Expenditure Response to Increases in In-Kind Transfers: Evidence from the Supplemental Nutrition Assistance Program

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Economic theory predicts that households who receive less in Supplemental Nutrition Assistance Program benefits than they spend on food will treat SNAP benefits as if they were cash. However, empirical tests of these predictions draw different conclusions. In this study, we reexamine this question using recent increases in Supplemental Nutrition Assistance Program benefits, the largest of which was due to the American Recovery and Reinvestment Act of 2009. We find that increases in benefits cause households to increase their food budget share by more than would be predicted by theory. Results are robust to a host of specification tests.

Key words: Labeling effect, Stimulus Bill, Supplemental Nutrition Assistance Program.

The Supplemental Nutrition Assistance Program (SNAP), formerly known as the Food Stamp Program, is the largest federal nutrition assistance program in the country. Its purpose is to increase the purchasing power of low-income households who face financial barriers to accessing sufficient food. Over the past decade, SNAP participation has increased dramatically due to the lasting effects of the "Great Recession" and an expansion of eligibility. SNAP benefits account for between 10% and 15% of total U.S. food-at-home spending and 50% of food-at-home spending of low-income households (Wilde 2013). In 2009, the American Recovery and Reinvestment Act (ARRA) increased per household benefits by an average of $80 per household. The implementation of the ARRA and the ongoing controversy surrounding SNAP highlights the need to examine the effectiveness of SNAP at meeting its stated goal: increasing the food spending of needy households.

We study the effect of an unprecedented increase in SNAP benefits on participant households' food expenditure. Because income is fungible, theory predicts infra-marginal households, that is, those who spend more on food than they receive in benefits, should treat in-kind transfers no differently than an equivalent cash transfer. In other words, SNAP benefits and income from other sources are pooled. The implication is that the marginal propensity to spend on food out of SNAP benefits is the same as the marginal propensity to spend out of equivalent cash. Participation in the program should not induce households to spend more on food than they would with an equivalent increase in cash income (Southworth 1945).

A large literature testing this hypothesis, using a variety of identification approaches, has drawn contradictory conclusions. One strand of the literature compares food spending of participant households to food spending of nonparticipant households. Typically these papers find the marginal propensity to spend on food out of SNAP is greater than the marginal propensity to spend on food out of cash (see *inter alia* Senauer and Young 1986; Fox, Hamilton, and Lin 2004; Wilde, Troy and Rogers 2009). A review of the early work in this vein (Fraker 1990) finds a range of estimates:

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The authors would like to thank Brian Roe, an anonymous referee, and seminar participate at the 2012 AAEA-EAAE Symposium in Boston. The views expressed are those of the authors and should not be attributed to the Economic Research Service or the United States Department of Agriculture.

Amer. J. Agr. Econ. 97(2): 390–404; doi: 10.1093/ajae/aau097
Published online November 21, 2014

a dollar of benefits raises food spending between 17 and 47 cents, whereas an equivalent cash transfer would be expected to raise food expenditure by five to ten cents.

Although results from the observational studies are consistent, they largely predate the "credibility revolution" (Angrist and Pischke 2010) in microeconometrics. In this case, the identification of a causal effect is largely attributed to functional form. Selection into treatment, for example, the fact that participants in voluntary social assistance programs may differ from nonparticipants in unobservable ways (see *inter alia* Currie 2003), are largely ignored. These differences may affect participation decisions as well as food expenditure decisions. Unobservable differences between groups may confound estimates of the program effects of participation. In sum, these studies may not directly account for the selection bias inherent in empirical analyses on participation in voluntary assistance programs.

A second strand of the literature addresses this identification problem by using data from a small number of "cash-out" experiments in which a random sample of households are provided with a cash transfer in place of an in-kind transfer. These studies also draw differing conclusions. Moffitt (1989) examines the effects of converting food stamps into cash in Puerto Rico in 1982 and finds this cash-out had no effect on the food expenditure decisions of participant households; food stamps were valued at roughly 100% of their face value, a result consistent with standard theory. Using more recent data from the 1990 San Diego cash–out experiment, Levedahl (1995) finds the marginal propensity to spend on food out of food stamps is greater than cash. He attributes the difference to the "stigma" associated with food stamp usage. Using the same data, Breunig and Dasgupta (2002, 2005) find the marginal propensity to spend on food is greater out of food stamp benefits than equivalent cash. However, rather than stigma, they attribute the difference to intrahousehold bargaining associated with benefit receipt in multi-adult households; single-adult households behave in a manner consistent with standard theory. Finally, Whitmore (2002), also using the same data, finds that inframarginal households treat food stamps and cash identically. Note that while some of this work has been published relatively recently, the data are from experiments that occurred a generation ago, during a time when the Food Stamp Program operated under a very different set of institutional arrangements. Therefore, the responses of participants to changes in the Food Stamp Program of the 1980s and early 1990s are not necessarily informative about how a SNAP recipient in 2009 would respond to program changes.

This article is perhaps closest in spirit to recent work by Hoynes and Schazenbach (2009). To address selection bias, the authors leverage the phased implementation of the Food Stamp Program during the 1960s and 1970s by exploiting variation of county-level adoption of the program. Using the Panel Study of Income Dynamics, they estimate the effects of participation on food at home, food away from home, and total food expenditure. The results indicate that, for inframarginal households, food stamp participation led households to increase food expenditure by similar rates as an equivalent cash transfer. The upshot is that spending behavior of participant households in the 1960s and 1970s followed the prediction of standard theory.

It is an open question how relevant these results are to the current program. SNAP has changed considerably since the the period studied by Hoynes and Schazenbach (2009). Notable changes include the elimination of the purchase requirement in 1979, the implementation of electric benefit cards (commonly referred to as EBT) and the concomitant reduction in the secondary market for SNAP, as well as a reduction in stigma associated with participation. The population served by SNAP has changed considerably since the program's inception. Participation is considerably wider, having more than tripled since the program's inception, from approximately 4% of the US population in 1971 (USDA 2011) to nearly 15% in 2011 (FRAC 2011). Half of all children in the United States are expected to participate in SNAP at some point in their lives (Rank and Hirshl 2009). Indeed some current SNAP participants may be third generation participants. Although Hoynes and Schazenbach improve on previous observational studies by addressing selection, as with the experimental "cash-out" studies, it is an open question as to whether these results are relevant for understanding the behavior of current SNAP participants.

This article estimates the effects of large changes in SNAP benefits on the food spending of participant households. After

an increase in benefits, we find that household food spending increases more than would be predicted by the Southworth hypothesis; in other words, households do not appear to treat increases in SNAP benefits as cash. This article makes four main contributions. First, we leverage the effect of a large increase in program benefits to identify the effect of increases in in-kind transfers on inframarginal households. This allows us to combine the best elements of the observational studies with a credible identification strategy. Second, we study the current program; estimates of program effects are directly relevant to policy makers. Third, this article asks a slightly different question than previous studies—how do SNAP participants respond to *increases* in their SNAP benefits?—a question of particular interest to economists and policy makers. Finally, because we directly examine a recently implemented federal policy intended to address the consequences of the economic downturn, we can provide some guidance as to its effectiveness.

The SNAP Program

As the largest food and nutrition program in the United States, SNAP assists low-income households in accessing sufficient food and nutrition when facing financial hardship by increasing household resources. Eligibility to participate in the program is determined by three financial criteria: (1) gross income, (2) net income, and (3) asset level. Households may also be categorically eligible if they participate in other welfare assistance programs such as Temporary Assistance to Needy Families (TANF) and Supplemental Security Income (SSI).

Over the past 30 years, SNAP has undergone a number of policy changes that affect eligibility and benefit levels. Originally called the Food Stamp Program, the program was introduced as a series of pilot programs in a select number of counties throughout the United States during the early 1960s. The program was created not only to assist needy households in nutritional access but also to strengthen the agricultural economy. It was expanded over the next decade and was widely available by 1974. During the 1980s and 1990s, the federal government implemented a number of policies to cut benefits and restrict eligibility, most notably via The Personal Responsibility and Work Opportunity Act of 1996 (PRWORA). After the implementation of PRWORA, participation declined faster than policy makers anticipated. In response, the Farm Bill of 2002 restored eligibility to formerly restricted groups as well as facilitated program access in order to encourage participation. At the same time, EBT cards were widely adopted throughout the country, reducing administration costs, and fraud, as well as stigma associated with food stamp use. By 2008, policy makers emphasized nutrition access and established pilot programs to educate participants and encourage consumption of healthy foods. The Food Stamp Program was officially renamed SNAP, the Supplemental Nutrition Assistance Program, in order to articulate the new focus on nutrition.

As a result of the "Great Recession" of 2007–2008 and the subsequent slow recovery, entitlement programs, notably SNAP, have seen important increases in enrollment. SNAP enrollment increased from around 11% of the U.S. population in 2008 to 15% of the U.S. population by 2011. The American Recovery and Reinvestment Act (ARRA) was implemented in February of 2009 in order to stabilize the U.S. economy. Commonly known as the "Stimulus Package," the ARRA injected $224 billion into entitlement programs. SNAP received an increase in funding of nearly $20 billion that allowed the program to increase administrative funding, temporarily eliminate time limits of participation for able-bodied adults, and increase per household benefits. ARRA increased maximum benefits by 13.6% for a SNAP household. On average, household benefit levels increased by $80 per month for a household of four. Table 1 reports the average SNAP benefit level for a family of four between 2005 and 2012.

Table 1. Average Benefit Levels – Family of Four

	Average Period SNAP Benefit Family of 4	Percent Change in Benefit Level
Oct 2005 – Sept 2006	$506	1.4%
Oct 2006 – Sept 2007	$518	2.4%
Oct 2007 – Sept 2008	$542	4.6%
Oct 2008 – March 2009	$588	8.5%
April 2009 – Sept 2009	$668	13.6%
Oct 2009 – Sept 2012	$668	0%

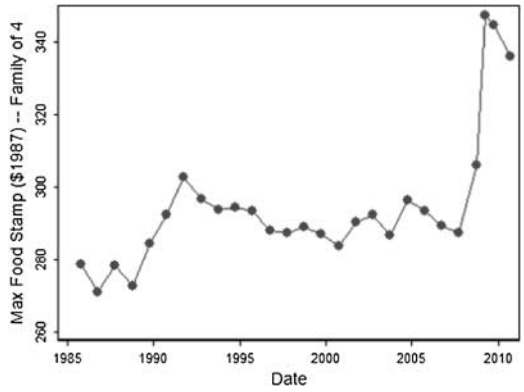

Figure 1. Maximum allotment for family of 4: 1985–2011

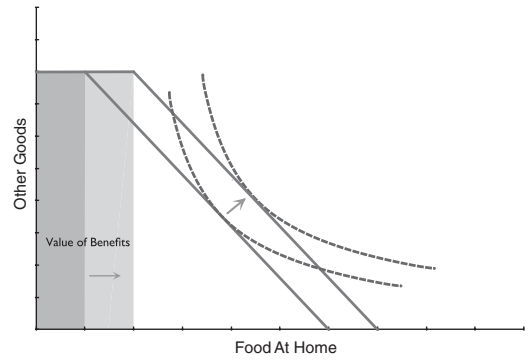

Figure 2. Expenditure changes due to an increase in SNAP benefits

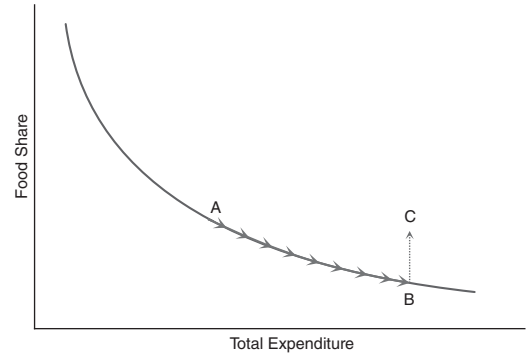

Figure 3. Engel curves: labeling effect

While the ARRA led to an unprecedented increase in benefits, maximum benefit levels for participant households have been adjusted over the past 30 years due to policy shifts. Figure 1 illustrates the changes in maximum benefit levels for a family of four in 1987 dollars. The figure shows that, throughout the 1980s, benefit levels remained fairly stable. In the early 1990s, benefits increased by $3 billion when maximum allotment was increased from 100% to 103% of the Thrifty Food Plan, a low cost diet plan to which benefits are pegged, but subsequently declined in real terms as a direct result of Personal Responsibility and Work Opportunity Act of 1996 and the change in maximum allotment calculation. Finally, we see that the increase in benefits after the implementation of the ARRA in 2009 was exceptionally large. This increase in benefits offers an opportunity to estimate the effects of a large change in benefits on spending habits of participant households.

Conceptual Framework

Figures 2 and 3 provide the basis for our empirical approach. Figure 2 lays out the textbook treatment of how households respond to an in-kind transfer. As the value of the in-kind transfer increases, the kinked household budget constraint shifts out, allowing for an increase in food and nonfood spending. Because income is fungible, as long as the household remains inframarginal, increases in resources should not induce substitution between goods.

We follow recent work in the area by Wilde, Troy, and Rogers (2009) and adopt an Engel curve approach. This allows us to estimate how food share responds to an increase in benefit levels while controlling for the effect of changes in total expenditure. Figure 3 provides some intuition. When households experience an increase in resources, in this case SNAP benefits, total expenditure increases and household expenditure moves along the Engel curve from point A to point B. Following Engel's law, as total expenditure increases, food's expenditure share falls; food both is a necessity and a normal good. But if a household has a higher propensity to spend on food out of SNAP benefits than out of total expenditure, food share will shift off the Engel curve from point B to point C. As a result, our empirical specification is designed to credibly identify a shift from B to C, holding total expenditure constant.

Data

Our sample is drawn from the Consumer Expenditure Quarterly Interview Survey

(CEX). The CEX is administered quarterly by the Bureau of Labor Statistics and represents the U.S. civilian noninstitutionalized population. Participating households are interviewed once per quarter for five consecutive quarters. Each quarter contains approximately 7,000 participating households. Participating households, or "consumer units," are either single families in a household, a financially independent person living in a household alone or with others, or two or more people who make financial decisions jointly. We will use consumer unit and household interchangeably to describe our unit of analysis.

The CEX collects data on large purchases such as property and vehicles as well as regular purchases such as food expenditure and rent. The CEX also contains detailed demographic information such as age, race, gender, marital status, family number, and annual salary as well as welfare program participation and benefit amount. In order to observe the same household under two different benefit regimes, we follow households across survey quarters. A potential issue is that the survey follows addresses and not specific households. Because of this, we exclude households whose demographic variables were inconsistent over the survey period. For example, a household is dropped from the sample if age changes by more than one year or family size changes implausibly. Further, we exclude households with six or more children

Throughout the period of analysis—with the notable exception of April 2009—benefit level changes typically occur in October of each year. Because a household appears multiple times in the survey, we use the longitudinal quality of the data set to observe households before and after an increase in benefits. We create a dummy variable that indicates whether the household responds to the survey before or after an increase in SNAP benefits. This variable, *After*, will take on the value of zero in the period before a benefit increase and one after an increase. Each dummy is specific to a household's timeline in the survey.

As with virtually all nationally representative survey data, the households in the CEX under-report participation in SNAP. A number of studies have explored measurement error in the context of reporting SNAP participation (Taeuber et al. 2004; Gundersen and Kreider 2008; Czajka et al. 2012; Kreider et al. 2012). These studies find that up to one in five households misreports participation status. In our total sample, the SNAP participation rate ranged from 4.5% in 2007 to 7.2% in 2010. This is much smaller than statistics reported by the USDA. In 2007, nearly 9% of the US population participated in SNAP. By 2010, this figure rose to 15%. As a result, our control group almost certainly erroneously contains SNAP participants. If SNAP benefits are treated as cash, treatment and control groups will not respond differentially to a benefit increase, and the difference in the change in food spending between the two groups will be zero. However, if SNAP benefits are spent disproportionately on food, the contaminated control group will spend a greater share of total expenditure on food than would an uncontaminated control group. As a result, the difference in the change in food spending between the two groups will be smaller than the true difference. To the extent that we find an effect, it will be an underestimate of the true magnitude.

The large increase in benefits in April 2009 resulting from the ARRA may have induced households to participate in the program. In other words, it is possible that the higher benefits encouraged nonparticipant households that were previously eligible to enroll in the program. In order to avoid any confounding issues associated with changes in the participant population, our sample only includes two types of households: (1) households that were participants in the program before *and* after the policy changes, and (2) households that were never participants in the program. By including only these groups, we avoid including households that were induced to join the program due to higher benefits or expansion of eligibility.

Empirical Approach

To estimate the effects of the benefit level changes on food–at–home expenditure, we consider the period 2007 through 2010, a period in which SNAP benefits experienced several large discrete increases.[1] Two factors may confound estimates: (1) the macroeconomic volatility of the time period under

[1] In principle, one could use any increase in SNAP benefits, but in practice the effects of small benefit increases may be too small to detect in relatively noisy expenditure data.

analysis and (2) seasonality associated with the timing of benefit changes. First, the time period of our analysis was unusually volatile due to a severe recession. It is possible that households altered their expenditure during this time period regardless of whether or not they participated in SNAP. Second, benefit level changes traditionally occur on October 1st of each year. In most cases, interviews before the benefit change occur during summer months and interviews after the change occur during late fall and winter months, capturing expenditure during different periods. As a result, these before/after comparisons may conflate program effects with seasonal effects.

To separate the effects of benefit increases from recent macroeconomic conditions and seasonality, we use a difference-in-difference design. Implementing a difference-in-difference model requires a control group. To this end, we use a matching on observables approach (specifically, Coarsened Exact Matching [CEM]; Iacus, King, and Porro 2011) to create a quasi-control group with a distribution of explanatory variables similar to the treatment group. This process improves the balance of observables between the treatment and control group. By balancing the data, we are able to compare two like groups who differ on observables only by whether they are program participants. In this way, we control for unobservable macroeconomic and seasonality effects—assuming they are common to participants and nonparticipants alike—that might bias estimates.

To balance treatment and control groups, we coarsen specific demographic variables by recoding continuous variables into well-defined categories and match households that fall within the same categories. For example, instead of matching the treatment and control groups by the exact family size reported in the data, we coarsen the *Family Size* variable by creating three categories for family size: family size less than or equal to two, family size between three and five, and family size greater than five. Likewise, we coarsen the *Age* variable to match treatment and control groups by age categories. Categories include ages below 20, between 20 and 35, between 36 and 50, between 51 and 65, and above 65. Households that fall within the same categories are then matched. We also match using race dummies, marital status, income brackets, and employment. Following Ho et al. (2011), we use CEM to construct a quasi-control group of nonparticipants that resembles our treatment group of SNAP participants and discard unmatched data; our sample consists of only matched households. From here, we exclude nonparticipant households with total expenditure 150% greater than average total expenditure of participating households.[2]

We retain only households that are inframarginal before and after benefits increase, in other words, households that—according to theory—should treat an increase in SNAP benefits as equivalent to a cash transfer. Because benefit levels increase, the number of inframarginal households might decrease in the second period. We find that roughly 3% of our matched sample moves from inframarginal to extramarginal after the benefit increase. These households are excluded from the analysis.

Table 2 contains summary statistics for our matched sample. Food expenditure and total expenditure levels differ between groups. The share of household total budget allocated toward food at home is higher for SNAP households than non-SNAP households. Predictably, food away from home is lower in participant households as is the share of expenditure allocated toward food away from home. Finally, total expenditure levels are similar between groups due to the sample construction process. Demographics, however, differ between the treatment and control groups. These differences are suggestive of the issues faced by the observational work cited above. Even after matching, our quasi-control group is more racially homogeneous, more likely to be headed by a male, more likely to be married, more likely to be employed, and, on average, more likely to have a smaller family. Because the increases in SNAP benefits were plausibly exogenous to individual households, in other words, participant households had no direct effect on program benefit levels, the differences between the treatment and quasi-control group are less problematic.

Our discussion of the difference-in-difference approach follows Angrist and Pischke (2008). The difference-in-difference model assumes that participants and nonparticipants would experience similar trends in food-at-home expenditure absent the policy change. Because we are specifically interested

[2] Results are robust to a wide range of alternative cut-offs.

Table 2. Summary Statistics 2007–2010 (by Quarter)

	SNAP Participants		Nonparticipants	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Food at Home Exp	531.13	369.09	438.36	252.48
Share FAH of Total	19.49	10.42	15.50	8.24
Food Away Exp	96.45	160.49	142.15	177.59
Share FAFH of Total	2.88	4.13	4.67	5.70
Total Exp	3,104.79	2,349.28	2,970.54	1,034.67
SNAP Amount	426.02	458.86		
Black	0.264	0.441	0.124	0.329
White	0.699	0.457	0.860	0.347
Asian	0.019	0.136	0.012	0.108
Female	0.737	0.440	0.572	0.495
Married	0.272	0.445	0.326	0.469
Employed	0.460	0.498	0.559	0.496
Family Size	2.921	1.783	1.833	1.167
Observations		2,940		15,997

in the effect of an increase in benefit level on participant households, the difference-in-difference approach allows us to control for differences between time periods that affect changes in expenditure behavior in both participant and nonparticipant households, namely, the macroeconomic conditions and seasonality induced by timing of benefit increases.

We define each household as a participant, $h = 1$, or a nonparticipant, $h = 0$. Each household reports the food-at-home share of total expenditure before and after a policy change where w_{1t} represents food-at-home budget share of a participant and w_{0t} represents food-at-home budget share for a nonparticipant.[3] The policy change occurs in two separate time periods represented by t; t takes on a value of zero before a policy change and one after a policy change.

For nonparticipating households, expected food-at-home budget share is determined by specific household characteristics, η_h, and time effects experienced by all households, γ. Therefore, the food-at-home budget share equation for each nonparticipant household is

$$(1) \qquad w_{0t} = \eta_h + \gamma * t + \varepsilon_{0t}.$$

Including participants in the analysis, we add a SNAP participation dummy, D_h, to the food-at-home budget share equation.

$$(2) \qquad w_{ht} = \eta_h + \gamma * t + \beta D_{h*t} + \varepsilon_{ht}$$

where β is the effect of SNAP participation on food-at-home budget share.

This is followed by the difference of the expected food-at-home budget share by nonparticipants before and after the policy change

$$(3) \qquad E(w_{ht}|h=0,t=0) - E(w_{ht}|h=0,t=1) = \gamma_0 - \gamma_1$$

and the difference of the expected food-at-home budget share by participants before and after the policy change

$$(4) \qquad E(w_{ht}|h=1,t=0) - E(w_{ht}|h=1,t=1) = \gamma_0 - \gamma_1 + \beta.$$

From here, we can estimate adjustments in food-at-home budget share by SNAP participants after the policy change by estimating the average treatment effect on the treated

$$(5) \qquad E(w_{ht}|h=0,t=0) - E(w_{ht}|h=0,t=1) - E(w_{ht}|h=1,t=0) - E(w_{ht}|h=1,t=1) = \beta$$

where β is the causal effect of SNAP benefit level change on the food-at-home budget share of SNAP participants. Using this approach, we are able to difference out the

[3] Due to restrictions on what households can purchase with food stamps, we use measures of food-at-home budget share rather than total food expenditure as the outcome variable for participants. In most cases, participant households are prohibited from using food stamps to purchase food-away-from-home items such as restaurant food and fast food.

Table 3. Difference-in-Difference – Food-at-Home

		Before	After	Difference in Difference
Food at Home Share	Treatment	18.83	18.93	0.41
		(0.499)	(0.617)	
	Control	15.34	15.03	
		(0.401)	(0.428)	
Food at Home Exp	Treatment	511.07	552.16	45.24
		(15.83)	(20.06)	
	Control	446.54	442.39	
		(11.62)	(12.58)	

period effect, $\gamma_0 - \gamma_1$, which may affect our results.

The simplest difference-in-difference model relies on sample means. Table 3 illustrates the difference-in-difference approach. Our treatment group increases their food-at-home budget share by 0.5% before and after the benefit change. Our control group decreases their budget share by 2%. The resulting difference-in-difference estimate is 0.41%. If we look at levels rather than budget shares, the difference-in-difference estimate is $45. The average recipient household in the sample saw SNAP benefits increase by $64. In other words, they spent approximately 64% percent of the benefit increase on food at home.

The simple comparison of means above does not control for a host of potential confounders, notably total expenditure. To this end, we embed the difference-in-difference identification strategy in a standard Working-Leser Engel curve specification to estimate the effects of the benefit level change on food-at-home's share of total expenditure. We write

$$w_{ht} = \alpha_1 + \alpha_2 After_t + \beta(SNAP_{ht}{}^{*} After_t) + \alpha_3 \ln(\text{TotalExp}_{ht}) + \eta_h + \delta_t + \gamma_t + \varepsilon_{ht} \quad (6)$$

where $After_t$ is the policy dummy; ln TotalExp_{ht} is the natural log of total household expenditure; η_h is a household fixed effect; and finally, δ_t and γ_t are month and year fixed effects.

We estimate both a discrete and a continuous measure of participation in SNAP. The discrete specification is the standard difference-in-difference estimator where we interact *SNAP*, a participation dummy equal to zero if households are nonparticipants and one if households are participants, with *After*, a policy dummy equal to one after the increase in SNAP benefits. For the continuous measure of treatment, we interact the natural logarithm of SNAP benefits, *Log SNAP*, with *After*. These distinct specifications allow us to distinguish between the average effect of SNAP benefit increases on food-at-home's share of total expenditure for all participating households and the marginal effect of an additional dollar of benefit levels on food-at-home's budget share.

Table 4. Main Results: 2007–2010

	(1)	(2)
Variables	Food-at-Home Share	Food-at-Home Share
After	−0.203**	−0.179*
	(0.096)	(0.095)
DiD_1	0.723**	
	(0.326)	
DiD_2		0.118*
		(0.647)
ln TotalExp_{ht}	−4.716***	−4.718***
	(0.405)	(0.406)
Constant	53.275***	53.292***
	(3.208)	(3.201)
Observations	19,328	19,328
R-squared	0.0750	0.0745

Notes: Regressions include household, year, and month fixed effects. Cluster robust standard errors in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively.

Results

Table 4 presents our main results. Column (1) contains results for the discrete specification, and column (2) contains results for the

continuous treatment specification. Note that budget shares, w_{ht}, are multiplied by 100 in order to ease interpretation.

The key policy variable for the discrete specification reported in column (1) is the difference-in-difference estimator, DiD_1, which estimates the effect of the policy change on the food-at-home budget share of participant households. We find that participating households increased the share of total expenditure allocated toward food at home by nearly 0.72% after an increase in SNAP benefits, above and beyond the effect of increased total expenditure on food-at-home expenditure. In other words, the distance from point B to point C in figure 3 is roughly 0.72%.

Similarly, in the continuous treatment reported in column (2), the difference-in-difference estimator, DiD_2, indicates participating households increase their share of total expenditure allocated toward food at home by 0.12% in response to a 1% increase in SNAP benefits, above and beyond the effect of increased household resources on food-at-home expenditure.

Our results indicate that food share increases in response to increases in benefits. Recall our sample consists only of inframarginal households, and assuming that income is fungible, theory predicts food share should decline after changes in benefit levels as illustrated in figure 1. Food at home is a normal good; therefore, an increase in resources should lead to more food spending. But because food is also a necessity, increased resources should lead to a lower food share (this is Engel's law). While we assert the large benefit change was exogenous to individual households, our empirical approach does not rely on this assumption. In fact, benefit level changes that are not exogenous may have similar effects. Note that these results are robust to functional form; comparable results are obtained from models with log of food-at-home expenditure as the outcome variable.

Sensitivity

A key assumption of difference-in-difference model is that participants and nonparticipants experience similar trends in food-at-home budget shares absent the policy change. To investigate deviations from this maintained assumption, we consider a number of placebo specifications including placebo periods before and after the policy change where benefit levels were constant, and a placebo good, food away from home, which cannot be purchased with SNAP benefits. Finally, to address concerns about misreporting in the CEX, we reestimate our main specification using data from the Current Population Survey.

Periods Before and After the Policy Change

To test whether households experience similar trends when benefits are not changing in a systematic way, we create a placebo policy dummy for the two consecutive quarters *prior* to the policy change and the two consecutive quarters *after* the policy change within each household's timeline in the survey. In the first robustness check, we consider the time period before the policy change. For example, if a household experiences an increase in benefits in the third quarter of its survey participation, we use the first two quarters of survey participation as a placebo period; in other words, the placebo policy dummy takes on the value of zero in quarter 1 and one in quarter 2. Likewise, if households experience the policy change in quarter 4, the placebo policy dummy takes on the value of zero in quarter 2 and one in quarter 3. This is a direct test of the the central assumption in the difference-in-difference approach as to whether treatment and control groups are experiencing similar trends before the increase in benefits.

Our model uses a placebo policy dummy, *Placebo 1*, in place of *After*, and difference-in-difference placebos, *Placebo 1* DiD_1, which interacts *SNAP* with *Placebo 1*, and *Placebo 1* DiD_2 which interacts *ln SNAP* with *Placebo 1*. Results are shown in columns (1) and (2) of table 5. We find that the placebo difference-in-difference point estimates are smaller in magnitude and are not statistically significant. This implies that any trends prior to the policy change were experienced similarly by participant and nonparticipant households alike. In other words, absent the policy change, SNAP participants and nonparticipants experience similar trends in food-at-home expenditure.

As a further check on the validity of the assumptions of the difference-in-difference model, we create a similar placebo policy dummy for the two consecutive quarters *after* the policy change for each household.

Table 5. Placebo Results: Before and After Policy Changes

	Before		After	
	(1)	(2)	(3)	(4)
Variables	Food-at-Home Share	Food-at-Home Share	Food-at-Home Share	Food-at-Home Share
Placebo 1	0.123	0.106		
	(0.117)	(0.116)		
Placebo 1 DiD$_1$	0.043			
	(0.398)			
Placebo 1 DiD$_2$		0.035		
		(0.081)		
Placebo 2			−0.137	−0.132
			(0.145)	(0.145)
Placebo 2 DiD$_1$			0.141	
			(0.382)	
Placebo 2 DiD$_2$				0.509
				(0.078)
ln TotalExp$_{ht}$	−4.725***	−4.727***	−4.722***	−4.724***
	(0.405)	(0.405)	(0.405)	(0.405)
Constant	53.269***	53.282***	53.293***	53.636***
	(3.204)	(3.204)	(3.202)	(3.202)
Observations	19,328	19,328	19,328	19,328
R-squared	0.0703	0.0707	0.0706	0.0709

Notes: Regressions include household, year, and month fixed effects. Cluster robust standard errors in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively.

For example, if households experience a policy change in quarter 2, the placebo policy dummy take on the value of zero in quarter 3 and one in quarter 4. We then create new difference-in-difference variables using the placebo dummy. The corresponding difference-in-difference variables are *Placebo 2 DiD*$_1$ and *Placebo 2 DiD*$_2$. Results are shown in columns (3) and (4) of table 4. As above, the placebo difference-in-difference estimates are small relative to our main results and statistically insignificant. This implies that households experience similar expenditure trends in periods after the policy change. This provides some evidence that changes are driven by increases in SNAP benefits.

Food Away from Home and Total Expenditure

Results indicate that large benefit level changes due to the ARRA has a disproportionate effect on household food-at-home expenditure share. To further check the robustness of our results, we now consider a placebo good: food away from home. SNAP restricts the kinds of foods participants can purchase with benefits; food away from home such as restaurant and fast food are excluded. Because of this, we would not expect to see an increase in food-away-from-home's budget share as a result of increased SNAP benefits. To test this, we run our main specification (equation 6) but use food-away-from-home's share of total expenditure as our outcome variable. Results are presented in columns (1) and (2) of table 6. Difference-in-difference estimates are small in magnitude and not statistically significant. Note that the coefficient on total expenditure is positive and significant, as one would expect from a luxury. The implication is that the increase in resources associated with the ARRA did increase food-away-from-home spending. The small (and not statistically significant) difference in difference coefficient tells us that the increase is no more than we would expect from the increase in resources. Put differently, in the context of figure 2, we see a shift from point A to point B but no subsequent shift to point C.

Finally, one concern is that results are driven by changes in total expenditure—in other words, results are driven by changes in the denominator of our outcome variable rather than in the numerator. To test

Table 6. Placebo Results: Food Away from Home and Total Expenditure

	(1)	(2)	(3)	(4)
Variables	Food-Away-from-Home Share	Food-Away-from-Home Share	Total Expenditure	Total Expenditure
After	−0.113	−0.116	−1.319	−3.032
	(0.068)	(0.067)	(10.184)	(10.346)
DiD_1	0.084		0.023	
	(0.164)		(0.031)	
DiD_2		−24.047	−2.549	
		(46.987)	(8.898)	
ln TotalExp$_{ht}$	0.573*	0.572*		
	(0.320)	(0.320)		
Constant	0.612	0.612	2,998.193***	2,998.152***
	(2.444)	(2.444)	(5.699)	(5.687)
Observations	19,328	19,328	19,328	19,328
R-squared	0.0024	0.0022	0.0007	0.0021

Notes: Regressions include household, year, and month fixed effects. Cluster robust standard errors in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively.

for this, we replace food-at-home share with total expenditure in our main specification. The results, shown in columns (3) and (4) of table 6, indicate that total expenditure does not change significantly as a result of an increase in resources. Results in this section are consistent with a policy change that only affected households' decisions on expenditure on food at home but not in food away from home or total expenditure.

Current Population Survey—Food Security Supplement

As noted above, SNAP participation is underreported amongst CEX survey respondents. A series of articles, notably Gundersen and Kreider (2008) and Kreider et al. (2012), make clear that, in the presence of substantial reporting error about participation, drawing definitive conclusions about the effects of SNAP can be challenging.

As a further robustness check, we repeat our main analysis using data from a different survey, the Current Population Survey—Food Security Supplement (CPS–FSS).[4] While the CPS–FSS is not without issue, the SNAP participation rate in the CPS–FSS is 7.4%, compared to 5% in the CEX and compared to 15% in the population at large over this period (FRAC 2011). Our sample of CPS–FSS households reports an average increase in benefits of 9%, compared to an average increase of 17% among CEX households; this is consistent with underreporting in the CEX.

Households that participate in the CPS–FSS are interviewed in two successive Decembers. For example, if a household participates for the first time in December of 2008, the same household will again participate in December 2009. As a result, we observe household spending during a period before and a period after a benefit increase. The CPS–FSS collects detailed information on SNAP participation as well as asking a general purpose question about food expenditures. A one shot recall question is thought to be somewhat less accurate than the more detailed questioning that occurs in the CEX (Browning and Crossley 2009). A further disadvantage in the CPS–FSS is that we do not observe households immediately before and immediately after an increase in benefits.

As before, our sample consists only of inframarginal households. We use CEM to create balanced treatment and control groups using the same criteria as in our original analysis. Our treatment group consists of households that have reported participating in SNAP in the month of December of both the year before the benefit increase and the year after the increase. Our control group are demographically similar nonparticipants—either before or after.

We estimate a model that is similar to our main specification presented in equation (6); it differs slightly because of differences in the expenditure information collected between the surveys. First, because the CPS–FSS does not collect information on total expenditure,

[4] We thank an anonymous referee for this suggestion.

Table 7. CPS – FSS: Food and Supermarket Expenditure

	(1)	(2)	(3)	(4)
Variables	Log Food Expenditure	Log Food Expenditure	Log Food Away from Home	Log Food Away from Home
CPS After	−0.018***	0.020***	−0.011	−0.002
	(0.005)	(0.005)	(0.008)	(0.011)
CPS DiD$_1$	0.127***		−0.078	
	(0.0021)		(0.050)	
CPS DiD$_2$		0.0005***		−0.000
		(0.008)		(0.000)
Constant	4.553***	4.552***	3.326***	3.310***
	(0.003)	(0.004)	(0.006)	(0.007)
Observations	58,052	38,509	37,041	24,183
R-squared	0.001	0.002	0.006	0.004

Notes: Regressions include household, year, and month fixed effects. Cluster robust standard errors in parentheses. *, **, and *** represent 10%, 5%, and 1% significance levels, respectively.

we use the natural log of the previous week's food expenditure as the outcome variable of interest rather than budget shares as in our main specification. Second, the before/after indicator *CPS After* takes on the value of zero in a household's first year in the survey and one in the household's second year in the survey.

Finally, we consider two participation measures: (1) *CPS SNAP*, a SNAP dummy representing participation in the program over the past month; and (2) *CPS SNAP Amount*, representing the average amount of monthly benefits the household received. As a robustness check on this exercise, we replicate the earlier placebo test using data on food-away-from-home expenditure collected in the CPS–FSS.

Results of this exercise are reported in table 7 and echo earlier findings. *CPS DiD*$_1$ and *DiD*$_2$ are the interactions between *CPS After* and the two measures of SNAP participation: *CPS SNAP* and *CPS SNAP Amount*, respectively. Point estimates in column (1) indicate benefit level increases induce households to increase their food expenditure by around 12.7%. Column (2) shows that a 1% benefit level increase causes households to increase food expenditure by around 0.05%. Results are statistically significant at all conventional levels. Columns (3) and (4) report results on food-away-from-home expenditure. Again, echoing earlier results, point estimates are smaller and not significantly different from zero. In sum, after an increase in SNAP benefits, SNAP participants in the CPS–FSS significantly increase spending on food more than we would predict from a simple cash transfer.

Discussion

We find that households change their spending behavior as a result of an increase in an in-kind transfer. Given a statistically significant expenditure response, we now ask whether the responses were economically important. In terms of figure 3, we ask how large the change in budget share was from point *B* to point *C* as a result of the in-kind nature of the increase in SNAP benefits. The average SNAP participating household in our sample spent approximately 19.5% of *total* expenditure on food. For the discrete specification, participating households respond to increases in benefits by increasing food's budget share by 0.72%, controlling for total expenditure. This results in an estimated increase from 19.5% to 20.22% of food–at–home's share of total expenditure. Continuous results tell a similar story. A 1% increase in SNAP benefits lead to a 0.12% increase in food's share of total expenditure. The average household's benefits increased by 17% after the policy change. This results in an estimated increase of food at home as a share of total expenditure by roughly 2.04%, or from 19.5% to 21.54%.

Given the model above, we now investigate the magnitude of the change in spending. The total change in spending on food at home as a result of the change in SNAP benefits is $\hat{\beta} \times X$, representing the treatment effect ($\hat{\beta}$) times total expenditure (X). This yields a total estimated change in food-at-home spending of $41. We now ask: had the household been given an equivalent increase in total expenditure, what share of it would

have we expected households to spend on food at home? In general, we can write the change in food–at–home spending (here x_f) for a change in total expenditure as $\frac{\partial x_f}{\partial X} = \hat{\alpha}_4 + w_f$, where $\hat{\alpha}_4$ is the coefficient on the natural logarithm of total expenditure in our Working–Leser Engel curve (6) and w_f is food-at-home's budget share. The average change in benefits was approximately \$64 for participant households. Given a cash-equivalent change in benefits of \$64, we would have expected that, on average, households would spend approximately \$10 on food at home, or about 15%. The remaining \$31 reflects the move from B to point C in figure 3. This suggests that households have a marginal propensity to spend on food at home out of an *increase* in SNAP benefits of 0.48.

While a direct comparison of magnitudes is difficult given differences in survey design, we see that, in the CPS–FSS sample, food spending was 12.7% higher after the benefit increase. In this sample, average food spending was \$96.54 per week, which translates to \$12.26 additional dollars spent on food at home as a result of the benefit increase. The average increase in benefit levels in the CPS–FSS sample was approximately \$23 per week (year over year), which implies that roughly 53% of the *increase* in SNAP benefits was spent on food—in keeping with results from the CEX.

Table 8 summarizes reviews by Fraker (1990) and Fox, Hamilton, and Lin (2004) as well as estimates of marginal propensities to spend from other studies discussed in this article. Fraker (1990) found that most estimates of the marginal propensity to spend from SNAP ranged from 0.17 to 0.47. Fox, Hamilton, and Lin (2004) found the estimates of the marginal propensity to spend from SNAP ranged from 0.17 to 0.86, although most estimates were between 0.20 and 0.40. On average, studies have found households have a marginal propensity to spend out of SNAP of around 0.30, while households have a marginal propensity to spend out of cash income of 0.05. Comparing our findings to the results in table 8, we can see our preferred calculation of marginal propensity to spend out of an increase in SNAP benefits is higher than the average of these calculations, at the upper end of the range of previous work that reports violations of the Southworth hypothesis. A couple of caveats. First, our estimate is the propensity to spend out of an *increase* in benefits and so results may not be directly comparable. Further, a high marginal propensity to spend may also reflect the extremely volatile macroeconomic conditions affecting both treatment and control groups during the study period.

Table 8. Summary: Marginal Propensities to Spend

Authors	MPS from Food Stamps	Time Period
Hoynes and Schazenbach (2009)	0.163	1968–1978
Breunig and Dasgupta (2005)	0.298	1990s
Fox, Hamilton, and Lin (2004)	0.17–0.86	1970s–2000s
Levedahl (1995)		
Mean	0.263	1990s
Fraker (1990)	0.17–0.47	1970s–1980s
Moffitt (1989)		
Linear	0.16	1982
Log	0.11	1982
Senauer and Young (1986)		
PSID 1978	0.05	1978
PSID 1979	0.073	1979

What drives the above results? Previous work has advanced a number of theories including intrahousehold bargaining (Breunig and Dasgupta 2002, 2005), stigma associated with SNAP use (Levedahl 1995) and budgeting or obligation (Senauer and Young 1986). An alternative theory—related to the budgeting obligation hypothesis—is Thaler's (1980, 1985) theory of mental accounting. Mental accounting posits that households categorize income based on its source: salary, asset, or future income. Accordingly, household expenditure is assigned to specific labeled income accounts. Because of this, the marginal propensity to spend may differ across income accounts; money from one category of income may not be equivalent to money from another and is allocated to specific and distinct expenditure categories (Rockenbach 2004). In this context, participants may classify SNAP benefits into

a specific income account intended only for food-at-home spending; as this specific income account increases with an increase in benefits, food expenditure increases disproportionately. The implication is that the marginal propensity to spend from SNAP benefits and from income need not necessarily be equivalent.

Conclusion

We study the effects of large increase in SNAP benefits on the food-at-home spending of participants during a time of economic crisis. We find that SNAP participants significantly increase spending on food at home as a result of an *increase* in benefits. The effect is larger than standard theory would predict. For households that participate in the program, the policy change brought about a 0.72% increase in food-at-home budget share. Similarly, a 1% increase in benefits causes a 0.12% increase in food-at-home budget share. We find an estimate of the marginal propensity to spend out of the increase in SNAP benefits of 0.48. Results are robust to a wide range of sensitivity analyses. These findings are consistent with earlier work in the agricultural economics literature that finds that SNAP participants do not necessarily treat SNAP benefits and cash equivalently. An important caveat is that our study period is in the middle of the largest economic downturn since the Great Depression; as a result some caution should be taken in extrapolating from these results to a less tumultuous period.

These results also shed light on current federal policies. The expiration of the ARRA benefit increases and the recent farm bill—the Agricultural Act of 2014—will lead to reductions in SNAP benefits. Because we find a large increase in benefits induces households to increase their food expenditure share by more than they would with cash, we speculate that a cut to benefits may, in turn, induce households to decrease household food expenditure.

References

Angrist, J.D., and J.S. Pischke. 2008. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton, NJ: Princeton University Press.

———. 2010. The Credibility Revolution in Empirical Economics: How Better Research Design Is Taking the Con out of Econometrics. *Journal of Economic Perspectives* 24 (2): 3–30.

Breunig, R., and I. Dasgupta. 2002. A Theoretical and Empirical Evaluation of the Functional Forms Used to Estimate the Food Expenditure Equation of Food Stamp Recipients: Comment. *American Journal of Agricultural Economics* 84 (4): 1156–60.

———. 2005. Do Intra-household Effects Generate the Food Stamp Cash-Out Puzzle? *American Journal of Agricultural Economics* 87 (3): 552–68.

Browning, M., and T. Crossley. 2009. Are Two Cheap, Noisy Measures Better Than One Expensive, Accurate One? *American Economic Review* 99 (2): 99–103.

Cunnyngham, K. 2012. Reaching Those in Need: State Supplemental Nutrition Assistance Program Participation Rates in 2010. Mathematica Policy Research AG-3198-K-12-0009.

Currie, J. 2003. "U.S. Food and Nutrition Programs" In *Means-Tested Transfer Programs in the United States*, ed. Robert Moffitt, 199–250. Chicago: University of Chicago Press for NBER.

Czajka, J., A. Peterson, B. McGill, B. Thorn, and C. Warner-Griffen. 2012. The Extent and Nature of Underreporting of SNAP Participation in Federal Surveys. Insight Policy Research AG-3198-B-11-0011.

Food Research and Action Center. 2011. SNAP/Food Stamp Participation—2011. http://frac.org/reports-and-resources/snap food-stamp-monthly-participation-data (accessed December 10, 2011).

Fox, M.K., W. Hamilton, and B. Lin. 2004. Effects of Food Assistance and Nutrition Programs on Nutrition and Health: Executive Summary of the Literature Review. *Food Assistance and Nutrition Research Report 19-4*. Washington, DC: U.S. Department of Agriculture, Economic Research Service.

Fraker, T. 1990. The Effects of Food Stamps on Food Consumption: A Review of the Literature. Washington, DC: U.S. Department of Agriculture, Food and Nutrition Service.

Gundersen, C., and B. Kreider. 2008. Food Stamps and Food Insecurity: What Can

Be Learned in the Presence of Nonclassical Measurement Error? *Journal of Human Resources* 43 (2): 352–82.

Ho, D., K. Imai, G. King, and E. A. Stuart. 2011. MatchIt: Nonparametric Preprocessing for Parametric Causal Inference. *Journal of Statistical Software* 42 (8) (accessed September 1, 2011).

Hoynes, H., and D. Whitmore Schanzenbach. 2009. Consumption Responses to In-Kind Transfers: Evidence from the Introduction of the Food Stamp Program. *American Economic Journal: Applied Economics* 1 (4): 109–39.

Iacus, S.M., G. King, and G. Porro. 2011. Causal Inference Without Balance Checking: Coarsened Exact Matching. *Political Analysis* (accessed September 1, 2011).

Kreider, B., J.V. Pepper, C. Gundersen, and D. Jolliffe. 2012. Identifying the Effects of SNAP on Child Health Outcomes When Participation Is Endogenous and Misreported. *Journal of the American Statistical Association* 107 (499): 958–75.

Levedahl, J.W. 1995. A Theoretical and Empirical Evaluation of the Functional Forms Used to Estimate the Food Expenditure Equation of Food Stamp Recipients. *American Journal of Agricultural Economics* 77 (4): 960–68.

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

Rank, M., and T. A. Hirschl. 2009. Estimating the Risk of Food Stamp Use and Impoverishment During Childhood. *Pediatrics and Adolescent Medicine* 163 (11): 994–9.

Rockenbach, B. 2004. The Behavioral Relevance of Mental Accounting for the Pricing of Financial Options. *Journal of Economic Behavior and Organization* 53: 513–27.

Senauer, B., and N. Young. 1986. The Impact of Food Stamps on Food Expenditures: Rejection of the Traditional Model. *American Journal of Agricultural Economics* 68 (1): 37–43.

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

Taeuber, C., D.M. Resnick, S.P. Love, J. Stavely, P. Wilde, and R. Larson. 2004. Differences in Estimates of Food Stamp Program Participation Between Surveys and Administrative Records. Working Paper, U.S. Census Bureau.

Thaler, R. 1980. Toward a Positive Theory of Consumer Choice. *Journal of Economic Behavior and Organization* 1 (1): 39–60.

———. Mental Accounting Matters. *Journal of Behavioral Decision Making* 12 (3): 183–206.

USDA. 2011. A Short History of SNAP. www.fns.usda.gov/snap/rules/Legislation/about.htm (accessed December 10, 2011).

Wilde, P.E. 2013. The New Normal: the Supplemental Nutrition Assistance Program. *American Journal of Agricultural Economics* 95 (2): 325–31.

Wilde, P.E., L.M. Troy, and B.L. Rogers. 2009. Food Stamps and Food Spending: An Engel Function Approach. *American Journal of Agricultural Economics* 91 (2): 416–30.

Whitmore, D. 2002. What Are Food Stamps Worth? Working Paper 468, Princeton University Industrial Relations Section.