How Are SNAP Benefits Spent?

Evidence from a Retail Panel

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Online Appendix

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1 Quantitative model of price misperception

Here we extend the model introduced in the body of the paper to allow, following Liebman and Zeckhauser (2004), that receipt of an in-kind benefit may lead the household to misperceive the price of food. We operationalize this idea by supposing that in any period w' the household believes that the price of food in any period $w \geq w'$ is $\left(1 - \sigma \frac{b_{w'-1}}{y_{w'-1}+m+b_{w'-1}}\right) d \left(\frac{s_w^f}{f_w}\right)$ where $\sigma \geq 0$ is a parameter. The value $\sigma = 0$ corresponds to correct perceptions.

The value $\sigma = 1$ corresponds to confusion of average and marginal prices. In a static model with cash endowment y, SNAP benefits b, and marginal price of food of 1, the average price of food, integrating over the budget set, is $\frac{y}{y+b}$. In this sense, the value $\sigma = 1$ corresponds to treating the average price as the marginal price. The same thought experiment corresponds to the model of tariff misperception in Ito (2014), with uniform weights over the entire budget set.

The household's misperception of prices may cause it to violate the budget constraint. To close the model, we suppose that, if in some period w' the household's desired choices lead to a violation of the budget constraints, then nonfood consumption $n_{w'}$ adjusts to the highest feasible value given the household's other choices. If this adjustment is insufficient we suppose that $f_{w'}$ adjusts in a similar manner.

Online appendix table 17 presents the results. Column (1) presents empirical counterparts to model outputs. Column (2) presents the model's implications under the neoclassical benchmark. Column (3) adds short-run time preference. Column (4) adds mental accounting. Column (5) drops mental accounting and adds price misperception assuming that $\sigma = 1$. Column (6) considers the more extreme possibility that σ is equal to the largest value such that food prices are never perceived to be negative.

With $\sigma = 1$, the model with price misperception predicts an MPCF of 0.28, well above the neoclassical benchmark but smaller than the estimated value of 0.59. With σ at the largest value consistent with perceiving nonnegative prices, the model nearly replicates the observed MPCF. In both cases, the model replicates the pattern that shopping effort declines more for food than for nonfood purchases following receipt of SNAP. In neither case does the model with price misperception match the fact, shown in online appendix table 18, that shopping effort declines more for food than for nonfood purchases in the second half of the month. The reason is that SNAP benefits are largely exhausted by the second period, so in this period households perceive the price of food almost correctly. By contrast, the model with mental accounting correctly predicts that shopping effort declines more for food than for nonfood purchases in the second half of the month.

Online Appendix Table 1: Change in in-state earnings and the six-month SNAP clock

	Change in in-state earnings
Multiple of six months	31.305
	(0.787)
Not multiple of six months	25.316
	(0.864)
Number of household-quarters	7032157
Number of households	182413

Notes: Data are from Rhode Island administrative records from October 2004 through June 2016. See section 2.1 for details on sample definition and variable construction. The unit of observation is the household-quarter. The table reports coefficient estimates from a regression with standard errors in parentheses clustered by household. The dependent variable is the change in in-state earnings and the regression controls for calendar quarter fixed effects. The key independent variables are indicators for whether or not the quarter contains a month whose time from the most recent SNAP adoption is divisible by six months. The omitted category consists of the first two quarters (inclusive of the adoption quarter) after the household's most recent SNAP adoption, all quarters after the first eight quarters (inclusive of the adoption quarter) following the household's most recent adoption, and all quarters for which there is no preceding adoption.

Online Appendix Table 2: SNAP participation and choice of food retailer, FoodAPS data

	Household's primary retailer is...				
	Most popular chain	Second most popular chain	Third most popular chain	Other chain	Number of households
Overall	0.347	0.192	0.108	0.353	4820
	(0.029)	(0.022)	(0.014)	(0.024)	
SNAP participant	0.335	0.181	0.116	0.368	1581
	(0.045)	(0.028)	(0.020)	(0.032)	
SNAP non-participant					
Income $\leq$ 100% FPL	0.332	0.162	0.065	0.442	354
	(0.052)	(0.033)	(0.022)	(0.052)	
Income 101 - 185% FPL	0.344	0.175	0.133	0.348	845
	(0.039)	(0.025)	(0.018)	(0.034)	
Income $>$ 185% FPL	0.352	0.199	0.104	0.345	2038
	(0.031)	(0.025)	(0.016)	(0.027)	

Notes: The table is modeled on table 5 of Ver Ploeg et al. (2015). Data are from the National Household Food Acquisition and Purchase Survey (FoodAPS), collected from April 2012 through January 2013. The first three columns show, respectively, the share of households whose primary food store is part of the most popular, second most popular, or third most popular retail chain in the state. The fourth column shows the share of households whose primary food store is part of a chain outside the top three retail chains in the state. Standard errors are in parentheses, and shares and standard errors are adjusted using recommended sample weights. We measure the popularity of each retail chain in each state by the share of resident households who list a store in the given retail chain as their primary food store, treating independent stores as single-store chains. The 2012 Federal Poverty Level (FPL) is a threshold level of income that depends on household size.

Online Appendix Table 3: Estimates of MPCF out of SNAP, baseline and single-store panels

	(1)	(2)	(3)
	SNAP-eligible spending		p-value for
Sample	Baseline	Single-store	equality of MPCFs
MPCF out of SNAP benefits	0.5884	0.5332	0.2111
	(0.0073)	(0.0484)	
Number of household-months	2005392	24600	
Number of households	24456	300	

Notes: In column (1), the data come from our baseline panel. In column (2), the data come from a panel consisting of all transactions at one of the retailer's stores over the period from February 2006 through December 2012. In both cases the sample is the set of SNAP adopters in the respective panel. The unit of observation is the household-month. Columns (1) and (2) report coefficient estimates from a 2SLS regression, with standard errors in parentheses clustered by household and calendar month using the method in Thompson (2011). All models are estimated in first differences and include calendar month fixed effects. The dependent variable is SNAP-eligible spending. The endogenous regressors are SNAP benefits and the additive inverse of fuel spending. The coefficient on SNAP benefits is reported as the MPCF out of SNAP benefits. Excluded instruments are (i) the product of the household's average gallons of gasoline per month and the change in the price of regular gasoline, (ii) an indicator for SNAP adoption, and (iii) an indicator for the first month of the SNAP clock. See the table in the main text for definitions of these instruments. Column (3) reports the $p-$value for a test of the hypothesis that the MPCF is equal between the two samples, treating the samples as independent.

Online Appendix Table 4: SNAP penetration, SIPP data

	(1)	(2)
Share of household-waves on SNAP	0.090	0.119
	(0.0006)	(0.0005)
Share of households ever on SNAP	0.172	0.217
	(0.0033)	(0.0016)
Sample	Households with nonzero longitudinal weight	All households
Cross-sectional weight	Yes	Yes
Longitudinal weight	Yes	No
Number of household-waves	234995	526997
Number of households	17451	66390

Notes: Data are from all waves of the 2008 Survey of Income and Program Participation (SIPP), which cover months May 2008 through November 2013 and are publicly available at `www.nber.org/data/survey-of-income-and-program-participation-sipp-data.html` as of October 2017. The sample includes interview months only. A household-wave is considered to be on SNAP if it has positive SNAP benefits in the interview month. Only observations with well-defined SNAP benefits are considered. The cross-sectional weight is the SIPP household-month weight of the interview month for the relevant survey wave. The longitudinal weight is constructed following the "Householder Weight Procedure" proposed in Ernst (1986): we assign each household present in the first wave of the panel the SIPP longitudinal person weight of the head of household as the longitudinal household weight. Households that are not present in the first wave are assigned a longitudinal weight of zero. Cross-sectional weights are used when calculating the share of household-waves on SNAP. Longitudinal weights are used when calculating the share of households ever on SNAP when specified. Column (1) calculates shares using the sample of households with nonzero longitudinal weights. Column (2) calculates shares using all households in the panel.

Online Appendix Table 5: SNAP penetration by geographic unit, retailer vs administrative data

Geographic unit used for comparison	Share of households on SNAP	
	Retail panel	Administrative data
National		
2006-2012	0.077	0.145
2006-2010	0.070	0.127
County		
2006-2010	0.071	0.139

Notes: The first column reports the share of household-months that are SNAP months in the retail panel. The first row is for the full sample, the second row restricts to period 2006-2010, and the third row restricts to the period 2006-2010 for those households for which information on county of residence is non-missing. The second column reports the corresponding shares from administrative data. The first two rows report the share of US households on SNAP for the average month in the given sample period. The third row reports the average share of US households on SNAP in the given period, weighting each county by the number of retailer households resident in that county. To measure the share of US households on SNAP in each month, we use monthly data on the number of SNAP households from the United States Department of Agriculture Food and Nutrition Service via `http://www.fns.usda.gov/sites/default/files/pd/SNAPZip69throughCurrent.zip` in May 2017, and annual data on the number of US households from the American Community Survey by the United States Census Bureau via `https://factfinder.census.gov/faces/nav/jsf/pages/download_center.xhtml` in November 2017. To measure the share of households in each county in each month, we begin with annual estimates of the share of the population receiving SNAP in each county from 2006 to 2010 from the United States Department of Agriculture Economic Research Service via `https://www.ers.usda.gov/data-products/supplemental-nutrition-assistance-program-snap--data-system/time-series-data/` in November 2017. We then convert these to estimates of the share of households on SNAP by multiplying by the ratio of the number of people per household in the state to the number of SNAP recipients per SNAP household in the state. We use annual population estimates for each state from the United States Census Bureau via `https://www.census.gov/data/datasets/time-series/demo/popest/intercensal-2000-2010-state.html` and `https://www.census.gov/data/datasets/2016/demo/popest/state-total.html` in November 2017. We use monthly estimates of the number of households and people on SNAP in each state from the United States Department of Agriculture Food and Nutrition Service via `http://www.fns.usda.gov/sites/default/files/pd/SNAPZip69throughCurrent.zip` in May 2017.

Online Appendix Table 6: Average income in ZIP code and county of residence for households in the retail panel

Average household income in ZIP code of residence	54156
Average household income in county of residence	49668
Ratio of average household income in ZIP code to average household income in county	1.087
Number of households	463120

Notes: The sample is the set of all households in the retailer data for which we observe the ZIP code of residence and are able to match it to a county of residence using the procedure described in the main text. Average household income in ZIP code and county of residence is the average Adjusted Gross Income in the 2007 tax year according to the IRS Statistics of Income series, generously provided to us by Atif Mian and Amir Sufi, who obtained it from the IRS (`http://www.irs.gov/taxstats/indtaxstats/article/0,,id=96947,00.html`).

Online Appendix Table 7: Average SNAP benefits in the retail panel and administrative data

	Average SNAP benefits
Retail panel	196.90
	(3.45)
Administrative data	240.10
	(3.46)
Number of household-months	6260
Number of households	1853

Notes: The administrative data are the SNAP Quality Control Data, which are publicly available at `https://host76.mathematica-mpr.com/fns/` as of May 2017. The sample is the set of household-months that are within six months following an adoption, inclusive of the adoption month, and that can be matched to cases in the administrative data based on state of residence, calendar month, number of adults in the household, number of children in the household, age range of the head of household, median years of education for household members age 25 or older, and income category. We require an exact match based on non-missing characteristics. The table shows the average SNAP benefit from the retail panel and the average SNAP benefit received as recorded in the administrative data for the corresponding matched household-months. Standard errors in parentheses are clustered by household.

Online Appendix Table 8: Estimated marginal propensities to consume, allowing for the effects of in-state earnings and number of children

	(1) SNAP-eligible spending	(2) SNAP-eligible spending	(3) SNAP-ineligible spending	(4) SNAP-ineligible spending
SNAP benefits	0.5404	0.4904	0.0235	0.0226
	(0.0067)	(0.0174)	(0.0036)	(0.0101)
In-state earnings		-0.0366		-0.0155
		(0.0404)		(0.0241)
Number of children under 5 years of age		122.86		-209.70
		(432.80)		(262.89)
Number of household-quarters	611400	611400	611400	611400
Number of households	24456	24456	24456	24456

Notes: The unit of observation is the household-quarter. Each column reports coefficient estimates from a 2SLS regression, with standard errors in parentheses clustered by household. All models are estimated in first differences and include calendar quarter fixed effects. In models (1) and (2) the dependent variable is average monthly SNAP-eligible spending in the quarter. In models (3) and (4) the dependent variable is average monthly SNAP-ineligible spending in the quarter. In models (1) and (3), the endogenous regressor is average monthly SNAP benefits in the quarter. The instrument is an indicator for whether the quarter contains the adoption month as defined in section 3.5. These models are estimated via 2SLS in the retailer panel using the sample of SNAP adopters. In models (2) and (4), we account for pre-event trends using the methodology described in Freyaldenhoven (2018). The endogenous regressors are average monthly SNAP benefits, average monthly in-state earnings and unemployment insurance benefits, and the average monthly number of children under 5 years of age. The instruments are the SNAP adoption indicator and its first two leads. These models are estimated in two samples using the two-sample 2SLS estimator defined in Inoue and Solon (2010). The first stages for in-state earnings and number of children are estimated in the Rhode Island adminstrative data described in section 2.1 on the sample of SNAP adopters. The first stage for SNAP benefits, and the second stage, are estimated in the retailer panel on the sample of SNAP adopters. In all models, only household-quarters in which the first two leads of SNAP adoption are well-defined are considered. Standard errors are estimated in models (1) and (3) with a nonparametric bootstrap over 30 replicates. Standard errors are estimated in models (2) and (4) by bootstrapping as follows: in the administrative data and retailer panel, we estimate the first stages with a nonparametric bootstrap over 30 replicates. For each replicate in the retailer data, we randomly assign the first stage estimates from one of the replicates in the administrative data. We use the estimates from all three first stages to calculate the fitted values in the retailer replicates. We then estimate the second stage for each replicate. The reported standard error of each coefficient is its standard deviation across the 30 bootstrap replicates. In each replicate for each model, we sample households with replacement, to match the original sample size.

Online Appendix Table 9: Estimates of MPCs out of SNAP based on benefit changes

	(1) SNAP benefits	(2) SNAP-eligible spending	(3) SNAP-ineligible spending
Post Farm Bill ×(Share of months during 2006-2007 on SNAP)	20.586	9.929	-2.535
	(5.421)	(5.209)	(3.891)
Post ARRA ×(Share of months during 2006-2007 on SNAP)	47.654	26.172	-3.938
	(3.318)	(4.095)	(4.463)
MPC out of SNAP benefits	—	0.532	-0.093
		(0.047)	(0.045)
Number of households	208245	208245	208245
Number of household-months	4997880	4997880	4997880

Notes: The sample includes all households in the retailer panel that have at least one SNAP month during the panel. Each column reports coefficient estimates from a regression model, with standard errors in parentheses clustered by household and calendar month using the method in Thompson (2011). The unit of observation is the household-month and only months from January 2008 to December 2009 are included in the regressions. The "share of months during 2006-2007 on SNAP" is the share of calendar months between February 2006 and December 2007 during which each household used SNAP. "Post Farm Bill" is an indicator equal to one in calendar months following the implementation of the Farm Bill in October 2008. "Post ARRA" is an indicator equal to one in calendar months following the implementation of the American Recovery and Reinvestment Act (ARRA) in April 2009. Marginal propensities to consume are estimated via a 2SLS regression of SNAP-eligible (SNAP-ineligible) spending on SNAP benefits, with the interactions of the post Farm Bill and post ARRA indicators and the share of months during 2006-2007 on SNAP as excluded instruments. All models include fixed effects for household and calendar month.

Online Appendix Table 10: Estimates of MPCF out of SNAP based on benefit changes, household- vs. store-level

	Unit of analysis	
	Household	Store
	(1)	(2)
Estimated MPCF out of SNAP	0.532	-0.001
	(0.047)	(0.384)
Number of units	208245	667
Number of unit-months	4997880	16008

Notes: Both columns report the estimated coefficient on SNAP benefits in a 2SLS regression, with standard errors in parentheses clustered by unit and calendar month using the method in Thompson (2011). In column (1), the sample includes all households in the retailer panel that have at least one SNAP month during the panel. The unit of observation is the household-month. The reported MPCF out of SNAP is from model (2) of table 9. In column (2), the sample includes all stores in the retailer panel that are the primary store for at least one household, among households with at least one SNAP month. For a given household, we define the primary store as the one with the highest total expenditure across all periods in the panel. We compute the average share of months between February 2006 and December 2007 in which SNAP was used for households with a given primary store. The marginal propensity to consume food out of SNAP is estimated via a 2SLS regression of SNAP-eligible spending on SNAP benefits, with the interactions of the post Farm Bill and post ARRA indicators and the average share of months during 2006-2007 on SNAP as excluded instruments. We include fixed effects for primary store and calendar month. In both columns, only months from January 2008 to December 2009 are included in the regressions.

Online Appendix Table 11: MPCF estimated from first and later SNAP adoptions

Sample	(1) All SNAP adopters	(2) SNAP adopters with at least two SNAP adoptions	(3)	(4)
MPCF out of				
SNAP benefits	0.5891	0.5566	0.5152	0.5314
	(0.0074)	(0.0251)	(0.0228)	(0.0177)
cash	-0.0019	-0.0059	-0.0047	-0.0017
	(0.0494)	(0.0783)	(0.0781)	(0.0783)
p-value for equality of MPCFs	0.0000	0.0000	0.0000	0.0000
p-value for overidentification test	-	-	-	0.2068
Instruments:				
Change in price of regular gasoline ×(Household average gallons per month)	Yes	Yes	Yes	Yes
Any SNAP adoption	Yes	No	No	No
First SNAP adoption	No	Yes	No	Yes
Second or later SNAP adoption	No	No	Yes	Yes
Number of household-months	2005392	117096	117096	117096
Number of households	24456	1428	1428	1428

Notes: In column (1) the sample is the set of SNAP adopters. In the remaining columns the sample is the set of SNAP adopters with at least two SNAP adoptions. The unit of observation is the household-month. Each column reports coefficient estimates from a 2SLS regression, with standard errors in parentheses clustered by household and calendar month using the method in Thompson (2011). All models are estimated in first differences and include calendar month fixed effects. The dependent variable is SNAP-eligible spending. Endogenous regressors are SNAP benefits and the additive inverse of fuel spending; coefficients on these regressors are reported as marginal propensities to consume food. The "price of regular gasoline" is the quantity-weighted average spending per gallon on regular grade gasoline among all households before any discounts or coupons. "Household average gallons per month" is the average monthly number of gallons of gasoline purchased by a given household during the panel. "Any SNAP adoption" is an indicator for whether the month is a SNAP adoption month as defined in the paper. "First SNAP adoption" is an indicator equal to one in the month of the household's first SNAP adoption and zero otherwise. "Second or later SNAP adoption" is an indicator equal to one in the month of the household's second (or later) SNAP adoption, and zero otherwise. The final column reports a p-value for a test of overidentification following Hansen (1982).

Online Appendix Table 12: Heterogeneity in MPCF by household and area characteristics

Sample	MPCF out of: SNAP benefits	MPCF out of: cash	p-value for equality of MPCFs	Number of household-months (households)
All SNAP adopters	0.5884	-0.0020	0.0000	2005392
	(0.0073)	(0.0494)		(24456)
Child present?				
No	0.6084	0.0430	0.0000	613114
	(0.0102)	(0.0622)		(7477)
Yes	0.5769	-0.0169	0.0000	1024016
	(0.0081)	(0.0428)		(12488)
Elderly head of household?				
No	0.5772	-0.0019	0.0000	1287974
	(0.0076)	(0.0486)		(15707)
Yes	0.6433	0.0484	0.0000	298070
	(0.0157)	(0.0547)		(3635)
Above median income category?				
No	0.5939	0.0241	0.0000	1042302
	(0.0089)	(0.0451)		(12711)
Yes	0.5754	-0.0167	0.0000	573590
	(0.0131)	(0.0507)		(6995)
Above high school education?				
No	0.5954	0.0226	0.0000	1024016
	(0.0077)	(0.0496)		(12488)
Yes	0.5749	-0.0334	0.0000	589416
	(0.0118)	(0.0505)		(7188)
Above median SNAP penetration?				
No	0.5904	-0.0083	0.0000	962844
	(0.0097)	(0.0554)		(11742)
Yes	0.5922	0.0125	0.0000	962024
	(0.0085)	(0.0478)		(11732)
Top quartile corr(regular gasoline share, price)?				
No	0.6159	-0.0054	0.0000	879860
	(0.0091)	(0.0619)		(10730)
Yes	0.6293	-0.0194	0.0000	293314
	(0.0177)	(0.0516)		(3577)
Above median share of eligible expenditure in first week of the month?				
No	0.5580	-0.0196	0.0000	1002696
	(0.0091)	(0.0447)		(12228)
Yes	0.6161	0.0191	0.0000	1002696
	(0.0093)	(0.0574)		(12228)

Notes: The sample is the set of SNAP adopters. The unit of observation is the household-month. Each column reports coefficient estimates from a 2SLS regression, with standard errors in parentheses clustered by household and calendar month using the method in Thompson (2011). All models are estimated in first differences and include calendar month fixed effects. Endogenous regressors are SNAP benefits and the additive inverse of fuel spending; coefficients on these regressors are reported as marginal propensities to consume. In all models instruments for these endogenous regressors are (i) the product of the household's average gallons of gasoline per month and the change in the price of regular gasoline, (ii) an indicator for SNAP adoption, and (iii) an indicator for the first month of the SNAP clock. See the table in the main text for definitions of these instruments. "Child present" indicates whether the household has at least one member with age 18 or below. "Elderly head of household" indicates whether the head of household is age 65 or above. "Above median income category" indicates whether the household's income category is above the median category for SNAP adopters. "Above high school education" indicates whether the median years of completed schooling for household members aged 25 or older is at least 12 years. In all cases we exclude households for which the corresponding demographic indicator is missing or undefined in our data. "Above median SNAP penetration" indicates whether SNAP penetration in the household's mailing ZIP code is above the median SNAP penetration across SNAP adopters' mailing ZIP codes. SNAP penetration is the fraction of all panelists in the given ZIP code with at least one SNAP month. "Top quartile corr(regular gasoline share, price)" indicates whether the correlation coefficient between the household's monthly share of gasoline consumption that are regular grade and the price of regular gasoline is in the top quartile among SNAP adopters who ever purchase fuel. The price of regular gasoline is computed as the quantity-weighted average spending per gallon on regular grade gasoline among all households before any discounts or coupons. "Above median share of eligible expenditure in first week of the month?" indicates whether the fraction of eligible spending that is spent in the first week of the month is above the median.

Online Appendix Table 13: Sensitivity of estimates of MPCF out of SNAP based on benefit changes to assumptions about retailer share of spending

	(1)	(2)	(3)	(4)	(5)
	SNAP-eligible spending across all retailers				
MPCF out of SNAP benefits	0.5317	0.5317	0.5338	0.5355	0.5659
	(0.0473)	(0.0473)	(0.0480)	(0.0485)	(0.0595)
Assumed retailer share of SNAP-eligible spending when household is:					
Not on SNAP	1.000	0.820	0.809	0.800	0.671
On SNAP	1.000	0.820	0.820	0.820	0.820
Basis for assumed effect of SNAP on retailer share of spending	No effect	No effect	Homescan point estimate	Homescan upper bound	Impose fungibility
Number of households	208245	208245	208245	208245	208245
Number of household-months	4997880	4997880	4997880	4997880	4997880

Notes: The sample includes all households in the retailer panel that have at least one SNAP month during the panel. The unit of observation is the household-month and only months from January 2008 to December 2009 are included in the regressions. Each column reports coefficient estimates from a regression model with standard errors in parentheses clustered by household and calendar month using the method in Thompson (2011). Marginal propensities to consume are estimated via a 2SLS regression of the dependent variable on the endogenous SNAP benefits, with the interactions of the post Farm Bill and post ARRA indicators and the share of months during 2006-2007 on SNAP as excluded instruments, as in column (2) of online appendix table 9. In each column, the dependent variable is total SNAP-eligible spending across all retailers, computed by dividing SNAP-eligible spending at the retailer by the "on SNAP" share in SNAP months and the "not on SNAP" share in other months. In column (1) we assume that all households devote all SNAP-eligible spending to the retailer in all months. In column (2) we assume that all households devote a constant share of SNAP-eligible spending to the retailer, with the share given by the ratio of average SNAP benefits between retailer and administrative data in online appendix table 7. In columns (3) through (5) we assume the same share of spending in SNAP months as in column (2). In columns (3) and (4) we assume that the difference in the share of spending between SNAP months and non-SNAP months is equal to the point estimate and upper bound of the 95 percent confidence interval, respectively, of the effect of SNAP participation on the share of spending devoted to the primary retailer in column (2) of appendix table 2. In column (5), we assume that the share of spending in non-SNAP months is the largest value such that we cannot reject the null hypothesis of an equal MPCF between SNAP and cash in the model of table 2.

Online Appendix Table 14: Tests of fungibility, asymptotic and bootstrap standard errors

	Consumption function:			
	Linear, homogeneous	Linear, heterogeneous	Nonlinear, heterogeneous (Linear spline with knots at the quintiles)	Nonlinear, heterogeneous (Local regression)
Excess sensitivity to SNAP benefits ($\hat{\gamma}$)	0.5809	0.6166	0.7296	0.8819
(asymptotic standard errors)	(0.1631)	(0.1809)	(0.1826)	(0.0824)
[bootstrap standard errors]	[0.1552]	[0.1664]	[0.1665]	[0.0693]
Number of household-months	1944056	1944056	1944056	1936594
Number of households	23708	23708	23708	23617

Notes: The sample is the set of SNAP adopters that purchase fuel at least once. The unit of observation is the household-month. The table presents estimates of the excess sensitivity γ to SNAP benefits using the three-step estimator described in the main paper. Standard errors are clustered by household and calendar month using the method in Thompson (2011), which estimates the asymptotic variance of the parameters by $\sqrt{\hat{V}_i + \hat{V}_t - \hat{V}_{it}}$, where $\hat{V}_i$ is an estimate of the variance clustered by household, $\hat{V}_t$ is an estimate of the variance clustered by calendar month, and $\hat{V}_{it}$ is an estimate of the variance without any clustering. The standard errors in parentheses use plug-in estimates for $\hat{V}_i$, $\hat{V}_t$, and $\hat{V}_{it}$, whereas the standard errors in brackets use nonparametric bootstrap estimates based on 30 replicates. These bootstrap estimates are obtained as follows. We obtain $\hat{V}_i$ by resampling households with replacement. We obtain $\hat{V}_t$ by resampling months with replacement, retaining values of all lags so that first-differencing is well-defined when needed. We obtain $\hat{V}_{it}$ by resampling household-months with replacement, retaining values of all lags so that first-differencing is well-defined when needed. For computing the second stage in the linear spline case, we compute the quintiles of $\hat{Y}_{it}$ (as defined in the main paper) for each household without using the sampled lags. Missing values in the fourth column are due to a small number of cases in which the rule-of-thumb bandwidth is ill-defined.

Online Appendix Table 15: Effect of SNAP adoption on shopping effort

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in adjusted store-brand share			Change in adjusted coupon redemption share		
	SNAP-eligible	SNAP-ineligible	Difference	SNAP-eligible	SNAP-ineligible	Difference
SNAP adoption	-0.0088	-0.0002	-0.0086	-0.0021	-0.0006	-0.0015
	(0.0005)	(0.0009)	(0.0011)	(0.0002)	(0.0007)	(0.0007)
Number of household-months	2003712	1970355	1969935	2003707	1968827	1968409
Number of households	24456	24456	24456	24456	24456	24456

Notes: The sample is the set of SNAP adopters. The unit of observation is the household-month. Each column reports coefficient estimates from a regression model, with standard errors in parentheses clustered by household and calendar month using the method in Thompson (2011). All models include calendar month fixed effects. In columns (1) and (2) the dependent variable is the change in the adjusted store-brand share for SNAP-eligible or SNAP-ineligible purchases, respectively. In column (3) the dependent variable is the difference between the change in the adjusted store-brand share for SNAP-eligible purchases and the change in the adjusted store-brand share for SNAP-ineligible purchases. In columns (4) and (5) the dependent variable is the change in the adjusted coupon redemption share for SNAP-eligible or SNAP-ineligible purchases, respectively. In column (6) the dependent variable is the difference between the change in the adjusted coupon redemption share for SNAP-eligible purchases and the change in the adjusted coupon redemption share for SNAP-ineligible purchases. Missing values arise when a given household does not buy any SNAP-eligible or SNAP-ineligible items in a given month.

Online Appendix Table 16: Effect of SNAP adoption on coupon redemption, alternative definition

	(1)	(2)	(3)
	Change in coupon redemption rate		
	SNAP-eligible	SNAP-ineligible	Difference
SNAP adoption	-0.0161	-0.0084	-0.0117
	(0.0065)	(0.0116)	(0.0148)
Number of household-months	1215050	326551	301050
Number of households	24334	22249	21794

Notes: The sample is the set of SNAP adopters. The unit of observation is the household-month. Each column reports coefficient estimates from a regression model, with standard errors in parentheses clustered by household and calendar month using the method in Thompson (2011). All models include calendar month fixed effects. In columns (1) and (2) the dependent variable is the change in the monthly coupon redemption rate for SNAP-eligible or SNAP-ineligible purchases, respectively. In column (3) the dependent variable is the difference between the change in the monthly coupon redemption rate for SNAP-eligible purchases and the change in the monthly coupon redemption rate for SNAP-ineligible purchases. The coupon redemption rate is computed as follows. The retailer provides us with information on each coupon mailed to each household, along with the amount of the discount and the dates and products for which the coupon is valid. We initialize the set of available coupons as the set of coupons ever mailed to a given household. Then for each product purchase in which a coupon was redeemed we execute, in chronological order, the following logic: If there is at least one coupon in the set of available ones that is valid on the transaction date and matches the amount of the coupon redeemed, we assume that the redeemed coupon is the one among these with the earliest expiration date and we remove that coupon from the available set. For any given purchase, we define the potential redemption to be the value of the most valuable valid coupon in the available set. We compute the monthly redemption rate as the ratio of the total value of all coupons redeemed in a given month that are matched to a counterpart in the available set, and the sum of all potential redemptions in the month. Missing values arise when potential redemptions are zero for purchases in the given category.

Online Appendix Table 17: Quantitative implications of price misperception

	(1)	(2)	(3)	(4)	(5)	(6)
	Observed			Simulated		
MPCF out of SNAP	0.5884	0.1454	0.1454	0.5912	0.2846	0.5456
	(0.0061)	(0.0006)	(0.0005)	(0.0065)	(0.0038)	(0.0213)
Relative change in effective shopping effort for						
Food	-0.0263	-0.0064	-0.0065	-0.0232	-0.0126	-0.0237
	(0.0013)	(0.0000)	(0.0000)	(0.0003)	(0.0003)	(0.0009)
Nonfood	-0.0008	-0.0064	-0.0064	-0.0032	-0.0055	-0.0035
	(0.0039)	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0002)
Food relative to nonfood, second period	-0.0202	-0.0000	-0.0000	-0.0200	-0.0000	-0.0000
	(0.0047)	(0.0000)	(0.0000)	(0.0004)	(0.0000)	(0.0000)
Short-run time preference	-	No	Yes	Yes	Yes	Yes
Price misperception	-	No	No	No	Yes	Yes
Mental accounting	-	No	No	Yes	No	No
					($\sigma = 1$)	($\sigma = 6.85$)

Notes: Column (1) shows empirical estimates for the sample of SNAP adopters. Columns (2) through (6) show calculations based on the model described in section 6.3 of the paper and extended in online appendix section 1. We set $\kappa = 0$ in all columns except for column (4), where we set κ so that the MPCF out of SNAP equals the observed MPCF from column (1). In column (2) we set $\beta = 1$ and $\sigma = 0$. In columns (3) and (4) we set $\sigma = 0$ and we set β so that the decline in food consumption between the first and second half of the month equals that implied by the estimated daily decline in caloric intake in table 1, column (2) of Shapiro (2005), assuming a constant daily rate of decline and that each period w consists of 15 days. In column (5) we set β as in column (3) and we set $\sigma = 1$. In column (6) we set σ to the largest value such that food prices are never perceived to be negative. The observed MPCF out of SNAP is the estimate from column (3) of table 1. The simulated MPCF out of SNAP is the difference in total monthly food expenditure $\sum_w f_w d\left(\frac{s_w^f}{f_w}\right)$ with and without SNAP, divided by the amount of SNAP benefits b_0 for SNAP recipients. The observed relative change in effective shopping effort for food (nonfood) items is the estimated effect of SNAP on the adjusted store-brand share for SNAP-eligible (SNAP-ineligible) purchases, as shown in online appendix table 15, divided by the expenditure-weighted average store-brand share of SNAP-eligible (SNAP-ineligible) purchases in the six months prior to adoption. The simulated relative change in effective shopping effort for food is the ratio of the effective shopping effort $\left(\sum_w f_w d\left(\frac{s_w^f}{f_w}\right) / \sum_w f_w\right)^{-1}$ with SNAP to the effective shopping effort without SNAP, less one. The simulated relative change in effective shopping effort for nonfood is defined analogously. The observed relative change in effective shopping effort for food relative to nonfood in the second period is computed as follows. We compute the expenditure-weighted average store-brand share of purchases in the second two weeks of the month in the six months prior to adoption, $\left(\bar{s}_f^{pre-SNAP}, \bar{s}_n^{pre-SNAP}\right)$, where f denotes SNAP-eligible items and n denotes SNAP-ineligible items. We define $\left(\bar{s}_f^{post-SNAP}, \bar{s}_n^{post-SNAP}\right)$ as the sum of $\left(\bar{s}_f^{pre-SNAP}, \bar{s}_n^{pre-SNAP}\right)$ and the corresponding estimated effect of SNAP on the adjusted store-brand share in the second two weeks of the month, as shown in online appendix table 18. The observed relative change is then given by $\frac{(\bar{s}_f^{post-SNAP} / \bar{s}_n^{post-SNAP})}{(\bar{s}_f^{pre-SNAP} / \bar{s}_n^{pre-SNAP})} - 1$. The simulated relative change in effective shopping effort for food relative to nonfood is given by computing the ratio of the effective shopping effort $\left(d\left(\frac{s_2^f}{f_2}\right) / d\left(\frac{s_2^n}{n_2}\right)\right)^{-1}$ with SNAP to the effective shopping effort without SNAP, less one. Standard errors in parentheses are obtained via a nonparametric bootstrap over households with 30 replicates. In each bootstrap replicate, we draw households with replacement to match the size of the main sample, and recompute all empirical objects. We also draw a value of the daily decline in caloric intake from a Gaussian distribution with mean given by the point estimate in table 1, column (2) of Shapiro (2005) and standard deviation given by the standard error in table 1, column (2) of Shapiro (2005).

Online Appendix Table 18: Effect of SNAP adoption on store-brand share, by part of month

	(1)	(2)	(3)	(4)	(5)	(6)
	Change in adjusted store-brand share: first two weeks			Change in adjusted store-brand share: second two weeks		
	SNAP-eligible	SNAP-ineligible	Difference	SNAP-eligible	SNAP-ineligible	Difference
SNAP adoption	-0.0058	-0.0016	-0.0034	-0.0045	0.0015	-0.0059
	(0.0006)	(0.0015)	(0.0017)	(0.0007)	(0.0012)	(0.0014)
Number of household-months	1973916	1812391	1806696	1997485	1833849	1827971
Number of households	24456	24456	24456	24456	24456	24456

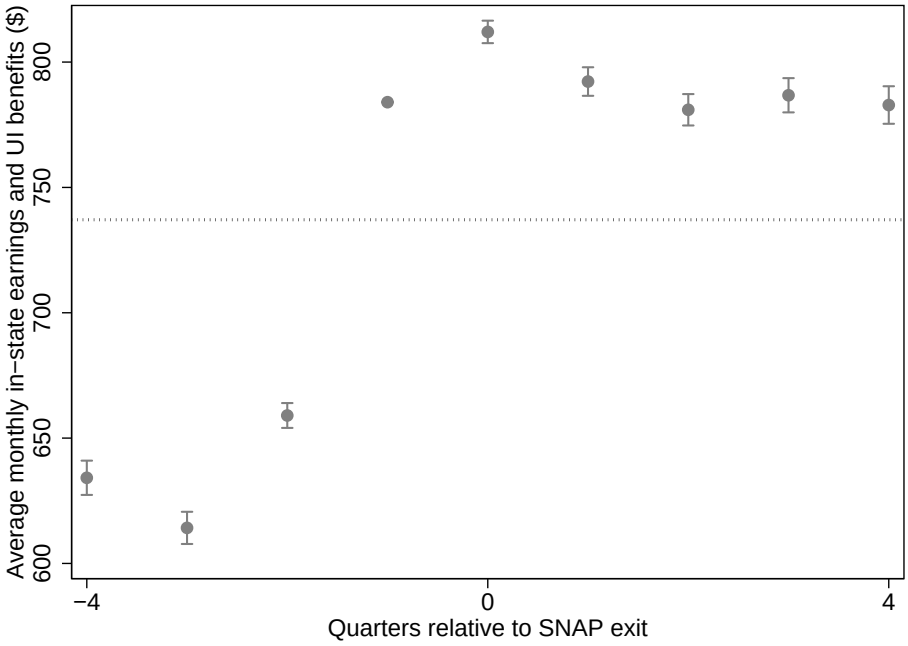
Notes: The sample is the set of SNAP adopters. The unit of observation is the household-fortnight, where we distinguish between first and second two weeks of the month. Each column reports coefficient estimates from a regression model, with standard errors in parentheses clustered by household and calendar month using the method in Thompson (2011). All models include calendar month fixed effects. In columns (1), (2), (4) and (5) the dependent variable is the change in the adjusted store-brand share for SNAP-eligible or SNAP-ineligible purchases. In columns (3) and (6) the dependent variable is the difference between the change in the adjusted store-brand share for SNAP-eligible purchases and the change in the adjusted store-brand share for SNAP-ineligible purchases. Missing values arise when a given household does not buy any SNAP-eligible or SNAP-ineligible items in a given fortnight.

Online Appendix Table 19: Quantitative implications of psychological departures from fungibility, sensitivity to alternative assumptions about shopping effort

	(1)	(2)	(3)	(4)	(5)
	Observed		Simulated		
MPCF out of SNAP	0.5884	0.5884	0.5912	0.5899	0.5893
	(0.0061)	(0.0061)	(0.0065)	(0.0061)	(0.0064)
Relative change in effective shopping effort for					
Food	-0.0263	-0.0833	-0.0232	-0.0193	-0.0267
	(0.0013)	(0.0082)	(0.0003)	(0.0003)	(0.0004)
Nonfood	-0.0008	-0.0107	-0.0032	-0.0027	-0.0037
	(0.0039)	(0.0109)	(0.0001)	(0.0000)	(0.0001)
Proxy for shopping effort	Store-brand share	Coupon redemption share	-	-	-
			-	-	-
Short-run time preference	-		Yes	Yes	Yes
Mental accounting	-		Yes	Yes	Yes
Shopping effort parameter (ρ)			0.085	0.07	0.10

Notes: Column (1) is identical to column (1) of table 4 in the main text. Columns (1) and (2) differ in the proxy for shopping effort. In column (1), the observed relative change in effective shopping effort for food (nonfood) items is the estimated effect of SNAP on the adjusted store-brand share for SNAP-eligible (SNAP-ineligible) purchases, divided by the expenditure-weighted average store-brand share of SNAP-eligible (SNAP-ineligible) purchases in the six months prior to adoption. In column (2), the observed relative change in effective shopping effort for food (nonfood) items is the estimated effect of SNAP on the adjusted coupon redemption share for SNAP-eligible (SNAP-ineligible) purchases, divided by the purchase-count-weighted average coupon redemption share of SNAP-eligible (SNAP-ineligible) purchases in the six months prior to adoption. Column (3) is identical to column (4) of table 4 in the main text. Columns (4) and (5) differ from column (3) in the value assumed for the shopping effort parameter ρ. See the notes to table 4 in the main text for additional details.

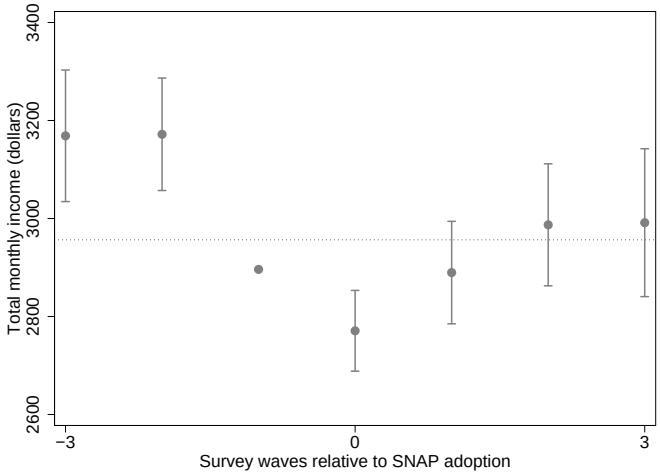
Online Appendix Figure 1: In-state earnings before and after SNAP exit



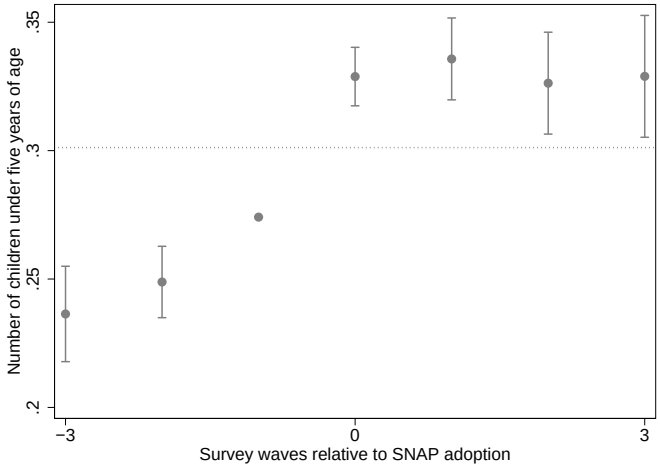
Notes: Data are from Rhode Island administrative records from October 2004 through June 2016. See section 2.1 for details on sample definition and variable construction. The plot shows coefficients from a regression of in-state earnings and unemployment benefits on a vector of lead and lagged indicators for quarters relative to SNAP exit, defined as the first period in which the household does not receive SNAP benefits after SNAP adoption. Only the first SNAP exit per household is considered. The period immediately prior to exit ("-1") is the omitted category. The regression includes calendar quarter fixed effects, household fixed effects, and indicators for observations more than one year before or after exit. The unit of observation is a household-quarter. The error bars are ±2 coefficient standard errors and standard errors are clustered by household. The dotted line shows the sample mean of the dependent variable across observations within one year of SNAP exit. The coefficient series is shifted by a constant so that the observation-count-weighted mean of the regression coefficients is equal to the sample mean of the corresponding dependent variable.

Online Appendix Figure 2: Household income and size before and after SNAP adoption, SIPP data

Panel A: Household total monthly income

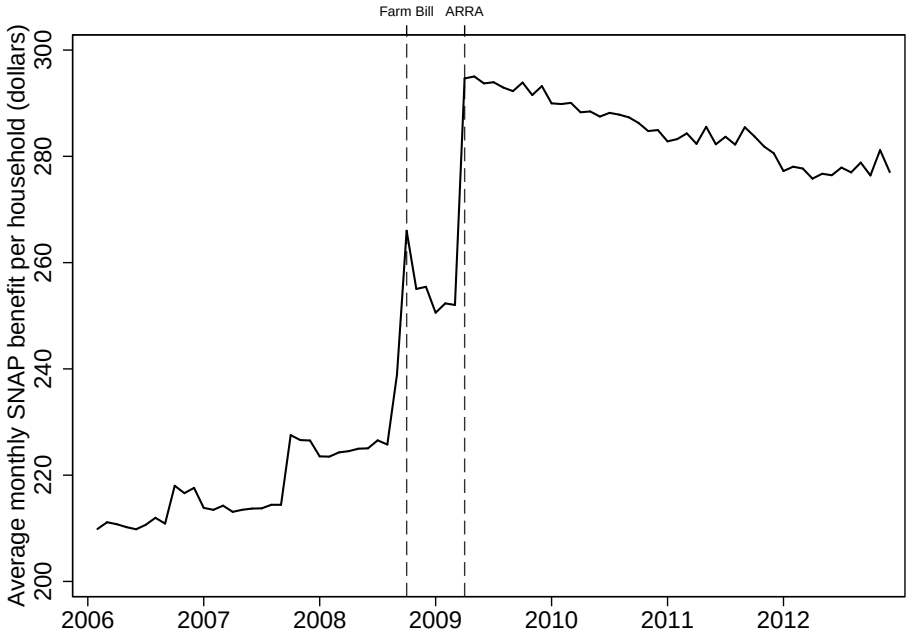


Panel B: Number of children under five years of age



Notes: Data are from all waves of the 2008 Survey of Income and Program Participation (SIPP), which cover months May 2008 through November 2013 and are publicly available at `www.nber.org/data/survey-of-income-and-program-participation-sipp-data.html` as of October 2017. The sample includes interview months only. Total household income is computed as the sum of reported household earned income, property income, means-tested cash, and 'other' income, such as Social Security income and unemployment income; it excludes SNAP benefits, WIC, and energy assistance. Each panel plots coefficients from a regression of the dependent variable on a vector of lead and lagged indicators for four-month periods ("survey waves") relative to SNAP adoption, defined as the first wave in which the household receives SNAP. The survey wave immediately prior to adoption ("-1") is the omitted category. Each regression includes survey wave fixed effects, household fixed effects, and indicators for observations more than one year before or after adoption. The unit of observation for each regression is the household-survey wave. Each regression is weighted using the SIPP household-month weights of the interview month for the relevant survey wave. In all panels, the error bars are ± 2 coefficient standard errors and standard errors are clustered by household. Dotted lines show the sample mean of the dependent variable across observations within one year (three survey waves) of SNAP adoption. Each coefficient series is shifted by a constant so that the observation-count-weighted mean of the regression coefficients is equal to the sample mean of the corresponding dependent variable.

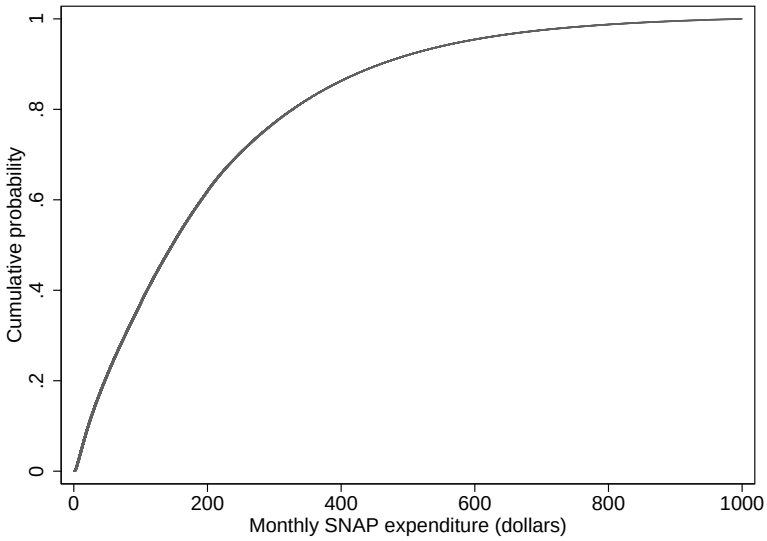
Online Appendix Figure 3: Legislated changes in SNAP benefits



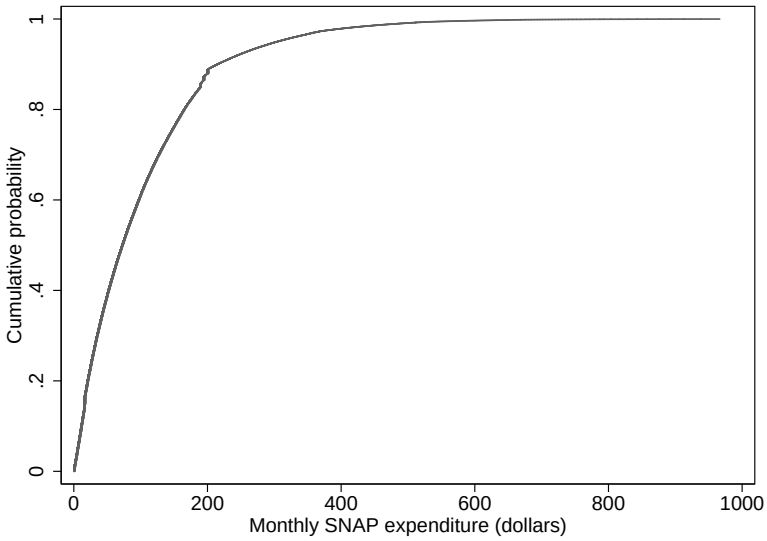
Notes: This figure plots the average monthly SNAP benefit per US household between February 2006 and December 2012. The series was obtained directly from the United States Department of Agriculture Food and Nutrition Service via `http://www.fns.usda.gov/sites/default/files/pd/SNAPZip69throughCurrent.zip` as of May 2017. The vertical lines at October 2008 and April 2009 denote the implementation dates of changes in SNAP benefits due to the Farm Bill and American Recovery and Reinvestment Act (ARRA), respectively.

Online Appendix Figure 4: Monthly SNAP expenditure, retailer panel and Rhode Island Retailer

Panel A: Retailer panel

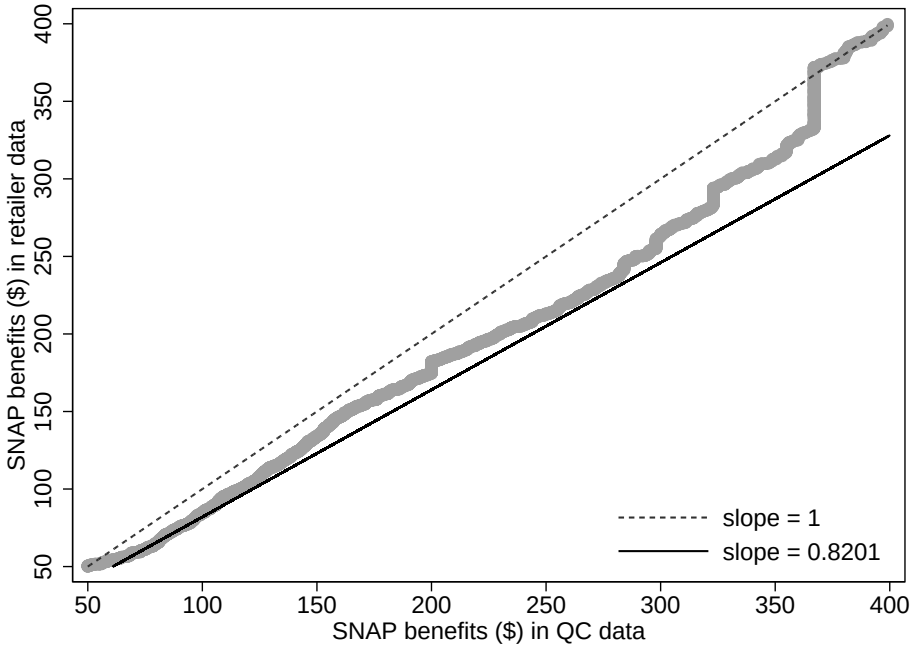


Panel B: Rhode Island Retailer



Notes: Each panel shows the cumulative distribution function for monthly SNAP expenditure truncated at $1000. The sample is all household-months with positive SNAP expenditure. In panel A, the data come from the retail panel described in section 3.1. In panel B, the data come from administrative EBT records for the Rhode Island Retailer described in section 2.1.

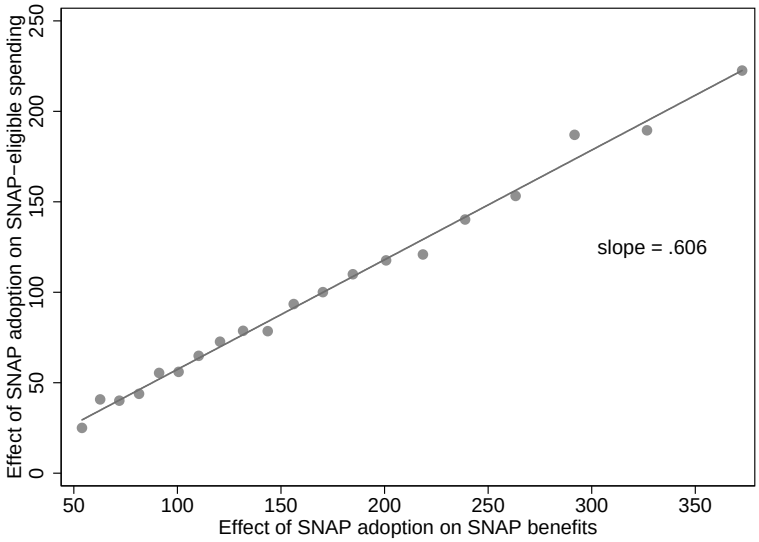
Online Appendix Figure 5: Distribution of SNAP benefits in the retail panel and administrative data, quantile-quantile plot



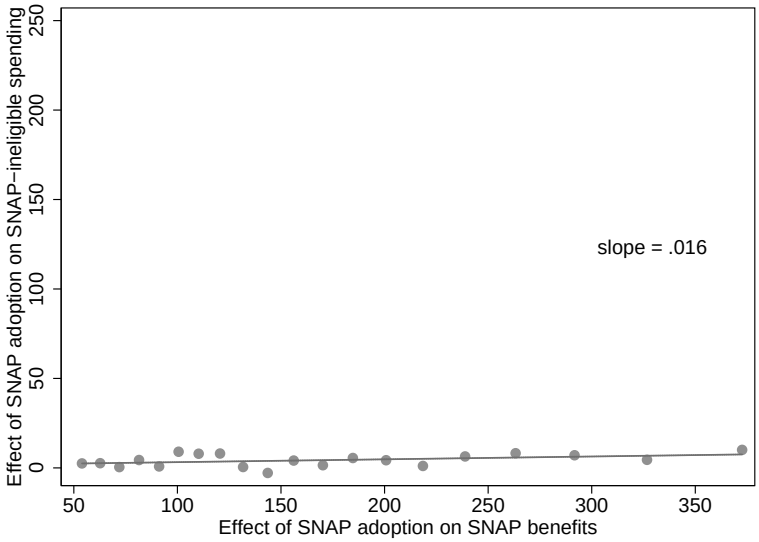
Notes: The administrative data are the SNAP quality control (QC) data, which are publicly available at `https://host76.mathematica-mpr.com/fns/` as of May 2017. The sample is the set of household-months that are within six months following an adoption, inclusive of the adoption month, and that can be matched to cases in the administrative data based on state of residence, calendar month, number of adults in the household, number of children in the household, age range of the head of household, median years of education for household members age 25 or older, and income category. We require an exact match based on non-missing characteristics. The figure plots the quantiles for SNAP benefits in the retailer data against the corresponding quantiles for benefits in the matched administrative data, restricting attention to benefits between 50 and 400 dollars per month, inclusive. The dashed line is a ray with slope 1. The dashed line thus corresponds to the case of identical distributions. The solid line is a ray whose slope is equal to the ratio of average benefits in the retail data to average benefits in the administrative data (reported in online appendix table 7). The solid line thus corresponds to the case in which each household spends an identical proportion of its benefits at the retailer.

Online Appendix Figure 6: Changes in spending vs. changes in benefits across households

Panel A: SNAP-eligible spending



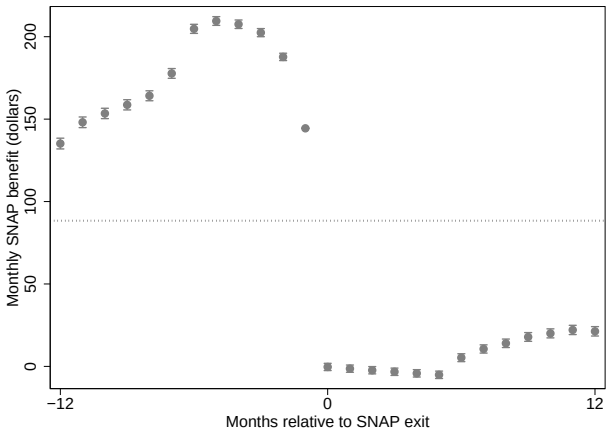
Panel B: SNAP-ineligible spending



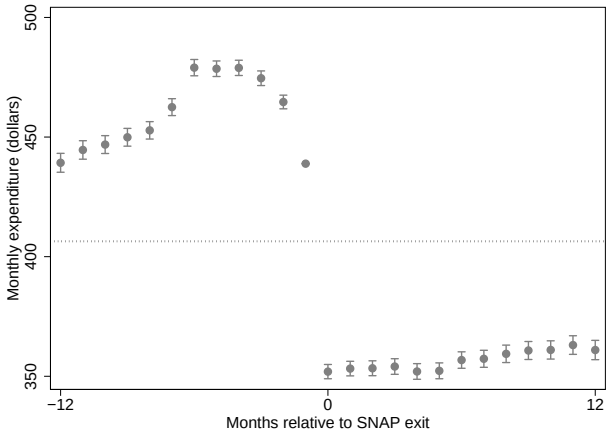
Notes: The sample is the set of SNAP adopters. The binned scatterplots are constructed as follows. We first pool all households and residualize the change in SNAP-eligible spending, the change in SNAP-ineligible spending, the change in SNAP benefits, and the SNAP adoption indicator with respect to calendar month indicators. In panel A, for each household, we regress the residual change in SNAP-eligible spending on the residual of the SNAP adoption indicator. The coefficient from this regression is the effect of SNAP adoption on SNAP-eligible spending. Next, for each household, we regress the residual change in SNAP benefits on the residual of the SNAP adoption indicator. The coefficient from this regression is the effect of SNAP adoption on SNAP benefits. In panel B, we do the analogous but for SNAP-ineligible spending. In both cases, we restrict attention to households for which the effect of SNAP adoption on SNAP benefits is between 50 and 400, inclusive. We then divide households into twenty equal-sized bins and plot, for each bin, the average effect of SNAP adoption on the corresponding spending variable (y-axis) and the average effect of SNAP adoption on SNAP benefits (x-axis). The solid lines shows the fit from an OLS regression of the effect of SNAP adoption on the corresponding spending variable on the effect of SNAP adoption on SNAP benefits.

Online Appendix Figure 7: SNAP benefits and monthly expenditure before and after SNAP exit

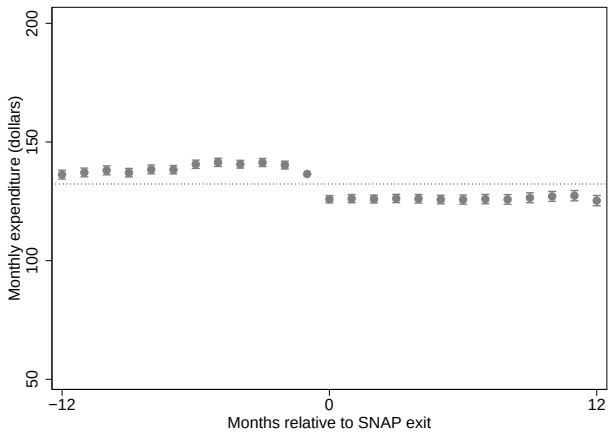
Panel A: SNAP benefits



Panel B: SNAP-eligible spending

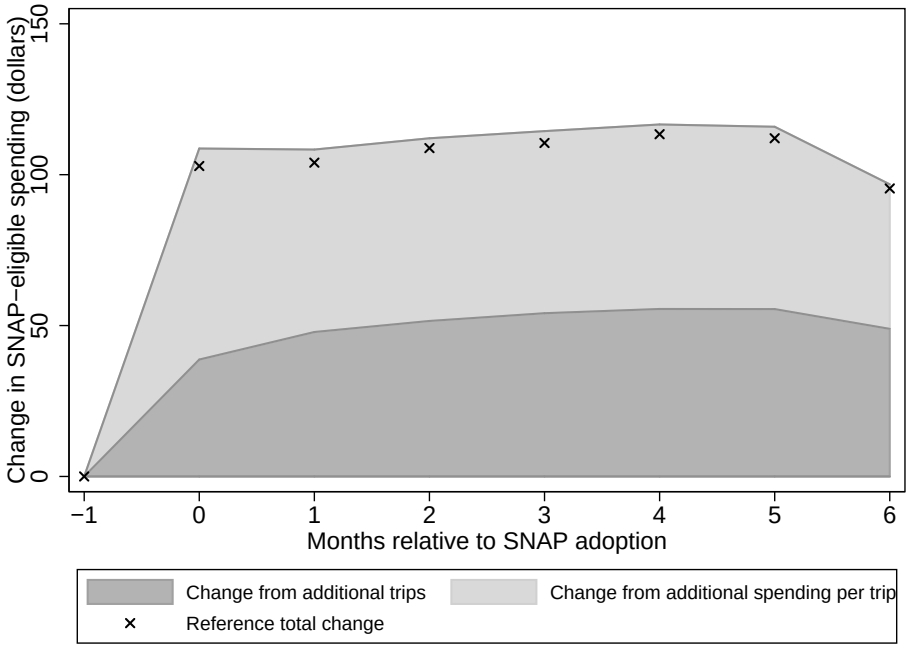


Panel C: SNAP-ineligible spending



Notes: Each figure plots coefficients from a regression of the dependent variable on a vector of lead and lagged indicators for months relative to SNAP exit, defined as six consecutive months of SNAP use followed by six consecutive months without SNAP use. Only the first SNAP exit per household is considered. The period immediately prior to exit ("-1") is the omitted category. The unit of observation for each regression is the household-month and the sample is the set of SNAP adopters. Error bars are ±2 coefficient standard errors. Standard errors are clustered by household. Each regression includes calendar month fixed effects, household fixed effects, and indicators for observations more than one year before or after SNAP exit. Dotted lines show the sample mean of the dependent variable across observations within one year of SNAP exit. Each coefficient series is shifted by a constant so that the observation-count-weighted mean of the regression coefficients is equal to the sample mean of the corresponding dependent variable. In panel A, the dependent variable is monthly SNAP benefits. In panel B, the dependent variable is monthly SNAP-eligible spending. In panel C, the dependent variable is monthly SNAP-ineligible spending.

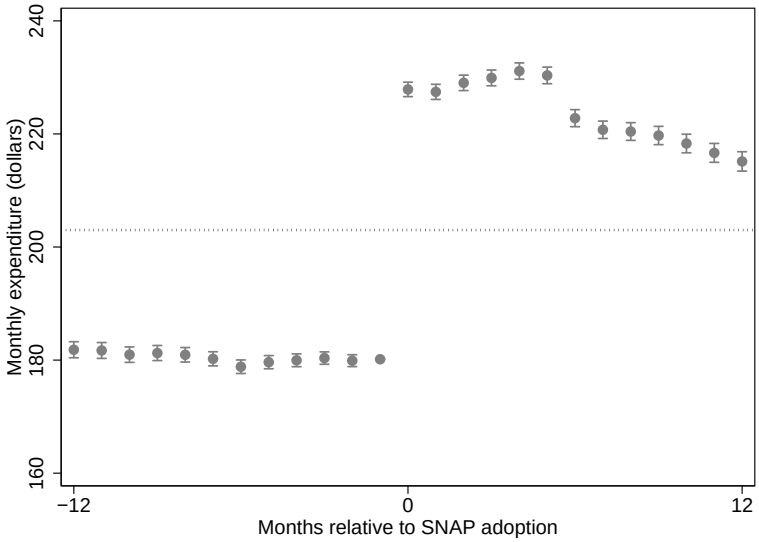
Online Appendix Figure 8: Decomposition of increase in SNAP-eligible spending into number of trips and spending per trip



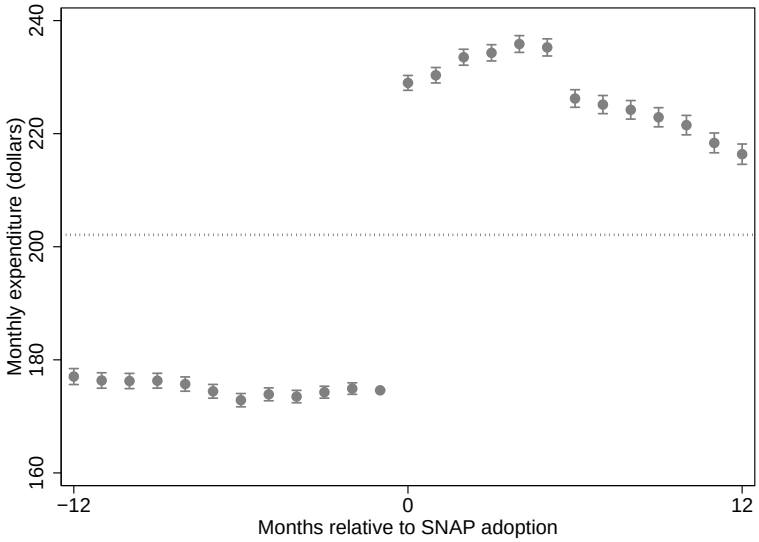
Notes: The figure plots a decomposition of the increase in SNAP-eligible spending after the household's first SNAP adoption. The dark-shaded area shows the change due to additional trips. It is computed by multiplying the average dollars spent in SNAP-eligible products per trip in the month prior to adoption by coefficients from a regression of number of trips on a vector of lead and lagged indicators for month relative to the household's first SNAP adoption. The light-shaded area shows the change due to additional SNAP-eligible spending per trip. It is computed by multiplying the average number of trips per month in the month prior to adoption with coefficients from a regression of SNAP-eligible spending per trip on a vector of lead and lagged indicators for month relative to the household's first SNAP adoption. A trip is defined to be a store-date on which the household makes at least one purchase of SNAP-eligible or SNAP-ineligible items at the retailer. The reference total change shows coefficients from a regression of SNAP-eligible spending on a vector of lead and lagged indicators for month relative to the household's first SNAP adoption. In each regression, the month prior to SNAP adoption ("-1") is the omitted category. The unit of observation for each regression is the household-month and the sample is the set of SNAP adopters. Each regression includes calendar month fixed effects, household fixed effects, and two indicators for observations before and after 12 months of SNAP adoption.

Online Appendix Figure 9: Monthly expenditure on SNAP-eligible items before and after SNAP adoption

Panel A: Spending on perishable SNAP-eligible items

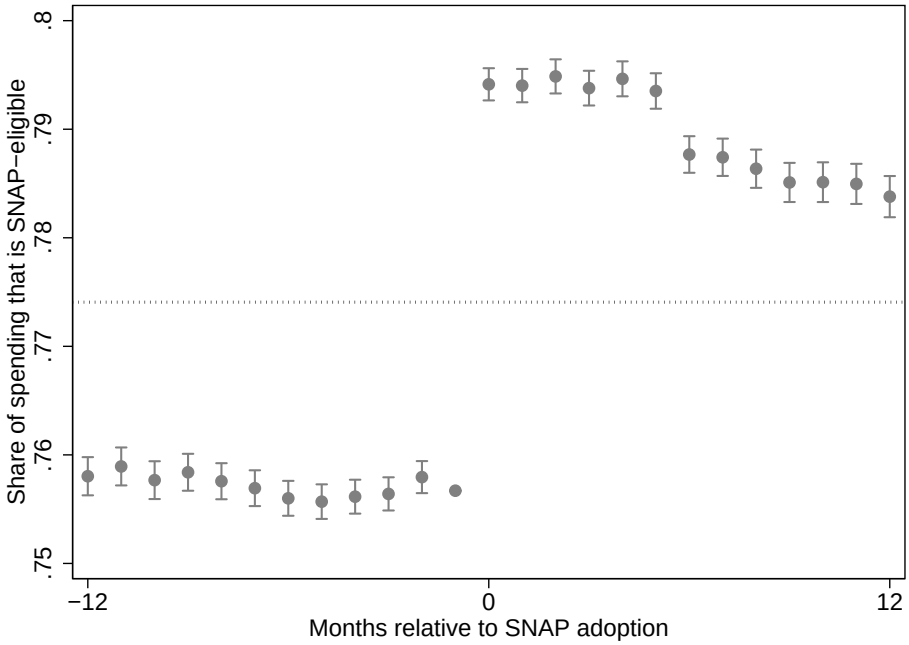


Panel B: Spending on non-perishable SNAP-eligible items



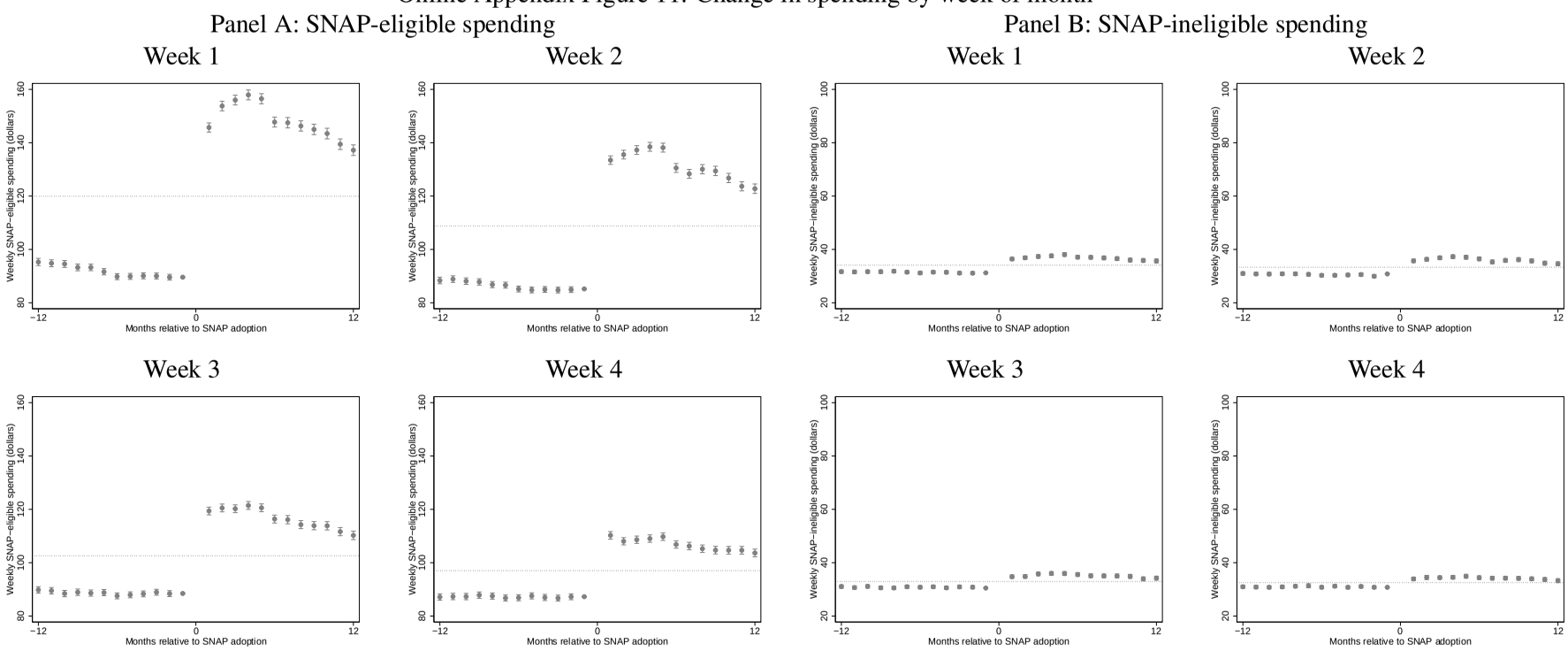
Notes: Each figure plots coefficients from a regression of spending on perishable or non-perishable SNAP-eligible items on a vector of lead and lagged indicators for month relative to the household's first SNAP adoption, with the month prior to SNAP adoption ("-1") as the omitted category. The unit of observation for each regression is the household-month and the sample is the set of SNAP adopters. Error bars are ± 2 coefficient standard errors. Standard errors are clustered by household. Each regression includes calendar month fixed effects, household fixed effects, and two indicators for observations before and after 12 months of SNAP adoption. The dotted lines show the sample mean of the dependent variable across observations within 12 months of SNAP adoption. Each coefficient series is shifted by a constant so that the observation-count-weighted mean of the regression coefficients is equal to the sample mean of the corresponding dependent variable. Perishability status has been hand-coded at the product category level. We define a product category to be perishable if it contains staple foods that will spoil within one month if left on the counter or in the refrigerator. We use the definition of staple foods from FNS (2017) and the recommended storage periods from Albrecht (2007).

Online Appendix Figure 10: SNAP-eligible share of expenditure before and after SNAP adoption



Notes: The figure plots coefficients from a regression of the share of nonfuel spending that is SNAP-eligible (out of spending that we classify as either SNAP-eligible or SNAP-ineligible) on a vector of lead and lagged indicators for month relative to the household's first SNAP adoption, with the month prior to SNAP adoption ("-1") as the omitted category. The unit of observation for each regression is the household-month and the sample is the set of SNAP adopters. Error bars are ± 2 coefficient standard errors. Standard errors are clustered by household. Each regression includes calendar month fixed effects, household fixed effects, and two indicators for observations before and after 12 months of SNAP adoption. The dotted lines show the sample mean of the dependent variable across observations within 12 months of SNAP adoption. Each coefficient series is shifted by a constant so that the observation-count-weighted mean of the regression coefficients is equal to the sample mean of the corresponding dependent variable.

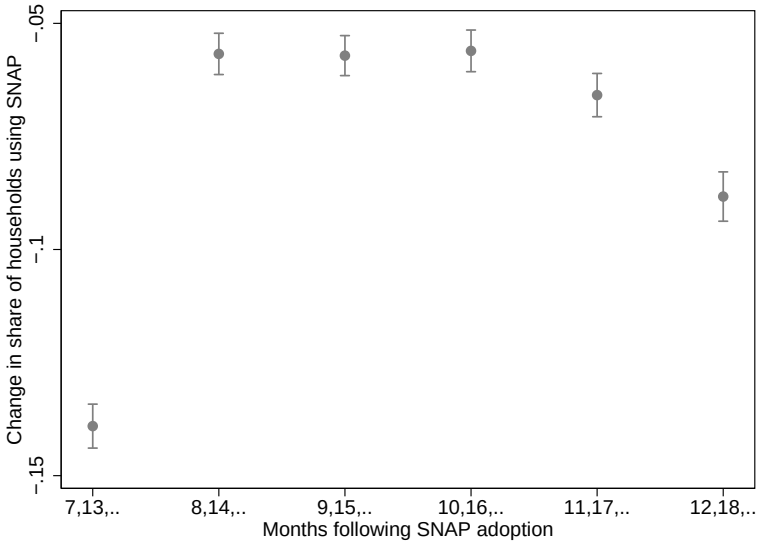
Online Appendix Figure 11: Change in spending by week of month



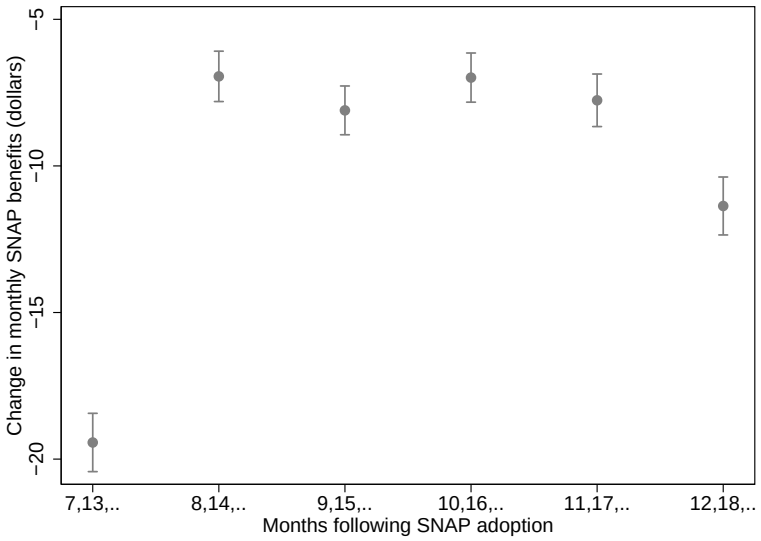
Notes: Each figure plots coefficients from a regression of SNAP-eligible or SNAP-ineligible spending in a given week of the month on a vector of lead and lagged indicators for month relative to the household's first SNAP adoption, with the month prior to SNAP adoption ("-1") as the omitted category. The unit of observation for each regression is the household-month. The sample is the set of SNAP adopters. Error bars are ± 2 coefficient standard errors. Standard errors are clustered by household. Each regression includes calendar month fixed effects, household fixed effects, and two indicators for observations before and after 12 months of SNAP adoption. The dotted lines show the sample mean of household weekly expenditure across observations within 12 months of SNAP adoption. Each coefficient series is shifted by a constant so that the observation-count-weighted mean of the displayed regression coefficients is equal to the sample mean of the corresponding dependent variable. The coefficient for month 0 is not shown because we do not know the timing of the adoption within the month.

Online Appendix Figure 12: Participation and benefits at Rhode Island Retailer, over the six-month SNAP clock

Panel A: SNAP use



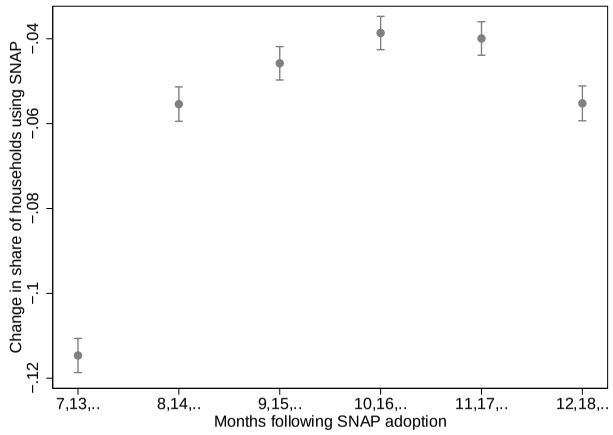
Panel B: SNAP benefits



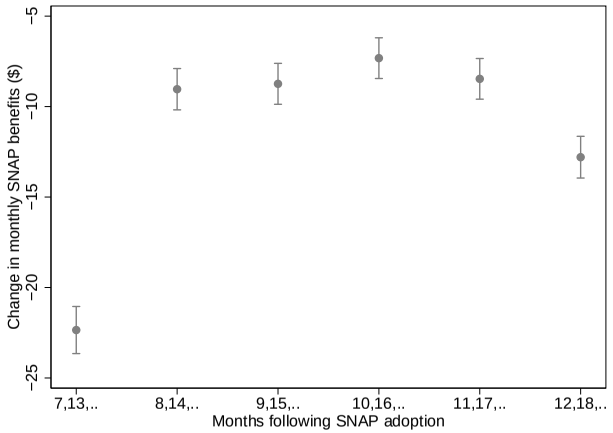
Notes: Data are from Rhode Island EBT transaction records from September 2012 through October 2015. See section 2.1 for details on sample definition and variable construction. Each figure plots coefficients from a regression of the dependent variable on a vector of indicators for the position of the current month in a monthly clock that begins in the most recent adoption month and resets every six months or at the next SNAP adoption, whichever comes first. So, for example, the first month of the clock corresponds to months 7, 13, 19, etc. following SNAP adoption. The unit of observation for each regression is the household-month. The sample is the set of SNAP adopters, where SNAP adoption is defined as in section 3.5. Error bars are ±2 coefficient standard errors. Standard errors are clustered by household. Each regression includes calendar month fixed effects. The omitted category consists of the first six months (inclusive of the adoption month) after the household's most recent SNAP adoption, all months after the first 24 months (inclusive of the adoption month) following the household's most recent adoption, and all months for which there is no preceding adoption. In panel A, the dependent variable is the change in an indicator for whether the household-month is a SNAP month. In panel B, the dependent variable is the change in monthly SNAP benefits.

Online Appendix Figure 13: Participation, benefits, and spending over the six-month SNAP clock for SNAP adopters who have at least six consecutive non-SNAP months after first adoption

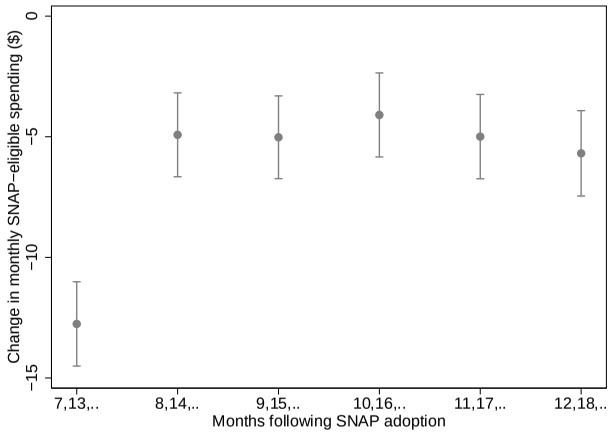
Panel A: SNAP use



Panel B: SNAP benefits

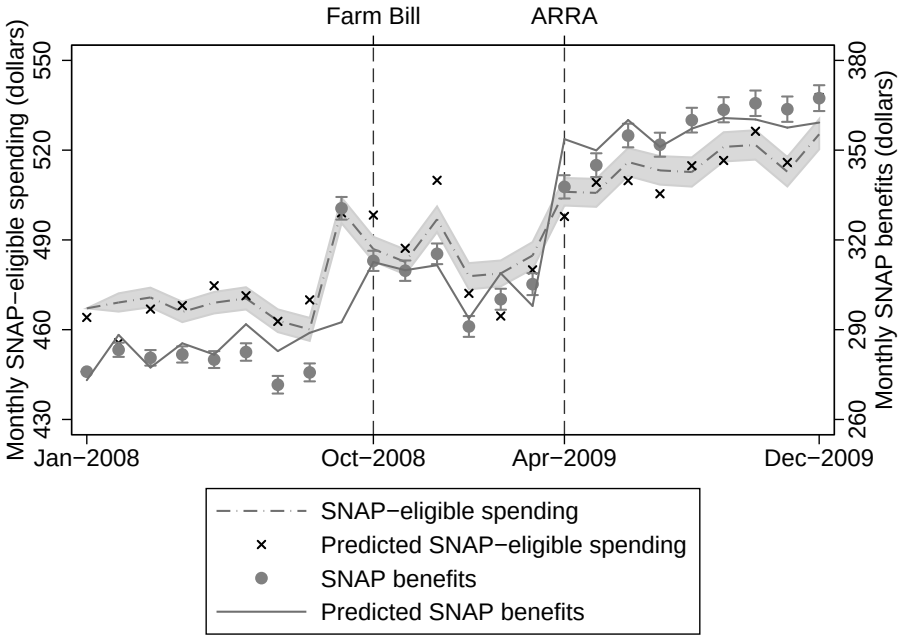


Panel C: SNAP-eligible spending



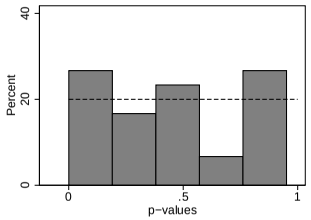
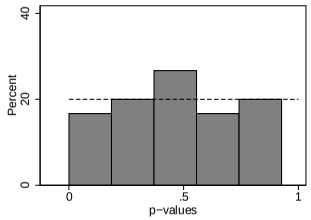
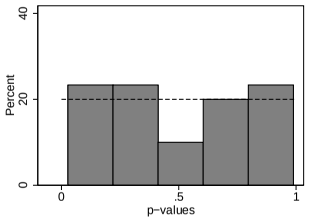
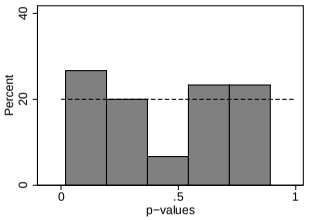
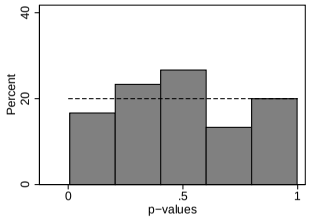
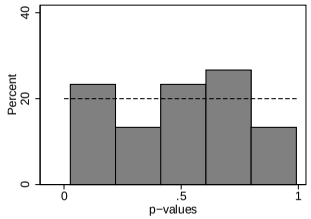
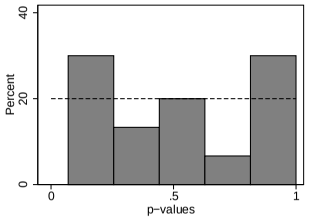
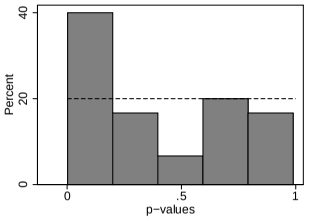
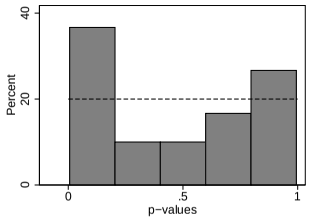
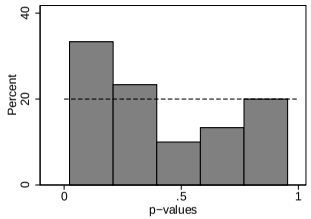
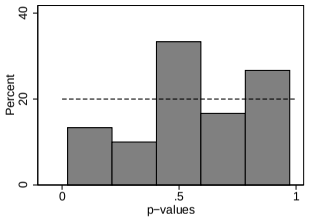
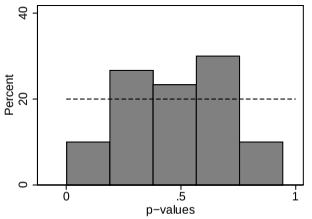
Notes: Each figure plots coefficients from a regression of the dependent variable on a vector of indicators for the position of the current month in a monthly clock that begins in the most recent adoption month and resets every six months or at the next SNAP adoption, whichever comes first. So, for example, the first month of the clock corresponds to months 7, 13, 19, etc. following SNAP adoption. The unit of observation for each regression is the household-month. The sample is the set of SNAP adopters who have at least one period of six consecutive non-SNAP months following the household's first SNAP adoption. Error bars are ±2 coefficient standard errors. Standard errors are clustered by household. Each regression includes calendar month fixed effects. The omitted category consists of the first six months (inclusive of the adoption month) after the household's most recent SNAP adoption, all months after the first 24 months (inclusive of the adoption month) following the household's most recent adoption, and all months for which there is no preceding adoption. In panel A, the dependent variable is the change in an indicator for whether the household-month is a SNAP month. In panel B, the dependent variable is the change in monthly SNAP benefits. In panel C, the dependent variable is the change in monthly SNAP-eligible spending.

Online Appendix Figure 14: Fit of regression model to monthly SNAP benefits and SNAP-eligible spending around benefit changes



Notes: We plot coefficients from a regression of SNAP benefits, SNAP-eligible spending, and their predicted counterparts on interactions between the share of calendar months between February 2006 and December 2007 during which each household used SNAP and calendar month indicators, with the January 2008 interaction normalized to zero. Predicted SNAP benefits and SNAP-eligible spending are computed from models (1) and (2), respectively, in online appendix table 9. The sample includes all households in the retailer panel with at least one SNAP month. The unit of observation is the household-month and only months from January 2008 to December 2009 are included in the regression. Error bars and shaded region represent ± 2 coefficient standard errors. Standard errors are clustered by household. Each regression includes household and calendar month fixed effects. Each coefficient series is seasonally adjusted by subtracting from each coefficient the corresponding coefficient from an auxiliary regression of the dependent variable on interactions between the share of months between February 2006 and December 2007 during which each household used SNAP and year and seasonal month indicators. The auxiliary regressions include household, year, and seasonal month fixed effects and are estimated using only data from January 2010 to December 2012. Each coefficient series is shifted by a constant so that the observation-count-weighted mean of the regression coefficients is equal to the sample mean of the corresponding dependent variable among households who used SNAP in every month between February 2006 and December 2007. Vertical lines at October 2008 and April 2009 denote the implementation dates of changes in SNAP benefits due to the Farm Bill and American Recovery and Reinvestment Act (ARRA), respectively.

Online Appendix Figure 15: Sampling experiments for fungibility tests

Simulated consumption function	Distribution of $p-$values from test that $\gamma = 0$: Linear, homogeneous	Linear, heterogeneous	Spline	Kernel
Linear, homogeneous				
Linear, heterogeneous				
Nonlinear, heterogeneous				

Notes: The sample consists of a random subset of 2000 SNAP adopters whose behavior is simulated as follows. Let f_{it} be SNAP-eligible spending, b_{it} be SNAP benefits, and y_{it} be the additive inverse of fuel spending. Let q_i be the average monthly gallons of gasoline purchased, p_t be the average price of regular gasoline, and z_{it} be the cumulative number of adoptions experienced. Let $U_{it}^{(n)}$ denote the n^{th} independent realization from a uniform distribution on $[0,1]$ for household i in calendar month t, and let $U_i^{(n)}$ denote a realization for household i, constant across all months. Food spending is given by $f_{it} = \alpha_i + \Psi_i(y_{it} + b_{it}) + \xi_{it}$, where $\alpha_i = 200U_i^{(1)} + 500$, $b_{it} = 10U_{it}^{(2)} + \left(200U_{it}^{(3)} + 100\right) z_{it} + \varepsilon_{it}^b$, and $y_{it} = 1000 - \left(U_{it}^{(4)} + 0.5\right) 0.9 q_i p_t + \varepsilon_{it}^y$. The error terms are modeled as $\xi_{it} = \left(U_{it}^{(5)} - 0.5\right) 50 + 0.1\varepsilon_{it}^b + 0.05\varepsilon_{it}^y$, $\varepsilon_{it}^b = 50\left(U_{it}^{(6)} - 0.5\right)$, and $\varepsilon_{it}^y = 50\left(U_{it}^{(7)} - 0.5\right)$. In the row labeled "linear, homogeneous" we assume that $\Psi_i(y_{it} + b_{it}) = 0.1(y_{it} + b_{it})$ for all i. In the row labeled "linear, heterogeneous" we assume that $\Psi_i(y_{it} + b_{it}) = \left(0.1U_i^{(8)} + 0.05\right)(y_{it} + b_{it})$ for all i. In the row labeled "nonlinear, heterogeneous" we assume $\Psi_i(y_{it} + b_{it}) = \left(U_i^{(9)} + 0.5\right) \ln(y_{it} + b_{it}) + \left(0.1U_i^{(10)} + 0.05\right)(y_{it} + b_{it})$ for all i. Each column corresponds to one of the four fungibility tests described in the main paper. Each plot shows the distribution across 30 simulation replicates of the $p-$values for the null hypothesis that $\gamma = 0$. The dashed horizontal line corresponds to a uniform distribution.

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