# Re-Examining the SNAP Benefit Cycle Allowing for Heterogeneity

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Abstract

A well-known feature of the Supplemental Nutrition Assistance Program (SNAP) is that recipients spend a disproportionate amount of their monthly benefit early in their benefit month. Using a finite mixture model that optimally separates households into two groups and the National Household Food Acquisition and Purchase Survey (FoodAPS), we reexamine this pattern of spending. Our results show that the benefit cycle is caused by a minority of SNAP recipients who spend an average of two-thirds of their monthly benefit within the first four days. If a program of education or behavioral modification can be designed and implemented to reorient the spending of these households to be more even throughout the benefit month, improvements in food security should be achievable at very low cost.



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## Introduction

Both anecdotal evidence and social science research have documented what is known as the SNAP benefit cycle, in which SNAP (Supplemental Nutrition Assistance Program) recipients spend much of their monthly benefit very early in the month. Such behavior is of concern to policy makers because SNAP is the government's main food assistance program (previously and still often known as food stamps) and if recipients spend their benefit early in the month they may still experience nutritional deficiencies or food insecurity in the latter part of every month. Previous studies have established that, on a purely descriptive level, about 20 percent of SNAP recipients experience very low food security (Coleman-Jensen et al., 2016). It seems a reasonable hypothesis that if SNAP recipients spend most of their SNAP benefit early in their benefit month, they have a higher probability of being food insecure late in the benefit month when they may lack the financial resources to purchase sufficient food. As SNAP is the largest of the USDA's food assistance programs, understanding the nature and causes of the benefit cycle is important because policies to improve SNAP and food assistance more generally could help to ameliorate the worst effects of the SNAP cycle.

This paper is motivated by the fact that while the existence of the SNAP benefit cycle is well established, there is considerably less research that has examined SNAP spending behavior across the benefit month at the micro level. Until recently, this has been due to lack of data. However from 2012 to 2013 the US Department of Agriculture conducted the first nationally representative survey on household food purchases and acquisition. The National Household Food Acquisition and Purchase Survey (FoodAPS) oversampled low-income households and asked about both food-at-home (FAH) and food-away-from-home (FAFH) purchase information,

inquired about any sources for acquiring free food, and collected demographic and income information including SNAP participation and the amount of any SNAP benefit. The data also recorded how each purchase was paid for and collected information on households' SNAP receipt date. These data provide the best opportunity to date for examining the SNAP benefit cycle at the household level. (A fuller description of this data is below.)

In this paper we will re-examine the SNAP benefit cycle using a finite mixture model that allows different groups of SNAP recipients to display different patterns of spending across the benefit month. Using a finite mixture model in which the number of groups is chosen by model selection criteria and which group each household belongs to is chosen to maximize the likelihood function, we will attempt to identify whether the benefit cycle is caused by the behavior of a sub-group of SNAP recipients and then to identify behaviors correlated with that suboptimal spending. Ideally, successful identification of such behaviors would allow the design of program improvements that could help SNAP better address nutritional outcomes and food insecurity.

The rest of the paper is organized as follows. Some literature review provides context for the model that is developed in the third section along with a description of the estimation methodology. The data are described next. This is followed by our empirical results. Finally, implications and conclusions complete the paper.

**Conceptual Background**

The life-cycle or permanent income hypothesis (LCPIH) is a mainstay of textbook economic theory. According this model, households' expectation of lifetime (permanent) income shapes their purchasing and decision-making activity in the present, rather than current income

(Friedman, 1957; Hall, 1978). Because markets for credit, information, and insurance are complete, households can always borrow against future income in executing consumption decisions today. A testable prediction that has developed from the empirical literature in this domain is that predictable changes in income – for example, regular paychecks, stipends, or program benefit payments -- should have no effect on consumption. Put another way, consumption decisions in the current period will not be related to current income or its timing – choices about consumption in the short and long term are perfectly consistent.

Behavioral departures from the LCPIH's rational calculus of utility could be due to market imperfections or other economic causes. In the case of the SNAP-cycle, some research has focused on preference heterogeneity—that is, difference in time preferences between SNAP and non-SNAP households. In this context, behavior of SNAP participants has been found to be consistent with hyperbolic discounting, which describes the situation in which people discount utility in the near future much more heavily than in the not-so-distant future (Laibson, 1997; Smith, Berning, Yang, Colson, & Dorfman, 2016; Wilde & Ranney, 2000). Empirical research has suggested that this could lead to reductions in food purchases and nutritional quality at the end of the benefit month. For example, Shapiro (2005) showed that the SNAP cycle led to decreased caloric intake *as well as* dollar value of intake across the benefit month. Differences in the estimates of these decreases implied a shift away from higher- to lower- quality foods over the course of the month. Wilde and Ranney (2000) examined average calorie intake and found decreased intakes in the fourth week of the SNAP distribution month. Todd (2015) found that, before the increase in SNAP benefits associated with the American Recovery and Reinvestment act of 2009, caloric intake declined by as much as 25% in the fourth week of the SNAP month. Tarasuk, (2007) showed that low-income women's dietary quality was sensitive to the time since

the receipt of income. Finally, Kharmats (2014) found that nutrient quality and energy declined for each day removed from SNAP receipt in a sample of low-income African-Americans in Baltimore.

Other research has shown that this lack of smoothing behavior may be linked to food insecurity. For example, Hamrick and Andrews (2016) used the American Time Use survey to show that SNAP recipients were more likely to have a day without eating at the end of the SNAP benefit month. Weinstein (2009) found that low income households were 5.5 times as likely to report food insecurity at the end of the benefit month than at the beginning; additionally, they found that, in households with children, food insecure households were much more likely to have a child with anemia.

Our study contributes to this literature by examining unobserved heterogeneity in responses to SNAP receipt and using administrative data to check the robustness of the results.

**Methodology**

In order to test our theory that the SNAP benefit cycle might be caused by only a subset of SNAP recipients, we apply a normal finite mixture model to data on spending patterns from the FoodAPS dataset. A mixture model assumes that data are generated by two or more different unobserved processes with each observation being assigned a probability of belonging to each process or group (Dempster, Laird, and Rubin, 1977). The model specification of the data generating process in each group can be different, or even if the model stays constant across groups, the model parameters will differ. During the estimation process, the parameters of each group's model are chosen to maximize the likelihood function and the number of groups is chosen to maximize a model selection criteria such as the Akaike Information Criterion or AIC.

For this application, we apply a normal finite mixture model, meaning that each group is assumed to follow a normal linear regression model. Our chosen dependent variable is the percent of each household's monthly SNAP benefit spent in the first three days of the benefit month. This variable is selected because it represents a strong signal of the SNAP benefit cycle. A recipient who spent their SNAP benefit evenly throughout the entire month would spend about 10 percent in the first three days. In extreme cases of the type of behavior that produces the benefit cycle, some households are observed spending their entire SNAP benefit in the first three days. By focusing on this measure of very rapid spending we narrow our examination to the behavior that is most indicative of the spending pattern we are seeking to identify and modify.

To explain the share of SNAP benefits spent in the first three days we include a host of factors in different categories: demographic, financial, health, and store-choice/location. These explanatory variables are identical in all group's models. Insight can be gained both from differences in the model parameters or in the distribution of exogenous variable values in different groups. We include the amount of monthly SNAP benefits, indicators for three levels of food security, and an indicator of if the household has utilized a food pantry in the past month. The demographic variables include standard variables such as age, gender, race, household size, employment status, and the number of children and elderly in the household. Health measures include variables for tobacco use, self-assessed health status, self-assessed diet quality, and how frequently the shopper looks at nutritional labels. In the shopping category, we have variables for time to the shopper's favored store location, reasons for choosing their usual grocery outlet, and the frequency of grocery list usage. The financial measures include whether the household owns their house or apartment, how regularly they pay their bills on time, a self-assessed measure of

the household's financial condition, and an indicator for the presence of more or less than $2000 in liquid assets.

Given this set of explanatory variables, the share of SNAP benefits expended in the first four days of the benefit cycle (*Ratio*) is represented as a linear model:

$$Ratio_i = \beta_{oj} + DG_i\beta_{1j} + FS_i\beta_{2j} + H_i\beta_{3j} + FN_i\beta_{4j} + SH_i\beta_{5j} + \varepsilon_i \quad (1)$$

where DG is a vector of demographic variables, FS are the food security measures, H is a vector of health-related variables, FN is a vector of financial measures, and SH is a vector of variables about shopping location choices and shopping behavior. The βs are parameters to be estimated with the first subscript denoting the subset of variables they are associated with and the second subscript denoting the group the observation belongs to (j=1, …, J), while $\varepsilon_i$ is a stochastic term for observation i.

*Ratio,* the share of SNAP benefits spent in the first three days cannot be negative and cannot exceed 2. Some households do spend more than their monthly SNAP benefit because benefits do rollover if not spent so it is possible to spend more than 100 percent in a month or in the first three days. While spending ratios above 1 are therefore possible, we censored any such observations to 1. Although the dependent variable, *Ratio* is censored on both ends of its range, we are estimating standard linear regression models. There are 45 observations at the lower limit, 10 observations at the upper limit, out of 163 total. While the model results do produce 32 predicted values above 1 and 17 below zero, it is important to note that values greater than one are theoretically possible and the vast majority of the predicted values outside the imposed range are quite nearby (e.g., 13 out of 17 negative predictions are between 0 and -0.1). Given this, we believe it is defensible to apply linear regression models to this data in spite of its censoring.

The likelihood function for a finite mixture model of normal distributions is given by

$$L(\pi, \beta, \sigma \mid X, y) = \prod_{i=1}^{n} \pi_{ij}\, \phi\left[\frac{Ratio_i - X_i\beta_j}{\sigma}\right], \quad (2)$$

where the $\pi_{ij}$ are the probabilities that observation *i* belongs to group *j*, $\phi(\circ\bullet)$ is the pdf of a standard normal distribution, *X* is the collection of all the explanatory variables and $\beta_j$ is the vector of all regression coefficients for group *j*. To estimate the mixture model for a given number of groups, one needs to maximize the likelihood function in equation (2) subject to constraints on the $\pi_{ij}$ to ensure they sum to one for each observation *i*. We use the Expectation Maximization (EM) algorithm to find the solution to this problem (Dempster, Laird, Rubin, 1977; Fruhwirth-Schattner, 2006). Basically, the EM algorithm works in two steps: in the first, E-step, with a set of estimates for $\pi_{ij}$ in hand, we take the conditional expectation of the log likelihood $\log L(y, \pi \mid X, \beta, \sigma)$ Then, given the estimates of $\beta_j$ and $\sigma$ from the E-step, find a new set of $\pi_{ij}$ that maximizes the complete likelihood function in (2) conditional on these updated regression parameters (M-step). This loop continues to repeat until estimates stop changing and convergence to a maximum is achieved. Finally, mixture models are estimated for several different numbers of groups and a model selection criterion such as the AIC is employed to choose the optimal number of groups.

**Data**

USDA's National Household Food Acquisition and Purchase Survey (FoodAPS) is the first nationally representative survey to collect comprehensive data about household[2] food purchases and acquisition. The seven-day survey was conducted between April 2012 and January 2013 on a nationally-representative sample of 4,826 households. This survey covers SNAP households,

[2] The FoodAPS household is defined as all persons who live together and share food and who expect to be present at the sampled address during at least part of the data collection week.

low-income households not participating in SNAP, and higher income households. SNAP households were oversampled to ensure good statistical variation and coverage of this subsample. Sampling weights are included to transform the data set into a nationally representative sample.

For a one week data collection period, each participating household was asked to record food-at-home (FAH) and food-away-from-home (FAFH) purchase information and also reported all sources of free food. Respondents also participated in two interviews which aimed to collect detailed household-level and individual-level information. This detailed information includes variables about shopping outlet choice and the reasons for those choices, self-assessed health measures, measures of both household financial condition and financial management, and many other variables on both food acquisition habits and household demographics.

FoodAPS has several advantages for this project. First, FoodAPS collects extensive information on demographic, labor market, program participation, income and expenditures – both food and non-food – for each household. This is helpful in determining if characteristics differ across the groups estimated by the mixture model. Additionally, each individual's shopping events are also characterized by the payment type: in particular, we know whether acquisitions are paid for with SNAP benefits, cash, or a combination. Finally, the data set also lists whether respondents are SNAP recipients and contains an administrative verification of that status (which is important as SNAP status is frequently misreported).

We focus on a subsample the 1,581 of the 4,826 total households that were administratively verified SNAP recipients during the week of the survey. The initial interview was usually conducted right before the seven-day survey period to screen the eligible households. Using information in the FoodAPS data set, we created a variable "*dayinterval*" to

record the number of days between the first day of the seven-day survey period and the last SNAP benefits date. Because each household receives SNAP benefits on the same calendar day as the previous month, *dayinterval* equals 0 on the day SNAP benefits are received and reaches a maximum of 30 before the benefit cycle repeats.

We are interested in the pattern of how households redeem their SNAP benefits throughout the month. Thus, we calculate the daily SNAP expenditure ratio ("daily ratio" for short) as the percentage of daily SNAP expenditure over monthly SNAP benefits, letting the daily ratio equal 0 if there is no shopping event on a survey day. Figure 1 presents the average daily ratio of SNAP expenditure throughout the SNAP benefit month. The average daily ratio is 30.27% on the day of benefit receipt (i.e., *dayinterval* = 0), which means that the average household spends about 30% of its SNAP benefits on the SNAP receipt day. The average daily ratio drops to 5.87% on the third day. Throughout the rest of benefit month, the daily ratio displays a consistent decrease.

As demonstrated by Figure 1, a well-known and oft-studied feature of SNAP recipients is that, on average, SNAP participants spend a large percentage of their benefits within the first few days of the benefit month. Figure 1 reaffirms this SNAP benefit cycle. Since we are most interested in the feature at the start of the benefit cycle, we focus on those households for whom days 0-3 are all observed (*dayinterval* = 0, 1, 2 and 3). The ratio of total SNAP expenditures in these days to monthly SNAP benefits is *Ratio*, the dependent variable in our mixture model.[3]

Because interview windows are distributed evenly throughout the benefit month, many observations do not include the necessary four days. We additionally restrict the sample in the following ways: (1) we exclude SNAP households with benefits less than $20 per month and (2)

[3] We name the dependent variable *Ratio* to distinguish it from the daily ratio also discussed above.

the primary household respondents must be adults (age of primary respondent greater than 19). We also drop households missing values for any of our included explanatory variables. These conditions leave us 734 observations and 163 households.

Full details of the explanatory variables and their construction is in Appendix Tables 1 and 2, including a description of how we built categorical variables from the survey's coded responses. In many cases, we took a variable with, for example, five responses and made it into one or two dummy variables by combining several responses into a single category; this allows us to keep the explanatory variables to a manageable number.

Notable included variables beyond number demographic ones are the number of dinners eaten together as a family at home, self-assessed health and diet ratings, tobacco usage, use of nutrition labels when shopping, familiarity with My Pyramid and My Plate diet recommendations, reported food security, whether the household used a food pantry or food bank in the past month, frequency of grocery usage, travel time to the household's primary food store, usual means of getting to their food store, if the household owns or rents their residence, how frequently they pay their bills on time, and if the household has used a payday loan in the past six months. For a full list of the explanatory variables, see Appendix Table 1.

**Results**

The estimation of the mixture model results in the finding of two groups of SNAP recipients, which we will dub the patient and impatient groups. A model selection criterion was not needed as models with more than two groups failed to converge (implying infinite values for model selection criterion such as the AIC). Out of our 163 households, we find 63 members of the impatient group (39% of the sample) and 100 members of the patient group (61%).

To measure the success at classifying the observations into the two groups, we compute the entropy measure of discrimination suggested by Celeux and Soromenho (1996). Discrimination measures how confidently the model has assigned observations to one of the groups. The entropy measure is computed in two steps:

$$E = \sum_{i=1}^{n} \sum_{j=1}^{J} \pi_{ij} \ln(\pi_{ij}) \quad (3)$$

$$ER = 1 - E/[n\ln(J)]. \quad (4)$$

With the scaling in equation (4), the value of *ER* is bound between 0 and 1 with common practice being that values above 0.8 demonstrate strong confidence in the classification process. Our model has a value of *ER* = 0.9574.

Figure 2 clearly displays the vast difference in average early-benefit cycle spending behavior by members of these two groups. The impatient groups spends four times as much of their monthly SNAP benefit in those first few days of the benefit cycle as the households in the patient group. While the patient households spend only slightly more than a proportional share of their monthly benefits on days 0 to 3 of the benefit cycle (a 17.7% spending ratio in 13.3% of the days), the impatient households spend an average of 67.2% of their benefit, over two-thirds of the benefit gone with roughly four weeks left in the benefit month.

The estimated coefficients of the mixture model are shown in Table 1, along with measures of their statistical precision. These results show that having a job makes impatient households spend their SNAP benefits faster while having more kids at home makes them spend their SNAP benefits more slowly; neither of these variables has a significant effect on patient household spending. Impatient people who use tobacco and rate themselves as more unhealthy spend their SNAP benefits faster, again with little similar effect among the patient households. Using a grocery list regularly slows the SNAP spending of impatient households. We also see more even

spending from impatient households who choose their primary grocery store because of its produce, but faster spending by impatient households who choose their primary store for variety or closeness. Owning their house and having some money in the bank both led impatient households to spend their SNAP benefit faster, likely because of a greater ability to buy food with cash later in the benefit month.

Interestingly, while the mixture model results show both that a number of the explanatory variables do effect the rapidity of SNAP spending and that some explanatory variables have very different marginal effects on SNAP spending for patient versus impatient households, there are few statistically significant differences between patient and impatient households in the average values of these explanatory variables. Impatient households self-rate their diet slightly worse, use a grocery list somewhat more often, are more likely to choose their primary food store based on price, but less likely to choose it based on variety, closeness, or because it has a loyalty program. Impatient households face a somewhat longer driving distance to their primary store (5.6 versus 3.8 miles) and have fewer SNAP-accepting stores nearby than do the patient households.

More notable are the significant differences we do not find. The patient and impatient households do not differ significantly in working, education, number of kids in the home, eating together as a family, reported food security, or use of food pantries. Importantly, there is no significant difference in total earnings or amount of SNAP benefit between our two groups. Both groups are equally likely to use their own car as their primary means of getting to the grocery store. They report very similar financial conditions.

The SNAP benefit cycle is caused by a subset of all SNAP recipients, but the behavior of those households is not driven by some difference that forces their shopping pattern to vary. For example, they are not spending all their money at once because it is harder for them to get to the

store. The simple story seems to be that a share of SNAP households (39% of them), choose to spend a large share of their SNAP benefits very rapidly as soon as they are received.

**Implications**

While our patient and impatient groups report roughly equal food security in the early days of the benefit month, food insecurity does rise through the SNAP benefit month. Low or very low food security rises from 44% to 48% of SNAP households when the first ten and last ten days of the benefit month are compared. Thus, it is likely that impatient households are running low on financial resources with which to purchase food at the end of their benefit month. It is also possible that better budgeting of SNAP benefits could improve this situation. Thus, it is worth trying to help impatient SNAP households to utilize their SNAP benefit more evenly throughout the month.

USDA can easily identify impatient households by examining their SNAP spending in the first few days of the benefit month. The few statistically significant differences between patient and impatient households suggest that the behavioral differences are not driven by a difference in circumstances. Nor could as simple a nudge as encouraging the use of grocery lists completely solve the problem because while our results show that grocery list usage does help, nearly half of the impatient households already use a grocery list regularly. Thus, an educational program seems to be the optimal response, teaching these households some basic budgeting skills and tools and helping them to understand the potential benefit of a more evenly distributed spending pattern.

Another possible response would be to provide SNAP benefits more frequently, for example twice a month, or even weekly. Such a policy change was raised as a possible remedy to

the SNAP benefit cycle by Smith, et al. (2016). While this change would involve modestly higher administrative costs, it might mitigate against the rising food insecurity seen later in the benefit month and would make it impossible to spend more than 25 percent of the current monthly SNAP benefit within a week.

## Conclusions

By examining the SNAP benefit cycle at the household level using a finite mixture model, we find that the phenomenon is caused by a minority of SNAP recipients. Within the subsample of households in the FoodAPS dataset examined here, 39 percent of SNAP recipients are in our impatient group, spending roughly twice the average amount of their monthly SNAP benefits within the first four days of receiving them. The remaining households appear to budget their benefits pretty evenly throughout the month and should not be concern of policymakers.

To address the heightened risk of food insecurity that the data show nearer the end of the benefit month, policymakers could try educational programs or a change in the program administration. Educational programs could be attempted that teach budgeting, use of grocery lists, and other techniques designed to encourage the impatient households to spend more evenly. Psychologists have been experimenting with programs to increase patience, so the goal is not impossible. Alternatively, an administrative approach would involve providing SNAP benefits in smaller amounts and higher frequencies rather than the current monthly payments.

With either approach, success and program efficiency will be increased simply by USDA recognizing that minimizing the SNAP benefit cycle and the food insecurity issues it can engender are confined to a subset of SNAP recepients. There is no need to force changes on households already efficiently and optimally utilizing the aid being provided.

**References**


Celeux, G., and Soromenho, G. (1996). An entropy criterion for assessing the number of clusters in a mixture model. *Journal of Classification*, 13:195-212.

Coleman-Jensen, A., Rabbitt, M., Gregory, C., & Singh, A. (2016). *Household Food Security in the United States 2015*. U.S. Department of Agriculture. Economic Research Service.

Dempster, A.P., Laird, N.M., and Rubin, D.M. (1977). Maximum Likelihood form Incomplete Data via the EM Algorithm. *Journal of the Royal Statistical Society,* 39(1):1-38.

Frühwirth-Schnatter, S.(2006). *Finite Mixture and Markov Switching Models*. Springer.

Friedman, M. (1957). *A Theory of the Consumption Function*. Wiley.

Kharmats, A., Jones-Smith, J.C., Cheah, Y., Budd, N., Flamm, L., Cuccia, A., Mui, Y., Trude, A., & Gittelsohn, J. (2014). Relation between Supplemental Nutrition Assistance Program Cycle and Dietary Quality in Low-Income African-Americans in Baltimore, Maryland. *American Journal of Clinical Nutrition*, 99: 1006-1014.

Hall, R. E. (1978). Stochastic Implications of the Life Cycle-Permanent Income Hypothesis: Theory and. *Source Journal of Political Economy, 86*(6), 971-987. Retrieved from http://www.jstor.org/stable/1840393.

Hamrick, K. & Andrews, M. (2016). SNAP Participants' Eating Patterns over the Benefit Month: A Time Use Perspective. *PLOS One*, 11(7): doi: 10.137/journal.pone.0158422.

Laibson, D. (1997). Golden Eggs and Hyperbolic Discounting. *The Quarterly Journal of Economics, 112*(2), 443-477. Retrieved from http://www.jstor.org/stable/2951242

Shapiro, J. M. (2005). Is there a daily discount rate? Evidence from the food stamp nutrition cycle. *Journal of Public Economics, 89*(2–3), 303-325. doi:10.1016/j.jpubeco.2004.05.003

Smith, T. A., Berning, J. P., Yang, X., Colson, G., & Dorfman, J. H. (2016). The Effects of Benefit Timing and Income Fungibility on Food Purchasing Decisions among Supplemental Nutrition Assistance Program Households. *American Journal of Agricultural Economics, 98*(2), 564-580. doi:10.1093/ajae/aav072.

Tarasuk,V.,McIntyre, L. & Li, J. (2007). Low-Income Women's Dietary Intakes Are Sensitive to Depletion of Household Resources in One Month. *Journal of Nutrition*, 137(8): 1980-1987.

Todd, Jessica. (2015). Revisiting the Supplemental Nutrition Assistance Program Cycle of Food Intake: Investigating Heterogeneity, Diet Quality, and a Large Boost in Benefit Amounts. *Applied Economic Policy and Perspectives*, 37(3): 437-458.

Weinstein, J., Martin, K., & Ferris, A. (2009). *Journal of Hunger and Environmental Nutrition*, 4(1): 48-61.

Wilde, P. E., & Ranney, C. K. (2000). The Monthly Food Stamp Cycle: Shooping Frequency and Food Intake Decisions in an Endogenous Switching Regression Framework. *American Journal of Agricultural Economics, 82*(1), 200-213. doi:10.1111/0002-9092.00016

Figure 1. Average ratio of SNAP expenditures to SNAP benefit by day of benefit cycle

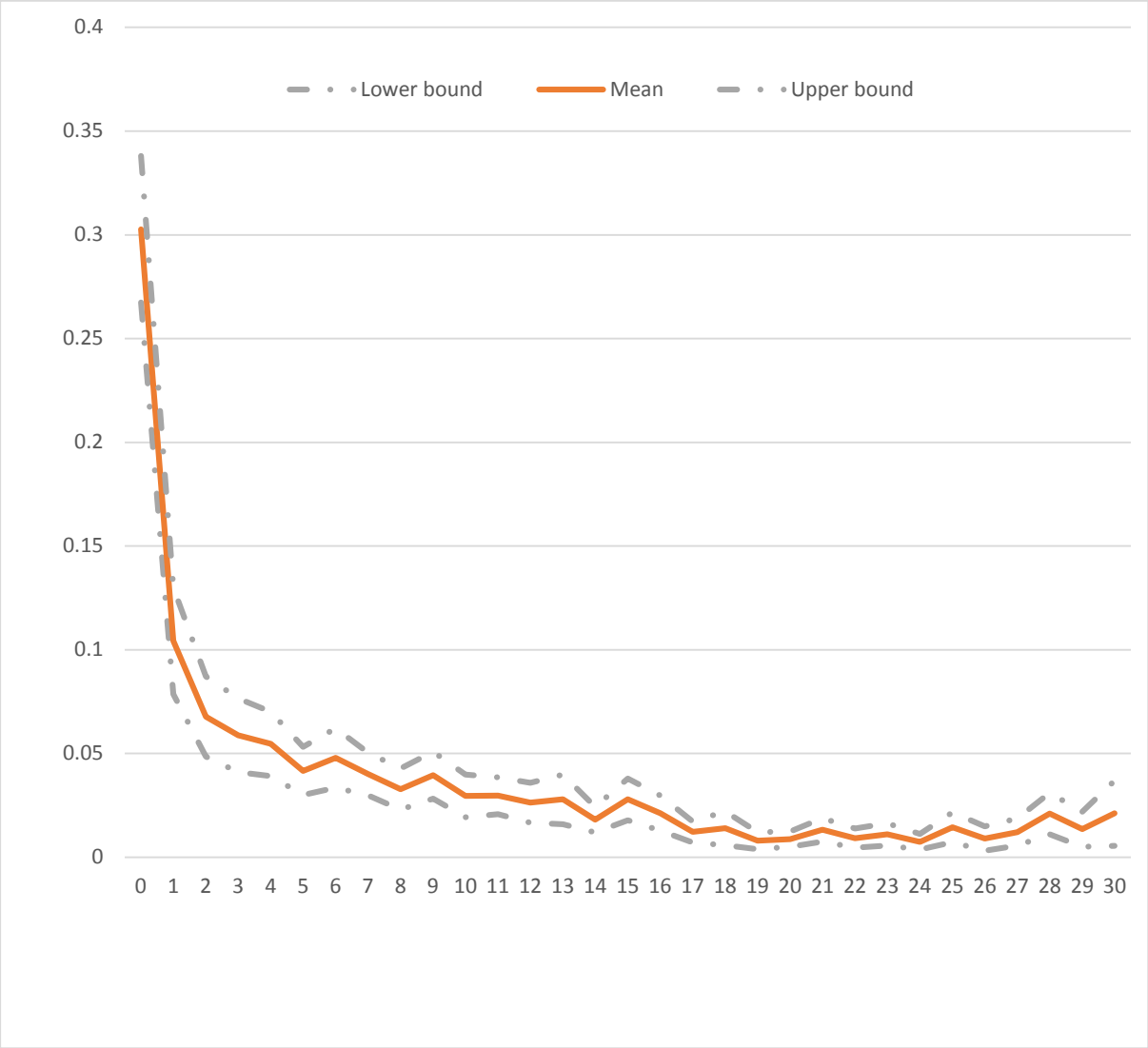
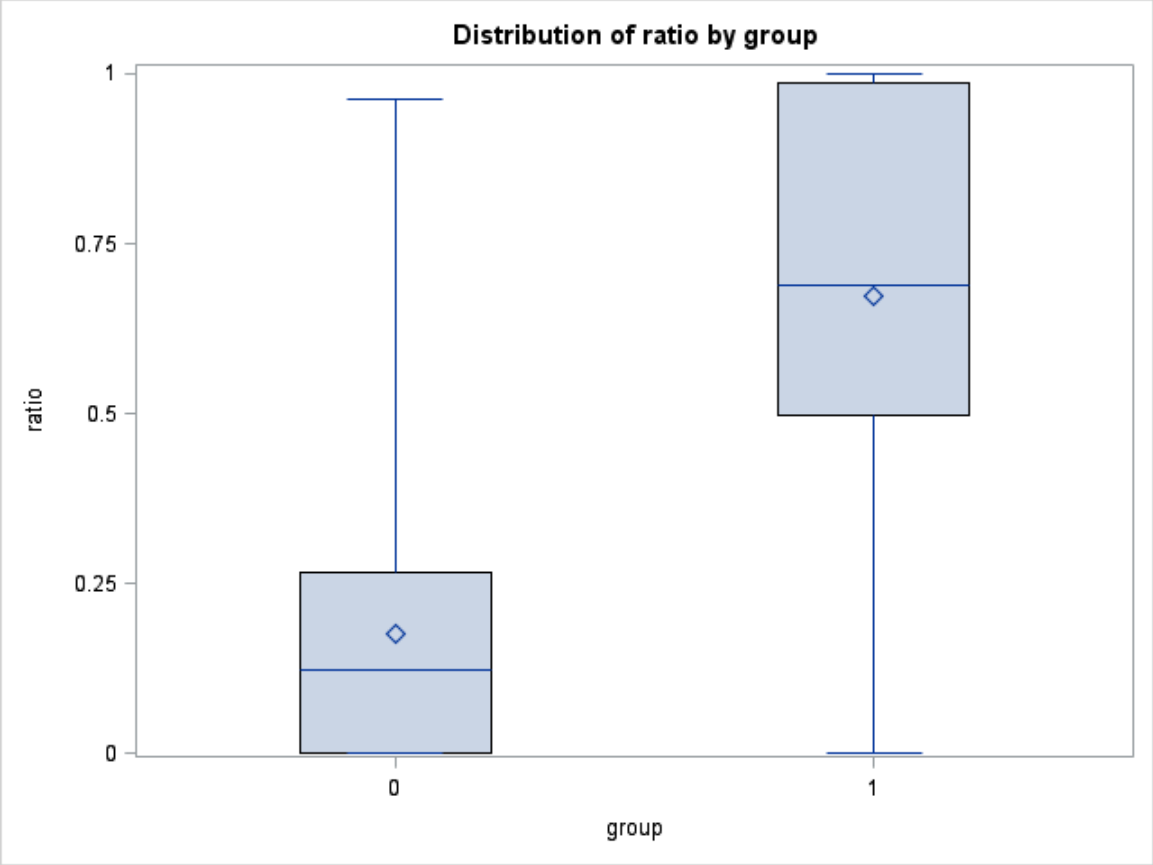


Figure 2. First three day SNAP expenditure ratios by group




Data summary for figure

| group | N | Mean | Std.Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| Impatient | 63 | 0.672 | 0.293 | 0 | 1 |
| Patient | 100 | 0.177 | 0.220 | 0 | 0.963583 |
| Total | 163 | 0.368 | 0.348 | 0 | 1[4] |

[4] There are 10 households whose ratios are greater than 1 among which there are 2 households whose ratios are greater than 2. We normalize all those ratios to 1s.

Table 1. Mixture model regression results

| | Group1: impatient | | | | Group2: patient | | | |
|---|---|---|---|---|---|---|---|---|
| Variable | Coefficient | std.err | z-score | p-value | coefficient | std.err | z-score | p-value |
| Constant | 2.072 | 0.069 | 30.217 | 0.000 | 0.061 | 0.116 | 0.528 | 0.149 |
| **Family and Personal Characteristics** | | | | | | | | |
| Sex | -0.169 | 0.014 | -12.209 | 0.500 | -0.029 | 0.029 | -0.972 | 0.417 |
| Age | -0.010 | 0.000 | -22.764 | 0.500 | 0.006 | 0.001 | 5.082 | 0.000 |
| Work | 0.289 | 0.013 | 22.203 | 0.000 | -0.014 | 0.022 | -0.630 | 0.368 |
| racecat1 | -0.232 | 0.023 | -9.999 | 0.500 | -0.056 | 0.027 | -2.090 | 0.491 |
| racecat2 | -0.330 | 0.023 | -14.419 | 0.500 | -0.089 | 0.034 | -2.607 | 0.498 |
| Highedu | -0.011 | 0.002 | -5.088 | 0.500 | 0.003 | 0.003 | 1.040 | 0.075 |
| Hhsize | 0.014 | 0.004 | 3.492 | 0.000 | -0.004 | 0.014 | -0.308 | 0.310 |
| Kidsnum | -0.161 | 0.006 | -26.644 | 0.500 | -0.002 | 0.021 | -0.119 | 0.274 |
| Oldersnum | 0.058 | 0.009 | 6.743 | 0.000 | -0.070 | 0.022 | -3.160 | 0.500 |
| Nmealshome | 0.002 | 0.002 | 0.868 | 0.096 | 0.006 | 0.005 | 1.246 | 0.053 |
| Nmealstogether | -0.012 | 0.001 | -16.227 | 0.500 | 0.001 | 0.003 | 0.548 | 0.146 |
| **Health lifestyle** | | | | | | | | |
| Tobacco | 0.167 | 0.010 | 16.722 | 0.000 | 0.022 | 0.026 | 0.822 | 0.103 |
| healthrate1 | -0.583 | 0.021 | -27.54 | 0.500 | 0.009 | 0.049 | 0.184 | 0.213 |
| healthrate2 | -0.522 | 0.016 | -32.425 | 0.500 | -0.086 | 0.040 | -2.184 | 0.493 |
| dietrate1 | 0.016 | 0.027 | 0.577 | 0.141 | 0.195 | 0.052 | 3.733 | 0.000 |
| dietrate2 | 0.011 | 0.014 | 0.806 | 0.105 | 0.066 | 0.037 | 1.790 | 0.018 |
| Nutritionfact | -0.012 | 0.011 | -1.051 | 0.427 | 0.015 | 0.028 | 0.531 | 0.149 |
| Nutritionsearch | 0.232 | 0.012 | 19.984 | 0.000 | -0.052 | 0.033 | -1.581 | 0.472 |
| Healthycost | -0.003 | 0.010 | -0.284 | 0.306 | -0.108 | 0.025 | -4.316 | 0.500 |
| **Food Security and Assistance** | | | | | | | | |
| Snaplastamt | 0.001 | 0.000 | 17.497 | 0.000 | 0.000 | 0.000 | 2.863 | 0.001 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| adltfscat1 | 0.150 | 0.015 | 9.851 | 0.000 | -0.183 | 0.037 | -4.936 | 0.500 |
| adltfscat2 | -0.052 | 0.015 | -3.398 | 0.500 | -0.111 | 0.032 | -3.450 | 0.500 |
| adltfscat3 | -0.148 | 0.013 | -11.309 | 0.500 | -0.134 | 0.028 | -4.742 | 0.500 |
| Foodpantry | -0.061 | 0.017 | -3.622 | 0.500 | -0.002 | 0.037 | -0.052 | 0.260 |
| **Food Shopping** | | | | | | | | |
| Primstoretraveltime | -0.009 | 0.001 | -12.551 | 0.500 | 0.001 | 0.002 | 0.582 | 0.140 |
| Grocerylistfrequency | -0.182 | 0.008 | -21.614 | 0.500 | -0.043 | 0.027 | -1.587 | 0.472 |
| Primstoreprices | 0.036 | 0.012 | 2.919 | 0.001 | -0.017 | 0.022 | -0.772 | 0.390 |
| Primstoreproduce | -0.246 | 0.016 | -15.405 | 0.500 | 0.068 | 0.035 | 1.932 | 0.013 |
| Primstoremeat | -0.117 | 0.019 | -6.054 | 0.500 | -0.020 | 0.038 | -0.539 | 0.353 |
| Primstorequality | 0.183 | 0.015 | 12.562 | 0.000 | -0.037 | 0.036 | -1.052 | 0.427 |
| Primstorevariety | 0.314 | 0.013 | 23.575 | 0.000 | 0.010 | 0.029 | 0.345 | 0.182 |
| Primstorespecial | -0.180 | 0.028 | -6.484 | 0.500 | -0.187 | 0.075 | -2.505 | 0.497 |
| Primstoreclose | 0.165 | 0.013 | 12.491 | 0.000 | -0.034 | 0.022 | -1.504 | 0.467 |
| Primstoreloyalty | -0.125 | 0.021 | -6.024 | 0.500 | 0.083 | 0.032 | 2.642 | 0.002 |
| shopplace1 | -0.267 | 0.016 | -16.261 | 0.500 | -0.048 | 0.024 | -1.964 | 0.488 |
| shopplace2 | 0.010 | 0.019 | 0.524 | 0.150 | -0.004 | 0.027 | -0.163 | 0.282 |
| shopplace3 | -0.313 | 0.024 | -12.96 | 0.500 | -0.121 | 0.073 | -1.653 | 0.475 |
| shopplace4 | 0.361 | 0.030 | 11.94 | 0.000 | 0.011 | 0.086 | 0.128 | 0.225 |
| shopmeans1 | 0.244 | 0.018 | 13.77 | 0.000 | 0.016 | 0.042 | 0.378 | 0.176 |
| shopmeans2 | 0.334 | 0.023 | 14.588 | 0.000 | -0.013 | 0.044 | -0.287 | 0.306 |
| **Financial Situation** | | | | | | | | |
| Ownhousing | 0.296 | 0.010 | 30.884 | 0.000 | -0.005 | 0.030 | -0.164 | 0.283 |
| Billsontime | 0.025 | 0.012 | 2.059 | 0.010 | 0.023 | 0.025 | 0.913 | 0.090 |
| Finccondition | -0.113 | 0.012 | -9.488 | 0.500 | -0.025 | 0.034 | -0.734 | 0.384 |
| liqassets2000 | 0.225 | 0.026 | 8.579 | 0.000 | 0.099 | 0.053 | 1.854 | 0.016 |
| **Observations** | | 63 | | | | 100 | | |
| **R2** | | | | 0.978 | | | | |

Table 2. Comparing characteristics across the groups

| Variable | Explanation | Impatient | | Patient | | P-value | P-value (Lower one-sided) | P-value (Upper one-sided) |
|---|---|---|---|---|---|---|---|---|
| | | Count | Mean (sd) | Count | Mean (sd) | | | |
| **Dependent variable** | | | | | | | | |
| Ratio | Percentage of SNAP expenditure over total SNAP benefits in the first 3-day | 63 | 0.672 (0.293) | 100 | 0.177 (0.220) | 0.000 | 1.000 | 0.000 |
| **Family and Personal Characteristics** | | | | | | | | |
| Sex | Gender: male=1 and female=2 | 63 | 1.825 (0.383) | 100 | 1.730 (0.446) | 0.163 | 0.919 | 0.081 |
| Age | Year | 63 | 40.746 (13.262) | 100 | 39.860 (12.792) | 0.672 | 0.664 | 0.336 |
| Work | Yes=1 | 63 | 0.317 (0.469) | 100 | 0.380 (0.488) | 0.420 | 0.210 | 0.790 |
| racecat1 | White=1 | 63 | 0.730 (0.447) | 100 | 0.660 (0.476) | 0.350 | 0.825 | 0.175 |
| racecat2 | Black=1 | 63 | 0.175 (0.383) | 100 | 0.160 (0.368) | 0.809 | 0.596 | 0.404 |
| racecat3 | Others=1 | 63 | 0.095 (0.296) | 100 | 0.140 (0.349) | 0.399 | 0.200 | 0.800 |
| Highedu | Higher education between household heads | 63 | 19.635 (2.802) | 99 | 19.323 (3.006) | 0.510 | 0.745 | 0.255 |
| Hhsize | Household size | 63 | 3.810 (2.162) | 100 | 3.330 (1.815) | 0.129 | 0.935 | 0.065 |
| Kidsnum | Number of household members (age<18) | 63 | 1.651 (1.557) | 100 | 1.340 (1.430) | 0.194 | 0.903 | 0.097 |
| Oldersnum | Number of household members (age>60) | 63 | 0.238 (0.499) | 100 | 0.240 (0.534) | 0.982 | 0.491 | 0.509 |
| Nmealshome | Number of times prepared food for dinner at home | 62 | 5.774 (2.658) | 100 | 5.560 (2.634) | 0.617 | 0.692 | 0.308 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Nmealstogether | Number of times family ate dinner together, at home | 54 | 7.296 (5.910) | 84 | 6.262 (4.842) | 0.264 | 0.868 | 0.132 |
| incamount1 | Amount of earnings from work for respondent | 49 | 411.265 (728.073) | 76 | 401.013 (548.451) | 0.929 | 0.536 | 0.464 |
| Incamounttotal | Total amount of earnings from work for household | 52 | 764.538 (1264.820) | 84 | 757.393 (1123.379) | 0.973 | 0.514 | 0.486 |
| stregion1 | Household comes from Northeast (Yes=1) | 63 | 0.079 (0.272) | 100 | 0.200 (0.402) | 0.038 | 0.019 | 0.981 |
| stregion2 | Household comes from Midwest (Yes=1) | 63 | 0.175 (0.383) | 100 | 0.200 (0.402) | 0.690 | 0.345 | 0.655 |
| stregion3 | Household comes from South (Yes=1) | 63 | 0.444 (0.501) | 100 | 0.440 (0.499) | 0.956 | 0.522 | 0.478 |
| stregion4 | Household comes from West(Yes=1) | 63 | 0.302 (0.463) | 100 | 0.160 (0.368) | 0.032 | 0.984 | 0.016 |
| **Health lifestyle** | | | | | | | | |
| Tobacco | Yes=1 | 63 | 0.381 (0.490) | 100 | 0.440 (0.499) | 0.460 | 0.230 | 0.770 |
| healthrate1 | Health condition is excellent (Yes=1) | 63 | 0.206 (0.408) | 100 | 0.210 (0.409) | 0.956 | 0.478 | 0.522 |
| healthrate2 | Health condition is good (Yes=1) | 63 | 0.730 (0.447) | 100 | 0.680 (0.469) | 0.499 | 0.750 | 0.250 |
| healthrate3 | Health condition is poor (Yes=1) | 63 | 0.063 (0.246) | 100 | 0.110 (0.314) | 0.320 | 0.160 | 0.840 |
| dietrate1 | Diet condition is excellent (Yes=1) | 63 | 0.079 (0.272) | 100 | 0.220 (0.416) | 0.019 | 0.009 | 0.991 |
| dietrate2 | Diet condition is good (Yes=1) | 63 | 0.825 (0.383) | 100 | 0.650 (0.479) | 0.015 | 0.992 | 0.008 |
| dietrate3 | Diet condition is poor (Yes=1) | 63 | 0.095 (0.296) | 100 | 0.130 (0.338) | 0.504 | 0.252 | 0.748 |
| Nutritionfact | Always use nutrition facts (Yes=1) | 63 | 0.254 (0.439) | 100 | 0.200 (0.402) | 0.422 | 0.789 | 0.211 |
| Nutritionsearch | searched internet for nutrition information (Yes=1) | 63 | 0.254 (0.439) | 100 | 0.210 (0.409) | 0.517 | 0.741 | 0.259 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Healthycost | It costs too much to eat healthy foods (Yes=1) | 63 | 0.476 (0.503) | 99 | 0.475 (0.502) | 0.986 | 0.507 | 0.493 |
| Healthytime | Respondent is too busy to take time to prepare healthy foods (Yes=1) | 63 | 0.127 (0.336) | 100 | 0.150 (0.359) | 0.683 | 0.342 | 0.658 |
| Mypyramid | Heard of MyPyramid (Yes=1) | 63 | 0.508 (0.504) | 100 | 0.530 (0.502) | 0.785 | 0.393 | 0.607 |
| Mypyramidfollow | Tried to follow MyPyramid plan recommendations (Yes=1) | 24 | 0.500 (0.511) | 32 | 0.406 (0.499) | 0.494 | 0.753 | 0.247 |
| Myplate | Heard of MyPlate (Yes=1) | 63 | 0.175 (0.383) | 100 | 0.190 (0.394) | 0.806 | 0.403 | 0.597 |
| Myplatefollow | Tried to follow MyPlate guidelines (Yes=1) | 11 | 0.636 (0.505) | 19 | 0.368 (0.496) | 0.167 | 0.916 | 0.084 |
| **Food Security and Assistance** | | | | | | | | |
| Snaplastamt | Reported amount of SNAP benefits last received | 63 | 297.365 (185.581) | 100 | 289.780 (193.071) | 0.805 | 0.598 | 0.402 |
| adltfscat1 | High food security (Yes=1) | 63 | 0.286 (0.455) | 100 | 0.360 (0.482) | 0.330 | 0.165 | 0.835 |
| adltfscat2 | Marginal food security (Yes=1) | 63 | 0.270 (0.447) | 100 | 0.210 (0.409) | 0.382 | 0.809 | 0.191 |
| adltfscat3 | Low food security (Yes=1) | 63 | 0.254 (0.439) | 100 | 0.220 (0.416) | 0.620 | 0.690 | 0.310 |
| adltfscat4 | Very low food security (Yes=1) | 63 | 0.190 (0.396) | 100 | 0.210 (0.409) | 0.764 | 0.382 | 0.618 |
| Foodpantry | Household went to a food bank or food pantry in past 30 days for groceries (Yes=1) | 63 | 0.111 (0.317) | 100 | 0.090 (0.288) | 0.661 | 0.669 | 0.331 |
| Kidsbrkfstindex | Child's school breakfasts are free or at a reduced price (Yes=1) | 18 | 1.000 (0.000) | 33 | 1.000 (0.000) | . | . | . |
| Kidslunchindex | Child's school lunches are free or at a reduced price (Yes=1) | 31 | 0.935 (0.250) | 47 | 0.936 (0.247) | 0.990 | 0.495 | 0.505 |
| **Food Shopping** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| primstoretraveltime | One-way travel time to primary food store, in minutes | 63 | 12.349 (8.106) | 100 | 11.300 (7.887) | 0.414 | 0.793 | 0.207 |
| grocerylistfrequency | respondent always or very often shops with a grocery list (Yes=1) | 63 | 0.492 (0.504) | 100 | 0.330 (0.473) | 0.039 | 0.980 | 0.020 |
| Primstoreprices | Shop at primary store b/c has low prices/good value (Yes=1) | 62 | 0.774 (0.422) | 100 | 0.590 (0.494) | 0.016 | 0.992 | 0.008 |
| Primstoreproduce | Shop at primary store b/c has good produce selection (Yes=1) | 62 | 0.177 (0.385) | 100 | 0.130 (0.338) | 0.412 | 0.794 | 0.206 |
| Primstoremeat | Shop at primary store b/c has a good meat department (Yes=1) | 62 | 0.097 (0.298) | 100 | 0.150 (0.359) | 0.330 | 0.165 | 0.835 |
| Primstorequality | Shop at primary store b/c has good quality food (Yes=1) | 62 | 0.177 (0.385) | 100 | 0.160 (0.368) | 0.774 | 0.613 | 0.387 |
| Primstorevariety | Shop at primary store b/c has good variety of general foods (Yes=1) | 62 | 0.129 (0.338) | 100 | 0.240 (0.429) | 0.086 | 0.043 | 0.957 |
| Primstorespecial | Shop at primary store b/c has good variety of special foods (Yes=1) | 62 | 0.048 (0.216) | 100 | 0.050 (0.219) | 0.964 | 0.482 | 0.518 |
| Primstoreclose | Shop at primary store b/c is close to home (Yes=1) | 62 | 0.371 (0.487) | 100 | 0.530 (0.502) | 0.049 | 0.025 | 0.975 |
| Primstoreloyalty | Shop at primary store for loyalty card program (Yes=1) | 62 | 0.048 (0.216) | 100 | 0.140 (0.349) | 0.065 | 0.033 | 0.967 |
| shopplace1 | Household shopped for food at a convenience store (Yes=1) | 63 | 0.381 (0.490) | 100 | 0.400 (0.492) | 0.810 | 0.405 | 0.595 |
| shopplace2 | Household shopped for food at a discount or big box store or wholesale club (Yes=1) | 63 | 0.302 (0.463) | 100 | 0.270 (0.446) | 0.665 | 0.668 | 0.332 |
| shopplace3 | Household shopped for food at a dollar store (Yes=1) | 63 | 0.095 (0.296) | 100 | 0.040 (0.197) | 0.154 | 0.923 | 0.077 |
| shopplace4 | Household shopped for food at a bakery or meat or fish market or produce store or vegetable stand (Yes=1) | 63 | 0.048 (0.215) | 100 | 0.040 (0.197) | 0.817 | 0.592 | 0.408 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| shopmeans1 | Usual means of getting to primary food store: own car (Yes=1) | 63 | 0.683 (0.469) | 100 | 0.630 (0.485) | 0.496 | 0.752 | 0.248 |
| shopmeans2 | Usual means of getting to primary food store: others' car (Yes=1) | 63 | 0.206 (0.408) | 100 | 0.220 (0.416) | 0.837 | 0.419 | 0.581 |
| primstoredist_d | Driving distance, in miles, between residence and primary food store | 58 | 5.551 (5.907) | 92 | 3.786 (5.024) | 0.052 | 0.974 | 0.026 |
| primstoredist_s | Straight-line distance, in miles, between residence and primary food store | 58 | 4.339 (4.719) | 92 | 2.803 (3.846) | 0.031 | 0.985 | 0.015 |
| snap1 | Number of SNAP-authorized retailers within 0.25 mi | 63 | 0.794 (1.608) | 100 | 1.630 (3.240) | 0.059 | 0.029 | 0.971 |
| snap2 | Number of SNAP-authorized retailers within 0.50 mi | 63 | 3.127 (4.401) | 100 | 5.790 (11.989) | 0.093 | 0.046 | 0.954 |
| snap3 | Number of SNAP-authorized retailers within 1 mi | 63 | 11.238 (17.138) | 100 | 17.030 (30.947) | 0.176 | 0.088 | 0.912 |
| snap4 | Number of SNAP-authorized retailers within 2 mi | 63 | 33.794 (57.319) | 100 | 48.820 (84.768) | 0.217 | 0.109 | 0.891 |
| snap5 | Number of SNAP-authorized retailers within 5 mi | 63 | 153.206 (371.588) | 100 | 232.240 (549.932) | 0.317 | 0.158 | 0.842 |
| snap6 | Number of SNAP-authorized retailers within 10 mi | 63 | 472.286 (1210.802) | 100 | 819.990 (2077.441) | 0.230 | 0.115 | 0.885 |
| snap7 | Number of SNAP-authorized retailers within 15 mi | 63 | 838.365 (1831.448) | 100 | 1305.790 (3116.821) | 0.283 | 0.141 | 0.859 |
| snap8 | Number of SNAP-authorized retailers within 30 mi | 63 | 1810.508 (3046.322) | 100 | 2180.940 (3861.750) | 0.520 | 0.260 | 0.740 |
| Totalnfexp | Household total non-food expenses | 63 | 1034.760 (2245.196) | 100 | 726.205 (557.492) | 0.191 | 0.905 | 0.095 |
| **Financial Situation** | | | | | | | | |
| Ownhousing | Household owns residential unit | 63 | 0.317 (0.469) | 100 | 0.260 (0.441) | 0.430 | 0.785 | 0.215 |
| Billsontime | Household always or often pays bills on time (Yes=1) | 63 | 0.683 (0.469) | 100 | 0.710 (0.456) | 0.712 | 0.356 | 0.644 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Finccondition | Household's reported financial condition is comfortable and secure (Yes=1) | 63 | 0.175 (0.383) | 100 | 0.180 (0.386) | 0.931 | 0.465 | 0.535 |
| liqassets2000 | Household has $2,000 or more in liquid assets (Yes=1) | 63 | 0.063 (0.246) | 100 | 0.080 (0.273) | 0.696 | 0.348 | 0.652 |
| paydayloan6mos | Household took out a payday-like loan within last 6 months (Yes=1) | 52 | 0.135 (0.345) | 82 | 0.122 (0.329) | 0.832 | 0.584 | 0.416 |
| utilnotpaid6mos | Household could not pay full amount of utility bills within last 6 months (Yes=1) | 52 | 0.385 (0.491) | 82 | 0.329 (0.473) | 0.517 | 0.742 | 0.258 |
| Povertyindex | Household average income is above 100 percent poverty guideline for household of this size (Yes=1) | 63 | 1.540 (0.502) | 100 | 1.460 (0.501) | 0.325 | 0.838 | 0.162 |

Appendix Table 1. Descriptive Statistics of Data

| Variable | Explanation | Mean | sd |
|---|---|---|---|
| **Dependent variable** | | | |
| Ratio | Percentage of SNAP expenditure over total SNAP benefits in the first 3-day | 0.368 | 0.348 |
| **Family and Personal Characteristics** | | | |
| Sex | Gender: male=1 and female=2 | 1.767 | 0.424 |
| Age | Year | 40.202 | 12.942 |
| Work | Yes=1 | 0.356 | 0.48 |
| racecat1 | White=1 | 0.687 | 0.465 |
| racecat2 | Black=1 | 0.166 | 0.373 |
| Highedu | Higher education between household heads | 19.444 | 2.923 |
| Hhsize | Household size | 3.515 | 1.964 |
| Kidsnum | Number of household members (age<18) | 1.460 | 1.483 |
| Oldersnum | Number of household members (age>60) | 0.239 | 0.519 |
| Nmealshome | Number of times prepared food for dinner at home | 5.642 | 2.637 |
| Nmealstogether | Number of times family ate dinner together, at home | 6.667 | 5.289 |
| **Health lifestyle** | | | |
| Tobacco | Yes=1 | 0.417 | 0.495 |
| healthrate1 | Health condition is excellent (Yes=1) | 0.209 | 0.408 |
| healthrate2 | Health condition is good (Yes=1) | 0.699 | 0.46 |
| dietrate1 | Diet condition is excellent (Yes=1) | 0.166 | 0.373 |
| dietrate2 | Diet condition is good (Yes=1) | 0.718 | 0.451 |
| Nutritionfact | Always use nutrition facts (Yes=1) | 0.221 | 0.416 |
| Nutritionsearch | searched internet for nutrition information (Yes=1) | 0.227 | 0.42 |
| Healthycost | It costs too much to eat healthy foods (Yes=1) | 0.475 | 0.501 |
| **Food Security and Assistance** | | | |
| Snaplastamt | Reported amount of SNAP benefits last received | 292.712 | 189.67 |
| adltfscat1 | High food security (Yes=1) | 0.331 | 0.472 |
| adltfscat2 | Marginal food security (Yes=1) | 0.233 | 0.424 |
| adltfscat3 | Low food security (Yes=1) | 0.233 | 0.424 |

| | | | |
|---|---|---|---|
| foodpantry | Household went to a food bank or food pantry in past 30 days for groceries (Yes=1) | 0.098 | 0.298 |
| **Food Shopping** | | | |
| primstoretraveltime | One-way travel time to primary food store, in minutes | 11.706 | 7.964 |
| grocerylistfrequency | respondent always or very often shops with a grocery list (Yes=1) | 0.393 | 0.49 |
| primstoreprices | Shop at primary store b/c has low prices/good value (Yes=1) | 0.660 | 0.475 |
| primstoreproduce | Shop at primary store b/c has good produce selection (Yes=1) | 0.148 | 0.356 |
| primstoremeat | Shop at primary store b/c has a good meat department (Yes=1) | 0.130 | 0.337 |
| primstorequality | Shop at primary store b/c has good quality food (Yes=1) | 0.167 | 0.374 |
| primstorevariety | Shop at primary store b/c has good variety of general foods (Yes=1) | 0.198 | 0.399 |
| primstorespecial | Shop at primary store b/c has good variety of special foods (Yes=1) | 0.049 | 0.217 |
| primstoreclose | Shop at primary store b/c is close to home (Yes=1) | 0.469 | 0.501 |
| primstoreloyalty | Shop at primary store for loyalty card program (Yes=1) | 0.105 | 0.307 |
| shopplace1 | Household shopped for food at a convenience store (Yes=1) | 0.393 | 0.49 |
| shopplace2 | Household shopped for food at a discount or big box store or wholesale club (Yes=1) | 0.282 | 0.451 |
| shopplace3 | Household shopped for food at a dollar store (Yes=1) | 0.061 | 0.241 |
| shopplace4 | Household shopped for food at a bakery or meat or fish market or produce store or vegetable stand (Yes=1) | 0.043 | 0.203 |
| shopmeans1 | Usual means of getting to primary food store: own car (Yes=1) | 0.650 | 0.478 |
| shopmeans2 | Usual means of getting to primary food store: others' car (Yes=1) | 0.215 | 0.412 |
| **Financial Situation** | | | |
| ownhousing | Household owns residential unit | 0.282 | 0.451 |
| billsontime | Household always or often pays bills on time (Yes=1) | 0.699 | 0.46 |
| finccondition | Household's reported financial condition is comfortable and secure (Yes=1) | 0.178 | 0.384 |
| liqassets2000 | Household has $2,000 or more in liquid assets (Yes=1) | 0.074 | 0.262 |
| **Observations** | | 163 | |

## Appendix Table 2. Specific Coding of Variables from Original Dataset

| Variable | Explanation | Original dataset |
|---|---|---|
| **Dependent variable** | | |
| ratio | Percentage of SNAP expenditure over total SNAP benefits in the first 3-day | |
| **Family and Personal Characteristics** | | |
| | | |
| Sex | Gender: male=1 and female=2 | Same |
| Age | Year | Same |
| work | Yes=1 | if INCAMOUNT1 (amount, earnings from work, individual) is positive, then work=1 |
| racecat1 | White=1<br>Racecat=1:white; | Racecat=1:white;<br>Racecat=2:black/African American<br>Racecat=3:American Indian or Alaska Native<br>Racecat=4:Asian<br>Racecat=5:Native Hawaiian or Other Pacific Islander<br>Racecat=6:Other race<br>Racecat=7:multiple races |
| racecat2 | Black=1<br>Racecat=2:black/African American | |
| highedu | Higher education between household heads | Max(edu) as highedu where relation=0,1,2 (which are respondent, spouse, unmarried partner, receptively) |

| | | |
|---|---|---|
| hhsize | Household size | |
| kidsnum | Number of household members (age<=18) | Count household members whose age is less than or equal to 18 |
| oldersnum | Number of household members (age>60) | Count household members whose age is greater than 18 |
| nmealshome | Number of times prepared food for dinner at home | Same |
| nmealstogether | Number of times family ate dinner together, at home | Same |
| **Health lifestyle** | | |
| tobacco | Yes=1 | Same |
| healthrate1 | Health condition is excellent (Yes=1)<br>Healthstatus=1:excellent | Healthstatus=1:excellent<br>Healthstatus=2:very good<br>Healthstatus=3:good<br>Healthstatus=4:fair<br>Healthstatus=5:poor |
| healthrate2 | Health condition is good (Yes=1)<br>Healthstatus=2:very good+<br>Healthstatus=3:good | |
| dietrate1 | Diet condition is excellent (Yes=1)<br>Dietstatuspr=1:excellent | Dietstatuspr=1:excellent<br>Dietstatuspr =2:very good<br>Dietstatuspr =3:good<br>Dietstatuspr =4:fair<br>Dietstatuspr =5:poor |
| dietrate2 | Diet condition is good (Yes=1)<br>Dietstatuspr =2:very good+<br>Dietstatuspr =3:good | |
| nutritionfact | Always use nutrition facts (Yes=1)<br>Nutritionfacts=1:always+<br>Nutritionfacts=2:most of the time | Nutritionfacts=1:always<br>Nutritionfacts=2:most of the time<br>Nutritionfacts=3:sometimes<br>Nutritionfacts=4:rarely<br>Nutritionfacts=5:never<br>Nutritionfacts=6:never seen |
| nutritionsearch | searched internet for nutrition information (Yes=1) | Same |
| healthycost | It costs too much to eat healthy foods (Yes=1) | Same |

| | | |
|---|---|---|
| **Food Security and Assistance** | | |
| snaplastamt | Reported amount of SNAP benefits last received | Same |
| adltfscat1 | High food security (Yes=1)<br>ADLTFSCAT=1:high food security | ADLTFSCAT=1:high food security<br>ADLTFSCAT=2:marginal food security<br>ADLTFSCAT=3:low food security<br>ADLTFSCAT=4:very low food security |
| adltfscat2 | Marginal food security (Yes=1)<br>ADLTFSCAT=2:marginal food security | |
| adltfscat3 | Low food security (Yes=1)<br>ADLTFSCAT=3:low food security | |
| foodpantry | Household went to a food bank or food pantry in past 30 days for groceries (Yes=1) | Same |
| **Food Shopping** | | |
| primstoretraveltime | One-way travel time to primary food store, in minutes | Same |
| grocerylistfrequency | respondent always or very often shops with a grocery list (Yes=1)<br>Grocerylistfreq=4:most of the time+ Grocerylistfreq=5:almost always | Grocerylistfreq=1:never<br>Grocerylistfreq=2:seldom<br>Grocerylistfreq=3:sometimes<br>Grocerylistfreq=4:most of the time<br>Grocerylistfreq=5:almost always |
| primstoreprices | Shop at primary store b/c has low prices/good value (Yes=1) | Same |
| primstoreproduce | Shop at primary store b/c has good produce selection (Yes=1) | Same |
| primstoremeat | Shop at primary store b/c has a good meat department (Yes=1) | Same |
| primstorequality | Shop at primary store b/c has good quality food (Yes=1) | Same |
| primstorevariety | Shop at primary store b/c has good variety of general foods (Yes=1) | Same |

| | | |
|---|---|---|
| primstorespecial | Shop at primary store b/c has good variety of special foods (Yes=1) | Same |
| primstoreclose | Shop at primary store b/c is close to home (Yes=1) | Same |
| primstoreloyalty | Shop at primary store for loyalty card program (Yes=1) | Same |
| shopplace1 | Household shopped for food at a convenience store (Yes=1)<br>Shopconv | Dummy:<br>Shopconv<br>Shopbigbox<br>Shopclub<br>Shopdollar<br>Shopbakery<br>Shopmeatfish<br>Shopvegstand<br>shopanyother |
| shopplace2 | Household shopped for food at a discount or big box store or wholesale club (Yes=1)<br>Shopbigbox+<br>Shopclub | |
| shopplace3 | Household shopped for food at a dollar store (Yes=1)<br>Shopdollar | |
| shopplace4 | Household shopped for food at a bakery or meat or fish market or produce store or vegetable stand (Yes=1)<br>Shopbakery+<br>Shopmeatfish+<br>Shopvegstand | |
| shopmeans1 | Usual means of getting to primary food store: own car (Yes=1)<br>Primstoretravelmode=1:drive own car | Primstoretravelmode=1:drive own car<br>Primstoretravelmode=2:use someone else's car<br>Primstoretravelmode=1:someone else drives me<br>Primstoretravelmode=1:walk<br>Primstoretravelmode=1:bus<br>Primstoretravelmode=1:taxi<br>Primstoretravelmode=1:ride bicycle |
| shopmeans2 | Usual means of getting to primary food store: others' car (Yes=1)<br>Primstoretravelmode=2:use someone else's car<br>Primstoretravelmode=1:someone else drives me | |

| | | |
|---|---|---|
| **Financial Situation** | | |
| ownhousing | Household owns residential unit<br>Housingown=2:own | Housingown=1:rent<br>Housingown=2:own<br>Housingown=3other |
| billsontime | Household always or often pays bills on time (Yes=1)<br>Billsontimefreq=4:usually<br>Billsontimefreq=5:always | Billsontimefreq=1:never<br>Billsontimefreq=2:rarely<br>Billsontimefreq=3:sometimes<br>Billsontimefreq=4:usually<br>Billsontimefreq=5:always |
| finccondition | Household's reported financial condition is comfortable and secure (Yes=1)<br>Fincondition=1:very comfortable and secure<br>Fincondition=2:able to make ends meet without much difficulty | Fincondition=1:very comfortable and secure<br>Fincondition=2:able to make ends meet without much difficulty<br>Fincondition=3:occasionally have some difficulty making ends meet<br>Fincondition=4:tough to make ends meet but keeping your head above walter<br>Fincondition=5:in over your head |
| liqassets2000 | Household has $2,000 or more in liquid assets (Yes=1) | Same |
| | | |