a lower discount *factor* for tomorrow which is inconsistent across time.

Laibson (1998) shows formally that the Euler equation for a quasi-hyperbolic household can be characterized as:

$$u'(C_t) = E_t\left[C'_{t+1}(X)\beta\delta + \left(1 - C'_{t+1}(X)\right)\delta\right] u'(C_{t+1}) \tag{2}$$

where $\beta$ is the degree of patience, $\delta$ is the intertemporal (exponential) discount factor, $X$ is available resources for food, and $C'_{t+1}(X)$ is tomorrow's MPS on food. When a household is perfectly patient ($\beta = 1$), the *effective discount factor* in the brackets equals $\delta$ and equation (2) reduces to the exponential case found in equation (1). When $\beta < 1$, the effective discount factor becomes a weighted average of the one-period-ahead discount factor ($\beta\delta$) and the discount factor of all future periods ($\delta$).

To compare the two types of discounting, we plot in figure 1 a hypothetical consumption path for an exponential (patient) household and a quasi-hyperbolic (impatient) household. Given the relatively short period of time horizon of one month, it makes sense to set $\delta$ as close to one as possible. In this case, we set $\delta = 0.999$ and $\beta = 0.8$ in the figure for illustrative purposes. As can be seen, the consumption path for the patient (exponential) household is smooth and decreases at a constant rate. The quasi-hyperbolic household exhibits short-run impatience, and the effective discount factor is determined by tomorrow's MPS. Specifically, an increase in tomorrow's MPS will place more weight on the one-period-ahead discount factor $\beta\delta$

[4] Levedahl (1995) hypothesizes that $\lambda_S/\lambda_I < 1$, which implies households value a SNAP dollar less than a non-SNAP dollar. However, Breunig and Dasgupta (2002) show that when $\lambda_S/\lambda_I > 1$, a lack of fungibility can still be observed. In this case, the valuation of a SNAP dollar is higher than a non-SNAP dollar. In either case, incomes are not perfectly fungible.

and less weight on the long-term discount factor $\delta$. Thus, intra-month variation in the MPS motivates a synthesized analysis of income fungibility.

### *Fungibility and Hyperbolic Preferences*

A key insight is that the intra-monthly consumption profile of an impatient household is partially determined by its marginal propensity to spend (MPS) on food out of available resources. This can be seen in equation (2), where tomorrow's MPS acts as the weight of the effective discount factor. The implication is that a high (low) MPS indicates a low (high) effective discount factor. For example, with a MPS closer to one, most of the weight is placed on the one-period-ahead discount factor $\beta\delta$ (the impatient consumption path in figure 1), and very little weight is placed on the long-term discount factor $\delta$ (the patient consumption path in figure 1). If the marginal propensity to spend on food at home is increased by the transfer of SNAP benefits, this will further push the household towards the impatient consumption path. As a result, households with higher differences in the shadow price of income source (i.e., an increased lack of fungibility) will exhibit more pronounced impatient consumption paths.

To encompass fungibility and hyperbolic preferences, we let total resources $X$ be a function of the type of income used to make a food purchase. Separating the two sources of income in equation (2) allows us to consider how the fungibility of income also affects the consumption path.

## Data

The National Food Acquisition and Purchase Survey (FoodAPS) is a nationally representative survey that collected daily food acquisitions of households over a seven-day period between April 2012 and January 2013.[5] Respondents recorded food acquisitions in two diaries: food at home (FAH) and food away from home (FAFH). In general, FAH includes food obtained from grocery stores, farmers' markets, food pantries, and home gardens, while FAFH includes restaurants, fast-food establishments, entertainment venues, and so forth.

Each diary entry corresponds to an "event," such as a grocery-shopping trip or a sit-down meal at a restaurant. For the FAH diary, households were asked to scan UPC codes, either on the food package or provided in the diary for loose/bulk items, and to write down the total expenditure for that event. Similarly for the FAFH diary, households provided the total expenditure for the event and were asked to write down each item purchased. In both diaries, households were also asked to provide the receipt if one was given. Importantly, households also record the type of income used to make the transaction. All analyses use the sum of the total expenditures for each event for FAH and FAFH by diary day.

FoodAPS emphasizes households participating in the Supplemental Nutrition Assistance Program (SNAP) and was stratified accordingly. Of the 4,826 households surveyed, 1,581 households had at least one member currently on SNAP. The initial interview took place prior to the start of the seven-day diary, in most cases the day before the first diary day. During this interview, households were asked the date they last received their SNAP benefits. Using this date and the diary dates, we calculated the number of days since receiving benefits. Thus, day zero indicates the day of benefit arrival and day 30 the last possible day of the cycle.

There were 261 households that were nearing the end of their benefit cycle during the initial interview. For example, suppose the initial interview took place on day 28 of the benefit cycle. In this case the first and final dairy days would have been calculated as the $29^{th}$ and $35^{th}$ days of the benefit cycle. For these households, we assumed benefits were again received on the same calendar day as the previous month so that the cycle starts over during the survey. After this adjustment and excluding households that reported receiving their benefits more than 30 days prior to the initial interview, our final sample consisted of 1,427 SNAP households.[6]

[5] Data last accessed on November 2, 2015.

[6] Administrative data was linked to the sample in an attempt to confirm current SNAP enrollment. Over 82% of our sample was confirmed ($N = 1,172$). A small portion ($N = 26$) did not grant permission for data matching, and the remaining 229 households could not be linked due to administrative data limitations. Results are robust to excluding the latter two groups although estimates are not as precisely estimated.

We make use of the standard demographic characteristics in the empirical section (household size, race/ethnicity, and the presence of children under the age of 6). As well, we consider reported frequency of grocery list usage. The survey asked how often households use a grocery list—never, seldom, sometimes, most of the time, or always. We categorize "infrequent grocery list users" as those that reported never or seldom. All other households are categorized as "frequent grocery list users."

### *Summary Measures*

Our final sample of 1,427 SNAP households contributed 3,400 purchase days. In the empirical methods below, we discuss zero purchase days. In short, we treat each purchase day as conditionally independent. Also note we will be examining *purchases* rather than *acquisitions.* There are many instances of free food acquisitions in the FAFH diaries (e.g., friend's/relative's home, food pantries, school meal programs, home gardens, and fishing/hunting) but relatively few free food events in the FAH diaries.[7] The goal of this study is to understand FAH purchasing patterns in relation to SNAP benefits, and as such we focus on food expenditures for at-home preparation.

Figure 2 presents graphical evidence of spending patterns. On the day of benefit receipt (i.e., days since benefit receipt $= 0$), the average SNAP household spends \$141.95 on food. Over half of this expenditure is from non-SNAP income (\$72.97), and the remainder largely comes from SNAP income (\$62.62) with relatively few FAFH purchases (\$6.36). Throughout the rest of the benefit month the average household consistently spends more out-of-pocket on FAH than with benefit income. Interestingly, during the last two weeks of the benefit month, FAFH significantly outpaces non-SNAP FAH purchases.

Table 1 presents average per-day spending for the entire month in column 1. SNAP

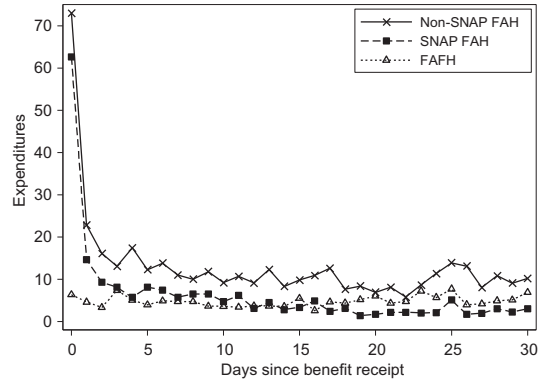


**Figure 2. Average daily expenditures over the benefit month**

*Notes:* The disbursement of SNAP benefits occurs on day 0.

households spend an average of \$45.70 per day on food (conditional on a positive purchase), with over 86% (\$39.59) spent on items for at-home consumption. Columns 2 and 3 split purchase days by those made in the first week of the benefit month and by the rest of the month. We can see that *total food expenditures* drop by over \$25 per day. This drop is entirely from *FAH expenditures*, and *FAFH expenditures* remain level at about \$6 per day. Although total food spending significantly declines over the benefit month, the share of expenditures devoted to food-at-home in week 1 (88%) are not significantly different than the last three weeks (85%).

Table 2 presents demographic characteristics and average weekly expenditures for our sample. To get a sense of how "beginning-of-the-month" households compare to those randomly surveyed during the rest of the month we split the sample accordingly. Column 2 includes households that have at least one diary day corresponding to benefit days 0, 1, 2, or 3 (labeled "Week 1"). In this manner we are capturing household diaries that "straddle" the day benefits are disbursed (e.g., when the diary starts on day 28) or when diaries begin shortly after benefit disbursement. All other household dairies falling outside this range are in column 3 (labeled "Weeks 2–4"). The *p*-values in column 4 test the significance between households randomly surveyed towards the beginning of the benefit cycle versus those that are surveyed during the rest of the month. We expect demographics to be insignificant. Yet we see that the

[7] Roughly 30% of the reported FAFH diary days had at least one free food acquisition, as compared to just over 2.6% of FAH acquisitions. We regressed an indicator for free food acquisitions on a full set of dummies for each day of the benefit month, conditional on household fixed effects and dummies for the diary day. All days of the benefit month are not significantly different from the sample average except days 3–6, which show higher rates of free food acquisitions. Importantly, there is no significant increase in free food acquisitions at the end of the month.

**Table 1. Average Daily Spending for SNAP Households Conditional on a Positive Purchase**

| Variable | Full Sample | Week 1 | Weeks 2–4 | *p*-value[a] |
|---|---|---|---|---|
| Total food expenditures | 45.70 | 62.69 | 37.17 | <0.001 |
| | (1.85) | (3.88) | (1.63) | |
| Food-at-home expenditures | 39.59 | 56.13 | 31.28 | <0.001 |
| | (1.66) | (3.62) | (1.45) | |
| Food-away-from-home expenditures | 6.11 | 6.56 | 5.89 | 0.554 |
| | (0.51) | (0.95) | (0.60) | |
| SNAP expenditures | 19.95 | 37.58 | 11.10 | <0.001 |
| | (1.33) | (3.31) | (0.87) | |
| Food-at-home share | 0.86 | 0.88 | 0.85 | 0.153 |
| | (0.01) | (0.01) | (0.01) | |
| No. of daily observations | 3400 | 1031 | 2369 | |

*Note*: All calculations use survey weights. Standard errors in parentheses are clustered at the household level. Week 1 is defined as purchasing days in the first seven days of the diary week. Weeks 2-4 are the rest of the month.
[a]*p*-values represent a two-sample t-test of week 1 versus weeks 2–4.

**Table 2. Household Characteristics and Total Weekly Expenditure Patterns**

| Characteristic | Full Sample | Week 1[a] | Weeks 2–4[a] | *p*-value |
|---|---|---|---|---|
| Household size | 3.04 | 3.34 | 2.88 | .023 |
| | (0.09) | (0.17) | (0.10) | |
| Non-Hispanic white | 0.47 | 0.47 | 0.47 | .949 |
| | (0.02) | (0.04) | (0.03) | |
| Hispanic | 0.23 | 0.27 | 0.20 | <.001 |
| | (0.02) | (0.04) | (0.02) | |
| Non-Hispanic black | 0.27 | 0.25 | 0.29 | .390 |
| | (0.02) | (0.03) | (0.03) | |
| Child under 6 present | 0.29 | 0.33 | 0.27 | .179 |
| | (0.02) | (0.04) | (0.01) | |
| Frequent grocery list user | 0.68 | 0.73 | 0.65 | .096 |
| | (0.02) | (0.03) | (0.03) | |
| Below 100% poverty | 0.58 | 0.54 | 0.60 | .251 |
| | (0.02) | (0.04) | (0.03) | |
| Total food expenditures | 130.04 | 175.32 | 105.03 | <.001 |
| | (6.51) | (11.30) | (7.46) | |
| Food-at-home expenditures | 93.35 | 140.50 | 67.31 | <.001 |
| | (4.56) | (9.75) | (3.62) | |
| Food-away-from-home expenditures | 36.68 | 34.81 | 37.72 | .691 |
| | (4.30) | (3.53) | (6.39) | |
| SNAP expenditures | 47.05 | 83.19 | 27.09 | <.001 |
| | (3.25) | (7.53) | (2.17) | |
| Food-at-home share | 0.66 | 0.72 | 0.62 | .001 |
| | (0.02) | (0.02) | (0.02) | |
| No. of households | 1427 | 446 | 981 | |

*Notes*: All calculations use survey weights.
[a]Week 1 households are defined as those that have at least one diary day corresponding to benefits days 0, 1, 2, or 3. All other households are defined as weeks 2–4.

proportion of *Hispanics* dropped significantly from 27% to 20%. Likewise we see that the proportion of *frequent grocery list users* also falls. As expected, all expenditures drop significantly over the month expect for FAFH.

## Empirical Methods

We start with a simple Engel curve specification:

$$w_k = \alpha_k + \beta_k \ln(X) + Z'\phi_k \quad (3)$$

where $w$ is the share of total daily food expenditures ($X$) on $k = \{$*food at home (FAH), food away from home (FAFH)*$\}$, $Z$ includes the natural logarithm of *household size*, indicators for race/ethnicity and a variable indicating the presence of a child under 6.[8] Time subscripts are excluded throughout to simplify notation.

Following previous empirical findings (Moffitt 1989; Levedahl 1995; Breunig and Dasgupta 2002, 2005), we express total daily expenditures as a linear function of cash and SNAP expenditures, $X = I + \gamma S$. The difference between the marginal propensity to spend cash income ($MPS_I$) and the MPS for SNAP ($MPS_S$) is indicated by $\gamma$. If $\gamma = 1$, the two sources of income are perfectly fungible and spending with cash or SNAP has no influence on the effective discount factor.

As previously discussed, an important consideration with a hyperbolic preference framework is that discount factors are inconsistent across time. To examine potential time-inconsistent preferences, we modify equation (3) to allow budget shares to shift via the intercept and slope (cf. Blundell and Lewbel 1991) as households progress through the benefit month. Specifically, we have:

$$w_k = \alpha_k + \beta_k ln(X) + Z'\phi_k + D_t'\delta_k + [\ln(X) \cdot D_t]'\eta_k \quad (4)$$

where $D_t$ is a flexible specification of the number of days since receiving SNAP benefits. We specify $D_t$ to be a set of six indicators corresponding to days 0, 1–3, 4–6, 7–14, 15–21, and 22–30.[9]

The effect of $D_t$ acts as a demand shifter estimated by the vector $\delta_k$. This allows us to capture any intra-monthly consumption that is determined strictly by temporal variation. The vector $\eta_k$ allows the MPS out of both cash and SNAP to change over the benefit month through its interaction with the log of total expenditures.

### *Marginal Propensities to Spend*

The average MPS out of SNAP for an entire benefit month is estimated by

$$MPS_S = \frac{\partial X_k}{\partial S} = w_k + (I + S)\frac{\gamma_k(\beta_k + D_t'\eta_k)}{I + \gamma_k S} \quad (5)$$

where we use the daily average values for expenditure share ($w_k$), cash ($I$), SNAP ($S$), and days since receiving SNAP ($D_t$). The remaining parameters are estimated from equation (4). Similarly, we calculate the average MPS out of cash over the benefit month as:

$$MPS_I = \frac{\partial X_k}{\partial I} = w_k + (I + S)\frac{(\beta_k + D_t'\eta_k)}{I + \gamma_k S}. \quad (6)$$

To estimate the MPS at different points in the benefit month, we evaluate all terms in (5) and (6) during the time period of interest. For example, suppose we want to know the propensity to spend on food at home out of SNAP benefits on the day of benefit receipt (i.e., $MPS_S^{t=0}$). We use the average of $w_k$, $I$, and $S$ when $t = 0$. Naturally, we then set $D_t = [1, 0, \ldots, 0]$ so that only the parameter estimate $\eta_k^{t=0}$ is used.

To test for fungibility, we take the difference between equations (5) and (6),

$$MPS_{(S-I)} = (I + S)\frac{(\beta_k + D_t'\eta_k)(\gamma_k - 1)}{I + \gamma_k S}. \quad (7)$$

It is easy to see that if $\gamma_k = 1$, there is no difference in the propensities to use SNAP and cash on food-at-home purchases (i.e., they are perfectly fungible).

Finally, to examine the interaction between fungibility and impatience, we estimate equation (7) at different points in the benefit month in the same manner as described above. Specifically, we first evaluate equations (5) and (6) for some time interval $D_{t=t'}$

[8] During the survey week, there are multiple occasions where the household does not make a food purchase. Consequently, the dependent variable of equation (4) is often zero. We view these zeros not as censoring, but rather as actual choices to not shop. In other words, a censored tobit approach would not be appropriate. We attempted to account for the decision to make a purchase on a given day using a Heckman two-step approach (Heckman 1979). Our exclusion restrictions included indicators for the diary day (1–7) and month of the year. The parameter estimate on the inverse Mills ratio is insignificant in all specifications. Moreover, likelihood ratio tests cannot reject the null that the models are equivalent. Consequently, our estimates are based on non-zero purchase days.

[9] Specifying $D_t$ as a continuous variable fails to capture the stark nonlinearities of the SNAP cycle. We also considered other bin widths for $D_t$ and came to similar conclusions. Likewise, $D_t$ could take on a high-order polynomial or be fully nonparametric through the use of a kernel.

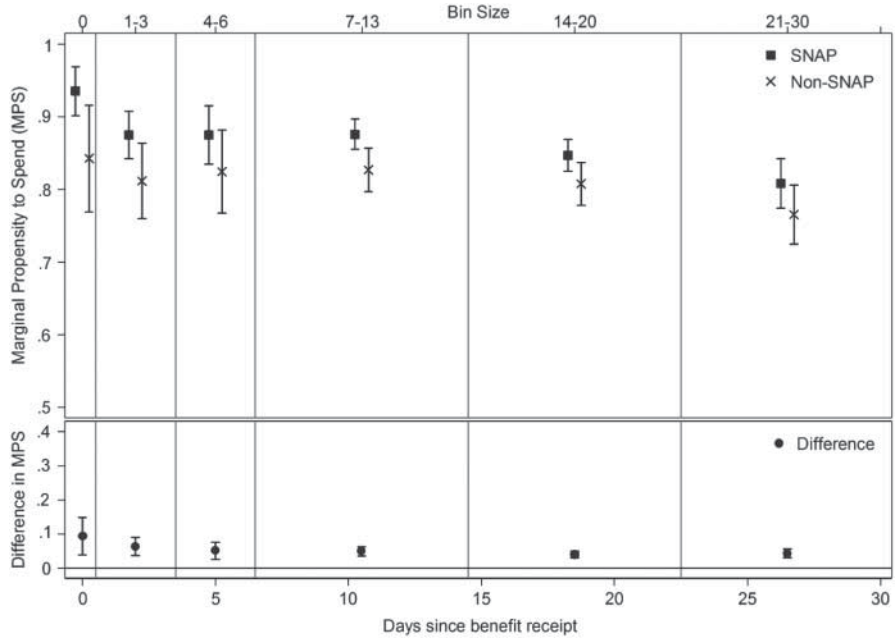


**Figure 3. Marginal propensity to spend on food at home, all SNAP households**

*Notes:* All point estimates are accompanied by 95% confidence intervals and correspond to a range of days since benefit receipt is shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level. See table 3 for estimates.

then take the difference:

$$MPS^{t=t'}_{(S-I)} = (I+S)\,\frac{\left(\beta_k + \eta_k^{t=t'}\right)(\gamma_k - 1)}{I + \gamma_k S} \tag{8}$$

where again, we use the average of $w_k$, $I$, and $S$ for the interval $t'$.

## Results

The main results are presented graphically in figures 3–7 with corresponding estimates in tables 3–5. All parameters from equation (4) are estimated using maximum likelihood and can be found in supplementary online appendix tables A1 and A2. The top panel of each figure plots the marginal propensities to spend (MPS) on food at home out of SNAP and non-SNAP expenditures throughout the benefit month using equations (6) and (7), respectively.[10] A general decline in the estimates over the month is consistent with hyperbolic discounting. The bottom panel of each figure estimates the difference in the propensities to spend using equation (8). Here, a positive difference is evidence against the fungibility of SNAP and non-SNAP income. For example, on the day benefits are received (day 0), SNAP households spend roughly \$0.09 more on food at home when using a SNAP dollar rather than a non-SNAP dollar. Finally, the compounding effect of time-inconsistent preferences and income fungibility can be seen in the bottom panel when the difference in MPS varies over the month.

All standard errors are calculated using the delta method and clustered at the household level. In the results that follow, there are cases where we find a statistically significant difference in the two MPS values in the bottom panel, but their individual confidence intervals overlap in the top panel. While this might seem contradictory, it is explained by the fact that the formulas for the standard errors include some parameters that cancel out when testing for a significant difference. In other words, the covariance between the two MPS values is positive, making the standard error of their difference smaller.

[10] Previous studies investigating the marginal propensity to spend on food out of SNAP typically use the monthly SNAP benefit allotment rather than actual SNAP spending; these studies find varying estimates falling between zero and one due to study design, survey period, and methodological approach (Cuffey, Beatty, and Harnick 2014).

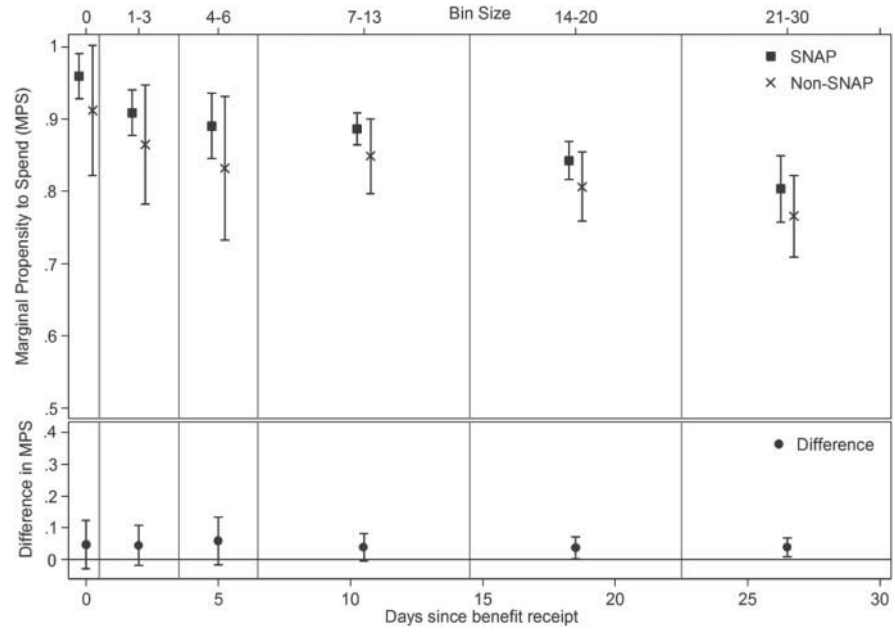


**Figure 4. Marginal propensity to spend on food at home, frequent grocery list users**

*Notes:* All point estimates are accompanied by 95% confidence intervals and correspond to a range of days since benefit receipt shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level. See table 4 for estimates.

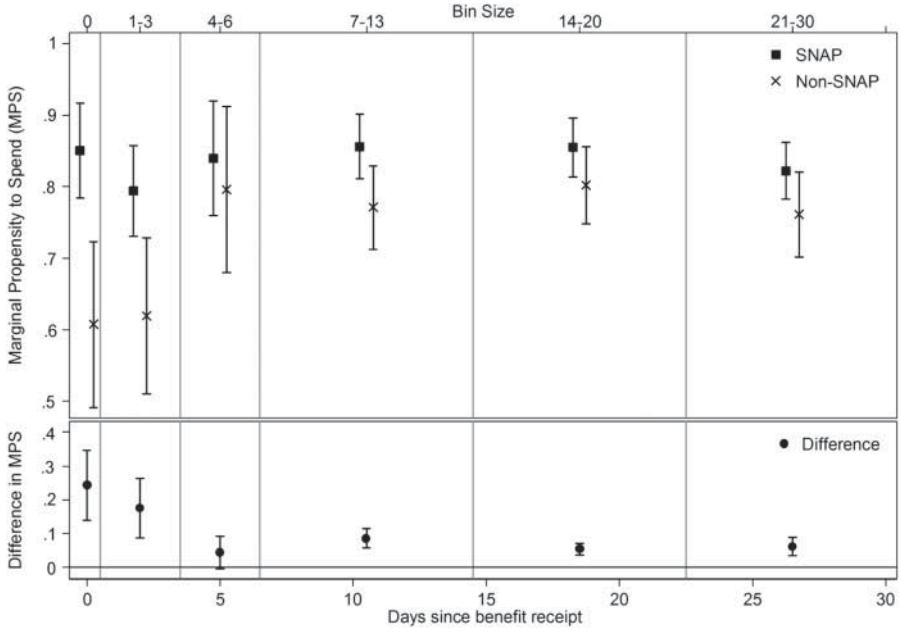


**Figure 5. Marginal propensity to spend on food at home, infrequent grocery list users**

*Notes:* All point estimates are accompanied by 95% confidence intervals and correspond to a range of days since benefit receipt shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level. See table 4 for estimates.

### *Full SNAP Sample*

Figure 3 shows the purchasing path for the full sample of SNAP households. First note that the purchasing path drops significantly from the day of benefit receipt ($t = 0$) to days 1–3 of the cycle. This is true for both SNAP

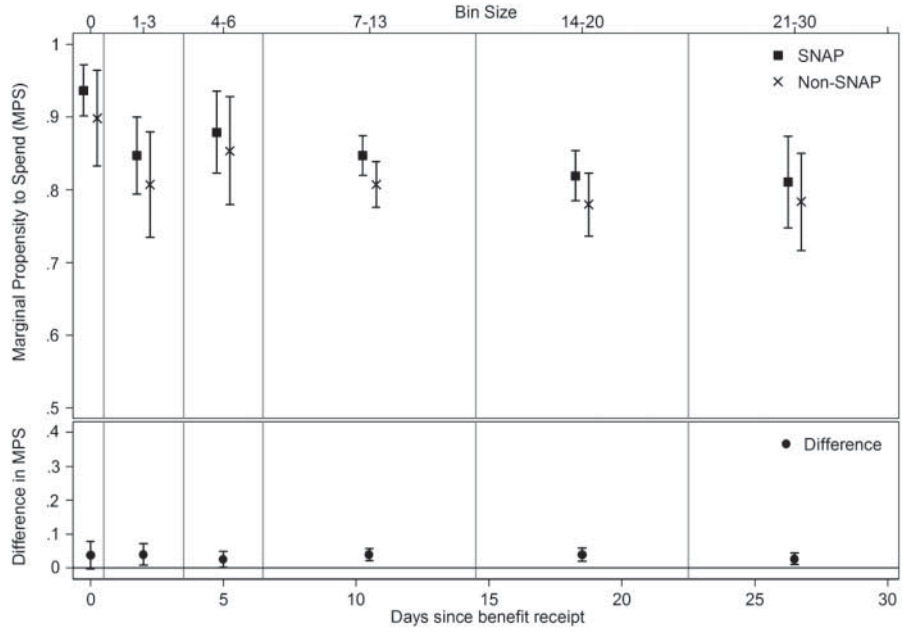


**Figure 6. Marginal propensity to spend on food at home, >100% of poverty guidelines**

*Notes:* All point estimates are accompanied by 95% confidence intervals and correspond to a range of days since benefit receipt shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level. See table 5 for estimates.

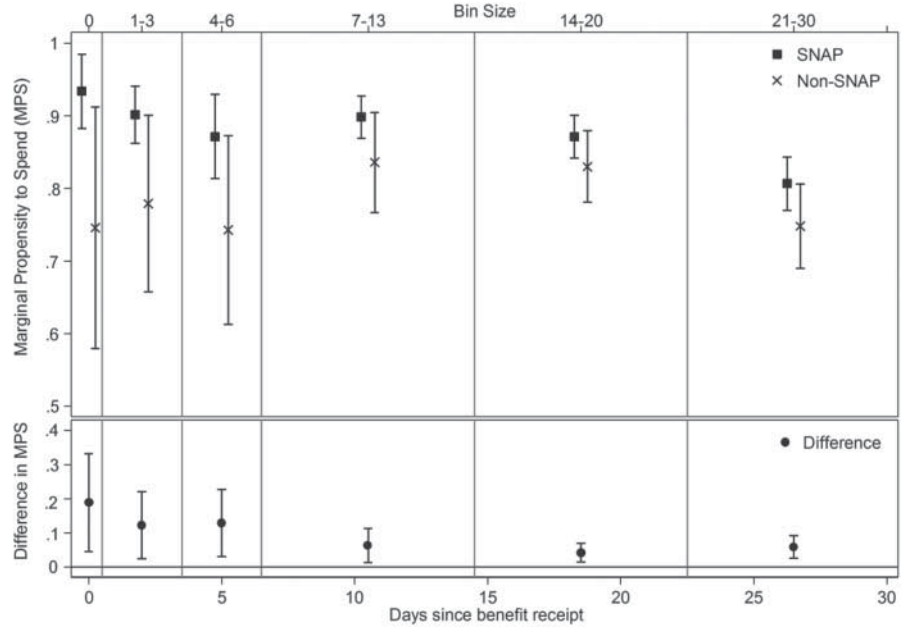


**Figure 7. Marginal propensity to spend on food at home, <100% of poverty guidelines**

*Notes:* All point estimates are accompanied by 95% confidence intervals and correspond to a range of days since benefit receipt shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level. See table 5 for estimates.

and non-SNAP food expenditures and is consistent with the hypothesis of hyperbolic preferences. Specifically, propensity to spend SNAP on food at home ($MPS_S$) falls from 0.94 on the day benefits are received and levels off at about 0.88 over the remaining

**Table 3. Marginal Propensity to Spend on Food at Home, All SNAP Households**

| Time Period | SNAP | Non-SNAP | Difference |
|---|---|---|---|
| Full month | 0.8608*** | 0.8092*** | 0.0516*** |
| | (0.0082) | (0.0119) | (0.0061) |
| Day 0 | 0.9354*** | 0.8424*** | 0.0930*** |
| | (0.0205) | (0.0448) | (0.0336) |
| Days 1–3 | 0.8751*** | 0.8118*** | 0.0633*** |
| | (0.0197) | (0.0316) | (0.0164) |
| Days 4–6 | 0.8751*** | 0.8245*** | 0.0506*** |
| | (0.0246) | (0.0347) | (0.0154) |
| Days 7–14 | 0.8760*** | 0.8267*** | 0.0493*** |
| | (0.0126) | (0.0182) | (0.0082) |
| Days 15–22 | 0.8468*** | 0.8075*** | 0.0394*** |
| | (0.0135) | (0.0178) | (0.0061) |
| Days 23–30 | 0.8083*** | 0.7653*** | 0.0430*** |
| | (0.0205) | (0.0246) | (0.0076) |

*Notes*: Standard errors in parentheses are clustered at the household level. Marginal propensity to spend (MPS) is calculated as the propensity to spend on food at home out of SNAP and non-SNAP food expenditures for the given time period.
*$p < .1$, **$p < .05$, ***$p < .01$.

days of the first two weeks (i.e., days 1–14). Over the last two weeks of the benefit month, the average SNAP household's propensity to spend SNAP on food at home continues to fall from 0.84 to 0.80. The propensity to spend non-SNAP income ($MPS_I$) has a similar time path, falling from 0.84 to 0.77 by month's end.

We examine the bottom panel for evidence of any compounding effects by testing if the difference in MPS is constant over the month. Although there appears to be a slight dip at the beginning of the month, we cannot reject the null that they are equivalent.

In total, our results pertaining to income fungibility and hyperbolic preferences as separate phenomena are consistent with previous findings (Fraker, Martini, and Ohls 1995; Levedahl 1995; Breunig and Dasgupta 2002, 2005; Shapiro 2005; Mastrobuoni and Weinberg 2009). One important finding is that fungibility is not just a short-term behavioral response that dissipates as the month progresses. Moreover, the *difference* in MPS between cash and SNAP does not change significantly over the entire month, suggesting an insignificant compounding effect. Next, we investigate heterogeneity of our results in certain subpopulations.

### *SNAP households that use a "commitment mechanism"*

Laibson (1998) presents the argument that consumers have different MPSs for different categories of assets (i.e., cash and SNAP in the present context). Hyperbolic SNAP households can create an endogenous liquidity constraint on their benefits by adhering to some rule-of-thumb. All that is required is the self-imposed constraint be committed to one period ahead. For example, to overcome splurging at the grocery store, households may pre-commit benefits to certain food items. In other words, simply committing to a grocery list could function as a self-imposed liquidity constraint.

As noted in the data section, the FoodAPS survey asks households how often they use a grocery list: never, seldom, sometimes, most of the time, or always. We categorize "infrequent grocery list users" as those that reported never or seldom. All other households are categorized as "frequent grocery list users."[11] We re-estimate our model for each type of household: frequent grocery list users in figure 4 and infrequent grocery list users in figure 5. Point estimates and standard errors can be found in table 4.

For frequent grocery list users, we again find that the propensity to spend on food at home out of cash and SNAP fall after the first day of the benefit month (figure 4 and table 4). In the bottom panel we can see the lack of fungibility between SNAP and non-SNAP income is relatively flat throughout the month – households tend to spend about \$0.04–0.05 more out of a SNAP dollar versus a cash dollar on food at home. Estimates are only marginally significant in the last two weeks of the benefit month.

Turning to infrequent grocery list users (figure 5 and table 4), we see inconsistent purchasing patterns over the first four days of the benefit month where these households have a much higher propensity to spend SNAP on food at home than their own cash. Infrequent grocery list users spend \$0.24 more on food at home using a SNAP dollar compared to a non-SNAP dollar. This stark difference persists over the next three days where we see a 0.17 difference on days 1–3. By the latter half of the first week of the benefit cycle, infrequent grocery list users are statistically indistinguishable from frequent grocery list users, although the point estimates remain slightly higher.

[11] We also considered placing households that report using grocery lists sometimes in the infrequent user category. Result did not change substantially.

**Table 4. Marginal Propensity to Spend on Food at Home, by Grocery List Usage**

| Time Period | SNAP | Non-SNAP | Difference |
|---|---|---|---|
| Frequent list users | | | |
| Full month | 0.8693*** | 0.8253*** | 0.0440 |
| | (0.0098) | (0.0295) | (0.0272) |
| Day 0 | 0.9593*** | 0.9119*** | 0.0474 |
| | (0.0189) | (0.0547) | (0.0463) |
| Days 1–3 | 0.9086*** | 0.8648*** | 0.0439 |
| | (0.0194) | (0.0503) | (0.0386) |
| Days 4–6 | 0.8905*** | 0.8318*** | 0.0587 |
| | (0.0274) | (0.0603) | (0.0459) |
| Days 7–14 | 0.8866*** | 0.8483*** | 0.0382 |
| | (0.0134) | (0.0313) | (0.0267) |
| Days 15–22 | 0.8426*** | 0.8062*** | 0.0363* |
| | (0.0159) | (0.0290) | (0.0210) |
| Days 23–30 | 0.8030*** | 0.7653*** | 0.0377** |
| | (0.0279) | (0.0343) | (0.0180) |
| Infrequent list users | | | |
| Full month | 0.8418*** | 0.7624*** | 0.0793*** |
| | (0.0149) | (0.0217) | (0.0110) |
| Day 0 | 0.8502*** | 0.6072*** | 0.2430*** |
| | (0.0404) | (0.0705) | (0.0629) |
| Days 1–3 | 0.7942*** | 0.6194*** | 0.1749*** |
| | (0.0384) | (0.0664) | (0.0534) |
| Days 4–6 | 0.8395*** | 0.7960*** | 0.0436 |
| | (0.0488) | (0.0706) | (0.0292) |
| Days 7–14 | 0.8561*** | 0.7709*** | 0.0853*** |
| | (0.0273) | (0.0354) | (0.0173) |
| Days 15–22 | 0.8549*** | 0.8019*** | 0.0530*** |
| | (0.0252) | (0.0328) | (0.0104) |
| Days 23–30 | 0.8222*** | 0.7610*** | 0.0612*** |
| | (0.0241) | (0.0360) | (0.0167) |

*Notes*: Standard errors in parentheses are clustered at the household level. Marginal propensity to spend (MPS) is calculated as the propensity to spend on food at home out of SNAP and non-SNAP food expenditures for the given time period.
*$p < .1$, **$p < .05$, ***$p < .01$.

Two important differences between infrequent and frequent grocery list users emerge. First, the difference between the MPS by income source on the day of benefit issuance is about five times higher for infrequent list users (0.24 vs. 0.05). We believe that frequent grocery list users have demonstrated the sort of pre-planning and commitment that likely translates into better budgeting skills. As a result, food planning can help mitigate the compounding effects of fungibility and impatience, especially on the day benefits are received. Second, the propensity to spend a SNAP dollar on food at home on the day of benefit issuance is much higher for frequent list users: 0.96 versus 0.85. This again may be an indication that food planning could help households precommit a larger percentage of food dollars to food at home. Moreover, those with better budgeting skills may place a priority on using their resources for purchasing food from SNAP eligible venues.

### *Poverty differences*

Households that have higher levels of impoverishment face more severe resource constraints than other SNAP households. Given that food is a necessity, a priori one may expect tighter liquidity constraints to force households to be more in tune with their food budgets. On the other hand, the severity of poverty is likely to be correlated with (unobservable) budgeting and planning skills.

To test these hypotheses, we divided households into those with income less than 100% of the poverty guidelines and those over the poverty guideline.[12] Point estimates and standard errors for the MPS out of each income source are reported in table 5, and results are presented graphically in figures 6

[12] As a reminder, SNAP eligibility is set at 130% of the poverty guidelines. FoodAPS oversampled households below the threshold of 100%, making our impoverished sample much larger.

**Table 5. Marginal Propensity to Spend on Food at Home, by Poverty Level**

| Time Period | SNAP | Non-SNAP | Difference |
|---|---|---|---|
| Above 100% poverty | | | |
| Full month | 0.8426*** | 0.8054*** | 0.0372*** |
| | (0.0118) | (0.0153) | (0.0098) |
| Day 0 | 0.9367*** | 0.8983*** | 0.0385 |
| | (0.0215) | (0.0400) | (0.0247) |
| Days 1–3 | 0.8471*** | 0.8071*** | 0.0400** |
| | (0.0323) | (0.0442) | (0.0191) |
| Days 4–6 | 0.8791*** | 0.8535*** | 0.0256* |
| | (0.0342) | (0.0451) | (0.0147) |
| Days 7–14 | 0.8467*** | 0.8071*** | 0.0396*** |
| | (0.0166) | (0.0191) | (0.0108) |
| Days 15–22 | 0.8191*** | 0.7794*** | 0.0397*** |
| | (0.0209) | (0.0262) | (0.0121) |
| Days 23–30 | 0.8105*** | 0.7833*** | 0.0272*** |
| | (0.0381) | (0.0404) | (0.0104) |
| Below 100% poverty | | | |
| Full month | 0.8752*** | 0.8002*** | 0.0750*** |
| | (0.0114) | (0.0343) | (0.0281) |
| Day 0 | 0.9339*** | 0.7455*** | 0.1883** |
| | (0.0310) | (0.1013) | (0.0877) |
| Days 1–3 | 0.9014*** | 0.7789*** | 0.1225** |
| | (0.0239) | (0.0740) | (0.0598) |
| Days 4–6 | 0.8714*** | 0.7426*** | 0.1288** |
| | (0.0351) | (0.0790) | (0.0595) |
| Days 7–14 | 0.8982*** | 0.8358*** | 0.0624** |
| | (0.0179) | (0.0419) | (0.0302) |
| Days 15–22 | 0.8713*** | 0.8301*** | 0.0412** |
| | (0.0178) | (0.0301) | (0.0164) |
| Days 23–30 | 0.8064*** | 0.7481*** | 0.0583*** |
| | (0.0223) | (0.0352) | (0.0197) |

*Notes*: Standard errors in parentheses are clustered at the household level. Marginal propensity to spend (MPS) is calculated as the propensity to spend on food at home out of SNAP and non-SNAP food expenditures for the given time period.
*$p < .1$, **$p < .05$, ***$p < .01$.

and 7. As shown in the top panels of figures 6 and 7, both types of households exhibit evidence of hyperbolic discounting. The bottom panels of the figures reveal that households with income above 100% of the poverty guidelines have a consistent difference in the MPS out of SNAP and non-SNAP ranging insignificantly from 0.026 to 0.04. Households below the poverty line exhibit a much higher propensity to spend SNAP on the day of issuance. Specifically, these households spend $0.19 more on food at home out of SNAP than out of pocket. This difference in MPS falls to about 0.13 over days 1–6 before leveling around 0.05. Thus, in this subpopulation (those below the poverty guideline), an interaction effect appears to exist. This evidence suggests that unobservable characteristics (such as budgeting skills in general) are driving the differences rather than resource constraints pushing households to be more in tune with their food budget.

## Conclusions and Policy Implications

This research investigated the purchasing patterns of SNAP households over the benefit month. Consistent with two separate strands of research, we find that SNAP households exhibit time-inconsistent preferences (Shapiro 2005; Mastrobuoni and Weinberg 2009; Hastings and Washington 2010) and do not view a SNAP dollar as fully fungible with a non-SNAP dollar (Moffitt 1989; Levedahl 1995; Breunig and Dasgupta 2002, 2005). We are able to estimate the degree of impatience and fungibility throughout the benefit month by utilizing daily food-purchasing activity in

the National Food Acquisition and Purchase Survey (FoodAPS). Consistent with theory (Laibson 1998), we then provide empirical evidence that these two behavioral mechanisms tend to exacerbate the SNAP benefit cycle, especially during the first week of issuance.

The tendency to make large food purchases at the beginning of the month may be a sign that households are stocking up; thus, food consumption could be smoother than food purchasing behavior over the month. We cannot directly test this hypothesis because detailed consumption data were not collected. Previous research, however, has consistently demonstrated that the consumption paths of SNAP households largely follow their purchasing paths.[13] Thus, our finding that the propensity to spend on food at home out of SNAP benefits is higher than out of non-SNAP income may be a reason for concern. Previous research has found that spending patterns are correlated with consumption patterns (Wilde and Ranney 2000) and that SNAP households do indeed appear to consume fewer calories at month's end (Shapiro 2005; Todd 2015). Put differently, this higher propensity to spend may displace cash spending in other budgeted categories and increase the risk of food insecurity near the end of the benefit month.

We uncover a previously unknown finding that the propensity to spend on food at home out of SNAP is consistently higher than out of non-SNAP income throughout the benefit month. We find some evidence that the lack of income fungibility is higher at the beginning of the month, indicating that households view SNAP as less fungible when benefits are flush. This lack of fungibility across income sources is not unique to SNAP households.[14] However, for low-income populations in general, the tendency to have a higher rate of spending out of one budgeted category may increase the risk to income shocks, particularly at the end of the month.

The compounding effects of fungibility and impatience are strongest for households that do not frequently engage in grocery trip planning (i.e., infrequent users of grocery lists) and those who are severely resource constrained (i.e., under the federal poverty guidelines). In particular, infrequent grocery list users have a propensity to spend \$0.24 more on food at home out of SNAP than non-SNAP income on the day benefits are received as compared to their counterparts. By the end of the first week, the two groups are spending about \$0.04–0.06 more out of SNAP, which is roughly the sample average. Likewise, we find similar comparisons between SNAP households living above and below the poverty guidelines—households below the poverty guidelines spend \$0.19 more out of SNAP on food at home on the day benefits are issued. Again, this higher-than-average MPS out of SNAP is concentrated during the first week and levels off throughout the remainder of the month. Households above the poverty line, on the other hand, consistently spend about \$0.04 more out of SNAP throughout the benefit month.

A relevant question is what actions can be taken to help mitigate the SNAP benefit cycle. Our finding that grocery list users tend to treat SNAP and non-SNAP income in a similar manner throughout the benefit month suggests that simple commitment strategies could be taught through the SNAP Education program. For example, guiding households on how to plan and budget their benefits may help overcome some of their behavioral shortfalls.

Previous authors have also suggested increasing the frequency of payments as a potential remedy (Wilde and Ranney 2000; Shapiro 2005; Hastings and Washington 2010). Doing so could enforce smoother consumption over the month. Some households, however, may prefer to make one large grocery trip per month. It might well be the case that these households are constrained in their ability to shop more frequently and forcing a bi-monthly or weekly disbursement may increase the cost of grocery shopping.

An alternative policy prescription could be to make bi-monthly or weekly disbursements an option when signing up for SNAP. Those who prefer or need a single monthly payment can simply enroll in that option. Such an approach would allow households to select into the payment option that best suited their needs. We suspect additional transaction costs to be minimal due to the electronic

[13] See, e.g., Shapiro (2005) and Todd (2015) who used data from 1989–91 and 2007–10, respectively. Both authors find that individuals living in SNAP households consume less calories at the end of the month.

[14] Kooreman (2000) and Blow, Walker, and Zhu (2012) investigate child benefits in the Netherlands and UK, respectively. Beatty et al. (2014) find similar effects among elderly UK households receiving heating assistance.

nature of the benefit transfer.[15] However, our results show the benefit-cycle effect is largest in the first few days suggesting that the often-recommended policy of bi-monthly benefit distribution may not be the cure-all. A possible negative consequence is a reduction in participation if the perceived amount of benefits is lower due to the bi-monthly arrangement.

## Supplementary Material

Supplementary material is available at http://oxfordjournals.org/our_journals/ajae/online.

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[15] Shapiro (2005) provides a back-of-the-envelope calculation of increased transaction costs due to more frequent disbursements using data from Maryland in 1993. Not only are these calculations rather outdated, they also precede the move to electronic benefit transfer (EBT) in 2003.

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