United States Department of Agriculture

Economic Research Service

Economic Research Report Number 213

August 2016

The Stimulus Act of 2009 and Its Effect on Food-At-Home Spending by SNAP Participants

Charlotte Tuttle

United States Department of Agriculture

Economic Research Service
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Recommended citation format for this publication:

Tuttle, Charlotte. *The Stimulus Act of 2009 and Its Effect on Food-At-Home Spending by SNAP Participants*, ERR-213, U.S. Department of Agriculture, Economic Research Service, August 2016.

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Abstract

The American Recovery and Reinvestment Act of 2009, commonly known as the Stimulus Act, increased maximum benefits for households that participate in the Supplemental Nutrition Assistance Program (SNAP, formerly the Food Stamp Program). In this analysis, SNAP households increased the food share of total expenditures by 1.44 percentage points after the increase in benefits and spent 53 cents of each additional dollar of SNAP benefits on food; this means that SNAP and cash income are not perfectly fungible. Neoclassical economic theory would predict a figure closer to 5-10 cents for each additional SNAP dollar. Thus, SNAP benefits provided a larger boost to food-expenditure share than an equal amount of cash. This report provides estimates of the marginal propensity to spend out of SNAP for vulnerable populations, including households at the lowest income level (under $15,000 annually), single-parent households, households with a member over age 65, and households with an unemployed member. In each subgroup but the elderly, households exhibited higher marginal propensities to spend on food out of SNAP than economic theory predicts, with the lowest income households demonstrating the highest marginal propensity to spend out of SNAP (0.62, or 62 cents for each additional dollar).

Keywords: food spending, SNAP, Supplemental Nutrition Assistance Program, ARRA, American Recovery and Reinvestment Act, Southworth theory, marginal propensity to spend

Acknowledgments

The author would like to thank peer reviewers Italo Gutierrez of RAND; Diane Whitmore Schanzenbach of Northwestern University, Travis Smith of University of Georgia, Kathryn Law with USDA Food and Nutrition Service, and Brian Stacy of the USDA Economic Research Service. I would like to thank my colleagues Erik Scherpf, David Smallwood, and Shelly Ver Ploeg at the USDA Economic Research Service for helpful comments and guidance. Thanks also to ERS editor Dale Simms and ERS designer Lori A. Fields.

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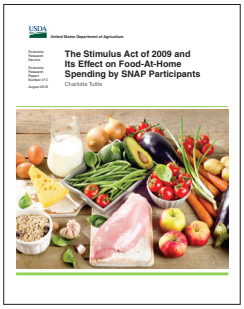

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The Stimulus Act of 2009 and Its Effect on Food-At-Home Spending by SNAP Participants

Charlotte Tuttle

What Is the Issue?

Understanding the effect of Supplemental Nutrition Assistance Program (SNAP) benefits on food spending is an important food assistance policy question. However, the investigation requires disentangling the effect of additional benefits from household characteristics that determine participation choices. This report does so by using a difference-in-differences estimation approach. The American Recovery and Reinvestment Act of 2009 (ARRA), commonly known as the Stimulus Act, included a provision that increased SNAP benefits by nearly 14 percent in April 2009. This temporary boost in benefits (benefit increases ended in October 2013) provides a unique opportunity to measure how participants respond to changes in benefit levels. Because SNAP accounts for a majority of USDA's food and nutrition assistance budget, policymakers and their constituents are particularly interested in how SNAP participation and benefit levels affect the spending behavior of low-income households.

What Did the Study Find?

Previous research and neoclassical economic theory predict that SNAP households treat SNAP benefits no differently than cash income when it comes to expenditure decisions. This means that the increase in benefits after ARRA should cause households to make the same spending choices as if they received an identical increase in cash income. More technically, the marginal propensity to spend (on food) out of SNAP and cash income is theoretically the same for infra-marginal households—those that spend more on food than their SNAP benefit.

This study examines the effects of the ARRA-induced increase in benefits by estimating the effect on households' food-at-home expenditure share of total expenditures. First, the study analyzes the entire population in the sample and compares the food-at-home share of SNAP participants to similar nonparticipants. Then, the population is separated into four, potentially overlapping, subgroups: households at the lowest income quartile, single parent-headed households, elderly households, and households with an unemployed member. Findings include:

- Among the entire SNAP population, for every additional $1 received in benefits, the household will spend 53 cents on food. This implies that the additional 47 cents is allocated to

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other household expenditures. By contrast, previous studies comparing SNAP and cash income have found that every additional $1 received in cash will result in just 5-10 cents more spent on food.

- Lowest income households (here, those with incomes under $15,000 per year), single-parent households, and households with an unemployed member increased the food share of total expenditures the most in response to increased benefit levels. The lowest income households increased food share by 3.5 percentage points, single-parent households by 2.4 percentage points, and unemployed households by 3.2 percentage points. Elderly households showed no significant changes in food share after an increase in SNAP benefits, perhaps due to reliance on other government assistance and savings. Although these results are statistically significant, they cannot be compared across groups because the subgroups likely overlap; a single-parent household may also be in the lowest income subgroup.

- SNAP households are only allowed to use benefits on food at home. Restaurant and takeout food (known as food away from home) cannot be purchased using SNAP. Therefore, the food-away-from-home share of total expenditures should not increase after the increase in SNAP benefits. This report found that the ***food-away-from-home*** share of total expenditures did ***not*** change after ARRA, implying that higher benefits disproportionately affected food-at-home spending, above and beyond the income effect (the increase in ***all*** household spending due to a higher income).

- Results suggest that SNAP benefits are not interchangeable with other income because the marginal propensity to spend on food out of SNAP is higher than the propensity to spend out of cash income. As such, higher SNAP benefits can redirect households' spending behavior toward food at home.

How Was the Study Conducted?

This study uses data from the 2008-09 Bureau of Labor Statistics' Consumer Expenditure Survey (CE). The CE is a nationally representative survey that collects information on household purchases as well as the amount of benefits received from food assistance programs such as SNAP. Respondents are interviewed quarterly for five consecutive quarters. Changes in spending behavior are analyzed using econometric models that control for other mutable factors.

To overcome empirical challenges faced by many previous studies associated with analysis of SNAP participants, the study uses a difference-in-differences approach to estimate changes in food share after the increase in SNAP benefits. This controls for the effects of changing macroeconomic circumstances as well as unobserved household-level characteristics that may cause estimates to misrepresent true behavior.

The Stimulus Act of 2009 and Its Effect on Food-At-Home Spending by SNAP Participants

Introduction

The Great Recession of 2008-09 affected low- and middle-income households disproportionately.[1] As a result, the number of low-income households in the United States increased by 250,000. Unemployment for low-income adults increased 4 percentage points from 2007 to 2009 (Roberts et al., 2011). Consequently, many households sought benefits from and qualified for public assistance programs, including USDA's Supplemental Nutrition Assistance Program (SNAP), the largest Federal nutrition assistance program in the country.

SNAP participation grew by 56 percent between 2007 and 2010 (Andrews and Smallwood, 2012). The increase in SNAP participation and benefit levels may have mitigated the effects of the economic downturn. Because SNAP aims to increase household resources by supplementing food budgets, program participation has been found to combat poverty (Tiehen et al., 2013).

The American Recovery and Reinvestment Act (ARRA), commonly known as the Stimulus Act, was implemented in 2009 to address the ongoing economic crisis, increasing funding to entitlement programs by $224 billion. SNAP received nearly $20 billion in additional money, resulting in higher administrative funding, the temporary elimination of time limits on participation, and an expansion of eligibility for jobless adults. ARRA also increased maximum monthly benefits for participating households by nearly 14 percent; for a family of 4, this equates to an $80 increase in maximum monthly benefit (from $588 to $668).

To examine how these changes in SNAP benefits affected participant spending behavior, this report, following Beatty and Tuttle (2015), estimates how ARRA affected the food spending of different participant households to determine whether some household types are more responsive than others to changes in benefits.

Neoclassical theory treats income as fungible: $5 can be used to buy children's clothing as easily as food at the grocery store. Likewise, for many SNAP households that use both cash and SNAP EBT (electric benefit transfers) to buy food at the grocery store, additional SNAP benefits can free up cash for other purchases. Because of this, neoclassical theory expects inframarginal households—those whose food-expenditures exceed the value of SNAP benefits received—to treat in-kind benefits such as SNAP no differently than the cash equivalent. This implies that the ARRA-induced increase in benefits should ***not*** cause households to buy more food than they would with extra cash of the same amount. In other words, an $80 increase in SNAP benefits should not cause households to behave differently than had they received an $80 increase in cash. Or, as theory indicates,

[1]Low-income households are defined here as those whose incomes are less than twice the Federal poverty line.

a household's marginal propensity to spend (MPS) out of SNAP is equivalent to its marginal propensity to spend out of cash.

This report examines how SNAP participant households responded to the large increase in benefits after ARRA and compares these results to the predictions of neoclassical theory. Whereas Beatty and Tuttle (2015) considered multiple benefit changes over a 4-year period that included ARRA, this study isolates the effects of ARRA by examining the time period immediately before and after its implementation, namely 2008 and 2009. This will better illuminate the effects of a specific policy intended to alleviate the consequences of an economic downturn. Also, this report examines dissimilar households to determine if households of differing compositions (by race, education, and size, for example) have different responses to benefit changes, perhaps addressing the adequacy of current benefits.

Anti-hunger advocates and policymakers sometimes differ on how food assistance should be issued. Cash allows households to optimize spending based on their preferences and needs (Whitmore, 2002). In-kind transfers, on the other hand, can direct household spending to specific items (i.e., food). Neoclassical theory suggests that a household's response to an increase in resources, whether in SNAP or cash, will be the same; food spending will not differ regardless of how food assistance is received. But results in this study suggest that households budget SNAP benefits differently than cash, a concept known as mental accounting (Thaler, 1980).

SNAP: Before and After ARRA

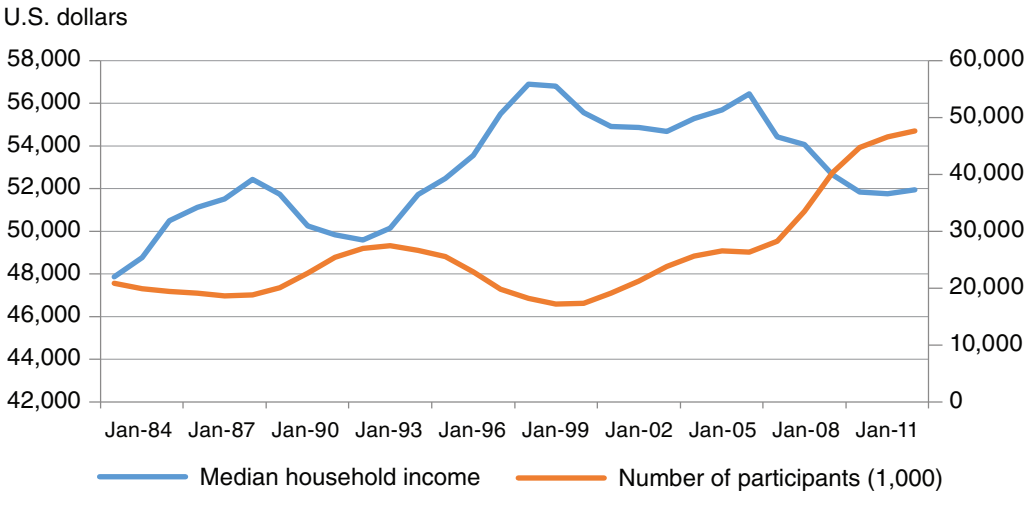
Participation in the SNAP program is based on income and asset levels, as well as allowable deductions. To participate in SNAP, a household's income must meet specific tests related to household size. A household's gross monthly income cannot exceed 130 percent of the Federal poverty guideline (FPG) ($27,560 for a family of four in 2008) and its net income cannot exceed 100 percent of the FPG ($21,200 for a family of four).[2] This means that, in 2008, a typical family of four could not have a net income greater than $1,721 per month. Asset limits are determined by States, although many States eliminated asset thresholds after the Farm Bill of 2008. Households may also be categorically eligible to participate in SNAP if they participate in other welfare programs such as TANF (Temporary Assistance for Needy Families).

Generally, households are allowed to participate in SNAP when they meet income and asset tests as well as recertification requirements. Households that meet those requirements or are categorically eligible are allowed to participate in the program with few restrictions. Individuals categorized as able-bodied adults without dependents (ABAWD) are only allowed to participate in the program for 3 months every 3 years unless they receive a waiver.

SNAP households receive monthly benefits through an EBT card, a sort of debit card that contains the household's monthly allotment. Benefits are determined by the cost of the Thrifty Food Plan, a low-cost diet plan calculated by the USDA; benefits are reduced by 30 cents for every dollar of net income.

During the Great Recession, unemployment reached 10 percent and 8.7 million jobs were lost (Edminston, 2013). Layoffs resulted in many middle-income workers across the Nation slipping into poverty. The drastic increase in unemployment and concomitant decrease in household income resulted in a jump in SNAP participation. Historically, drops in household income have coincided with increases in SNAP benefits (figure 1). As U.S. median income declined after 2007, SNAP participation increased.

Figure 1
Household income and Supplemental Nutrition Assistance Program participation 1984-2011



Source: USDA, Economic Research Service, Bureau of Labor Statistics and USDA Food and Nutrition Service, Median Income and SNAP Participation, 1984-2011.

[2]Net income is gross income minus allowable deductions.

To mitigate the consequences of the Great Recession, the American Recovery and Reinvestment Act was implemented in 2009 and included a substantive stimulus package for entitlement programs. The Federal Government increased funds to Federal and State-run programs that provided aid to low-income families. State-level TANF and WIC (Special Supplemental Nutrition Program for Women, Infants and Children) programs were augmented with emergency funds. SNAP received $20 billion from ARRA for increased benefit levels and administrative costs. The EITC (Earned Income Tax Credit) was expanded for larger families, and the marriage penalty was eliminated. Time limits for ABAWD were suspended.

SNAP benefits increased by 13.6 percent of the maximum allotment assigned to each household size. This means households of the same size that receive different benefit levels would receive the same benefit increase. For example, if a family of four qualified for the maximum monthly allotment ($588) prior to ARRA, the benefit grew by $80, or 13.6 percent, after ARRA. On the other hand, a family of four with a net income of $1,000 per month would qualify for $288 in monthly benefits prior to ARRA. After ARRA, this household would also receive an additional $80 in benefits, an increase of nearly 30 percent (table 1).

Table 1
Pre- and post-ARRA maximum SNAP allotments

		Maximum Allotment ($)		%	$
		Pre-ARRA	Post-ARRA	Change	Change
Number in Household	1	176	200	13.6	24
	2	323	367	13.6	44
	3	463	526	13.6	63
	4	588	668	13.6	80
	5	698	793	13.6	95
	6	838	952	13.6	114
	7	926	1052	13.6	126
	8	1058	1202	13.6	144

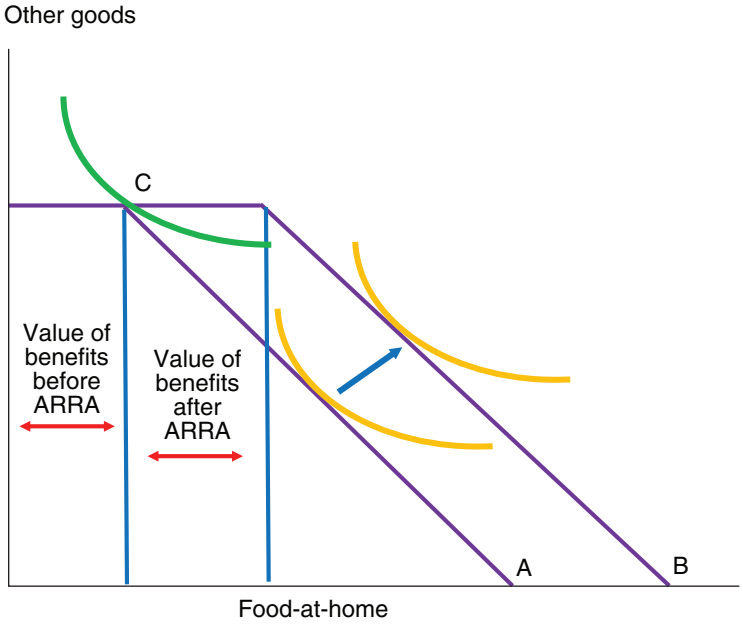
ARRA = American Recovery and Reinvestment Act, SNAP = Supplemental Nutrition Assistance Program. Source: USDA, Economic Research Service, USDA Food and Nutrition Service, Supplemental Nutrition Assistance Program (SNAP), and American Recovery and Reinvestment Act (ARRA), 2014.

Neoclassical Economic Theory

Previous research on SNAP participant spending behavior has addressed how inframarginal households—those who spend more on food than they receive in benefits—respond to in-kind transfers such as SNAP. According to the seminal theory on this topic, known as the Southworth theory, an inframarginal household should treat an in-kind benefit no differently than a cash transfer.

For example, prior to an increase in benefits, a household will purchase a combination of food and nonfood goods along its budget constraint (line A in figure 2). A household can afford any combination of food and nonfood goods along this line. After receiving more resources (whether SNAP or cash), the household budget increases and the line shifts to line B, enabling more purchases of food and nonfood goods. Because the Southworth theory holds that households treat in-kind transfers no differently than equivalent cash transfers as long as the households are inframarginal, SNAP households have the same marginal propensity to spend on food out of SNAP as they do out of cash (see box, "Marginal Propensity To Spend," p. 7). In short, a household's food/nonfood bundle would be identical regardless of an increase in cash or SNAP benefits. Constrained households, or households at the kink of the budget constraint (point C), will increase their food spending by more than will inframarginal households.

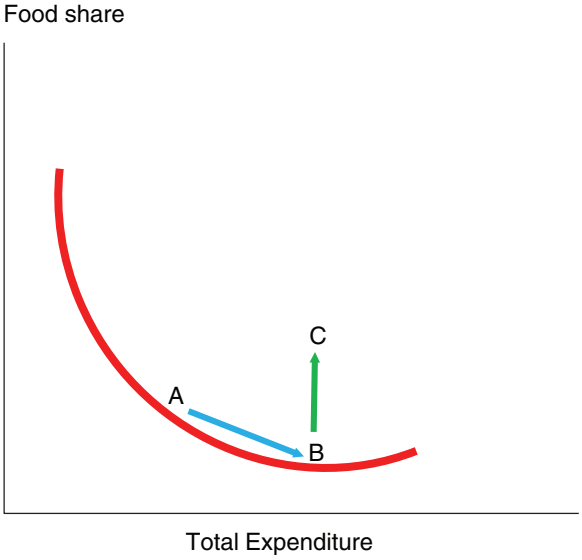
Figure 2
Standard theory



Source: USDA, Economic Research Service.

According to Engel's Law, when a household receives an increase in income, household expenditures will move along a curve from point A to point B (figure 3). Total expenditures increase but food's share of expenditures declines. However, if food-expenditures increase faster than total expenditures after an increase in SNAP benefits, the food share would shift (off the Engel curve) from point B to point C. This means a household will increase the proportion of food-expenditures relative to total expenditures because of the in-kind transfer. An increase from B to C does ***not*** reflect the prediction of Southworth theory.

Figure 3
Engel's law



Source: USDA, Economic Research Service.

Previous Literature on SNAP Participant Behavior

Previous studies have examined the effect of SNAP benefits on household food-expenditures. However, the estimates may be confounded by empirical problems associated with participation decisions that are potentially correlated with expenditure decisions. Evidence suggests that this self-selection bias adversely affects estimates of food spending. Self-selection implies that there is a systematic difference—observable and unobservable—between SNAP participants and nonparticipants. The differences that affect participation decisions may also affect spending decisions. When the systematic differences are unobservable (for example, households may value homemade meals over takeout, making SNAP more desirable for those households), a causal relationship between SNAP participation/benefits and food spending is difficult to determine.

Previous studies have attempted to surmount this self-selection bias using data from randomized control trials. A series of "cash-out" experiments were administered in Puerto Rico in 1982, Washington State in 1987-1988, San Diego in 1989-1990, and Alabama in 1990. These experiments allowed researchers to measure spending behavior and the marginal propensity to spend (MPS) while avoiding self-selection issues. In these experiments, a randomly selected group of participant households were given cash transfers for the same value as their monthly food stamps (Blanciforti, 1983; Fraker et al., 1995; Ohls et al., 1992; Whitmore, 2002). The cash-out studies did not necessarily limit their experiments to inframarginal households, but they assume most are inframarginal.

Marginal Propensity To Spend

The marginal propensity to spend (MPS) represents consumers' induced consumption after a change in resources, namely household disposable income. MPS can be defined as the proportion of the change in income a household spends (versus saves). Mathematically, one can calculate the MPS by dividing the change in household consumption by the change in disposable income or total expenditure:

$$MPS = \frac{Consumption_1 - Consumption_0}{Disposable\,Income_1 - Disposable\,Income_0}$$

One can apply the MPS to the relationship between increases in SNAP benefits and food-at-home spending. If a household receives a $50 increase in benefits and increases spending on food by $10, the household has a marginal propensity to spend on food out of SNAP of 0.20. For every dollar of benefits a household receives, it increases its food-spending by $0.20.

Observational studies, most notably Fraker (1990), have found participant households have an MPS on food out of SNAP between 0.17 and 0.47, or an average of 0.30. An increase in benefits of $1 induces households to increase food-spending by $0.30. On the other hand, the same studies have found that participant households have a lower MPS on food out of cash than out of SNAP. These studies reported an MPS to spend on food out of cash of 0.05-0.10, which means households increase food-spending by 5 to 10 cents for every $1 increase in cash income.

If the explicit goal of SNAP is to increase the food purchasing power of participants, calculations of MPS suggest that in-kind benefits are more effective at this than equivalent cash benefits.

Researchers compared food-expenditures for households given cash to food-expenditures for households given equivalent in-kind benefits. Fraker and colleagues (1995) found that households in the San Diego and Washington experiments responded to cash-outs by decreasing food-expenditures. The Alabama cash-out experiment, on the other hand, resulted in no change in food-expenditures. In the Puerto Rico cash-out experiment (Moffitt, 1989), cash recipients displayed spending behavior similar to that of food stamp recipients. Neoclassical theory correctly predicts spending behavior of these participants; in-kind and cash transfers result in similar food spending responses. On the other hand, Bruenig and Dasgupta (2005) find that multi-adult households using food stamps purchase more food than households using cash. Single-adult households are found to have similar marginal propensities to spend regardless of how they receive their benefits.

Observational studies comparing the food-expenditures of program participants to those of nonparticipants have found that households buy more food using food stamps than they do using equivalent cash—that is, the MPS on food out of food stamps is greater than out of cash. Fraker (1990), comparing the MPS out of food stamps and cash from a number of early studies, finds that for each dollar in food stamps a household receives, food-expenditures increase by 17 to 47 cents, versus 5 to 10 cents for each dollar increase in cash income. Consistently, these studies have shown that an increase in benefits will cause participant households to increase food spending by more than they would if receiving the cash equivalent.

Wilde and colleagues (2009) estimated Engel curves for participant and nonparticipant households of similar income levels. SNAP participants had higher food-at-home spending (relative to income) than nonparticipants of the same income level, suggesting a higher propensity to spend on food-at-home out of SNAP than out of equivalent income. Senauer and Young (1986) examined expenditure changes after elimination of the food stamp purchase requirement in 1979, finding that households spent more on food with food stamps than with cash. Both Wilde and Senauer concluded that households have a higher MPS out of food stamps than cash. When households receive benefits, they tend to change spending behavior and purchase more food than they would with equivalent cash.

While these studies are consistent in refuting the Southworth theory, they may suffer bias due to self-selection challenges. To address this bias, Hoynes and Schanzenbach (2007) used the phased implementation of the Food Stamp Program during the 1960s and 1970s to find that households purchase the same amount of food using food stamps as they do using equivalent cash, a result that aligns with neoclassical theory. However, food assistance programs have changed considerably since food stamps were introduced and the cash-out studies were conducted. Participation requirements and program design have changed, as has the composition and characteristics of its participants. Therefore, past studies based on older data may not accurately describe the behavior of current SNAP participants.

This report uses current data on SNAP participant spending behavior to examine how policy changes can affect the spending decisions of participants. It also contributes to the literature by considering heterogeneous responses to changes in SNAP benefit levels. Moreover, this report informs policy by addressing how SNAP participants respond to higher SNAP benefits (as opposed to equivalent benefits received as cash). And because ARRA was plausibly exogenous, the self-selection bias that taints previous observational studies is avoided.

Data

This report examines changes in food-expenditure shares among low-income households after the ARRA-induced increase in SNAP benefits. To estimate these changes, food-expenditure shares of participant households are compared to similar nonparticipant households immediately before and after the ARRA was implemented in April 2009. Expenditure data are from the Consumer Expenditure Survey (CE), which reports quarterly food spending and SNAP benefit levels. While a longer time period was assessed in a related study (Beatty and Tuttle, 2015), this study captures the most immediate effects of the policy.

The CE is administered quarterly by the U.S. Census Bureau and represents the U.S. civilian non-institutionalized population. Respondent households are interviewed once per quarter for five consecutive quarters. Each quarter contains approximately 7,000 respondents. These households, or "consumer units," are single families in a household, a person financially independent living in a household alone or with others, or two or more people who make financial decisions jointly.

The CE collects data on large purchases such as property and vehicles, as well as regular purchases such as food and rent. The CE also contains detailed demographic information such as age, race, gender, marital status, household size, annual salary, and program participation. The CE contains information on quarterly SNAP benefits, enabling longitudinal studies of changes in benefit levels and food-expenditure shares before and after ARRA.[3]

Empirical Approach

Empirical challenges can affect estimates of spending proportions, causing inaccurate representations of the effects of ARRA. Challenges include:

1. A household's decision to participate in SNAP likely relates to its food-spending decisions. In other words, expenditure decisions are non-random. Due to this selection bias, it is difficult to isolate the effects of ARRA on food-spending decisions versus participation decisions.

2. SNAP expanded at an unprecedented rate after the Great Recession and ARRA. Due to job and income losses, more people qualified to participate in the program. SNAP also loosened eligibility restrictions, permitting more individuals to participate who were previously ineligible. Moreover, categorical eligibility that allows households in other Federal assistance programs (most notably, TANF) to be eligible for SNAP likely expanded participation as more households became eligible to participate amid the economic downturn. With the expansion in participation, households that joined SNAP after ARRA may have had higher incomes and more prosperity than those who participated prior to ARRA. This would cause this study's results to underestimate the true effect of the policy.

[3]One caveat with using the Consumer Expenditure Survey is measurement error associated with underreporting of SNAP participation (Taeuber et al., 2004; Gundersen and Kreider, 2008; Kreider et al., 2012). During the time period of this study, only 6.14 percent of the CE sample reported participating in SNAP, nearly 9 percentage points under the true participation rate. This means there are likely SNAP participant households erroneously included in the nonparticipant group. If participating households spend disproportionately more on food with SNAP than cash, the results will underestimate the effects of ARRA since the control group will be increasing food spending disproportionately as a result of erroneously including SNAP participants in the group.

3. Finally, 2008-2009 was an economically volatile time. Many households suffered job losses and drops in income regardless of participation in assistance programs. Food prices also declined, influencing the food-spending decisions of all households.

To evaluate the impact of an exogenous policy change, namely ARRA, this report uses a difference-in-differences approach. This model is widely used for policy analysis by mimicking random assignment into treatment (SNAP participant) and control (nonparticipant) groups. Difference-in-differences also addresses the potential measurement issues outlined above by controlling for expenditure changes associated with the volatile economy as well as self-selection into the program.

This analysis is implemented in two steps. First, a difference-in-differences model is used to analyze the effects of ARRA on the SNAP population in the sample by comparing spending behavior of participant and similar nonparticipant households immediately before and after ARRA (2008-2009). Second, a triple-difference model is used to examine heterogeneous responses to ARRA by estimating the effects on four separate subgroups: households in the lowest income quartile, single-parent households, elderly households, and the unemployed.

Difference-in-Differences

The implementation of ARRA presents an opportunity to exploit the natural experiment that occurred due to the increase in benefits. (A natural experiment is an exogenous event—in this case, a Federal policy—that causes an exogenous change to the household.) Because the increase in benefits as a result of ARRA was plausibly exogenous to the current participants, this allows an evaluation of the increase in benefits exogenous to household characteristics and how this increase affects the spending of participants. A difference-in-differences model can then be used to examine the effects of the natural experiment by comparing the outcome of the treated group of households—food-expenditure share of SNAP participants—to the outcome of the control group of households—food-expenditure share of nonparticipants. The underlying assumption of difference-in-differences is that food-expenditure trends for SNAP participants and nonparticipants would be similar without ARRA. This is because any other household characteristics or mutable economic factors that affect spending (and comparisons before and after ARRA) are eliminated by difference-in-differences. Table 2 illustrates how to calculate difference-in-differences using the food-at-home share of total expenditures and food-at-home expenditures by quarter and comparing SNAP participants and nonparticipants.

Table 2
Difference-in-differences comparing food-expenditure changes of SNAP (treatment) households to non-SNAP (control) households before and after ARRA

	Average food-at-home expenditure before ARRA ($)	Average food-at-home expenditure after ARRA ($)	Difference between before and after	Difference-in-differences
SNAP households (Treatment)	496.10	527.43	31.33	54.78
Non-SNAP households (Control)	453.29	429.84	-23.45	

SNAP = Supplemental Nutrition Assistance Program, ARRA = American Recovery and Reinvestment Act.
Source: USDA, Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

Difference-in-differences (hereafter DD) requires a treatment and a control group whose trends would be similar absent ARRA. Because the treatment group consists of SNAP participants, the analysis requires a control group of nonparticipants that would exhibit similar trends. To create a comparable control group of nonparticipants, SNAP participant and nonparticipant households are matched on observable characteristics using Coarsened Exact Matching (CEM). The purpose of matching is to assign each treated household (SNAP participant) a similar control household (nonparticipant) for comparison. Ideally, this means the data are "balanced" and the only observable differences between the groups is SNAP participation status. Any unobservable differences, then, can be addressed using the DD model, which removes static differences between treatment and control groups (see box, "CEM Explanation").

CEM Explanation

To balance, or match, the data using CEM, I coarsen, or recode, specific continuous demographic variables. In other words, I recode continuous variables into well-defined categories. For example, I recode Family Size, a continuous variable, into three categories: less than or equal to two, between three and five, and greater than five. Instead of matching a participant household to a nonparticipant household of the identical size, I match a participant household that falls into one of three categories to a nonparticipant household that falls into the same category. As such, a SNAP household of four can be matched with a non-SNAP household of five.

Likewise, I coarsen the age variable into five categories: under 20, 20 to 35, 36 to 50, 51 to 65, and above 65. I also coarsen the continuous income variable into five income brackets. Finally, I match SNAP participant and nonparticipant households based on these coarsened variables as well as demographic dummy variables that include race, marital status, employment, and gender. A SNAP participant need not be identical to its matched nonparticipant. Instead, observable characteristics must fall within the same category.

After constructing the control group of non-participants that resemble participants, I discard any respondent households that were not matched in the CEM process. Accordingly, the sample consists only of matched participant and nonparticipant households. I also exclude nonparticipant households with total household expenditures that are 150 percent greater than average total expenditure of SNAP households. Finally, I retain only households that are inframarginal before and after ARRA. These are households that, according to theory, should treat an increase in SNAP benefits as an increase in cash and therefore should display no changes in food share after the benefit increase.

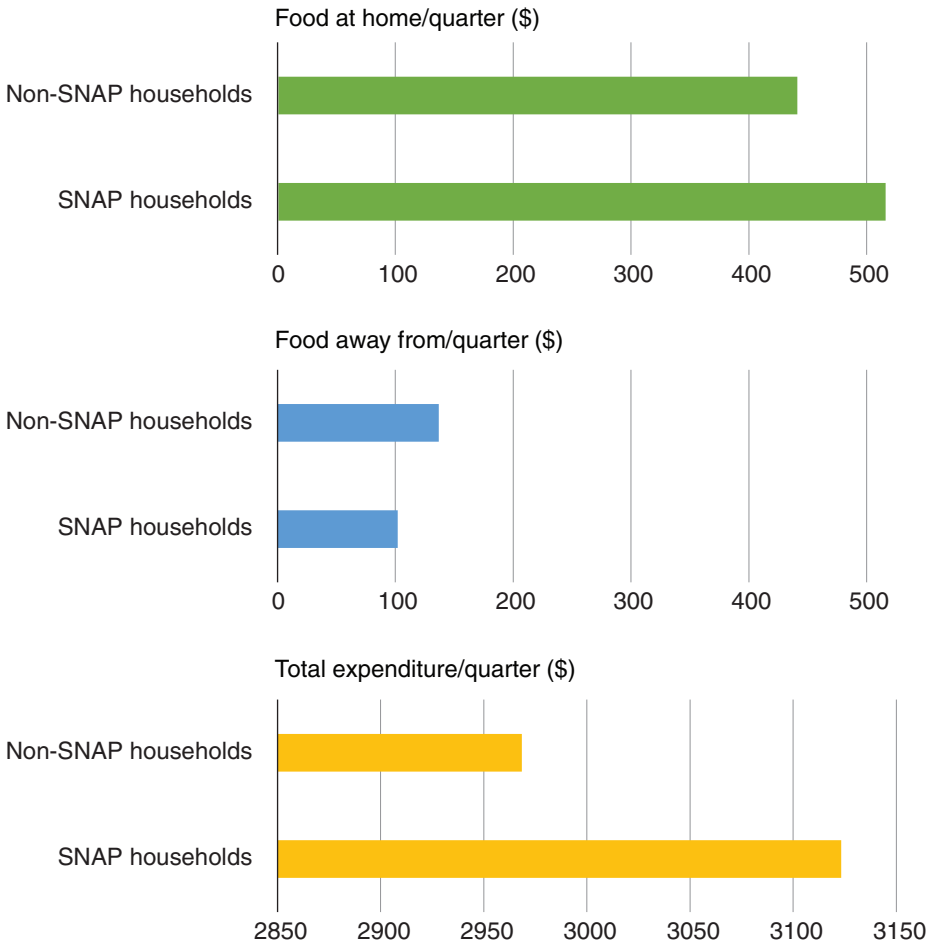
Average expenditure information of the matched data representing participants and nonparticipants is presented in figure 4. Although total spending is similar between the groups, SNAP participants spend more on food than nonparticipants. Consequently, food as a share of total expenditures is greater for participants. Food away from home is predictably lower in participant households because SNAP disallows restaurant and ready-to-eat purchases.

Demographics differ importantly between the treatment and control groups (table 3). Despite matching SNAP participant households to nonparticipant households, the control group is more racially homogenous (86 percent White), more likely to be headed by a male, more likely to be married and employed, and more likely to have a smaller household. The changes in SNAP benefits as a result of ARRA are plausibly exogenous, meaning participant and nonparticipant households' characteristics did not cause or influence the change in benefits nor change the benefit amount. Because of this, these differences in observable characteristics will be less problematic in the analysis.

The Southworth theory indicates that only inframarginal households—or households whose food spending is greater than the benefits they receive—will treat cash and in-kind transfers equivalently. Constrained households, or those whose benefits are greater or equal to their food spending, will increase food spending at a greater rate with higher benefits. Because of the distinct behavioral differences in inframarginal and constrained household responses, this analysis considers only inframarginal households. Any household whose benefit levels are greater or equal to food spending is dropped from the sample.

Figure 4

Differences in average food spending – SNAP participants versus nonparticipants



SNAP = Supplemental Nutrition Assistance Program.
Source: USDA, Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

Table 3

Summary statistics of matched sample – participants and nonparticipants

	SNAP participants		Nonparticipants	
	Mean	Std. Dev	Mean	Std. Dev
SNAP ($)/month	398.79	453.76		
Black	0.265	0.441	0.126	0.331
White	0.702	0.457	0.858	0.349
Asian	0.168	0.128	0.012	0.111
Female	0.744	0.437	0.573	0.494
Married	0.248	0.432	0.321	0.467
Employed	0.471	0.499	0.549	0.498
Family size	2.896	1.797	1.798	1.119
Observations	1,430		8,742	

SNAP = Supplemental Nutrition Assistance Program.
Source: USDA Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

Methods – Difference-in-Differences

Using the matched sample and a DD approach, the change in food share of total expenditures is estimated for 2008 and 2009. Then, using a triple-difference model, changes in food share are estimated to examine whether vulnerable populations (i.e., low-income, unemployed) respond at different rates to ARRA. Because SNAP restricts the kinds of foods that households can buy (such as restaurant and ready-to-eat foods), this study considers the effect of higher benefits on the food-at-home expenditure share only. For the following discussion, "food" is equivalent to food at home.

To estimate the effects of ARRA on the food-expenditure share while controlling for the income effect for the entire population, the DD model is embedded into an Engle curve function, which allows one to measure the effects of the policy on food share of total expenditures. The empirical model is:

$$w_{ht} = \alpha_1 + \alpha_2 After_t + \beta\left(SNAP_h * After_t\right) + \alpha_3 \ln\left(TotalExp\right) + X_h \mu_h + \delta_t + \gamma_t + \varepsilon_{ht}.$$

This model includes the following variables:

w_{ht} **(food share of total expenditure)** represents the proportion of total expenditures by households on food at home. This variable is equivalent to Food-at-Home/Total Expenditures.

SNAP **(SNAP-participation dummy)** represents participation status of the household. *SNAP* takes on the value of one if the household reports any SNAP benefits over the prior 12 months and zero if the household reports no benefits.

After **(ARRA policy variable)** represents the time period immediately before and after the implementation of ARRA. *After* takes on the value of zero before April 2009 and one after April 2009, when additional SNAP benefits went into effect.

TotalExp (**total household expenditures)** represents the natural log of total expenditures. The CE reports total household expenditure as a sum of detailed expenditure information collected in the survey. This includes expenditures on food and drink, apparel, transportation, health care, and other household items. Including this variable will control for the income effect resulting from greater household resources. Previous studies have included total income as opposed to total expenditures when using an Engel function approach. Robustness checks show that using either log of total expenditure or log of household income yields similar results.

X **(household fixed effects)** represents all characteristics of the household that do not vary over time. Including fixed effects further addresses selection bias by controlling for observable and unobservable household characteristics that may cause endogeneity.

Finally, δ_t and γ_t represent a year dummy and month fixed effects.

Results of Full Sample

Neoclassical theory predicts inframarginal households treat in-kind transfers identically to cash transfers. The results of this analysis, however, tell a different story. The variable, DD_1, represents the interaction *SNAP*After*, or the difference-in-differences estimator. The coefficient on DD_1 is 1.44. This indicates that total household expenditures allocated to food increased by 1.44 percentage points as a result of the increase in benefits after ARRA. (The implied distance from point B to point C in figure 3 is 1.44 percentage points.) Participant households increase food as a share of total expenditures by more than theory would predict. Higher SNAP benefits cause households to move off the Engel curve, or to purchase more food relative to total expenditures.

To calculate the marginal propensity to spend (MPS) out of SNAP, one must divide the change in food-expenditures by the change in total expenditures over time.[4] SNAP households spent around 19.2 percent of total expenditures on food at home (table 4), with that share increasing by 1.4 percentage points, to 20.6 percent, after ARRA. Prior to ARRA, the average SNAP household's total expenditures were $3,035 per quarter; if the household spent 19.2 percent of that on food at home, this translates to $581 per quarter. After ARRA, the average SNAP household's total expenditures were $3,167. If a household spends 20.6 percent of total expenditures on food at home, this translates to $651 per quarter. Thus, participant food-at-home expenditures increased by an estimated $70 per quarter after the increase in benefits, while total expenditures increased by $132. Therefore, the MPS out of SNAP for this analysis is 70/132, or 0.53. For every $1 increase in SNAP benefits, participant households spend an additional 53 cents on food at home.

Table 4
Difference-in-differences results for total matched sample

	Difference-in-differences coefficient^	Food share of total expenditure pre-ARRA	Food share of total expenditure post-ARRA	Marginal propensity to spend out of SNAP^^
Total matched sample	1.444*** (0.489)	19.2% (0.434)	20.6%	0.53 (0.188)

*** p<0.01, ** p<0.05, * p<0.1
^Difference-in-differences coefficient represents After*SNAP Dummy
^^Standard error of the MPS calculated using bootstrapping

ARRA = American Recovery and Reinvestment Act, SNAP = Supplemental Nutrition Assistance Program, MPS = marginal propensity to spend.
Source: USDA Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

[4]The marginal propensity to spend is traditionally calculated using a change in food spending divided by a change in total income. This study uses a different approach by using total expenditures as the denominator. Using total expenditures, however, may not reflect all consumption if households rely on savings, assets, loans (most notably payday loans) or family and friends' financial help. This would suggest total expenditures underestimate household resources, thereby overestimating the marginal propensity to spend. But because low-income households tend to have few savings and assets (Angeletos et al., 2001), expenditures may be a better measure of household resources than income.

Methods – Triple Differences

SNAP targets the most vulnerable populations and, by increasing household resources, lifted nearly 4 million individuals out of poverty in 2011 alone (Tiehen et al., 2013). Financially unstable households such as single-parent households or those in the lowest income bracket may receive the greatest benefit from SNAP because of resource constraints. Results here suggest that the SNAP population as a whole altered spending behavior in response to the increase in benefits, but focusing on vulnerable populations—households at the lowest income quartile (below $15,000 per year) within the CE data, with an individual age 65 or older, with an unemployed member, or headed by a single parent (table 5)—would further highlight the effectiveness of SNAP in increasing money spent on food.

Because these households are not exclusive (i.e., some single-parent families may also have earnings in the lowest quartile of income), results cannot be compared across groups. Instead, change in food share after ARRA, as well as the MPS on food from SNAP, are reported for each group.

Table 5
Subgroup summary statistics – SNAP participants

	Lowest income		Single parents		Elderly		Unemployed	
	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev	Mean	Std. Dev
Food at home/ quarter ($)	476.27	278.06	618.66	379.88	409.23	229.55	603.46	359.99
Food at home share of total expenditure	21.30	10.52	19.96	19.47	16.34	10.96	16.42	9.09
Food away from/ quarter ($)	90.24	134.06	123.27	58.29	124.03	142.31	146.34	157.24
Food away from share	3.78	5.68	3.64	2.18	3.69	4.11	3.65	4.11
Total expenditure ($)	2,403.36	1,248.69	3533.85	2282.86	2056.17	2102.31	4286.77	2871.86
SNAP ($)/ quarter	257.70	327.77	515.94	244.51	374.21	461.33	410.79	394.56
Black	0.319	0.466	0.371	0.277	0.448	0.483	0.303	0.462
White	0.655	0.476	0.616	0.652	0.477	0.487	0.696	0.461
Asian	0.015	0.121	0.004	0.041	0.199	0.066	0	0
Female	0.783	0.412	0.873	0.749	0.434	0.334	0.778	0.418
Married	0.097	0.297	0	0.150	0.358	0.001	0.414	0.495
Family size	1.90	1.406	3.787	1.735	1.343	1.361	3.878	1.579
Observations	2,956		1,091		3,455		411	

SNAP = Supplemental Nutrition Assistance Program.
Source: USDA Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

To estimate the effects of ARRA on spending behavior across vulnerable groups, the triple-difference approach, or difference-in-difference-in-differences (DDD), is used. This method analyzes the behavior of specific groups and compares this behavior to other SNAP households and the rest of the population.

For example, participant households in the lowest income quartile may behave differently than participants with higher incomes or comparable nonparticipants with similar incomes. The triple difference approach can isolate the changes in mean food-expenditure share for only these households while subtracting change in food-expenditure share for non-SNAP households and higher income SNAP households.

The triple difference model can be written as:

$$w_{ht} = \alpha_1 + \alpha_2 After_t + \beta_1 \left(SNAP_h * After_t \right) + \beta_2 \left(SNAP_h * Subgroup_h \right) + \beta_3 \left(Subgroup_h * After_t \right)$$
$$+ \beta_4 \left(SNAP_h * Subgroup_h * After_t \right) + \alpha_5 \ln \left(TotalExp \right) + X_h \mu_h + \delta_t + \gamma_t + \varepsilon_{ht},$$

Where α_4 represents the subgroup and β_4 represents the variable of interest or the effects of the ARRA on spending behavior of each subgroup. (See full regression results in the Appendix in tables 1A through 5A.)

Results — Households in the Lowest Income Quartile

Matched population data from CE are categorized into income-equivalent quartiles with the lowest income group representing households with income below $15,000 per year.

Because households with the lowest income allocate the highest proportion of income toward food, they are potentially more responsive to an increase in resources. Indeed, Smith and colleagues (2015) found that SNAP households with income below 100 percent of the Federal poverty line (FPL) have a higher MPS than SNAP households above 100 percent of the FPL. For this analysis, the variable of interest is DDD_{LI}, representing the change in food share after the ARRA for the lowest income group, or the interaction *SNAP Dummy*After*Lowest Income Dummy.*

The lowest income households increased their food share by an estimated 3.5 percentage points (compared to nonparticipant and higher income SNAP households) above and beyond any increase in total expenditures from ARRA. The lowest income SNAP households spend around 21 percent of total expenditures on food at home, higher than the average SNAP household (17 percent). ARRA causes these households to increase their share spent on food from 21.3 percent to 24.8 percent, an increase of around $130 per quarter. The MPS out of SNAP for this population is 0.62, higher than for the total SNAP population (0.53). This implies that the lowest income SNAP households behave counter to standard economic theory by buying more food than they would with an equivalent increase in cash income. These households are likely more responsive to an increase in benefits because they must make spending decisions under tighter budget constraints than higher income households.

Results — Single-Parent Households

In 2008, 48.5 percent of SNAP participants were children, and many of them lived in households with only one parent present (USDA ERS, 2015). Single-parent households tend to have longer participation stints in SNAP (Leftin et al., 2014) and to be more income- and time-constrained than married households. Therefore, if these households suffered job losses or reduced working hours during the Great Recession, the loss of income likely had more severe consequences on well-being than it would with dual earners or households without children.

Single-parent households increased food spending by 2.4 percentage points after the ARRA (table 6). (Note that this group may overlap with the lowest income group.) Average food share of total expenditures for single-parent households was nearly 20 percent of total expenditures before ARRA and 22.4 percent after, an increase of $79 per quarter. Therefore, the MPS out of SNAP for this group is 0.42, within the range of previous studies' estimates. These results suggest that single-parent households are significantly more responsive to changes in benefit levels than economic theory would predict, indicating that an increase in benefits increases food spending, and possibly nutritional access, for these households.

Table 6
Triple difference results for lowest income quartile

	Triple differences coefficient^	Food share of total expenditure pre-ARRA	Food share of total expenditure post-ARRA	MPS out of SNAP^^
Lowest income quartile	3.505*** (1.297)	21.3% (1.071)	24.8%	0.62 (0.277)
Single parent	2.419** (1.075)	19.9% (0.806)	22.4%	0.42 (0.094)
Elderly	-0.674 (1.214)	17.2% (0.819)	16.3%	--
Unemployed	3.198* (1.677)	16.4% (1.618)	19.9%	0.39 (0.095)

*** p<0.01, ** p<0.05, * p<0.1
Standard errors in parentheses when available
^Triple differences coefficient represents After*SNAP Dummy*Subgroup Dummy
^^Standard errors of MPS were calculated using bootstrapping

ARRA = American Recovery and Reinvestment Act, SNAP = Supplemental Nutrition Assistance Program, MPS = marginal propensity to spend.
Source: USDA Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

Results — The Elderly

In 2008, 9.1 percent of SNAP participants were over age 65 (USDA ERS, 2015). Although elderly household members may have greater access to public programs and savings than other low-income households, the Great Recession severely eroded asset levels for many individuals over 65 (Hurd and Rohwedder, 2010).

For individuals age 65 and older, the triple difference estimator is negative and insignificant, indicating that the elderly SNAP population did ***not*** increase food share more than the general population or the non-elderly SNAP population as a result of ARRA. This may be due to elderly households' reliance on other Federal programs such as Medicare, Medicaid, and Social Security. Some research suggests that the economic crisis did not affect elderly households as severely as younger households (Munnell and Rutledge, 2013). Moreover, retired individuals tend to be less time constrained and more apt to allocate time to food preparation and use cheaper food staples. As time constraints loosen for older individuals, food spending tends to decline as these households substitute time spent in food preparation for food spending (Aguiar and Hurst, 2005).

Results — The Unemployed

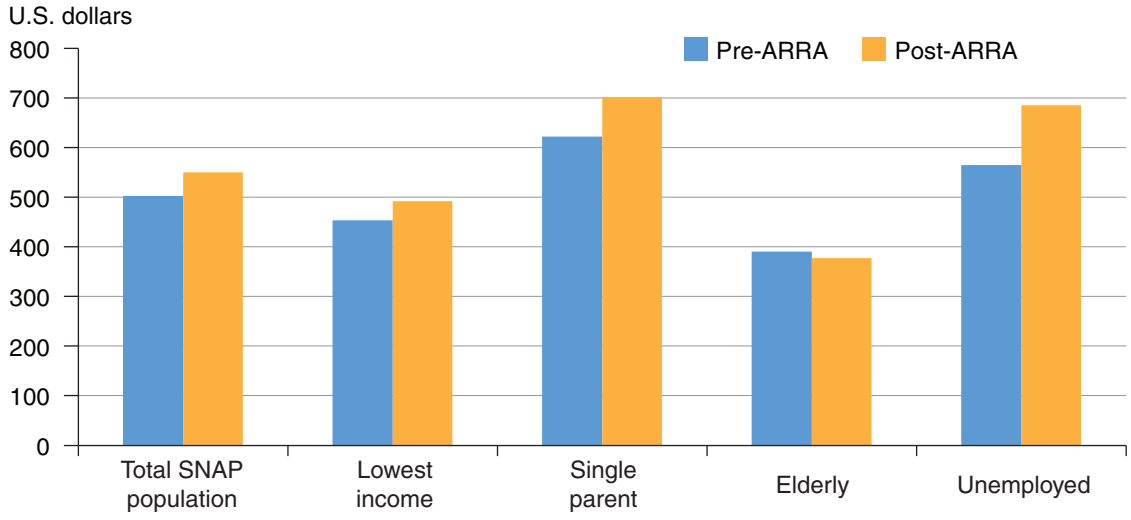
Unemployment jumped during and after the Great Recession and remained above 9 percent in 2010 despite the economic recovery (Theodossiou and Hipple, 2011). Unemployment has been shown to coincide with food insecurity; high levels of unemployment may be associated with a drastic drop in income, limiting access to food (Nord et al., 2014). To avoid including individual respondents who choose not to work, such as retirees, the unemployed subgroup is defined as those respondents who reported receiving unemployment insurance sometime during the prior 12 months.

Like the lowest income and single-parent households, unemployed households increased their food share by more, after ARRA, than neoclassical theory would predict. Unemployed households increased food share after the benefit increase by 3.5 percentage points, from 16.4 percent of total expenditures to 19.9 percent, an increase of $120 per quarter (table 6) The MPS out of SNAP for this group is 0.39, again within the range of previous estimates.

Of note, the number of observations for the unemployed subgroup is small compared to the rest of the sample. Moreover, summary statistics (table 3) suggested high SNAP benefits and spending levels for this subgroup. The ARRA contained provisions that affected households receiving unemployment insurance, and this may have affected household spending as well.

In short, households within each subgroup were able to increase food-expenditure share by more than economic theory would predict. In other words, higher SNAP benefits induced a higher proportion of spending on food in participant households. For every subgroup but the elderly, post-ARRA spending on food at home is higher than previous spending (figure 5).

Figure 5
Predicted changes in food-at-home spending for each subgroup



ARRA = American Recovery and Reinvestment Act, SNAP = Supplemental Nutrition Assistance Program.
Source: USDA, Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

These results illustrate the heterogeneous responses to changes in SNAP benefits; households of different compositions respond differently. This suggests that other factors than are accounted for in the calculation of SNAP benefits may determine food-spending behavior. In most cases, previous estimates of MPS out of cash income fall between 5 and 10 cents for every $1 increase in income (table 7).[5] Previous results and results here find a much higher MPS (on food) out of SNAP than out of income. With the exception of Hoynes and Schazenbach (2009) and Moffit (1989), most estimates of MPS are between 0.20 and 0.50. While SNAP households' estimated MPS for the total population is slightly higher here at 0.53, this may reflect the large increase in benefits as well as the macroeconomic volatility that characterized the Great Recession. MPS for the SNAP subgroups examined here—0.62 for the lowest income households, 0.42 for single-parent households, and 0.39 for the unemployed—are in line with previous studies, though on the high end.

Table 7
Marginal propensity to spend – previous estimates

Study	MPS out of SNAP	MPS out of income	Time period
Hoynes and Schazenbach (2009)	0.163	0.086	1968-1978
Breunig and Dasgupta (2005)	0.298	0.057	1990s
Fox, Hamilton and Lin (2004)	0.17-0.86	—	1970s-2000s
Levedahl (1995)	0.263	0.066	1990s
Fraker (1990)	0.17-0.47	0.05-0.13	1970s-1980s
Moffitt (1989)	0.11	0.12	1982
Senauer and Young (1986)	0.327 0.264	0.05 0.07	1978 1979
*This paper	0.53	0.07	2008-2009

MPS = marginal propensity to spend, ARRA = American Recovery and Reinvestment Act.
Source: USDA Economic Research Service.

[5]Studies that found a measure of MPS from 0.5 to 0.10 are from 20-30 years ago, and the population in these studies likely changed over the past few decades. The SNAP participant population has changed since the program's inception. Spending behavior using SNAP and cash may be fundamentally different than it was in the 1980s and 1990s.

Placebo Tests

To test the robustness of this model, two separate difference-in-differences models are estimated. First, SNAP benefits can only be used for grocery store food or food at home. Purchase of restaurant foods or ready-to-eat meals (also known as food away from home) is disallowed under SNAP. Results indicate that the food-at-home share of total expenditures increased disproportionately among SNAP recipients after ARRA. Consequently, the share of expenditures on food away from home should remain constant after ARRA.

To test whether the food-away-from-home share was affected by higher SNAP benefits, the original model is rerun using food-away-from-home expenditure share on the total sample as well as each subgroup. Results indicate that ARRA had no significant effect on the food-away-from-home budget share in the total sample or in any subgroup (table 8, column 1).

A second robustness check tests the underlying assumption that treatment and control households should experience similar trends absent a policy change. To test this assumption, the identical difference-in-differences model is rerun for a time period (2003-2004) when average benefits changed minimally ($2.50 per quarter, or around 3 percent). Again, the difference-in-differences coefficient (as well as the triple differences coefficients) is statistically insignificant (table 8, column 2), indicating that SNAP participants and nonparticipants experienced similar trends in food-at-home spending absent the policy change.

Table 8
Placebo tests – food away from home and years 2003-2004

	Food away from home (1)	Years 2003-2004 (2)
Total sample (difference-in-differences coefficient)	0.127 (0.218)	-0.057 (0.116)
Lowest income quartile (triple difference coefficient)	0.982 (0.665)	-0.101 (0.131)
Single parent (triple difference coefficient)	0.401 (0.566)	-0.191 (0.131)
Elderly (triple difference coefficient)	-0.427 (1.067)	-0.102 (0.261)
Unemployed (triple difference coefficient)	-0.431 (0.395)	0.002 (0.131)

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Source: USDA Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

Mental Accounting

SNAP households' food-expenditure shares were found to increase after the implementation of ARRA and increased more than would be expected if the benefit was in the form of cash income. While previous studies have hypothesized reasons for participant households to act counter to theory such as the stigma associated with participation, obligation, and budgeting, an alternative theory may apply. Thaler's theory of mental accounting suggests that participant households may use benefits to define their food budgets, allocating the amount the household receives in benefits for food (Thaler, 1980, 1995).

Mental accounting theorizes that households categorize and spend differently out of different income sources such as salary, assets, or welfare assistance. For example, SNAP participants may earmark SNAP benefits for food purchases only. This suggests that SNAP benefits are ***not*** fungible with cash income, as previous studies have indicated (Beatty and Tuttle, 2015; Smith et al., 2015). If, as benefits increase, SNAP benefits are not perfectly fungible with cash income in the rebudgeting, then benefits will displace a *smaller* amount of cash income in the food budget than predicted by the Southworth theory. As a result, even though households spend more on food and other goods due to an income effect, the mental accounting effect—or the lack of perfect income fungibility—may cause a disproportionate increase in the food budget.

The mental accounting effect suggests that because households budget SNAP differently than other income, public policies related to SNAP can significantly influence the spending behavior of individuals. This influence has been shown in recent research that examines a potential labeling effect of public assistance on spending decisions. Beatty and colleagues (2014) found that households spend 47 percent of a labeled cash transfer intended for heating on fuel, while an equivalent nonlabeled cash transfer would result in only 3 percent spent on fuel. Similarly, Kooreman (2000) found that in the Netherlands, recipients of (labeled) child benefits disproportionately spent the extra income on child-related goods.

If, as previous studies and this study suggest, nutritional policies can influence households to respond contrary to neoclassical theory, what are the implications of these results for current nutrition policy? Recent policy proposals have included restrictions on the kinds of foods participants can buy using benefits. For example, former New York City Mayor Bloomberg proposed restricting SNAP households from using their benefits to purchase sugar-sweetened beverages (SSBs). If SSBs remain in the mental account for food, consumption may be affected due to the imperfect fungibility between SNAP and cash. Because SNAP cannot be used to purchase SSBs, and SNAP and cash are not perfect substitutes (i.e., households will not simply use equivalent cash to purchase the soda they originally used SNAP to purchase), a ban could reduce the consumption of SSBs via SNAP.

On the other hand, mental accounting also suggests that households may recategorize SSBs from "food-expenditure" to "other goods expenditure." As benefits increase, an income effect will result in an increase in total expenditures, including expenditures on SSBs. This would counteract any intended reduction in spending on SSBs.

Conclusion

This report examined whether an increase in benefits as a result of the American Recovery and Reinvestment Act (ARRA), commonly known as the Stimulus Act, causes SNAP participant households to increase the food share of total expenditures by more than a similar increase in cash income. For every $1 increase in SNAP benefits, households were found to increase food spending by 53 cents. By comparison, previous estimates found that households increase food spending by 5-10 cents for every $1 increase in cash income. Thus, an increase in SNAP benefits will result in a disproportionate increase in food spending compared with an equivalent increase in cash income.

This report also considers dissimilar households with varying compositions and estimates their response to an increase in SNAP benefits. Included are households in the lowest income quartile, single-parent households, elderly households, and households with an unemployed member. The lowest income, single-parent, and unemployed households demonstrated significant increases in the food share of total expenditures after ARRA. The lowest income households demonstrated an MPS of 0.62, single-parent households 0.42, and unemployed households 0.39. This suggests that the lowest income households may be operating close to the margin—that is, their total monthly food-expenditure is closer to their SNAP benefits than other participant households. Elderly households showed no significant change in food budget shares after the benefit increase, suggesting they may rely on other forms of income to supplement food spending.

SNAP households exhibit different responses to changes in income than neoclassical theory predicts. These results may have policy implications for SNAP benefit levels and the method of distribution. While in-kind benefits induce higher spending on food than equivalent cash benefits, in-kind benefits may also result in a disproportionate increase in food spending, which may not reflect the current preferences or needs of the household.

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Appendix

Difference-in-Differences Method

Following Angrist and Pischke (2010), each household, h, is defined as a participant (i=1) or nonparticipant (i=0), where the household reports quarterly food-at-home expenditures before and after the ARRA. F_{1t} represents food-expenditures for a participant while F_{01} represents food-expenditures for a nonparticipant. To account for temporal changes, the policy variable, t, takes on the value of zero before ARRA and one after ARRA. To determine changes in food-expenditures, one must first consider the nonparticipant cohort. Food-expenditures are determined by household characteristics, μ_h, and time effects, $\gamma * t$. Food-expenditures for nonparticipant households are determined by the following function:

$$F_{0t} = \mu_h + \gamma * t + \varepsilon_{0t}.$$

Next, the SNAP participant population is included by adding a SNAP participation dummy, D_h:

$$F_{ht} = \mu_h + \gamma * t + \beta D_{ht} + \varepsilon_{0t}.$$

Here β represents the effect of SNAP participant on food-expenditures. The difference in expected food-expenditures before and after ARRA for nonparticipants is calculated as:

$$E\left[F_{ht} \mid h=0, t=0\right] - E\left[F_{ht} \mid h=0, t=1\right] = \gamma_0 - \gamma_1.$$

And the difference in expected food-expenditures before and after the policy for participants is:

$$E\left[F_{ht} \mid h=1, t=0\right] - E\left[F_{ht} \mid h=1, t=1\right] = \gamma_0 - \gamma_1 + \beta.$$

Finally, the effects of ARRA on SNAP participants' food-expenditure decisions are estimated, resulting in the average treatment effect on the treated, or the difference in differences:

$$E\left[F_{ht} \mid h=0, t=0\right] - E\left[F_{ht} \mid h=0, t=1\right] - E\left[F_{ht} \mid h=1, t=0\right] - E\left[F_{ht} \mid h=1, t=1\right] = \beta,$$

which leads to the resulting variable β, the causal effect of ARRA on food-expenditures of participant households.

To estimate the effects of ARRA on food-expenditures while controlling for the income effect, the difference-in-differences model is embedded into an Engle curve function, which allows the effects of the policy on food share of total expenditures to be measured—thereby directly measuring whether standard theory correctly predicts participant behavior. The empirical model is:

$$w_{ht} = \alpha_1 + \alpha_2 SNAP_{ht} + \alpha_3 After_t + \beta\left(SNAP_{ht} * After_t\right) + \alpha_4 \ln\left(TotalExp\right) + X_h \mu_h + \delta_t + \gamma_t + \varepsilon_{ht}.$$

Regression Results

Full regression results are presented in appendix table 1A. The outcome variable w_{ht} is multiplied by 100 to ease interpretation. The variable of interest—DD_1 (*SNAP Dummy*After*), or the DD estimator—represents the "treatment effect on the treated," or how an increase in SNAP benefits affects participant household expenditures while controlling for macroeconomic conditions, food price changes, and selection effects associated with participation choices.

DD_1 is the variable of interest, or the difference-in-differences estimate. The coefficient 1.44 is significant at the 1-percent level, indicating SNAP households increase food share by 1.44 percentage points after the ARRA-induced increase in benefits, a $70 increase in quarterly food spending.

Appendix tables 2A-5A represent the results from the triple difference models. For households in the lowest income quartile, DDD_{LI} (*SNAP Dummy*After*Low Income Dummy)* indicates that these households increase their food share by 3.5 percentage points, or $130 per quarter (appendix table 2A). For single-parent households, DDD_{SINGLE} (*SNAP Dummy*After*Single Parent Dummy)* indicates that these households increase their food share by 2.4 percentage points, or $79 per quarter. For households with an elderly member (over 65), $DDD_{ELDERLY}$ (*SNAP Dummy*After*Elderly Dummy)* is negative and insignificant, indicating that these households did ***not*** change their food-spending behavior after ARRA (appendix table 4A). In fact, their food-expenditure trends were not significantly different from those of non-SNAP elderly households or non-elderly SNAP households. Finally, for households with an unemployed member or an individual who receives unemployment insurance, $DDD_{UNEMPLOYED}$ (*SNAP Dummy*After*Unemployed Dummy)* is significant at the 10-percent level, indicating that these households increased their food share by 3.2 percentage points, or $120 per quarter, after ARRA.

Appendix table 1A

Results – full sample

Variables	Food share
After	-0.163 (0.140)
DD_1^	1.444*** (0.474)
Log total expenditure	4.971*** (0.549)
Constant	55.412*** (4.356)
Observations	10,172
R-Squared	0.0982

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
^Difference-in-differences coefficient represents After*SNAP Dummy

DD = Difference-in-differences, SNAP = Supplemental Nutrition Assistance Program.
Source: USDA Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

Appendix table 2A

Lowest income quartile

Variables	Food share
After	-0.144 (0.143)
DD_1^	0.579 (0..559)
Lowest income dummy	0.363 (0.628)
Log total expenditure	4.936*** (0.551)
DDD_{LI}^^	3.278* (1.297)
Constant	15.926*** (0.119)
Observations	10,172
R-Squared	0.0917

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
^Difference-in-differences coefficient represents After*SNAP Dummy
^^Triple differences coefficient represents After*SNAP Dummy*Subgroup Dummy

DD = Difference-in-differences, DDD = Triple differences, SNAP = Supplemental Nutrition Assistance Program.
Source: USDA Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

Appendix table 3A

Single-parent households

Variables	Food share
After	-0.118 (0.146)
DD_1^	0.889 (0.591)
Single-parent dummy	0.099 (1.443)
Log total expenditure	4.964*** (0.547)
DDD_{SINGLE}^^	2.419** (1.075)
Constant	55.191*** (4.358)
Observations	10,172
R-Squared	0.1053

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
^Difference-in-differences coefficient represents After*SNAP Dummy
^^Triple-differences coefficient represents After*SNAP Dummy*Subgroup Dummy

DD = Difference-in-differences, DDD = Triple differences, SNAP = Supplemental Nutrition Assistance Program.
Source: USDA Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

Appendix table 4A

Elderly

Variables	Food share
After	-0.163 (0.143)
DD_1^	1.620*** (0.532)
Elderly dummy	-0.076 (1.214)
Log total expenditure	4.965*** (0.550)
$DDD_{Elderly}$^^	-0.537 (1.204)
Constant	15.181*** (0.560)
Observations	10,172
R-Squared	0.0904

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
^Difference-in-differences coefficient represents After*SNAP Dummy
^^Triple differences coefficient represents After*SNAP Dummy*Subgroup Dummy

DD = Difference-in-differences, DDD = Triple differences, SNAP = Supplemental Nutrition Assistance Program.
Source: USDA Economic Research Service calculations using the Consumer Expenditure Survey 2008-2009.

Appendix table 5A

Unemployed

Variables	Food share
After	-0.152 (0.143)
DD_1^	1.320*** (0.489)
Unemployed dummy	-1.831 (1.161)
Log total expenditure	4.973*** (0.549)
$DDD_{Unemployed}$^^	3..198* (1.677)
Constant	15.524*** (4.355)
Observations	10,172
R-Squared	0.005

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
^Difference-in-differences coefficient represents After*SNAP Dummy
^^Triple differences coefficient represents After*SNAP Dummy*Subgroup Dummy

DD = Difference-in-differences, DDD = Triple differences, SNAP = Supplemental Nutrition Assistance Program.
Source: USDA Economic Research Service using the Consumer Expenditure Survey 2008-2009.