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The Supplemental Nutrition Assistance Program and Material Hardships among Low-Income Households with Children

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Abstract

This study examines the effects of participation in the Supplemental Nutrition Assistance Program (SNAP) on the risk of food as well as non-food material hardships experienced by low-income households with children. Data are drawn from the 1996, 2001 and 2004 panels of the Survey of Income and Program Participation (SIPP). We identify the effects of SNAP on material hardships by estimating jointly the likelihood of household participation in SNAP and the risk of experiencing material hardships, using a bivariate probit model. We estimate that SNAP reduces household food insecurity by 13.0 percentage points. We also find that SNAP reduces the risk that households will fall behind on their non-food essential expenses including housing (by 7.4 percentage points), utilities (by 15.7 percentage points), and medical costs (by 8.5 percentage points).

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Introduction

This study examines the effects of participation in the Supplemental Nutrition Assistance Program[1] (SNAP) on the food and non-food material hardships of low-income households with children. A primary goal of SNAP is to reduce food insecurity among recipients, and recent studies have found that SNAP reduces food insecurity (Mykerezi & Mills, 2010; Ratcliffe, McKernan & Zhang, 2011). Beyond food insecurity, however, there is little research on the effects of SNAP participation on measures of non-food material hardship.

Data are drawn from the 1996, 2001 and 2004 panels of the Survey of Income and Program Participation (SIPP). We identify the effects of SNAP on material hardships among low-income households with children by estimating jointly the likelihood of household. participation in SNAP and of experiencing non-food material hardships using a bivariate probit model. Our main model specifications include instrumental variables that exploit changes in state SNAP program recertification period lengths and use of biometric eligibility requirements

Our estimates of the negative impacts of SNAP on the risk of food insecurity—a reduction of 13.0 percentage points—are in line with recent existing studies (Ratcliffe et al., 2011). We also find a substantive and statistically significant negative relationship between SNAP participation and the risk that households will fall behind on their essential expenses including housing (by 7.4 percentage points), utilities (by 15.7 percentage points), and medical costs (by 8.5 percentage points).

These findings suggest that SNAP has a sizeable effect not just on the food security of households with children, but also on their non-food material well-being as well. This should have implications for federal policymakers, who are scheduled to consider SNAP reauthorization in 2012.

[1] Formerly the Food Stamp Program.

Background

SNAP benefits were received by 46.2 million individuals in October 2011; in fiscal year 2011, spending on SNAP totaled $75.3 billion. Food security, a primary outcome used to evaluate SNAP, is defined as "access by all people at all times to enough food for an active, healthy life," while food insecurity is the absence of food security (Nord, Kabbani, Tiehen, Andrews, Bickel & Carlson, 2000). Beyond food insecurity, SNAP participation may reduce non-food material hardships by allowing recipients to reallocate resources originally directed toward the purchase of food to other essential expenses, such as housing, utilities and medical costs.

In recent years, scholars have analyzed measures of material hardships as alternatives to the official poverty line for assessing the well-being of low-income families (Cancian & Meyer, 2004; Heflin, Sandberg & Rafail, 2009; Mayer & Jencks, 1989; Nolan & Whelan, 2010; Sullivan, Turner & Danziger, 2008; USDHHS, 2004). Such measures "employ direct indicators of consumption and physical living conditions to examine whether families meet certain basic needs" (USDHHS, 2004, p. V). However, to our knowledge no existing study uses rigorous econometric methods to assess the effects of SNAP on non-food material hardship.

It is not straightforward to evaluate the relationship between SNAP receipt and material hardships because it is likely that households with the most serious problems, after holding observed characteristics constant, are also the most likely to apply for benefits. Wilde (2007) and others have shown that low-income households who receive food stamps are more likely to report food insecurity than similar nonparticipating households (See also Jensen, 2002 Gundersen, Jolliffe & Tiehen, 2009). Gibson-Davis and Foster (2006) write, "the problem with analyzing the impact of food stamps on food insecurity is that unmeasured or unobserved

characteristics are likely correlated with both food stamps use and food security" (p.94, see also Bartfeld & Dunifon, 2006; Gundersen & Kreider, 2008; Wilde & Nord, 2005). Recent studies have used more sophisticated techniques, including instrumental variables approaches, and found a negative relationship between SNAP participation and food insecurity (Borjas, 2004; Mykerezi & Mills, 2010; Nord & Golla, 2009; Ratcliffe et al., 2011; Yen, Andrew, Chen, & Eastwood, 2008).

Borjas (2004) uses state variation in the treatment of immigrants before and after the 1996 welfare reform to test the effects of participation in means-tested programs on the food insecurity of immigrants. He concludes that the evidence "suggests an important [negative] causal link between public assistance and food insecurity" for immigrants (p.1439). Yen et al. (2008) use the 1996-1997 National Food Stamp Program Survey, a small survey of income eligible households, to examine the effects of SNAP participation on food insecurity. They utilize a non-linear instrumental variable approach, with instruments measuring stigma as well as cross-sectional variation in some state SNAP policies and state-level immigrant population shares (state controls are not included). They also find a negative association between SNAP participation and food insecurity. However, their data may not be representative, as households receiving SNAP in their sample were less likely to report food insecurity than eligible households not receiving SNAP, which differs from virtually all nationally-representative samples.

Ratcliffe et al. (2011) pool data from the 1996-2004 SIPP panels and take a bivariate probit approach similar to the one we employ here to measure the effects of SNAP on food insecurity among households who are below 150 percent of poverty and have low assets. They include as instruments changes over time in state outreach spending per capita, use of biometric

requirements, and a term interacting states' treatment of immigrants with noncitizen immigrant status of household heads. They find that SNAP participation substantially and statistically significantly decreases the risk of household food insecurity.[2]

Mykerezi and Mills (2010) use cross-sectional data from the 1999 PSID and utilize static state-level error rates in benefits payments as an instrument, without including state-level controls. This leaves open the possibility that these instruments are capturing state characteristics other than error rates. Mykerezi and Mills also examine the impact on food insecurity of self-reported loss of benefits reportedly due to a decision by a government office. Like Ratcliffe et al., they find that SNAP participation has a substantial and statistically significant negative effect on food insecurity.[3]

Beyond improving food security through increased food consumption, Southworth's (1945) canonical model shows how households can, in most circumstances, indirectly use part of their SNAP benefits for non-food consumption by reducing their out-of-pocket food expenditures and redirecting those resources to other uses. Hoynes and Schanzenbach (2007) use county-level variations in the original date of implementation of the Food Stamps Program (from 1963 to 1975) and data from the PSID and the Decennial Censuses to show that the introduction of the FSP led to an overall increase in household food expenditures, but also to a decrease in out-of-pocket food spending, suggesting that households were redirecting some dollars originally

[2] Ratcliffe et al. (2011) construct their sample in a problematic way. SIPP households only report on the main food insecurity measures once, in reference to a four-month wave, while they report on SNAP receipt in each month of the wave. They treat each reference month that respondents are in the wave as a unique observation, even though the food insecurity outcome is the same across the wave. This artificially inflates their sample and hence reduces their standard errors. They do, however, report that they re-ran models with only one observation per household, and still find that SNAP participation reduces the risk of food insecurity. They do not report if the smaller sample is robust to sensitivity tests.

[3] While not looking at food insecurity, Schmeiser (2011) uses, among other instruments, the maximum combined state and federal Earned Income Tax Credit (which varies by state and time) to instrument SNAP participation to examine child obesity. However, our reading of his specification is that it does not include year fixed effects. Since SNAP participation rates have changed considerably over the past two decades, this leaves open the possibility that identification in this model is being driven by changes in SNAP participation rates over time, which are co-linear with rising EITC benefits over time.

spent on food to other expenses. The Southworth (1945) model predicts that SNAP works essentially as an unconditional cash transfer program, unless participants are "constrained," meaning that their desired food consumption level is less than their SNAP benefit. Evidence from experimental designs (Fraker et al. 1995) and from nationwide consumption surveys (Fraker 1990) indicates that only a small fraction of SNAP participants are constrained. Therefore, for most households, the economic effects of SNAP should be similar to those of a cash transfer program, warranting the analysis of its effects not only on food consumption but also on other non-food expenses. A first step in this investigation is to look at the impact of SNAP on other essential household expenses such as rent, utilities, and medical care expenses, which are captured in standard measures of non-food material hardship included in the SIPP.

To our knowledge, the current paper is the first to use a bivariate probit approach to examine the effects of SNAP participation on measures of both non-food material hardships and household food insecurity among households with children. SNAP serves a heterogeneous population, and the program's impacts may be different for the various sub-groups, such as individuals and families without children and the elderly. By focusing on households with children, the largest group of SNAP recipients, we more precisely model both participation and program effects. We hypothesize that SNAP receipt should increase total household consumption and allow recipients to reallocate out of pocket resources across both food and non-food essential expenses.

Data

Data are drawn from public use files of the SIPP, collected by the U.S. Census Bureau. SIPP interviews are conducted every four months about each individual in the household for each intervening month, gathering data on demographics, income sources, public assistance

program participation, household and family structure, and jobs and work history. We pool data from the 1996, 2001, and 2004 panels of the SIPP, each of which is 3-4 years long.[4]

Recent analyses of a number of large nationally representative surveys that measure income and program participation find that the SIPP generally does a superior job of measuring the income of poor households and measuring public program participation (Czajka & Denmead, 2008; Meyer, Mok, & Sullivan, 2008). Under-reporting of benefits receipt in household surveys (in which respondents do not report public benefits that they have accessed) remains a limitation (Gundersen & Kreider, 2008). However, the SIPP does relatively well in terms of SNAP reporting rates. Meyer et al. (2008) estimate that the SIPP reported 87.7 percent of SNAP participants for 1998, 84.8 percent for 2003, and 82.9 percent for 2005, the years in our study frame that include the material hardship measures.

Our sample includes households with resident children under 18 with at least one adult member over 18. Rather than trying to simulate SNAP eligibility, we follow Mykerezi and Mills (2010) and Ratcliffe et al. (2011) and restrict our sample to households based on low-income.[5] We restrict our main sample to households with an average gross income at or below 150 percent of poverty during the reporting wave (up to 4 reference months), using the monthly household-level poverty thresholds provided in the SIPP. If our sample were restricted by simulated eligibility, a significant proportion of households reporting SNAP participation would be coded as ineligible. This may relate to limitations in comparing income and assets reported in the SIPP with state eligibility calculations, or may be a result of fluctuating household incomes and assets

[4] A few states (Maine, Vermont, Wyoming, North Dakota and South Dakota) were not uniquely identifiable in the 1996 and 2001 panels, so observations from these states are dropped because they cannot be matched with state SNAP policy data (as is done by Gruber and Simon, 2008; and Ratcliffe et al., 2011).

[5] Unlike Ratcliffe et al. 2011, we and Mykerezi and Mills (2010) do not restrict by household assets. Doing so only marginally changes the sample composition and requires merging in assets data collected in other waves, which may not be representative of the household's circumstances when they applied for SNAP or when they completed the topical module with the material hardship questions.

following initial certification. The most important reason for using a gross income threshold for sample selection rather than simulating SNAP eligibility, though, is that there are concerns that income may be endogenous to participation. Households near the eligibility threshold may modify their earnings or assets in ways that makes them eligible (Ashenfelter, 1983). Thus, the effective eligibility threshold may be somewhat higher than the official one. In order to account for this, we use a threshold of 150 percent of the poverty line (rather than SNAP's gross income limit of 130 percent). We test the robustness of our findings to sample selection with sensitivity analyses.

Our key outcome variables are drawn from the SIPP's adult well-being topical modules administered once per panel in wave 8 of the 1996 panel (administered during 1998), wave 8 of the 2001 panel (administered during 2003), and wave 5 of the 2004 panel (administered during 2005). The SIPP is the primary source of nationally-representative data on material hardship in the US (Bauman, 1999; Beverly, 2001; Heflin et al, 2009; USDHHS, 2004; Wu & Eamon, 2010).

Our first measure indicates whether a household broadly had difficulty meeting its essential household expenses. Households were asked "Next are questions about difficulties people sometimes have in meeting their essential household expenses for such things as mortgage or rent payments, utility bills, or important medical care. During the past 12 months, has there been a time when (YOU/YOUR HOUSEHOLD) did not meet all of your essential expenses?" Households that responded affirmatively were classified as having trouble meeting essential expenses. We also examine three additional, more specific, measures that ask whether a household reported falling behind on their rent/mortgage; whether they reported falling behind on their utility bills; and whether anyone in the household did not see a doctor or got to the

hospital when needed because of cost. These are the hardships measured in SIPP that are most likely to be impacted by SNAP participation.[6]

We also report models in which the outcome is food insecurity, to benchmark our estimates against existing studies that focus only on this outcome. The SIPP adult food security measures do not conform exactly to the official USDA food security scale; however, they have been used in several studies and are closely related to the official food security measure (Bitler, Gundersen, & Marquis, 2005; Gundersen et al., 2009; Nord, 2006; Ratcliffe et al., 2011).[7] Households are classified as food insecure if they responded affirmatively to at least two of a set of questions that can be used to measure food insecurity in the Adult Well-being Topical Module. See the Appendix for further details. SIPP households only report on the main food insecurity measures once, in reference to the four months of the wave.

Econometric Model

When dealing with two binary outcomes, an alternative to a linear instrumental variable approach such as two-stage least squares (2SLS) is to jointly estimate the system of equations describing each outcome using non-linear models, in particular a fully observed recursive bivariate probit model, as is done by Ratcliffe et al. (2011) (see Heckman 1978; Greene 1998; Angrist & Pischke, 2009). Consider the following system where i indexes households:

$$SNAP_i^* = Z_i\beta + \epsilon_i \qquad (1)$$

[6] The SIPP adult well-being topical modules (TMs) ask households that reported trouble paying housing and utility costs whether they faced eviction or utility shut off. However, the incidence of these outcomes is so small that they do not adequately allow for the statistical power needed to test the relationship between them and SNAP. The TMs also include questions on housing quality, however, SNAP participants may have greater difficulty reallocating resources formerly spent on food to these expenses. We did estimate models in which the outcome was phone line disconnection. We found no negative effect across all model specifications. We think this may be an outmoded material hardship measure, given the increasing reliance of low-income households on pre-paid cell phones.

[7] Nord (2006) reports that an "assessment of the food security items using statistical methods based on the Rasch measurement model indicated that relative item severities were very nearly identical to those in the 1998 Current Population Survey Food Security Supplement, and analysis of CPS data comparing the SIPP scale with the standard U.S. Food Security Scale indicated that the SIPP scale was reasonably reliable and only moderately biased" (p. 2).

$$y_i^* = X_i\gamma + \delta \text{SNAP}_\text{i} + \text{v}_\text{i} \qquad (2)$$

We posit that (potentially) eligible households decide to participate in SNAP by comparing costs and benefits using a net benefit function or latent index ($SNAP_i^*$), as described by equation (1). We do not observe directly the net benefit index $SNAP_i^*$, but only the program participation decisions. Thus we observe the dummy variable $SNAP_i = 1$ if $SNAP_i^* > 0$, and $SNAP_i = 0$ otherwise.[8]

Our outcomes of interest are several measures of material hardship. Conceptually, we model that households report experiencing a hardship if an underlying latent index of financial distress (y_i^*), as described by equation (2), is above a certain threshold, which can be set to zero without loss of generality. We do not observe y_i^* but only whether the household reports they are experiencing material hardship or not. In, other words, we observe the dummy variable $y_i = 1$ if $y_i^* > 0$ and $y_i = 0$ otherwise.

We assume that the error terms ϵ_i and v_i follow a bivariate normal distribution with variances equal to one and covariance equal to ρ . Placing a restriction on the variances of the random components allows for unique identification of the parameters. We also assume that the errors are serially uncorrelated and homoscedastic.

The system described by equations (1) and (2) is fully-observed and recursive. The fully-observed condition means that endogenous variables appear on the right hand side only as observed (Roodman, 1999). For example, in equation (2) the endogenous variable that appears in the right hand side is $SNAP_i$ (program participation) and not $SNAP_i^*$ (the net benefit latent index). The recursive nature of the system means that there are clearly defined stages of

[8] In our main specification, $SNAP_i$ is measured as SNAP participation in the final month of the wave because respondents' reporting is known to be most accurate in the month closest to the interview (Moore, 2007). In sensitivity analyses we utilize alternative definitions of SNAP participation, including requiring SNAP receipt in all months of the wave, any month of the wave, and just the first month of the wave. Results are robust.

causation (Roodman, 1999; Wilde, 2000). In other words, SNAP participation has a causal impact on material hardship, and thus is included in equation (2), but material hardship does not affect the program participation net benefit latent index and therefore is excluded from equation (1). At first, this may seem a strong assumption, but that is not necessarily true since we are only ruling out any independent causal effect of material hardship after controlling for the effect of observed factors Z_i and modeling the unobserved terms ϵ_i and v_i. Moreover, the recursive nature of the system follows from the condition of logical consistency (Maddala & Lee, 1976).[9]

Parameters identification

Parameters of equation (1) can be consistently estimated via a probit regression. However, if $\rho \neq 0$, then a standard probit regression of equation (2) using the observed SNAP participation variable would produce biased results because $Cov(SNAP_i, v_i) \neq 0$. In particular, if $\rho > 0$, meaning that, after controlling or for the effects of observed characteristics, households who are more likely to participate in SNAP are also more likely to experience material hardship, then the estimated value of δ would be biased upwards. This is the source of the bias that, if not accounted for, produces positive associations between SNAP participation and material hardship, as has been documented between SNAP and food insecurity. Under the distributional assumptions of the error terms, though, consistent estimation of δ requires jointly estimating

[9] Consider rewriting the system in its non-recursive form as follows:

$$SNAP_i^* = Z_i \beta + \theta y_i + \epsilon_i \quad (1a)$$

$$y_i^* = X_i \gamma + \delta SNAP_i + v_i \quad (2a)$$

Then we could substitute equation (1a) into (2a) and obtain the following expression:

$$y_i^* = X_i\gamma + \delta * 1[\epsilon_i > -(Z_i\beta + \theta y_i)] + v_i$$

Thus, we would observe:

$$y_i=1 \text{ if } v_i > -X_i\gamma - \delta * 1[\epsilon_i > -Z_i\beta - \theta]$$
$$y_i=0 \text{ if } v_i \leq -X_i\gamma - \delta * 1[\epsilon_i > -Z_i\beta]$$

Note that if $\theta \neq 0$, then it is possible to find values of v_i and ϵ_i--given the parameters in the model—such that y_i equals both 0 and 1 – or neither. Thus, the model is logically consistent only if $\theta = 0$, i.e. if it is recursive.

equations (1) and (2) within a bivariate probit model.

An important misconception in the literature is that identification of the parameters in a system described by equations (1) and (2) requires the use of instrumental variables. For example, Maddala and Lee (1976) argue that the parameters of the second equation are not identified without exclusion restrictions on the exogenous variables. Ratcliffe et al. (2011) use a similar method to ours to study the effect of SNAP on households food security and assert that "The ability of our bivariate probit model to correct for the endogeneity of SNAP receipt depends on the explanatory power of the instruments in the SNAP receipt equation and on whether it is appropriate to exclude the instruments from the food insecurity equation" (p. 1088).

However, within the bivariate probit framework, identification of the parameters in equation (2) does not require exclusion restrictions. Wilde (2000) builds on Heckman (1978) and shows that in a fully-observed recursive system only the existence of an exogenous regressor with varying values in both equations is sufficient for identification of the parameters of the model. In other words, the parameters in equations (1) and (2) would be identified even if $Z_i = X_i$ as long as they contained a regressor with varying values. The estimates will be valid as long as the covariates included in X_i (or Z_i) are exogenous (uncorrelated with the errors) and the distributional assumptions of the disturbances terms are correct.[10]

It is important, however, to recognize that, without exclusion restrictions, identification is coming from the non-linearities introduced by censoring and from the structure of the model, rather than by a (quasi) natural experiment as in the standard linear instrumental variables approach. Even in the case where instruments are included that meet standard metrics for strength, it is still possible that the non-linearities are driving the estimates, which may lead to a

[10] For example, whereas heteroskedasticity only affects the efficiency of linear models, it may be a more serious threat for the consistency of limited dependent variable models like the probit.

mis-interpretation of the type of evidence produced by these models. In this case, it is important to verify to what extent the results are being driven by the instruments or by the structure of the model. We conducted two tests: 1) estimating the bivariate model without instruments and 2) using a standard linear IV approach.

Instruments

In our main specification, vector Z_i encompasses X_i but also includes instruments coming from SNAP state policy variables, which are predicted to increase the cost of participation. Policy data by state-year are drawn from a dataset prepared by USDA ERS researchers, similar to that used by Ratcliffe et al. (2011). We selected two instruments that are strong predictors of SNAP participation in our sample. Our first instrument is the proportion of assistance units with earners within each state with a recertification period of 3 months or less, by state-year. Numerous studies have shown that the length of recertification periods has a significant effect on SNAP participation (Hanratty, 2006; Ratcliffe, McKernan and Finegold, 2008; Ribar, Edelhoch & Liu, 2008; Schmeiser, 2011), and various constructions of state recertification periods have been used for instrumenting SNAP participation (Yen et al., 2008; Schmeiser, 2011). Recertification periods typically range between 1 and 12 months, and in some cases longer. As a result of federal encouragement (exogenous to conditions within states), the late 1990s saw a large increase in the proportion of recipients—especially those in assistance units with earners—recertified within three months. This proportion, though, fell considerably after 2000 (Hanratty, 2006).[11]

Our second instrument is the use of biometric technology (mostly fingerprinting of applicants), used with the goal of reducing fraud. We hypothesize—as did Ratcliffe et al.

[11] The average percentage of states' caseloads that had a recertification period of three months or less fell considerably from 1998 to 2003 and from 2003 to 2005.

(2011)—that this should discourage program participation. Biometrics technology was used by Texas, Arizona, and New York throughout our study period, but was introduced in California halfway through the study period. Massachusetts implemented biometrics and then ended it during our study period. While this instrument relies on changes in only two states, biometric requirements have a significant impact on the probability of SNAP participation.[12] When our models are run using 2SLS, the F-statistic associated with the excluded instruments in the first stage is 21.2, above the standard suggested cut-off value of 10.0 (Stock, Wright & Yogo, 2002).

Other controls included in X_i (and in Z_i) are demographic and geographic characteristics that have been shown to be related to SNAP participation and/or material hardship. We include a count variable for the number of children in the household[13] and an indicator for household headship (headed by husband/wife, single-male headed, and single-female headed). We also control for the highest level of schooling reported by an adult household member, and include an indicator for the presence of a full-time worker. Race and ethnicity, age (and age squared), sex, metropolitan residence and U.S. citizenship of the household head are included. We also control for the state-month unemployment rate. Finally, dummies for state, year, and calendar month are included in all models.

To estimate the average causal effect of SNAP participation on the probability of experiencing material hardship, we average the difference between the predicted hardship probability with and without SNAP for each individual in the sample. In other words, we use the following formula:

$$\mathrm{E}\left[\mathrm{y_{i,j,t}}\middle|\mathrm{X_{i,j,t}}, \mathrm{SNAP_{i,j,t}} = 1\right] - \mathrm{E}\left[\mathrm{y_{i,j,t}}\middle|\mathrm{X_{i,j,t}}, \mathrm{SNAP_{i,j,t}} = 0\right] = \frac{1}{\mathrm{n}}\sum_{\mathrm{i=1}}^{\mathrm{N}}\left(\Phi\left(\mathrm{X_{i,j,t}}\,\gamma + \delta\right) - \Phi\left(\mathrm{X_{i,j,t}}\,\gamma\right)\right) \qquad (3)$$

[12] The percentage of our sample subject to biometric requirements rose from 1998 to 2003 and fell from 2003 to 2005.

[13] Originally we used three age categories, but consistency in the point estimates led us to collapse this variable into one.

Alternatively, we estimated the average causal effect of SNAP participation by the percentage change in the probability of material hardship, given by the following formula:[14]

$$\frac{E[y_{i,j,t}|X_{i,j,t},SNAP_{i,j,t}=1]-E[y_{i,j,t}|X_{i,j,t},SNAP_{i,j,t}=0]}{E[y_{i,j,t}|X_{i,j,t},SNAP_{i,j,t}=0]} * 100 = \frac{1}{n}\sum_{i=1}^{N}\left(\frac{\Phi(X_{i,j,t}\gamma+\delta)}{\Phi(X_{i,j,t}\gamma)}-1\right) * 100 \quad (4)$$

Results

Table 1 presents weighted summary statistics. Column 1 reports means for the households with incomes above 150 percent of poverty who are excluded from the multivariate analyses. The next three columns are restricted to households below 150 percent of poverty, divided into 4,948 observations for low-income households not reporting SNAP (column 3) and 3,079 observations for those reporting receipt of SNAP benefits (column 4). Only 13.4 percent of households with incomes above 150 percent of poverty lived in households that reported difficulties meeting essential expenses, and only 6.2 percent reported food insecurity. Among households at or below 150 percent of poverty, 29.7 percent of those not receiving SNAP and 48.7 percent of SNAP recipients reported trouble meeting their essential expenses. Similarly, just over a third of low-income SNAP households reported that they were food insecure, compared to 21.4 percent of non-SNAP households. This positive association between reported SNAP participation and measures of material hardship are likely the result of the selection process of what households decide to participate in SNAP. Among those with incomes below 150% of the poverty line, the average monthly income of SNAP households is 67.8 percent of poverty, compared to 94.4 percent of poverty for non-SNAP households. SNAP households are far more likely to be female-headed (67.9 vs. 34.5 percent), and the heads of these households are more likely to be Black (37.1 vs. 19.4 percent) and less likely to be of Hispanic Origin (22.3 vs. 28.1 percent) than families not reporting SNAP.

[14] Standard errors for average causal effects were calculated using 250 bootstrap (within state) replications.

Table 2 reports coefficients and standard errors from bivariate probit models with two key outcomes: food insecurity and trouble paying household essential expenses.[15] Estimates are reported as probit coefficients; average causal effects for the effects of SNAP participation on these outcomes are reported in Table 3 (along with the other outcomes). The SNAP participation equations are modeled jointly with food insecurity in columns 1 and 2 and jointly with difficulty meeting essential expenses in columns 3 and 4. We find that, after controlling for other factors, each additional child in a household is associated with a higher probability of SNAP participation. Female-headed households are much more likely to participate than those headed by a married couple. Households in which the reference person is Black or Asian or Pacific Islanders are more likely to participate than those in which the reference person is white, and households in which the reference person is a US citizen are more likely to participant than those with a non-citizen reference person. Increased education is associated with a decreased probability of SNAP participation, and households with 1 or more full-time workers are less likely to participate than families without.

Our instruments are strong predictors of SNAP participation.[16] As a larger proportion of a state's SNAP caseloads are recertified in three months or less, the probability of participation decreases. Use of biometrics is also associated with a reduction in the probability of participation. Columns 1 and 3 of Table 2 also report on the correlation coefficient between the error components in the SNAP participation equation and in the material hardship equation. As expected, the correlation coefficient is positive ($\rho_{\epsilon v} > 0$), large, and statistically significant in both models. This means that, after controlling for observed characteristics, there are unobserved

[15] In line with the existing literature, our naïve probits that use the observed SNAP variable to predict our outcomes consistently lead to positive and statistically significant point estimates, meaning that observed SNAP participation is associated with increased material hardship.

[16] The Chi-square statistics for the null hypothesis that the excluded instruments coefficients are zero are 53.80 (p-value 0.0000) for column 1 and 30.62 (p-value of 0.0000) for column 3.

factors driving both SNAP participation and material hardship, so that households that are more likely to report SNAP are also more likely to report experiencing food insecurity or difficulty meeting essential household expenses.

Columns 2 and 4 report on the effect of SNAP participation and other covariates on the latent indexes for food insecurity (columns 2) and trouble meeting essential expenses (column 4). There is significant consistency across the exogenous covariates shared by the two equations. Additional children are associated with increased food insecurity and non-food material hardship. Female-headed households are more likely to experience both outcomes than households headed by a married couple. Higher levels of education and the presence of full-time workers are both associated with a lower risk of food insecurity and trouble meeting essential expenses. Households in which the reference person is black are more likely to experience both outcomes than households in which the reference person is white. Households in which the reference person is of Hispanic origin are more likely to be food insecure but not more likely to experience non-food material hardship that families in which the reference person is non-Hispanic.

The results in Table 2 indicate that SNAP participation has a statistically significant negative effect on both the latent indexes for food insecurity and for difficulty meeting essential household expenses. In table 3, we translate those effects into average causal effects on the probability of reporting (1) food insecurity; (2) difficulty meeting essential household expenses; and the three sub-categories of (2): (3) falling behind on rent or mortgage; (4) falling behind on utility bills and (5) medical hardship. We present estimates from our main specification in percentage points in column 1 and as percentage changes in column 2.

SNAP participation results in a statistically significant 13.0 average percentage point reduction in the risk of being food insecure, which is equivalent to an average decrease of 41.7 percent in its incidence.[17] This effect size is quite close to what is reported by Ratcliffe et al. (2011), who find that SNAP reduces food insecurity among households (not restricted to households with children) by 16.2 percentage points, even though they use a different set of instruments (a point we return to later).

We also find that SNAP is associated with a statistically significant 28.8 average percentage point reduction in the risk that households will have trouble meeting their essential expenses, equivalent to a 60.1 percent reduction in the incidence of non-food material hardship. SNAP participation leads to a statistically significant decrease of 7.4 percentage points (or 35.7 percent) in the risk that households fall behind on their rent or mortgage, and a 15.7 percentage point (46.8 percent) decrease in the risk of falling behind on household utility bills. Finally, SNAP is associated with a decrease of 8.5 percentage points in medical hardship (a reduction of 47.3 percent).[18]

These results from columns 1 and 2 appear to provide relatively robust evidence from an instrumental variable model that SNAP not only reduces the food insecurity of recipient households, but also has a statistically significant and substantial negative effect on non-food material hardships. The standard metrics of strength for our instruments suggest that the instruments are performing well. Importantly, though, columns 3 and 4 report point estimates from a simple test to assess the source of our identification of these effects. These columns report

[17] We calculate percentage change effects for all outcomes by estimating the average predicted incidence of the material hardship outcome if no household participates in SNAP and subtracting from it the incidence if all households were to participate in SNAP.

[18] It is worth noting that the point estimates for the marginal effect of SNAP coverage in percentage points for rent + utilities + medical hardship add to approximately the marginal effect in percentage points on difficulty meeting essential expenses. These three categories make up the prompt given to respondents in the broader question, which suggests consistency across respondent reporting.

on results from bivariate probit models that are identical to those reported in columns 1 (and 2) in every way, except that our instruments (recertification periods and biometric requirements) are omitted. The resulting point estimates for the impact of SNAP participation on material hardship are virtually identical to the models with the instruments: a 13.9 percentage point decrease in food insecurity, a 33.9 percentage point decrease in trouble meeting essential expenses, a 9.4 percentage point decrease in the risk of falling behind on rent/mortgage, a 19.7 percentage point decrease in the risk of falling behind on utility bills, and a 9.2 percentage point decrease in the probability of not seeking medical care.

Moreover, when we estimated a standard 2SLS regression, in no case do we obtain a statistically significant, negative point estimate. In two cases the point estimates for the effect on food insecurity and problems meeting essential expenses are negative, but neither are statistically significant. Taken together, these results suggest that identification of our estimates does not rely on the instruments, but rather is coming from the structural form of the bivariate probit model.

As previously discussed, theoretically, instruments are not required for identification of the parameters in the bivariate probit. According to Wilde (2000), one exogenous regressor with enough variation should suffice to identify δ in equation (2). Table 4 tests the robustness of our results to the sequential introduction of model covariates that are arguably exogenous. In the case of food insecurity, a negative and statistically significant effect of SNAP is achieved after controlling only for the number of children in the household. Note that the estimated effects are very stable to the introduction of additional covariates. In the case of problems meeting essential expenses, it takes adding just two exogenous controls (number of children and household structure) to obtain a negative and statistically significant effect. Similarly, adding extra controls

does not change the estimated effects significantly. Thus, Table 4 suggests that the estimated effects are robust to potentially unobserved factors and provides reassurance of their validity.

In table 5, we report on a series of additional sensitivity tests. We began by trying alternative constructions of our observed SNAP receipt variable, requiring 1) receipt in all reference months of the wave, 2) receipt in any reference month, and finally 3) receipt in the first reference month of the wave. In all cases, the point estimates of the causal effects on food insecurity and non-food material hardship remain statistically significant. Requiring participation in any reference month or the first reference month reduces the size of the point estimates somewhat.

We also restricted the sample at two alternative income thresholds. Our estimates at the 175 percent threshold are highly significant. At the more-restrictive 125 percent threshold sample, the point estimates are smaller and the food insecurity outcome becomes insignificant, most likely due to the loss of statistical power because of the smaller sample size.

Some studies on SNAP and food insecurity control for income (Yen et al., 2008). Although this is an endogenous variable, we do this in panel C of table 5 (using dummies for household income falling within 0-50%, 51-100%, and 101-150% of poverty level) and our results remain robust. We also ran a specification that drops all SIPP observations with imputed values. Finally, we ran models adding household-level weights. In all cases, our results remain robust.

Discussion

Because SNAP participation may allow households to reallocate resources otherwise directed toward purchase of food to other essential expenses, it can affect economic well-being in many dimensions. The prominence of SNAP among means-tested programs suggests that it

should be evaluated using a broader set of material hardship outcomes than food insecurity and other food-related outcomes. To our knowledge, this study is the first to use a bivariate probit approach to estimate the effect of SNAP benefits on non-food measures of material hardship.

Under-reporting of benefits receipt in the SIPP remains a limitation, even though the SIPP does relatively well in terms of reporting rates (Meyer, Mok, & Sullivan, 2008). Unfortunately, there is currently no source of nationally-representative data linking the demographic characteristics of individuals with administrative data on SNAP participation. Thus, the current study would be impossible with any existing source of administrative data.

There are now a number of studies using different data and different methods that offer evidence that SNAP reduces food insecurity. We find that our estimates of the effects of SNAP of food insecurity are similar to those reported by Ratcliffe et al. (2011). It should be noted, though, that our point estimates are virtually identical in models with and without instruments, even though our instruments meet standard metrics of strength. Thus, we are confident that identification of our estimates is coming from the structure of the bivariate probit. The same may be true in the case of Ratcliffe et al.'s findings on food insecurity as well, and may be true of other papers in the SNAP and food insecurity literature—and even other literatures—that use instrumental variables in non-linear estimation frameworks.

While our own estimates are not evidence from a "quasi" natural experiment, they remain suggestive that SNAP participation significantly reduces not just food insecurity, but also non-food material hardship. Our estimates suggest that households spread their SNAP benefit over food and non-food essential expenses, and that SNAP is having a substantively large and broad impact on the material well-being of recipient households. This is an important finding, largely because of the major changes to means-tested income maintenance programs since the 1990s. In

effect, SNAP is acting like a negative income tax, providing a base level of support to recipient households that is not (typically) conditioned on labor force participation. Because it is playing this important role in the US, future studies of SNAP should include outcomes that are commiserate, even in the absence of adequate instruments.

At $75.3 billion in federal spending for fiscal year 2011, and serving 46.2 million people SNAP is now our largest means-tested income transfer program both in terms of caseload and cost. As federal policy makers consider reauthorization of the program in 2012, it is important to keep in mind that the benefits of the program extend beyond food. If federal or state policy makers adopt policies that put greater restrictions on access to SNAP—through shorter recertification periods, biometric requirements, or re-instituting asset tests—our results suggests that this would be associated with an increase not just in food insecurity, but further non-food material hardship among households with children.

Table 1: Sample means, Households with Children

Characteristics	> 150% poverty	<= 150% of poverty		
		All	Non-SNAP	SNAP
	(1)	(2)	(3)	(4)
Observations	24,347	8,027	4,948	3,079
Material Hardship characteristics				
Food Hardship				
Food Insecurity in past four months	0.062	0.261	0.214	0.345
Non-Food Hardship				
Problem meeting essential expenses	0.134	0.365	0.297	0.487
Did not pay full rent	0.053	0.177	0.142	0.240
Did not pay full gas, oil, or electricity bills	0.095	0.277	0.214	0.389
Did not go to the doctor because of cost	0.052	0.139	0.133	0.150
Household Characteristics				
SNAP Participation	0.026	0.360	0.000	1.000
Household Income as % Poverty	4.244	0.848	0.944	0.678
Number of children	1.821	2.284	2.182	2.464
Household structure				
Headed by husband/wife	0.773	0.467	0.584	0.260
Male Headed	0.066	0.068	0.071	0.061
Female Headed	0.160	0.465	0.345	0.679
Maximum education Level				
Less than High School	0.031	0.203	0.164	0.273
High School	0.185	0.352	0.332	0.387
Some college	0.380	0.339	0.358	0.304
BA degree or above	0.404	0.106	0.146	0.036
1+ Full time workers in household	0.891	0.554	0.665	0.355
Live in a metropolitan area	0.811	0.762	0.768	0.752
State-month unemployment rate	5.196	5.343	5.318	5.387
Reference person characteristics				
Male	0.537	0.343	0.424	0.197
Female	0.463	0.657	0.576	0.803
Age	40.533	37.480	38.203	36.192
Race				
White	0.829	0.678	0.741	0.567
Black	0.111	0.257	0.194	0.371
American Indian	0.020	0.024	0.025	0.022
Asian or Pacific Islander	0.039	0.040	0.040	0.040
Hispanic Origin	0.125	0.260	0.281	0.223
US citizen	0.928	0.836	0.807	0.888

Source: Authors' analyses of a pooled sample from the 1996-2004 panels of the SIPP

Note: Means are weighted. Observations belong to the fourth reference month only. Households must have a positive number of children. The household reference person must be 19 or older. We used the following waves: 1996w8, 2001w8, 2004w5. These are the waves in which adult well-being topical modules were collected.

Table 2: Effects of SNAP Participation on Material Hardships of Low-Income Households with Children
(Linear index coefficients and standard errors reported)

	SNAP Participation (1)	Food Insecurity (2)	SNAP Participation (3)	Problem meeting essential expenses (4)
SNAP Participation	---	-0.427**	---	-0.874***
		[0.168]		[0.248]
Household characteristics				
Number of children	0.169***	0.063***	0.168***	0.092***
	[0.014]	[0.019]	[0.014]	[0.018]
Married couple Headed Household	---	---	---	---
Male Headed Household	0.315***	0.295***	0.317***	0.273***
	[0.061]	[0.063]	[0.057]	[0.075]
Female Headed Household	0.579***	0.317***	0.589***	0.317***
	[0.035]	[0.063]	[0.037]	[0.073]
Less than High School	---	---	---	---
High School Diploma	-0.204***	-0.170***	-0.197***	-0.113***
	[0.037]	[0.033]	[0.039]	[0.036]
Some college	-0.392***	-0.225***	-0.389***	-0.070
	[0.046]	[0.038]	[0.047]	[0.072]
BA degree or Advanced degree	-0.853***	-0.548***	-0.844***	-0.534***
	[0.070]	[0.073]	[0.074]	[0.078]
1+ full time workers	-0.652***	-0.362***	-0.655***	-0.455***
	[0.031]	[0.059]	[0.032]	[0.054]
Lives in a metropolitan area	-0.069	0.038	-0.077*	-0.047
	[0.047]	[0.049]	[0.047]	[0.039]
State-month unemployment rate	0.052	0.085***	0.064*	0.060*
	[0.038]	[0.026]	[0.038]	[0.032]
Reference person characteristics				
Female	0.129**	0.131***	0.113**	0.129***
	[0.052]	[0.048]	[0.050]	[0.042]
Age	-0.025***	0.020***	-0.025***	0.010
	[0.006]	[0.006]	[0.006]	[0.009]
Age Squared	0.000**	-0.000***	0.000**	-0.000**
	[0.000]	[0.000]	[0.000]	[0.000]
White	---	---	---	---
Black	0.333***	0.099**	0.331***	0.186***
	[0.038]	[0.048]	[0.037]	[0.047]
American Indian	0.165	0.026	0.179	0.036
	[0.141]	[0.132]	[0.144]	[0.099]
Asian or Pacific Islander	0.296***	0.084	0.295***	-0.012
	[0.088]	[0.084]	[0.092]	[0.113]
Hispanic Origin	0.063	0.152**	0.079	-0.015

	[0.086]	[0.060]	[0.091]	[0.038]
US citizen	0.214**	0.016	0.209**	0.184***
	[0.083]	[0.056]	[0.086]	[0.054]
State Policies				
Biometrics	-0.350***		-0.283***	
	[0.058]		[0.055]	
Short period recertification	-0.186**		-0.156*	
	[0.093]		[0.088]	
Correlation of errors terms	0.403***		0.726***	
	[0.110]		[0.148]	
Observations	8,027	8,027	8,027	8,027

Source: Authors' analyses of a pooled sample from the 1996-2004 panels of the SIPP

Notes: All estimations include state dummies, year dummies and calendar month dummies. Standard errors [in brackets] are clustered by state.

*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Table 3: Average Causal Effect of SNAP Participation on Material Hardships

	Bivariate Normal Results				IV approach (2SLS)		
	With Instruments		Without Instruments		Using recertification period	Using Biometrics	Both Instruments
	percentage points	percentage change	percentage points	percentage change	All estimates are in percentage points		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Food Hardship							
(1) Food Insecurity	-0.130**	-0.417***	-0.139***	-0.437***	0.626	-0.196	0.138
	[0.051]	[0.140]	[0.045]	[0.115]	[0.399]	[0.144]	[0.202]
Non-Food Hardship							
(2) Problem meeting essential expenses	-0.288***	-0.601***	-0.339***	-0.668***	0.298	-0.027	0.105
	[0.081]	[0.132]	[0.056]	[0.082]	[0.285]	[0.153]	[0.130]
(3) Did not pay full rent	-0.074**	-0.357***	-0.094***	-0.430***	0.302	0.236**	0.259**
	[0.030]	[0.121]	[0.029]	[0.100]	[0.249]	[0.114]	[0.130]
(4) Did not pay full gas/oil/electricity bills	-0.157***	-0.468***	-0.197***	-0.549***	0.434	0.042	0.206
	[0.061]	[0.146]	[0.057]	[0.121]	[0.335]	[0.119]	[0.168]
(5) Did not go to the doctor because of cost	-0.085**	-0.473**	-0.092**	-0.502***	-0.048	-0.196	-0.136
	[0.041]	[0.193]	[0.040]	[0.180]	[0.292]	[0.153]	[0.168]

Source: Authors' analyses of a pooled sample from the 1996-2004 panels of the SIPP

Notes: All estimations include state dummies, year dummies and calendar month dummies. Standard errors are calculated from 250 bootstrap draws within each state.

*** p-value<0.01, ** p-value<0.05, * p-value<0.1

Table 4: Sensitivity of SNAP Participation Effects to inclusion of different controls

In percentage points

	Model Specifications									
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
I. Food Insecurity										
SNAP Participation	0.133***	-0.166	-0.152***	-0.176***	-0.154***	-0.159***	-0.130***	-0.133***	-0.135***	-0.139***
	[0.010]	[0.130]	[0.033]	[0.036]	[0.042]	[0.039]	[0.041]	[0.041]	[0.042]	[0.044]
Errors correlation (rho)	0.000	0.545*	0.467***	0.502***	0.432***	0.446***	0.390***	0.397***	0.400***	0.419***
	[0.063]	[0.260]	[0.081]	[0.092]	[0.111]	[0.106]	[0.106]	[0.105]	[0.101]	[0.101]
II. Problem meeting essential expenses										
SNAP Participation	0.185***	0.484*	-0.289***	-0.301***	-0.321***	-0.312***	-0.308***	-0.324***	-0.329***	-0.339***
	[0.011]	[0.285]	[0.062]	[0.063]	[0.047]	[0.048]	[0.066]	[0.062]	[0.057]	[0.062]
Errors correlation (rho)										
	0.000	-0.549	0.735***	0.761***	0.790***	0.771***	0.760***	0.796***	0.809***	0.841***
	-	[0.757]	[0.096]	[0.089]	[0.098]	[0.094]	[\0.118]	[0.113]	[0.104]	[0.100]
Observations	8,027	8,027	8,027	8,027	8,027	8,027	8,027	8,027	8,027	8,027
Number of children		X	X	X	X	X	X	X	X	X
Household structure			X	X	X	X	X	X	X	X
Maximum education Level				X	X	X	X	X	X	X
1+ Full time workers in household					X	X	X	X	X	X
Reference person sex and age						X	X	X	X	X
Race, ethnicity and citizenship							X	X	X	X
Urban/Rural area								X	X	X
State unemployment rate									X	X
State FE, year FE and month FE										X

Source: Authors' analyses of a pooled sample from the 1996-2004 panels of the SIPP

Notes: All estimations include state dummies, year dummies and calendar month dummies. Standard errors are calculated from 250 bootstrap draws within each state.

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

Table 5: Average Causal Effect of SNAP Participation on Material Hardships, Sensitivity Analyses
(Effects in percentage points reported)

	Food Insecurity	Problem meeting essential expenses
A. Alternative definitions of SNAP participation		
= 1 if participation in all reference months, 0 otherwise	-0.161***	-0.315***
	[0.051]	[0.072]
= 1 if participation in any reference month, 0 otherwise	-0.092*	-0.211**
	[0.054]	[0.088]
= 1 if participation in first reference month, 0 otherwise	-0.122**	-0.276***
	[0.057]	[0.083]
B. Alternative samples by Income		
175% of Poverty	-0.163***	-0.309***
	[0.037]	[0.058]
125% of Poverty	-0.049	-0.216**
	[0.056]	[0.107]
C. Other sensitivity tests		
Controlling for household income	-0.130***	-0.229**
	[0.047]	[0.102]
Dropping imputed values	-0.192***	-0.373***
	[0.043]	[0.058]
Weighted regressions	-0.152***	-0.280***
	[0.053]	[0.092]

Source: Authors' analyses of a pooled sample from the 1996-2004 panels of the SIPP
Notes: All estimations include state dummies, year dummies and calendar month dummies. Standard errors are calculated from 250 bootstrap draws within each state.
*** p-value<0.01, ** p-value<0.05, * p-value<0.1

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APPENDIX

Food security in the SIPP

We defined a household as being *food insecure* if they report at least two of the following, in reference to the previous 4 months (Nord, 2006):

- The food the household bought didn't last and they didn't have money to get more (answers "often" or "sometimes").
- The household couldn't afford to eat balanced meals (answers "often" or "sometimes").
- The adults in the household ever cut the size of their meals or skipped meals because there wasn't enough money for food (answer "yes").
- The adults in the household ever ate less than they felt they should because there wasn't enough money to buy food (answer "yes").
- The adults in the household ever did not eat for a whole day because there wasn't enough money for food (answer "yes").