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The Effects of Benefit Timing and Income Fungibility on Food Purchasing Decisions among SNAP Households

Joshua P. Berning

Gregory Colson

Jeffery H. Dorfman

Travis A. Smith

Xiaosi Yang

University of Georgia
Department of Agricultural and Applied Economics

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Abstract

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. This "SNAP benefit cycle" has been found to have negative effects on beneficiaries. We examine two behavioral responses of SNAP participants that may work in tandem to drive much of the cycle: short-run impatience – a higher preference to consume today; and 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), we find evidence of both behavioral responses. 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. Food purchase planning education could be used to counter the observed benefit cycle.

Deeper analysis of the purchase data suggests that the benefit cycle is primarily associated with a decrease in the purchase of healthful and perishable foods—which could lead to lower dietary quality. We also find evidence that suggests households compensate for the effects of the SNAP benefit cycle by acquiring free food, primarily from schools. This highlights the importance of programs like the National School Lunch Program for SNAP households.

Executive summary

Prior research has found that SNAP participants have higher food consumption shortly after receiving their benefits, followed by lower consumption towards the end of the benefit month. This "SNAP benefit cycle" can lead to consumption patterns that have negative effects on beneficiaries. For example, SNAP beneficiaries consume fewer calories towards the end of the benefit cycle, suggesting potential increased risk of food insecurity. There is evidence of increased hospital admissions due to hypoglycemia among low-income individuals at the end of the benefit month as well.

We consider two behavioral mechanisms that might lead to such benefit cycles. The first mechanism suggests that households exhibit short-run impatience and therefore have a higher preference for today's consumption. As such, they spend more of their SNAP resources early in the month, leaving themselves at higher risk to negative income shocks later in the month. In addition, we explore whether a second behavioral phenomenon, income fungibility, could be exacerbating the degree of the cycle. This behavioral mechanism suggests that SNAP households exhibit a higher propensity to spend on food when using benefit income rather than cash income. As a result, a one-dollar increase in SNAP benefits generates more spending on food than an equal increase in cash income. Put differently, SNAP income is budgeted differently than an equal amount of cash income.

To empirically examine SNAP-spending patterns, we use 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. 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).

We find significant evidence of time-inconsistent spending. Specifically, households spend roughly 96 cents of every food dollar (regardless of its income source) on food at home the day 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. Given that food at home is of higher nutritional value than food away from home, this spending pattern may have important implications for household dietary quality throughout the month.

In addition, 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, we find that an increase in SNAP benefits will generate 5.2% more in food-at-home spending than an equal increase in non-SNAP income. This finding implies that SNAP income is less fungible than an equal amount of cash income despite the fact that economic theory suggests the two should be equally fungible.

We next examine how households might overcome their impatience and/or budgeting difficulties. To do so, 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. We also 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 spending on food at home throughout the month. Moreover, these households tend to budget SNAP income more similarly to cash income, just as economic theory would suggest. These results suggest that small

measures to facilitate household food planning could be an effective way to mitigate the SNAP benefit cycle.

Simple commitment strategies could be taught through the SNAP Education program that could help mitigate the SNAP benefit cycle. For example, teaching households how to plan and budget their benefits may help overcome some of their behavioral shortfalls. Another policy prescription could be to make bi-monthly or weekly disbursements the default option for SNAP disbursements. Previous findings have suggested that increasing the frequency of payments could encourage smoother consumption over the month. Some households, however, may prefer to make one large grocery trip per month due to costs. Those who prefer or need a single monthly payment can simply enroll in that option.

We further break down the SNAP purchase data into specific food categories. Over the benefit cycle, we find that household purchases of more healthful foods (defined by the Healthy Eating Index) and perishable foods decline over the month. Alternatively, purchases of less healthful and non-perishable foods, such as snacks and sugar-sweetened beverages, are constant over the month. This suggests that the SNAP benefit cycle may result in purchases of foods with lower nutritional quality. At the same time, storability appears to be an important consideration of the SNAP benefit cycle as well.

Finally, we examine a component of food acquisition by low-income households that has not been extensively investigated to date: the acquisition of free food. Over the course of the benefit month, SNAP household food purchases decline, but the acquisition of free food remains relatively constant. As a result, free food tends to compensate for a reduction in food purchases via cash and SNAP spending. As SNAP households are highly dependent on schools for their

largest share of free food, this highlights the importance of school lunch programs for SNAP households.

Introduction

The Supplemental Nutrition Assistance Program (SNAP) is the nation's largest food assistance program providing over 45 million low-income Americans a monthly benefit. 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 has been linked to potentially negative consequences for participants: SNAP beneficiaries consume fewer calories towards the end of the benefit cycle, suggesting potential increased risk of food insecurity (Shapiro 2005; Todd 2014; and Wilde and Ranney 2000). 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 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). A time-inconsistent household exhibits short-run impatience and therefore has a higher preference for today's consumption. An impatient household has a higher tendency to spend when resources are flush. This is *inconsistent* with the household's preference to spend at the end of the month. Households may therefore put themselves at a higher risk to negative income shocks and food insecurity later in the month.

Economic theory predicts that SNAP households 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; Levedhal 1995; Breunig and Dasgupta 2002, 2005). This means a one-dollar increase in SNAP benefits generates more spending on food than an equal increase in cash income. We explore whether this second behavioral phenomenon, referred to in the literature as income fungibility, could be exacerbating the degree of the cycle.[i]

Laibson (1998) shows that an impatient SNAP household will spend relatively more upon receiving benefits, and a higher MPS out of SNAP can increase this effect. If this occurs, then part of the SNAP benefit cycle is being driven by income fungibility and cannot be completely attributed to time-inconsistent preferences. Understanding time-inconsistent preferences *and* income fungibility can help guide the development of policy prescriptions to reduce the SNAP benefit cycle.

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. 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). Further, respondents report the acquisition of free food from a variety of sources (e.g. school, family and friends). The data also includes nutritional content of the food items allowing us to assess the nutritional content of purchases as well as the overall healthfulness of purchases throughout the month.

Methods

To examine how time inconsistency and income fungibility affect SNAP-spending patterns, we start with a simple Engel curve specification:

(1) $$w_k = \alpha_k + \beta_k ln(X) + Z'\phi_k,$$

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. 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 γ. If γ=1, the two sources of income are perfectly fungible and spending with cash or SNAP has no influence on the effective discount factor.

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 (1) to allow budget shares to shift via the intercept and slope (cf. Blundell and Lewbel, 1991) as households progress through the benefit month:

$$(2) \qquad w_k = \alpha_k + \beta_k ln(X) + Z'\phi_k + D_t'\delta_k + [\ln(X) \cdot D_t]'\eta_k$$

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.[ii] The effect of D_t acts as a demand shifter estimated by the vector δ_k. This allows us to capture any intra-monthly consumption that is determined strictly by temporal variation. The vector η_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

We estimate the average MPS out of SNAP for an entire benefit month as:

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

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 (2). We calculate the average MPS out of cash over the benefit month as:

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

To estimate the MPS at different points in the benefit month, we evaluate all terms in (3) and (4) during the time period of interest. To test for fungibility, we take the difference between (3) and (4),

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

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). To examine the interaction between fungibility and impatience, we estimate equation (5) at different points in the benefit month in the same manner as described above.

Expenditure Patterns by Food Type

To explore how the SNAP benefit cycle persists across different types of food, we modify equation (2) to specify a log-log model as:

(6) $$E_j = \alpha_j + \beta_j ln(I+S) + \gamma_j P + Z'\phi_j + D_t{}'\delta_j + [\ln(I+S)\cdot D_t]'\eta_j + P\cdot D_t{}'P\phi_j$$

where the dependent variable, E_j, is now the log of the expenditure share for food product *j*. Due to a limited number of observations, we no longer estimate the fungibility of income, so that $X = I + S$. Further, we add *P*, which is the share of SNAP expenditures out of the entire budget: *S/(I + S)*. This simplified model allows us to focus on the trend in spending over the month with specific food products.

Free Food Acquisition

By definition, free food does not have a price so we cannot estimate changes in free food acquisition using an expenditure share dependent variable. We therefore modify equation (6) to examine the share of free food in terms of grams for specific food categories. For example, we evaluate grams of dairy a household acquired for free relative to a household's total acquisition of dairy. We also examine the share of nutrition from free food relative to all other food. Both of these variables allow us to track how free food acquisition changes over the month following the receipt of SNAP benefits.

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. Respondents recorded food acquisitions in two diaries: food at home (FAH) and food away from home (FAFH). 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 28th of the benefit cycle. In this case the first and final dairy days would have been calculated as the 29th and 35th 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.[iii]

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."

The data also provide nutritional information for each of the items in the food diaries. This extensive process developed by the USDA, Economic Research Service allows us to develop various measures of the nutritional content of household food acquisitions. Together

with food descriptions, we create four broad categories of food: healthful or unhealthful and perishable or non-perishable (Table 1). The term healthful is based on the Healthy Eating Index (HEI) definition which suggests certain foods should be eaten more (*adequacy*). Alternatively, unhealthful foods are based on the HEI suggestion for foods that should be eaten in moderation (*moderate*). We identify perishable and non-perishable foods using a classification from the University of Nebraska (http://food.unl.edu/food-storage). While these are broadly defined categories, they allow us to examine how the SNAP benefit cycle impacts the types of foods being eaten.

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.*

Figure 1 presents graphical evidence of spending patterns. On the day of benefit receipt, 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 2 presents average per-day spending for the entire month in column 1. SNAP 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 3 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 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.

Table 4 describes expenditures for different categories of foods (e.g. healthful, unhealthful, perishable and non-perishable) for the first 3 days after receiving SNAP and the last 2 – 4 weeks. There was no difference in expenditures over the 2- to 4-week period, so the data is grouped together as such. As can be seen, both total food expenditures and SNAP expenditures go decrease after the first 3 days since receiving SNAP benefits. Further, expenditures go down significantly from the first 3 days to the rest of the month for all of the

broad food categories. This does not indicate, however, that the MPS for these food categories changes over the month.

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. The majority of free food for SNAP households comes from school with family and friends being the next largest source (Figure 2). The former is likely from the National School Lunch Program. Alternatively, non-SNAP households (Figure 3) obtain the majority of their free food from family and friends and the share received from school is about half as much as SNAP households.

For estimation purposes, we aggregate free food it into 5 large categories: dairy, fruits, vegetables, grains and protein. We also examine free food based on its contribution to: calories, carbohydrates, fat and added sugar. While these are not extensive descriptions of household diets, they help provide an idea about how SNAP households utilize free food throughout the month.

Results

All parameters from equation (2) are estimated using maximum likelihood and can be found in tables 5 and 6[iv]. The marginal propensities are presented graphically in figures 4-8 with corresponding estimates in tables 7-8. 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.[v] A 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.

Full SNAP Sample

Figure 4 shows the purchasing path for the full sample of SNAP households. 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 and non-SNAP food expenditures and is consistent with the hypothesis of hyperbolic preferences. Specifically, the 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 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.

Our results pertaining to income fungibility and hyperbolic preferences as separate phenomena are consistent with previous findings (Fraker Fraker, Martini and Ohls 1995; Levedhal 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"

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. Simply committing to a grocery list could function as a self-imposed liquidity constraint.

We categorize "infrequent grocery list users" as those that reported never or seldom using a grocery list. All other households are categorized as "frequent grocery list users."[vi] We re-estimate our model for each type of household: frequent grocery list users in figure 5 and infrequent grocery list users in figure 6. Point estimates and standard errors can be found in table 8.

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 5 and Table 8). 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.

Looking at infrequent grocery list users (Figure 6 and Table 8), 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.

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 versus 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 pre-commit 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.[vii] Point estimates and standard errors for the MPS out of each income source are reported in table 9, and results are presented graphically in figures 7 and 8. As shown in the top panels of figures 7 and 8, 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.

SNAP Cycle by Food Category

We further examine the SNAP cycle across our broad food categories (e.g. healthful, unhealthful, perishable and non-perishable) which reveals interesting purchasing patterns. In the

first day after receipt, the MPS of SNAP and non-SNAP for healthful foods is significantly larger than the rest of the month (Figure 9). After that, however, the MPS for SNAP and non-SNAP are not significantly different over time. In contrast, the MPS for SNAP for unhealthful foods (Figure 10) is significantly lower in days 1-3, but not significantly different the rest of the month. The MPS for non-SNAP is not significantly different across the month.

Looking at perishable foods (Figure 11) we see a similar pattern as healthful foods, where the MPS of SNAP and non-SNAP are significantly larger in the first day after benefit receipt, and then constant over time. The non-perishable foods follow a similar pattern as well (Figure 12), with the MPS of SNAP being larger in day 0 than days 1-3 and days 4-6. However, the MPS for cash is not significantly different over time.

Taken all together, these results suggest that the SNAP benefit cycle is primarily driven by changes in healthful foods, i.e. foods the HEI suggests should be eaten more often. The same can also be said for perishable foods, which by definition, do not last as long. Importantly, perishable foods tend to also be fresher, more healthful foods. Unfortunately, this analysis could not be run for foods that were also healthful *and* perishable, due to limited observations in the data.

Free Food Acquisition

Looking at the acquisition of free food offers important insights into how SNAP households may utilize free food over the benefit month. In particular, across all the food categories (Table 10) we find that there is a significant increase in free food acquisition on all days relative to day 0, which is the reference day. Importantly, after days 1 – 3, the acquisition of free food increases significantly as well across all food categories, but for the rest of the month (i.e. days 4 – 30) there is not a significant increase in the acquisition of free food. In practical

terms, this means a greater share of each food category comes from sources of free food during the first week after receiving SNAP benefits. This contrasts with the SNAP benefit cycle, which shows a decline in MPS or of SNAP and cash after the first few days of receiving benefits. This suggests that free food may be used strategically to offset spending from SNAP and cash over the month. This is particularly important given that the primary source of free food for SNAP households is the school, presumably school lunches.

Looking at calories and other nutritional content (Table 11), we notice a similar pattern that is slightly less drastic. Specifically, during the first 3 days, the amount of calories and nutrition from free food is not significantly different relative to day 0. After day 4, however, free food provides a significantly larger proportion of calories and nutrition. Again, this contrasts with the SNAP benefit cycle pattern of purchases. That is, as the propensity to spend on food declines the first days after receiving SNAP, the share of food from free sources increases.

It is important to note that over the month, the amount of free food acquired does not change significantly. Rather, the amount of food *purchased* decreases, making the share of free food relatively larger. Again, this emphasizes the importance of *other* sources of food for SNAP households.

Conclusions and discussion

This research investigated the purchasing patterns of SNAP households over the benefit month. We find that SNAP households exhibit time-inconsistent preferences and do not view a SNAP dollar as fully fungible with a non-SNAP dollar. We also find 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 (Wilde and Ranney 2000 Shapiro 2005; Todd 2014); 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.

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. 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). Likewise, we find similar comparisons between SNAP households living above and below the poverty guidelines. 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 more out of SNAP throughout the benefit month.

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. 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 nature of the benefit transfer.[viii] Our results show the benefit-cycle effect is largest in the first few days, however, 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.

Our research also sheds light on the types of purchases that might be driving the SNAP benefit cycle. In particular, we find that healthful and perishable foods tend to follow the benefit cycle pattern, whereas unhealthful and non-perishable foods are purchased more consistently throughout the month. This emphasizes the potential nutritional implications of the SNAP benefit cycle. Incentives to encourage more healthful purchases throughout the month could prove to be beneficial. For example, the Healthy Incentives Pilot (HIP) offers cash back for buying fruits and vegetables (Klerman et al 2015; Wilde et al 2015). Such a program could possibly encourage more consistent purchases of healthful foods.

Finally, we also provide preliminary results highlighting the role that free food plays for SNAP recipients. While the SNAP cycle progresses throughout the month and food purchases decline, the acquisition of free food increases. This also translates into more calories and nutrition from free food. Since free food for SNAP households primarily comes from the school lunch program, it is important to consider the year round availability of this resource. To be sure, some locations already provide alternative ways to disperse free food outside the school year.

References

Blundell, R. and A. Lewbel, (1991). "The Information of Equivalence Scales." *Journal of Econometrics*, 50(1-2): 49-68.

Breunig, R. and I. Dasgupta, (2002). "A Theoretical and Empirical Evaluation of the Functional Forms Used to Estimate the Food Expenditure Equation of Food Stamp Recipients: Comment" *American Journal of Agricultural Economics,* 84(4): 1156-1160.

Breunig, R. and I. Dasgupta, (2005). "Do Intra-Household Effects Generate the Food Stamp Cash-out Puzzle?" *American Journal of Agricultural Economics,* 87(3): 552-568.

Cuffey, J., T. Beatty and K. Harnick, (2014). "Are Food Stamps Income or Food Supplementation? A Meta-Analysis." Selected Poster prepared for presentation at the Agricultural & Applied Economics Association's 2014 AAEA Annual Meeting, Minneapolis, MN, July 27-29, 2014.

Fraker. T.M., (1990). *The Effects of Food Stamps on Food Consumption: A Review of the Literature,* FNS-USDA.

Fraker, T.M., A.P. Martini, and J.C. Ohls, (1995). "The Effect of Food Stamp Cashout on Food Expenditures: An Assessment of the Findings from Four Demonstrations." *Journal of Human resources*.

Hastings, J. and E. Washington, (2010). "The First of the Month Effect: Consumer Behavior and Store Response." *American Economic Journal: Economic Policy,* 2: 142-162.

Heckman, J. J. (1979). "Sample Selection Bias as a Specification Error." *Econometrica* 47(l): 53-161.

Klerman, J. A., S. Bartlett, P. Wilde, and L. Olsho. (2014). "The short-run impact of the Healthy Incentives Pilot Program on fruit and vegetable intake." *American Journal of Agricultural Economics*, *96*(5): 1372-1382.

Kooreman, P., (2000). "The Labeling Effect of a Child Benefit System." *American Economic Review*, 90(3): 571-583.

Laibson, D., (1997). "Golden Eggs and Hyperbolic Discounting." *Quarterly Journal of Economics,* 116(4): 1261-1303.

Laibson, D., (1998). "Life-cycle Consumption and Hyperbolic Discount Functions." *European Economic Review*, 42(3-5): 861-871.

Levedahl, J.W., (1995). "A Theoretical and Empirical Evaluation of the Functional Forms Used to Estimate the Food Expenditure Equation of Food Stamp Recipients" *American Journal of Agricultural Economics,* 84(4): 1161-1164.

Mastrobuoni, G. and M. Weinberg, (2009). "Heterogeneity in Intra-Monthly Consumption Patterns, Self-Control and Savings at Retirement." *American Economic Journal: Economic Policy*, 1(2): 163-189.

Moffitt, R., (1989). "Estimating the Value of an In-Kind Transfer: The Case of Food Stamps." *Econometrica*, 57(2): 385-409.

Shapiro, J., (2005). "Is there a Daily Discount Rate? Evidence from the Food Stamp Nutrition Cycle." *Journal of Public Economics*, 89(2-3): 303-325.

Seligman, H. K., Bolger, A. F., Guzman, D., López, A., & Bibbins-Domingo, K. (2014). "Exhaustion of food budgets at month's end and hospital admissions for hypoglycemia." *Health Affairs* 33(1): 116-123.

Southworth, H.M. (1945). "The Economics of Public Measures to Subsidize Food Consumption." *Journal of Farm Economics*, 27(1): 38-66.

Thaler, R.H., (1999). "Mental Accounting Matters." *Journal of Behavioral Decision Making*, 12(3):183-206.

Todd, J.E. (2014). "Revisiting the Supplemental Nutrition Assistance Program cycle of food intake: Investigating heterogeneity, diet quality, and a large boost in benefit amounts." *Applied Economic Perspectives and Policy*, online: 10.1093/aepp/ppu039.

Wilde, P.E. and C.K. Ranney, (2000), "The Monthly Food Stamp Cycle: Shopping Frequency and Food Intake Decisions in an Endogenous Switching Regression Framework." *American Journal of Agricultural Economics*, 82(1): 200-213.

Wilde, P., J.A. Klerman, L.E. Olsho, and S. Bartlett. (2015). "Explaining the Impact of USDA's Healthy Incentives Pilot on Different Spending Outcomes." Applied Economic Perspectives and Policy, ppv028.

Tables

Table 1. Household food purchases aggregated into four groups.

	healthful	*unhealthful*
Perishable	dairy, protein, fruit and vegetables	french fries, hash browns
Non-perishable	whole grains, beans nuts, canned fish	snacks, sugar-sweetened beverages, refined grains

Table 2. 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 3. 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	0.023
	(0.09)	(0.17)	(0.10)	
Non-Hispanic White	0.47	0.47	0.47	0.949
	(0.02)	(0.04)	(0.03)	
Hispanic	0.23	0.27	0.20	<0.001
	(0.02)	(0.04)	(0.02)	
Non-Hispanic Black	0.27	0.25	0.29	0.390
	(0.02)	(0.03)	(0.03)	
Child under 6 present	0.29	0.33	0.27	0.179
	(0.02)	(0.04)	(0.01)	
Frequent grocery list user	0.68	0.73	0.65	0.096
	(0.02)	(0.03)	(0.03)	
Below 100% poverty	0.58	0.54	0.60	0.251
	(0.02)	(0.04)	(0.03)	
Total food expenditures	130.04	175.32	105.03	<0.001
	(6.51)	(11.30)	(7.46)	
Food-at-home expenditures	93.35	140.50	67.31	<0.001
	(4.56)	(9.75)	(3.62)	
Food-away-from-home expenditures	36.68	34.81	37.72	0.691
	(4.30)	(3.53)	(6.39)	
SNAP expenditures	47.05	83.19	27.09	<0.001
	(3.25)	(7.53)	(2.17)	
Food-at-home share	0.66	0.72	0.62	0.001
	(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.

Table 4. Household Food-at-Home Expenditures

	Full Sample	0-3 days	Weeks2-4	p-value[a]
Total food expenditure	105.39	151.54	79.90	<0.001
	(4.74)	(9.73)	(4.03)	
SNAP expenditure	44.76	80.18	25.20	<0.001
	(3.18)	(7.36)	(2.09)	
Healthful food	36.35	58.01	24.39	<0.001
	(2.17)	(4.83)	(1.51)	
Unhealthful food	19.75	28.78	14.76	<0.001
	(1.00)	(2.10)	(0.85)	
Perishable food	34.46	55.07	23.08	<0.001
	(2.06)	(4.64)	(1.42)	
Non-perishable food	35.65	54.31	25.34	<0.001
	(1.87)	(3.95)	(1.48)	

Notes: a. Test of statistical difference in expenditures from days 0-3 and weeks 2-4.

Table 5. Parameter Estimates from Equation (2) for Full SNAP Sample and by Grocery List Usage

Variables	Full Sample	Frequent List Users	Infrequent List Users
ln(X)	-0.0175***	-0.0087	-0.0490***
	(0.0047)	(0.0052)	(0.0101)
SNAP purchases	0.0032*	0.0021	0.0086***
	(0.0012)	(0.0098)	(0.0017)
ln(X) × Days 1-3	-0.0118*	-0.0124	-0.0206
	(0.0071)	(0.0129)	(0.0154)
ln(X) × Days 4-6	-0.0116	-0.0202	0.0179
	(0.0077)	(0.0165)	(0.0206)
ln(X) × Days 7-14	-0.0108*	-0.0138	0.0027
	(0.0062)	(0.0107)	(0.0123)
ln(X) × Days 15-22	-0.0120*	-0.0200*	0.0139
	(0.0062)	(0.0116)	(0.0116)
ln(X) × Days 23-30	-0.0172**	-0.0215**	-0.0013
	(0.0076)	(0.0104)	(0.0167)
ln(household size)	-0.0362***	-0.0495***	-0.0034
	(0.0112)	(0.0139)	(0.0200)
Days 1-3	-0.0366**	-0.0242	-0.0560
	(0.0168)	(0.0289)	(0.0553)
Days 4-6	-0.0466***	-0.0527	-0.0497
	(0.0178)	(0.0417)	(0.0543)
Days 7-14	-0.0479***	-0.0554*	-0.0394
	(0.0151)	(0.0296)	(0.0507)
Days 15-22	-0.0613***	-0.0740**	-0.0569
	(0.0158)	(0.0308)	(0.0512)
Days 23-30	-0.0576***	-0.0807**	-0.0129
	(0.0196)	(0.0337)	(0.0452)
Non-Hispanic White	0.0360	0.0401	0.0015
	(0.0250)	(0.0276)	(0.0270)
Non-Hispanic Black	-0.0130	-0.0084	-0.0363
	(0.0273)	(0.0307)	(0.0277)
Hispanic	-0.0050	-0.0137	-0.0035
	(0.0291)	(0.0329)	(0.0284)
Presence of child < 6	0.0146	0.0583***	-0.0707**
	(0.0183)	(0.0202)	(0.0311)
Constant	0.9793***	0.9859***	1.0050***
	(0.0282)	(0.0339)	(0.0515)
sigma	0.2174***	0.2087***	0.2256***
	(0.0063)	(0.0075)	(0.0100)
Observations	3400	2205	1195

Notes: Dependent variable is the daily share of total food expenditures on food at home. Standard errors in parentheses are clustered at the household level.

* *p<0.1,* ** *p<0.05,* *** *p<0.01*

Table 6. Parameter Estimates from Equation (2) for Households Above and Below the Poverty Line

Variables	<100% Poverty	>100% Poverty
ln(X)	-0.0241**	-0.0114*
	(0.0095)	(0.0065)
SNAP	0.0062	0.0017
	(0.0137)	(0.0028)
ln(X) × Days 1-3	-0.0118	-0.0130
	(0.0172)	(0.0104)
ln(X) × Days 4-6	-0.0233	-0.0072
	(0.0207)	(0.0091)
ln(X) × Days 7-14	-0.0068	-0.0150**
	(0.0144)	(0.0068)
ln(X) × Days 15-22	-0.0030	-0.0216**
	(0.0113)	(0.0088)
ln(X) × Days 23-30	-0.0211	-0.0117
	(0.0153)	(0.0102)
ln(household size)	-0.0239*	-0.0486**
	(0.0136)	(0.0212)
Days 1-3	-0.0284	-0.0471**
	(0.0234)	(0.0230)
Days 4-6	-0.0604**	-0.0367*
	(0.0306)	(0.0199)
Days 7-14	-0.0327*	-0.0645***
	(0.0195)	(0.0217)
Days 15-22	-0.0510**	-0.0693***
	(0.0226)	(0.0238)
Days 23-30	-0.0394*	-0.0763**
	(0.0220)	(0.0366)
Non-Hispanic White	0.0116	0.0770**
	(0.0272)	(0.0350)
Non-Hispanic Black	-0.0403	0.0385
	(0.0293)	(0.0416)
Hispanic	-0.0111	0.0125
	(0.0319)	(0.0422)
Presence of child < 6	-0.0184	0.0419*
	(0.0237)	(0.0236)
Constant	0.9977***	0.9527***
	(0.0488)	(0.0449)
sigma	0.2092***	0.2238***
	(0.0085)	(0.0091)
Observations	1989	1411

Notes: Dependent variable is the daily share of total food expenditures on food at home. Standard errors in parentheses are clustered at the household level.
* *p<0.1*, ** *p<0.05*, *** *p<0.01*

Table 7. 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<0.1, ** p<0.05, *** p<0.01*

Table 8. 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<0.1*, ** *p<0.05*, *** *p<0.01*

Table 9. 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<0.1*, ** *p<0.05*, *** *p<0.01*

Table 10. Share of free food purchased, in grams, over the month by food category

Variables	Dairy	Vegetables	Grains	Fruit	Protein
Days 1-3	0.110*	0.152**	0.093	0.196***	0.129**
	(0.060)	(0.066)	(0.061)	(0.074)	(0.062)
Days 4-6	0.153***	0.159***	0.131**	0.210***	0.140**
	(0.056)	(0.060)	(0.056)	(0.067)	(0.059)
Days 7-14	0.147***	0.185***	0.135**	0.238***	0.162***
	(0.054)	(0.057)	(0.054)	(0.066)	(0.057)
Days 15-22	0.176***	0.202***	0.174***	0.271***	0.203***
	(0.055)	(0.058)	(0.055)	(0.066)	(0.057)
Days 23-30	0.177***	0.202***	0.182***	0.263***	0.173***
	(0.054)	(0.057)	(0.055)	(0.065)	(0.057)
Log(HH size)	-0.047***	-0.080***	-0.085***	0.004	-0.082***
	(0.017)	(0.018)	(0.017)	(0.025)	(0.017)
Non-Hispanic White	0.001	0.064	0.001	-0.013	0.032
	(0.044)	(0.058)	(0.046)	(0.052)	(0.050)
Non-Hispanic Black	0.060	0.107*	0.040	0.061	0.091*
	(0.046)	(0.059)	(0.048)	(0.053)	(0.051)
Hispanic	0.027	0.055	0.028	-0.027	0.071
	(0.047)	(0.060)	(0.048)	(0.055)	(0.051)
Presence of child < 6	-0.016	-0.007	-0.007	0.009	-0.008
	(0.019)	(0.020)	(0.019)	(0.023)	(0.020)
HH average income	-0.001	-0.001	-0.000	-0.001	-0.001
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Constant	0.589***	0.524***	0.610***	0.484***	0.583***
	(0.073)	(0.083)	(0.074)	(0.091)	(0.079)
Observations	2573	2636	2743	2024	2561

Notes: Standard errors in parentheses and clustered at the household level.
* *p<0.1*, ** *p<0.05*, *** *p<0.01*
For all models, days 1-3 are statistically lower than Days 4-6 and beyond.

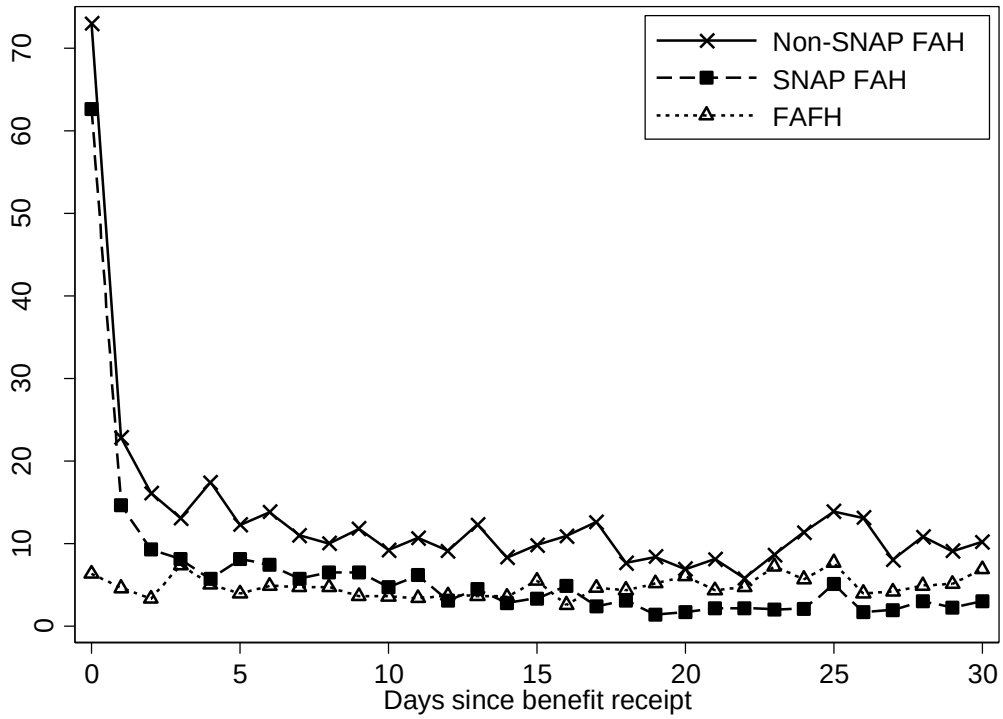
Table 11. Share of free food purchased, in grams, over the month by calories and nutrients

	calories	carbs	fat	added sugar
Days 1-3	0.069	0.075	0.078	0.077
	(0.058)	(0.058)	(0.059)	(0.063)
Days 4-6	0.115**	0.120**	0.114**	0.140**
	(0.054)	(0.054)	(0.054)	(0.058)
Days 7-14	0.115**	0.123**	0.119**	0.154***
	(0.051)	(0.052)	(0.052)	(0.056)
Days 15-22	0.135***	0.153***	0.135**	0.177***
	(0.052)	(0.052)	(0.053)	(0.056)
Days 23-30	0.160***	0.172***	0.148***	0.189***
	(0.052)	(0.052)	(0.053)	(0.055)
Log(HH size)	-0.102***	-0.099***	-0.103***	-0.110***
	(0.017)	(0.018)	(0.017)	(0.019)
Non-Hispanic White	0.002	-0.008	0.013	0.030
	(0.046)	(0.048)	(0.046)	(0.051)
Non-Hispanic Black	0.050	0.036	0.059	0.049
	(0.048)	(0.049)	(0.048)	(0.053)
Hispanic	0.016	0.007	0.022	0.049
	(0.049)	(0.051)	(0.049)	(0.054)
Presence of child < 6	-0.007	-0.005	-0.014	-0.009
	(0.019)	(0.020)	(0.019)	(0.021)
HH average income	-0.000	-0.000	-0.000	-0.000
	(0.002)	(0.002)	(0.003)	(0.002)
Constant	0.592***	0.585***	0.610***	0.550***
	(0.072)	(0.073)	(0.072)	(0.079)
Observations	2884	2870	2882	2773

Notes: Standard errors in parentheses and clustered at the household level.
* *p<0.1*, ** *p<0.05*, *** *p<0.01*
For all models, days 1-3 are statistically lower than Days 4-6 and beyond.

Figures

Figure 1. Average daily expenditures over the benefit month



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

Figure 2. Sources of Free Food for SNAP households

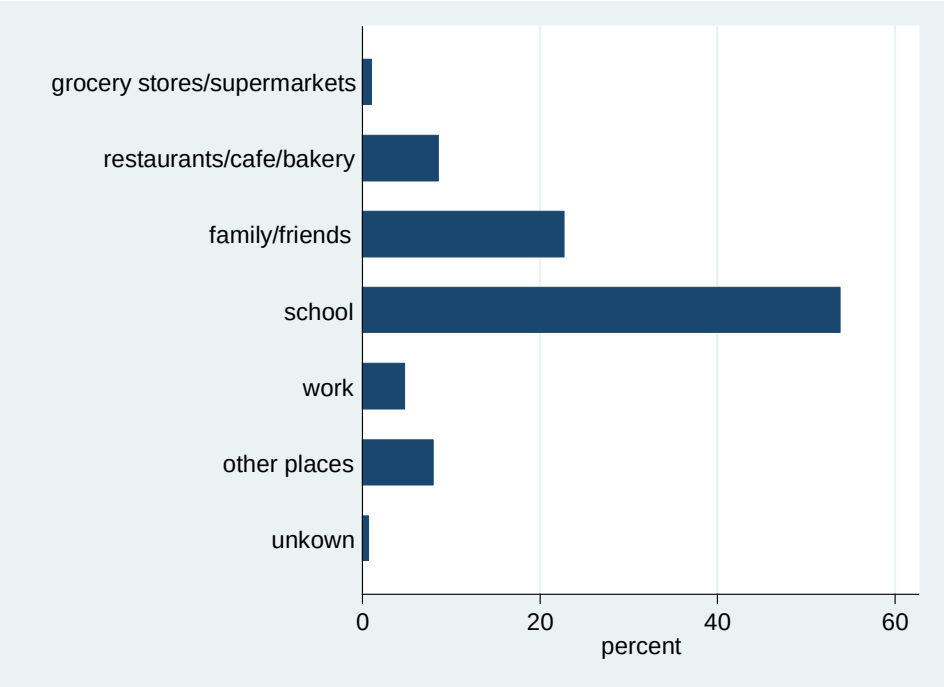


Figure 3. Sources of Free Food for non-SNAP households

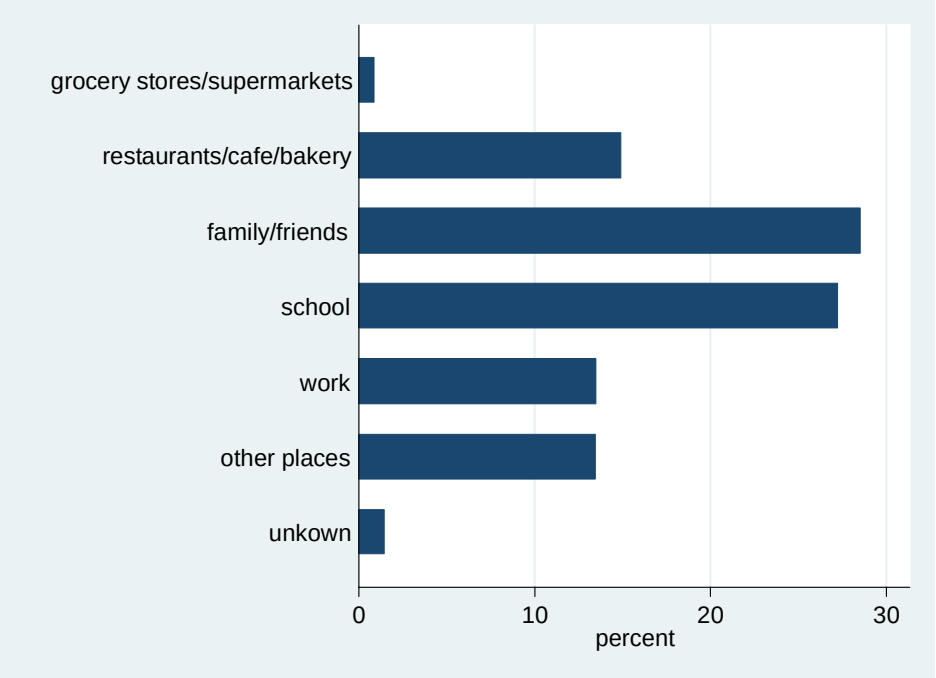
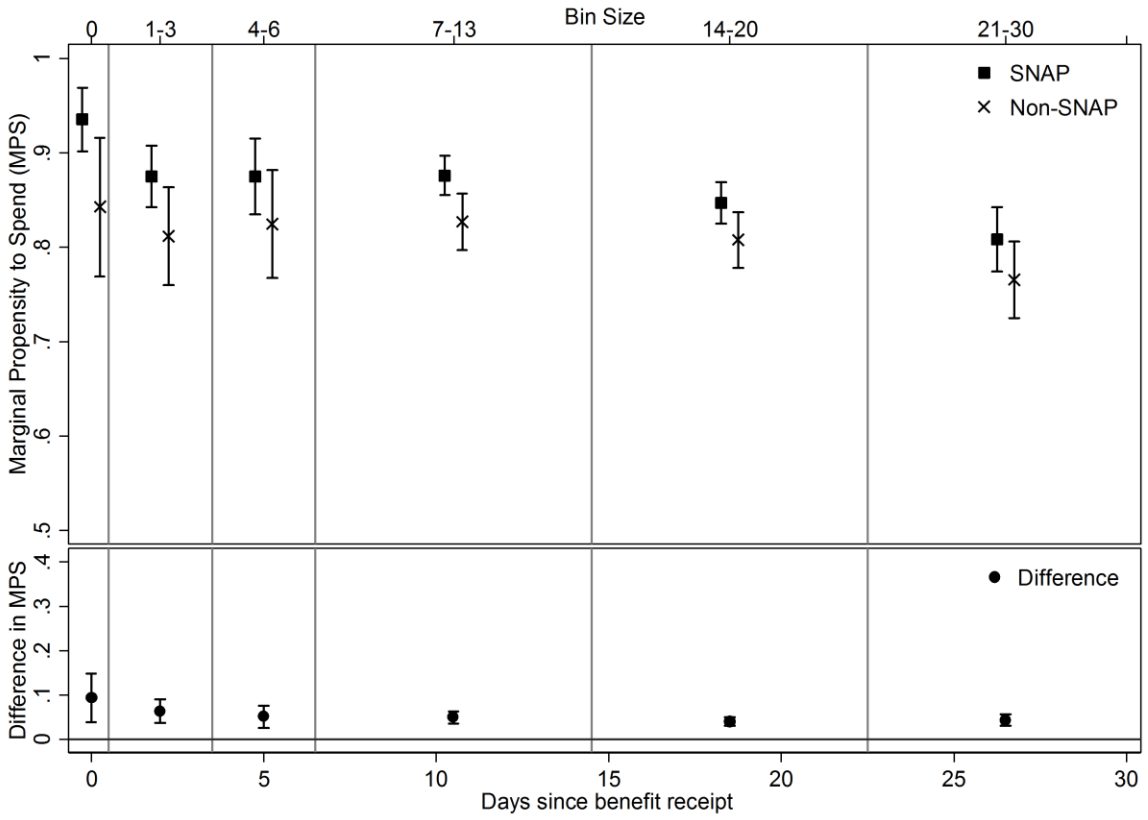
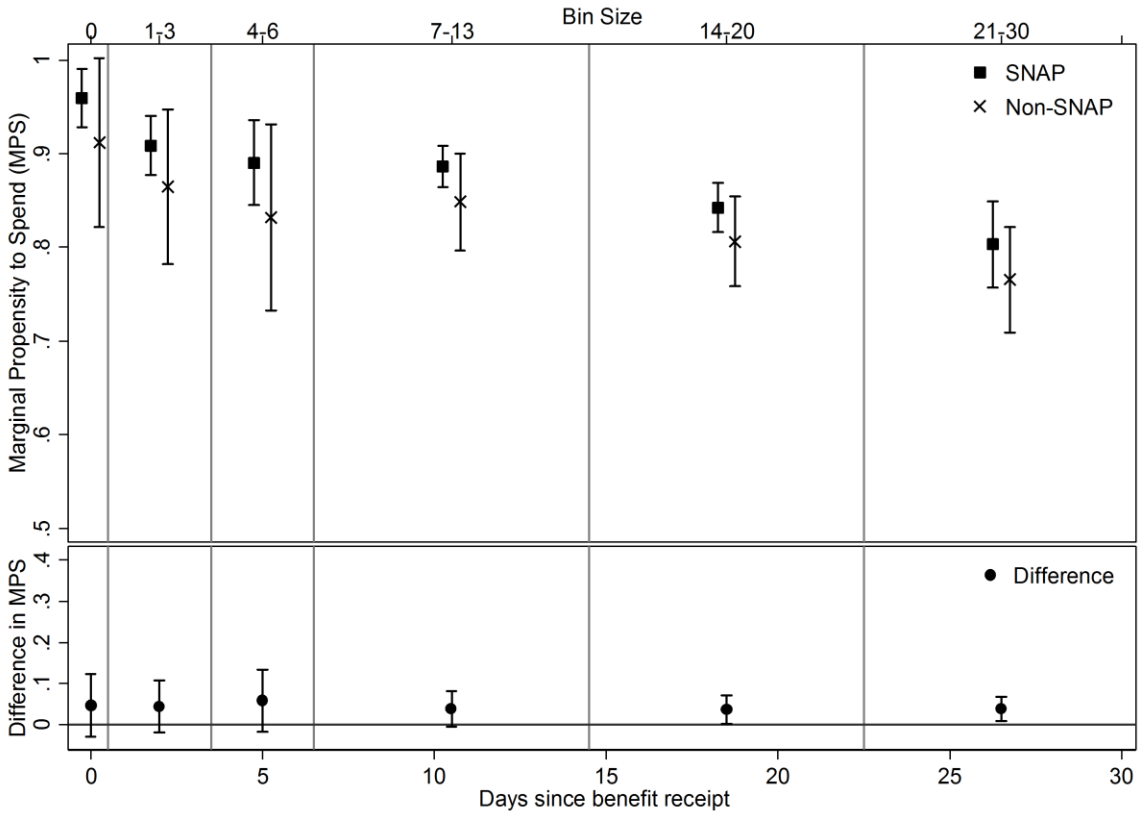


Figure 4. Marginal propensity to spend on food at home, all SNAP households



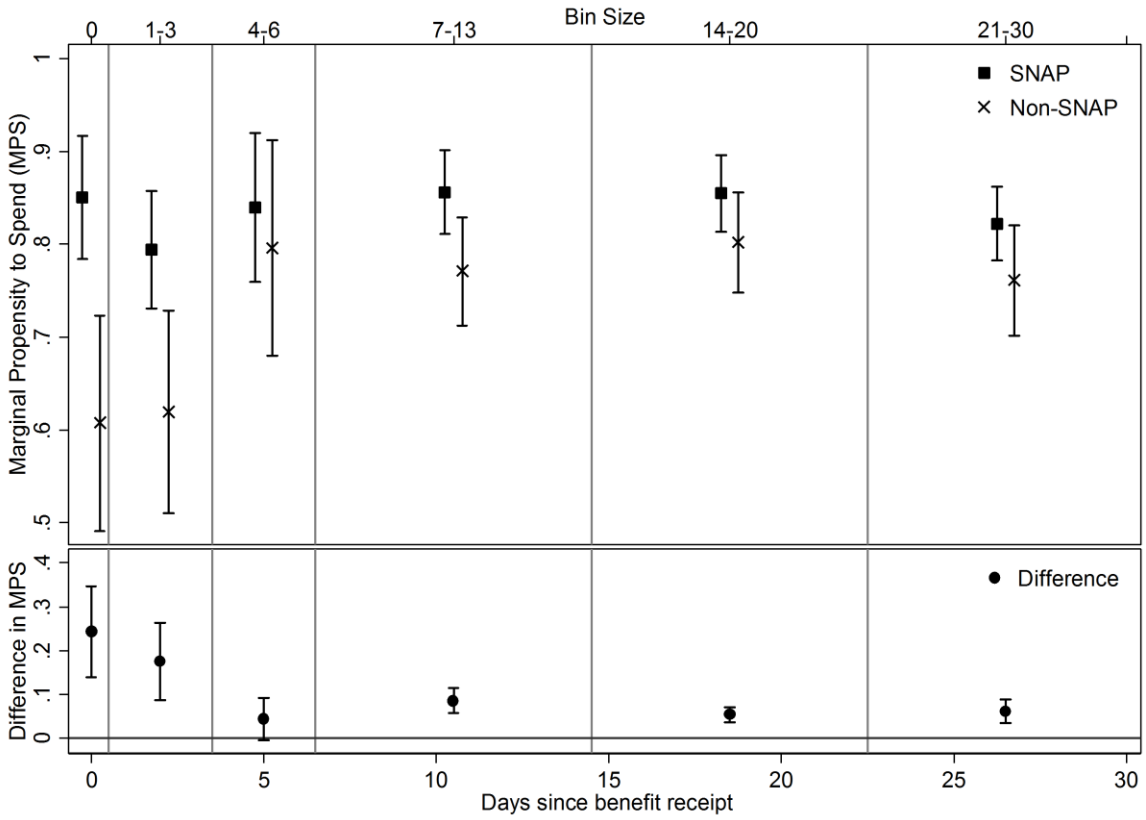
Notes: All point estimates are accompanied by 95- % confidence intervals and correspond to a range of days since benefit receipt shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level. See table 5 for estimates.

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



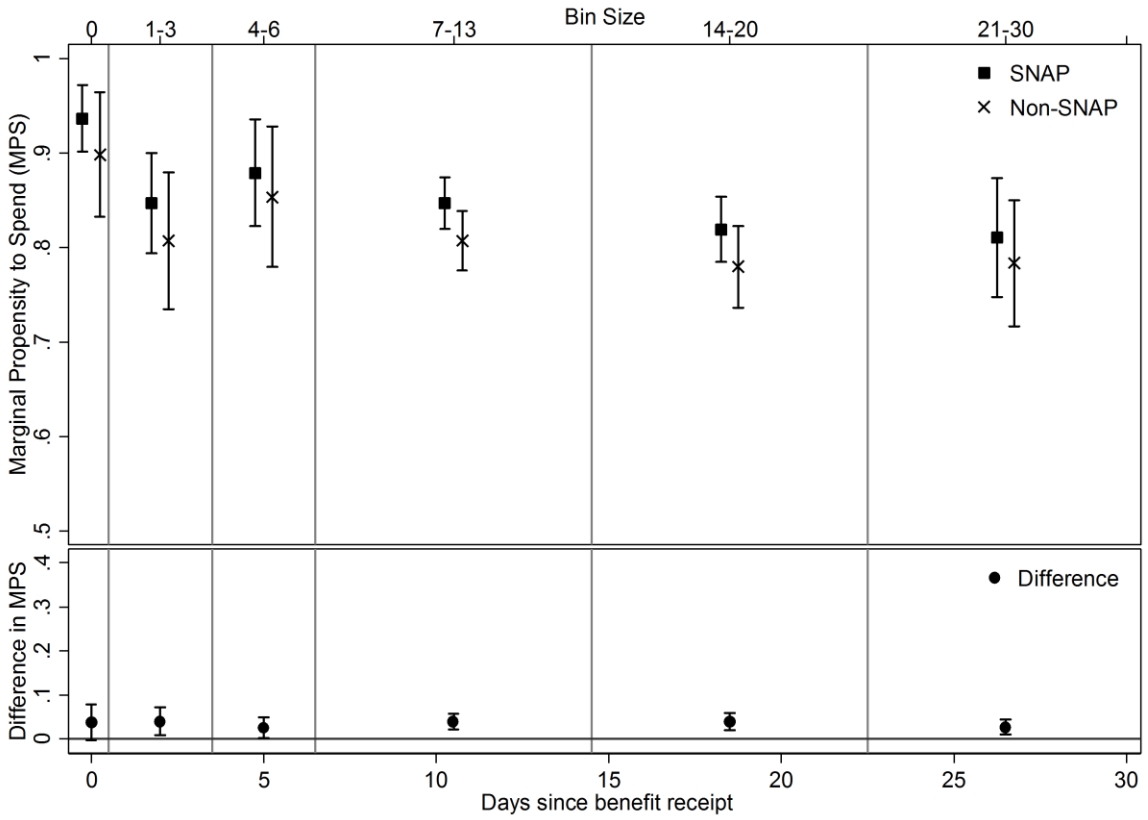
Notes: All point estimates are accompanied by 95- % confidence intervals and correspond to a range of days since benefit receipt shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level. See table 6 for estimates.

Figure 6. Marginal propensity to spend on food at home, infrequent grocery list users



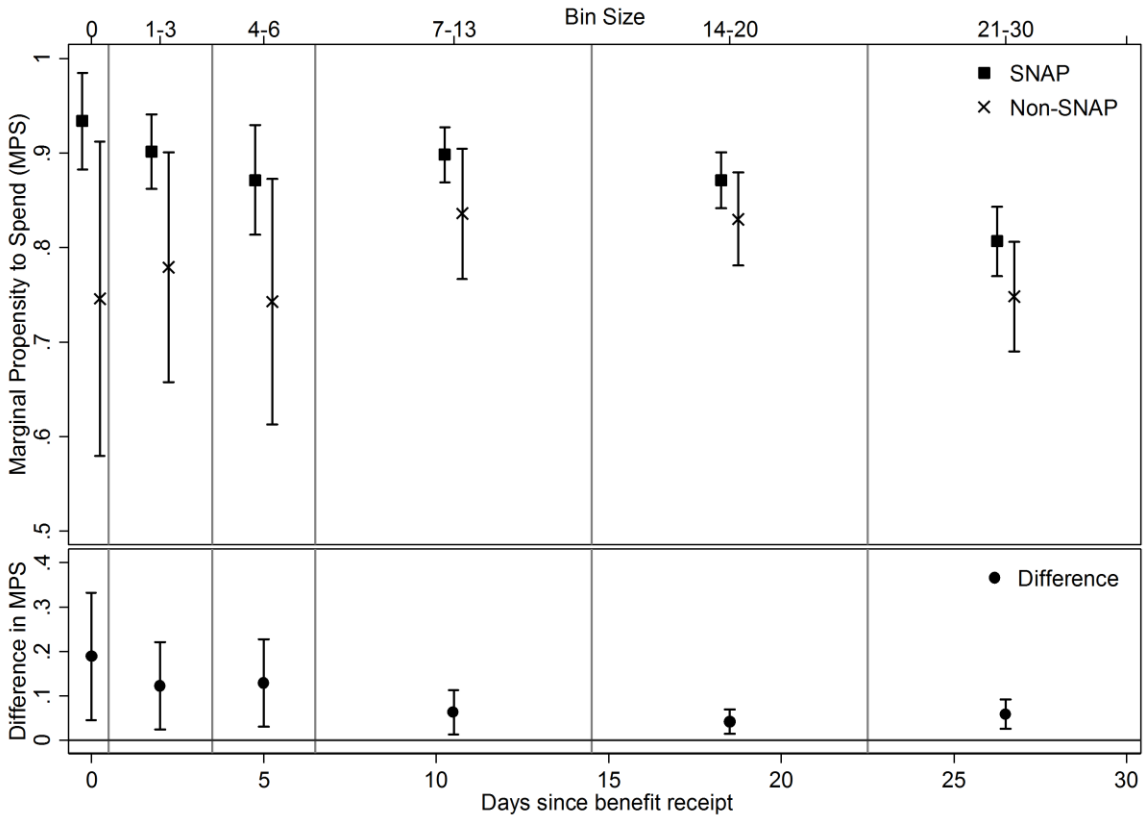
Notes: All point estimates are accompanied by 95- % confidence intervals and correspond to a range of days since benefit receipt shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level. See table 6 for estimates.

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



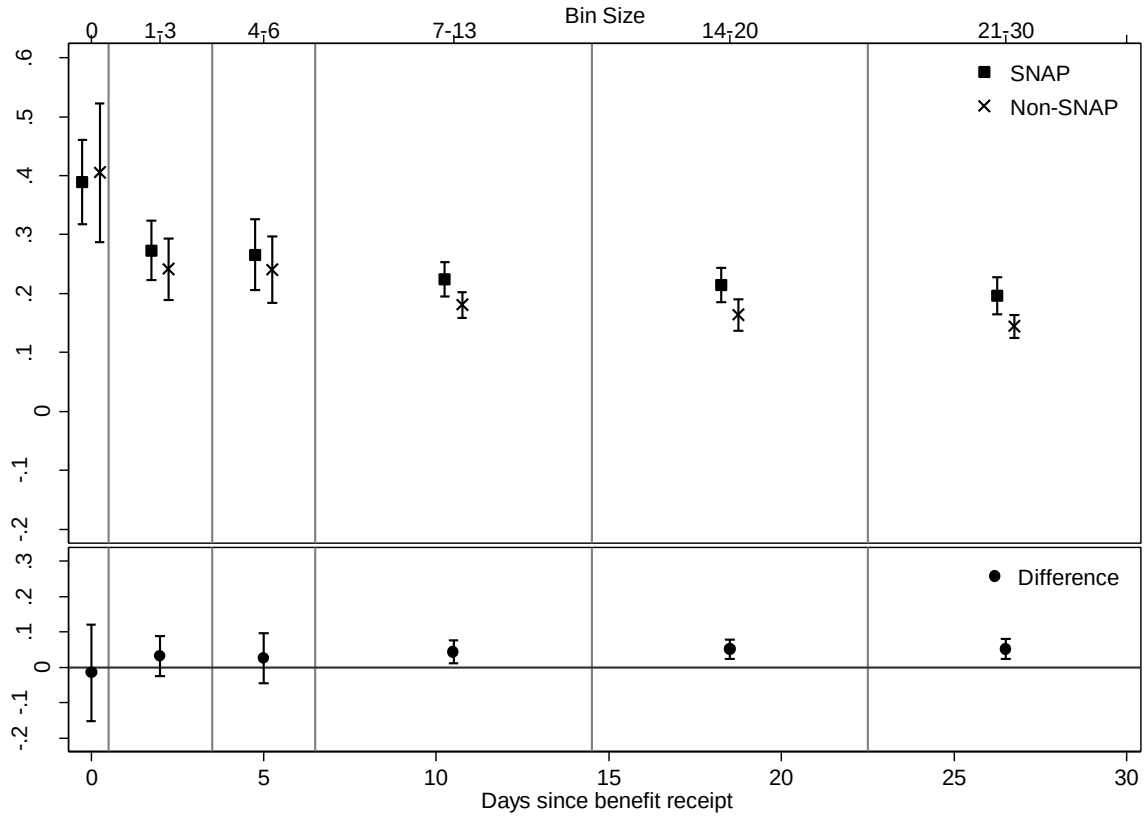
Notes: All point estimates are accompanied by 95- % confidence intervals and correspond to a range of days since benefit receipt shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level. See table 7 for estimates.

Figure 8. Marginal propensity to spend on food at home, <100% of poverty guidelines



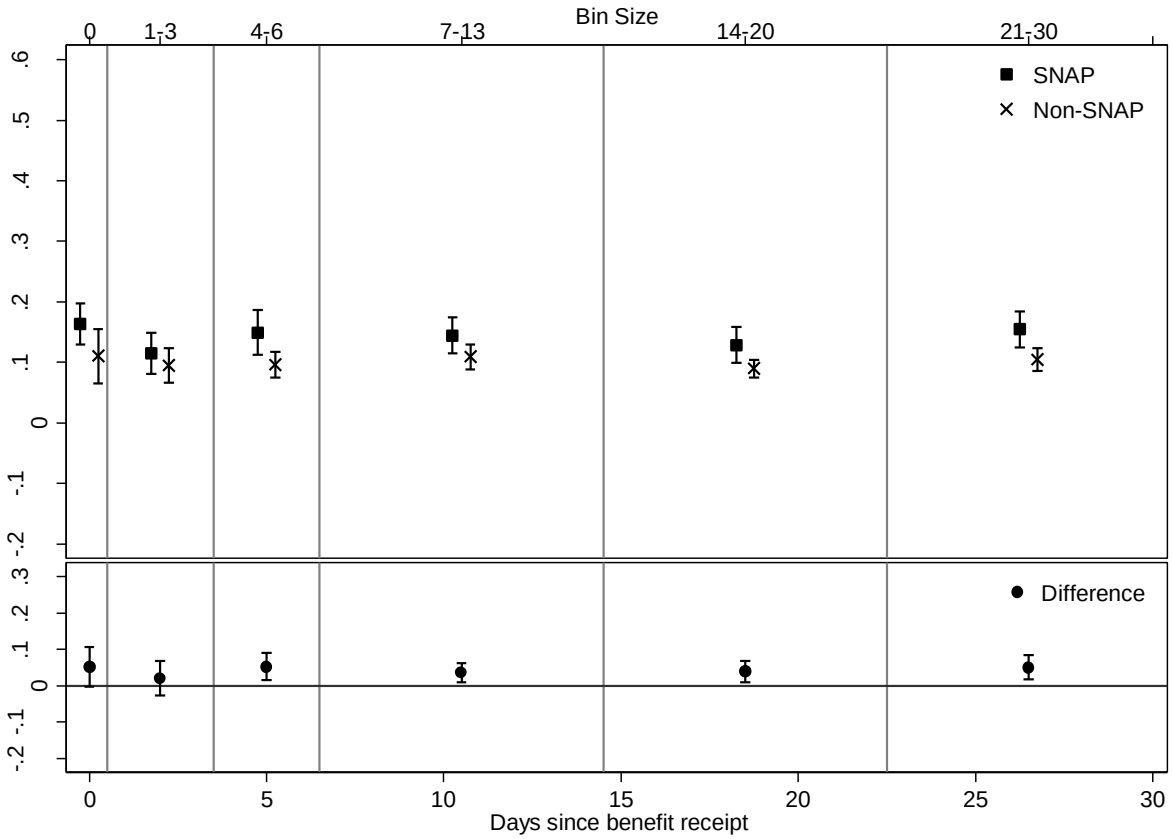
Notes: All point estimates are accompanied by 95- % confidence intervals and correspond to a range of days since benefit receipt shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level. See table 7 for estimates.

Figure 9. Marginal propensity to spend on healthful food



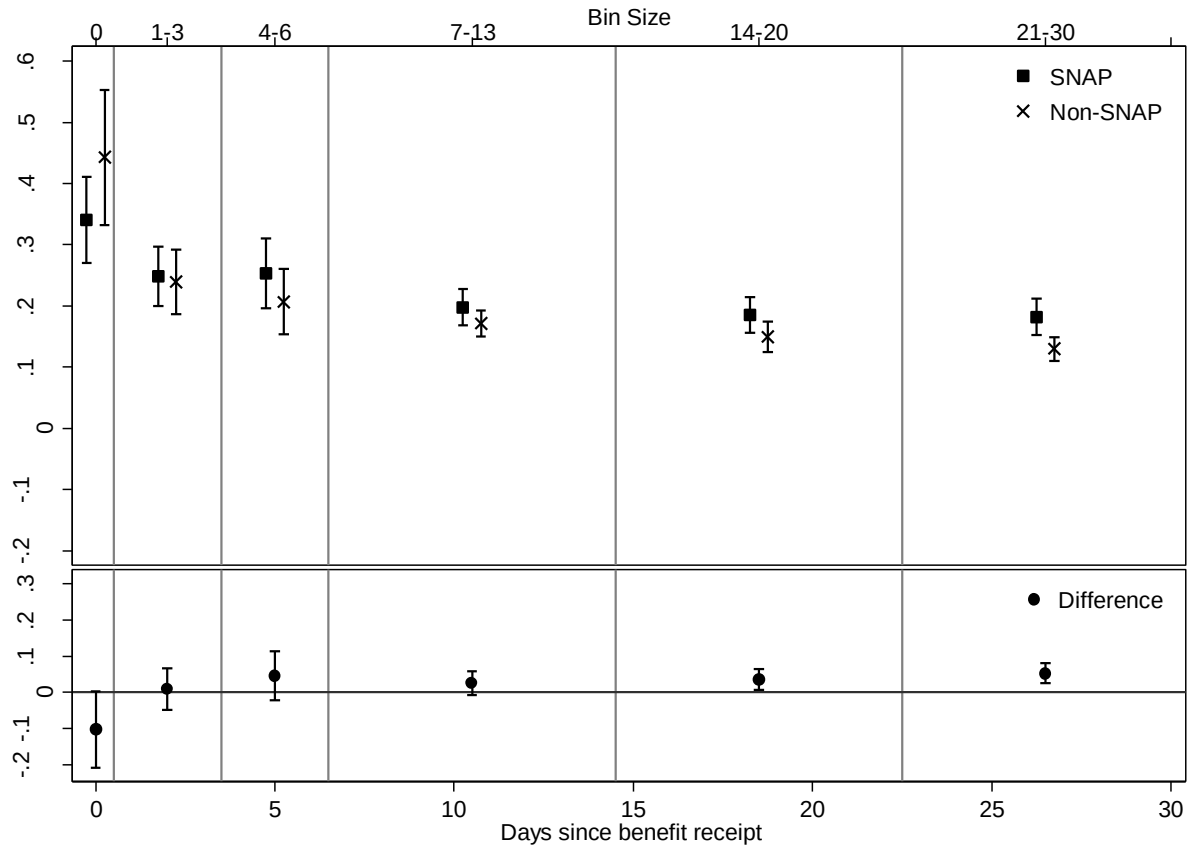
Notes: All point estimates are accompanied by 95- % confidence intervals and correspond to a range of days since benefit receipt shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level.

Figure 10. Marginal propensity to spend on unhealthy food



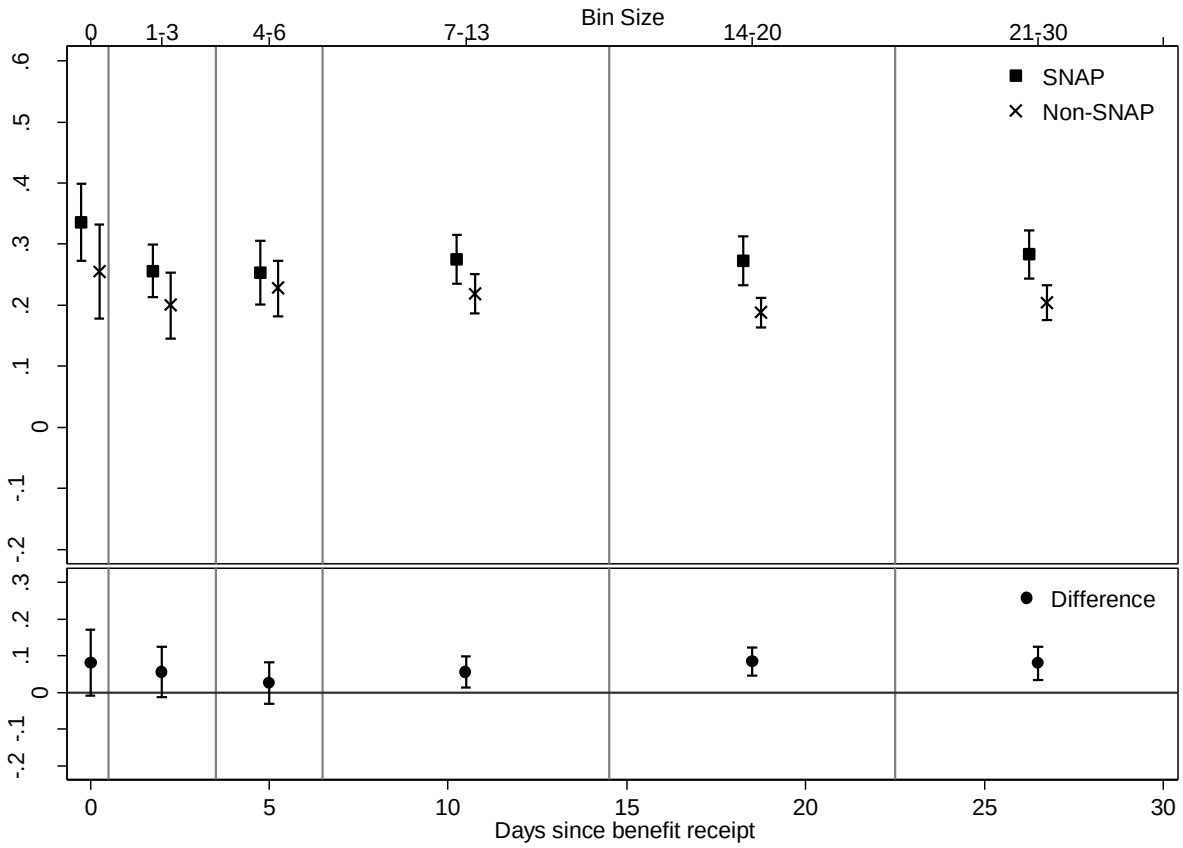
Notes: All point estimates are accompanied by 95- % confidence intervals and correspond to a range of days since benefit receipt shown on the top *x*-axis as "bin size." Standard errors are clustered at the household level.

Figure 11. Marginal propensity to spend on perishable food



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.

Figure 12. Marginal propensity to spend on nonperishable food



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.

[i] Income fungibility, or the idea that "money in one mental account is not a perfect substitute for money in another account" (Thaler 1999), has also been investigated as a 'cash-out effect' (e.g.,Moffitt 1989) and a 'labeling effect' (e.g,, Kooreman 2000).

[ii] 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.

[iii] 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.

[iv] 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, 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 estimated are based on non-zero purchase days.

[v] 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).

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

[vii] SNAP eligibility is set at 130 percent of the poverty guidelines.

[viii] Shapiro (2005) provides a back-of-the-envelope calculation of increased transaction costs due to more frequent disbursements using data from Maryland in 1993. These calculations are however and they precede the move to electronic benefit transfer (EBT) in 2003.