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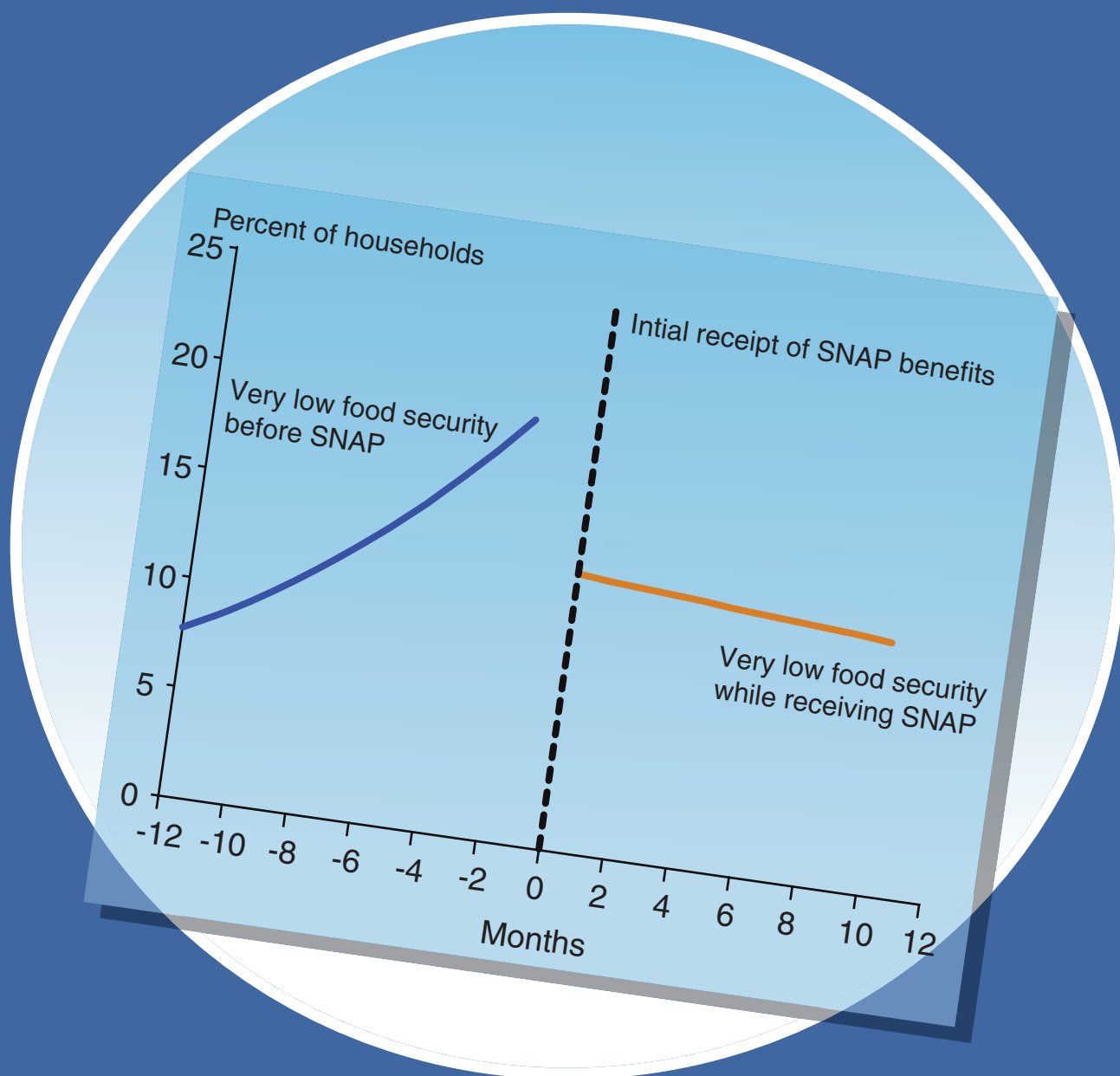
Does SNAP Decrease Food Insecurity?

Untangling the Self-Selection Effect

Economic
Research
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Number 85

Mark Nord
Anne Marie Golla

October 2009



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Does SNAP Decrease Food Insecurity?

Untangling the Self-Selection Effect

Mark Nord, marknord@ers.usda.gov

Anne Marie Golla

Abstract

Self-selection by more food-needy households into the Supplemental Nutrition Assistance Program (SNAP, formerly called the Food Stamp Program) makes it difficult to observe positive effects of the program in survey data. This study investigates self-selection and ameliorative program effects by examining households' food security month by month for several months prior to initial receipt of SNAP benefits and for several months after joining the program. Two-year panels are constructed by matching the same households interviewed in the Current Population Survey Food Security Supplement in 2 consecutive years using data from 2001 to 2006. Food security is observed to deteriorate in the 6 months prior to beginning to receive SNAP benefits and to improve shortly after. The results clearly demonstrate the self-selection by households into SNAP at a time when they are more severely food insecure. The results are consistent with a moderate ameliorative effect of SNAP—reducing the prevalence of very low food security among recent entrants by about one-third—although they do not conclusively demonstrate that extent of amelioration.

Keywords: food insecurity, food stamps, food security, hunger, very low food security, SNAP, longitudinal analysis

Mark Nord is a sociologist in the Food Economics Division, Economic Research Service, U.S. Department of Agriculture. Anne Marie Golla is an economist at the International Center for Research on Women (ICRW).

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Contents

Summary iii

Introduction 1

Previous Research on SNAP and Food Security 4

Needed: More Detailed Information on the Timing
of Food Insecurity 6

Data and Methods 7

 Two-Year Panel Construction 7

 Identifying the Beginning of SNAP Spells 7

 Assessing Food Security During the 30 Days Ending
 in Mid-December 8

 Analytic Methods 9

Findings 11

Conclusion 15

References 16

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Summary

The Supplemental Nutrition Assistance Program (SNAP), formerly the Food Stamp Program, is the largest Federal food assistance program, serving over 28 million households monthly in 2008. This study examines households' food security (their access to adequate food for active healthy living) month by month just prior to and just after SNAP entry in order to estimate the influence of benefits on the food security of recipient households.

What Is the Issue?

SNAP benefits are intended to increase the access of eligible low-income households to food and a nutritious diet—to improve their food security. However, it has proven difficult to demonstrate this positive effect or estimate its extent using household survey data. Food insecurity has always been found to be more prevalent in households enrolled in SNAP than in other low-income households. The hypothesized reason for this seeming anomaly is that food-needy households are more likely to enroll in SNAP, and that the initial difference in food security between SNAP participants and nonparticipants is greater than the ameliorative effect of the program. Researchers have used various statistical methods to untangle these opposite forces, but have not obtained consistent or convincing results.

This report provides greater detail on the timing of food insecurity relative to a household's first receiving SNAP benefits (or beginning to receive them again after being off the program for a year or more). The extent of food insecurity in households month by month in the year prior to their enrolling indicates whether signup generally occurred after a period of deteriorating food insecurity, as the self-selection hypothesis suggests. The prevalence of food insecurity among households in the months just after versus just before enrollment may reflect the effect of SNAP benefits on food security.

What Did the Study Find?

Households' food security deteriorated substantially beginning 7 or 8 months prior to SNAP entry and improved shortly after benefits began. The prevalence of very low food security among sample households increased from around 8 percent 1 year prior to entering SNAP to nearly 20 percent in the 4-6 months prior to entry. Within a few months of entering SNAP, the prevalence of very low food security declined to around 12 percent, where it settled for the first 10 months on the program.

These patterns could not be observed either in cross-sectional or 1-year longitudinal analysis of the food security survey data. Only with finer-grained detail of the month-by-month analysis can the deterioration in food security prior to receipt of SNAP benefits and the improvement after be observed.

These results clearly demonstrate the self-selection by households into SNAP at a time when they are more severely food insecure. The results are consistent with a moderate ameliorative effect of SNAP—reducing the prevalence of very low food security among recent entrants by about one-third—although they do not conclusively demonstrate that extent of amelioration.

How Was the Study Conducted?

Data for the study come from annual food security surveys from 2001 to 2006 sponsored by USDA and conducted by the U.S. Census Bureau as supplements to the monthly Current Population Survey. The nationally representative samples included about 48,000 households in each year. Two-year panels were assembled by matching households that were interviewed in 2 successive years. The primary analysis sample comprised 635 households that began receiving SNAP benefits in their second year in the survey but did not receive SNAP at any time during their first year in the survey nor in January of their second year in the survey.

The food security status of each household in the 30 days prior to each survey (conducted in mid-December) was based on the number of food-insecure conditions reported by one respondent in each household—conditions such as cutting the size of meals because there was too little money for food, or being hungry because there was too little money for food. Households were grouped by the month in Year 2 in which they began receiving SNAP benefits, and the prevalence of very low food security for each group was calculated for December of Year 1 and December of Year 2.

Introduction

The Supplemental Nutrition Assistance Program (SNAP), formerly the Food Stamp Program, is the largest Federal food assistance program, serving over 28 million persons monthly in 2008 with an average monthly benefit of \$102 per person (USDA/Economic Research Service, 2009). SNAP benefits are intended to increase the access of eligible low-income households to food and a nutritious diet and can only be used to purchase food. Because of the program's size and importance, there is substantial policy interest in assessing its effectiveness.

Early research on the impact of Food Stamp Program participation focused on food expenditures and the availability of nutrients (see Fox et al., 2004, for a review of this literature). More recently, researchers have examined the effect of SNAP on food security—a survey-based measure of households' consistent access to adequate food—and food sufficiency, a closely related condition.¹

Identifying the impact of SNAP participation on food security has proved difficult. It is expected that SNAP benefits lessen the severity of food insecurity for participants. However, in cross-sectional surveys, food insecurity has always been found to be more prevalent among SNAP participants than among similarly low-income nonparticipants, even controlling as completely as data allow for income, employment, household composition, and other household characteristics.

Self-selection by more food-needy households into the program has been hypothesized as the reason for this seeming anomaly. Participation in food assistance programs is voluntary, and it has been assumed that households with greater unmet food needs are more likely to participate. If the initial difference in food security between households that self-select into SNAP and those that do not is larger than the positive effect of SNAP benefits on food security, then the self-selection effect could account for the consistent finding of greater food insecurity in SNAP recipient households than in other low-income households. However, untangling the self-selection and amelioration effects has presented great methodological difficulties (see box, "Evaluating Program Effects: In Search of the Counterfactual").

¹ Prior to the development of the food security measures, the National Health and Nutrition Examination Survey (NHANES) and the Continuing Study of Food Intake by Individuals (CSFII) assessed the adequacy of households' food access using a single question. Respondents were asked which of three statements best described the food eaten in their household:

- "We always have enough to eat."
- "Sometimes we don't have enough to eat."
- "Often we don't have enough to eat."

Households were classified as food sufficient if they reported that they always had enough to eat and food insufficient if they reported that they sometimes or often did not have enough to eat.

Evaluating Program Effects: In Search of the Counterfactual

Evaluating a program such as SNAP involves estimating the effect of the program on food security, food spending, food intake, and other outcomes of interest. In concept, the “program effect” is the change in food security (or in some other condition) that is due to participation in SNAP. Other terms for the same concept are “treatment effect,” “participation effect,” and “ameliorative effect.” For any one participant, the program effect on food security is the difference between the participant’s (measurable) food security while in SNAP and the (inherently unmeasurable) food security that person *would have experienced* if they were not participating in the program. That is, the program effect is the difference between his/her actual condition and the counterfactual condition that would exist if he/she were not participating. The difference between the actual and counterfactual conditions, averaged across all participants, is an estimate of the average program effect on the food security of participants.

By their nature, however, counterfactuals can never be known with certainty—precisely because they did not happen. The main challenge of program evaluation is to estimate counterfactuals using the best available approaches and data.

The gold standard for program evaluation is often considered to be the random assignment experiment. In such experiments, a large number of potential participants are each assigned at random to either a treatment group (which receives the program benefit) or a control group (which does not). If assignment is random, statistical theory justifies using the (measured) outcome of the control group as an *estimate* of the (nonmeasurable) counterfactual for the treatment group. Such experiments are widely used in medical research and in research on plants and animals. However, random assignment is not generally considered to be a suitable methodology for evaluating a program such as SNAP. The program is an entitlement, and eligible recipients cannot legally be denied access to benefits for the purpose of assessing its effects. Furthermore, random assignment experiments with human subjects may be considered unethical if it is already known that one of the two assignments (treatment versus control, or one of two treatments) is more beneficial than the other.¹

When data from a random assignment experiment are not available, so-called “natural experiments” can sometimes provide counterfactuals in survey data. In social science

research, “natural” experiments do not, in fact, usually result from natural processes, but from changes in programs or policies that restrict or enhance program access for some groups. They are “natural” only in the sense that the changes were not made specifically for purposes of program evaluation. They are “experiments” in the sense that assignment to participation or nonparticipation (or, as is usually the case, to eligibility or ineligibility for program participation), while not random, does not depend entirely on decisions of individuals. For example, in the mid-1990s, the Personal Responsibility and Work Opportunity Reconciliation Act made certain groups of non-citizen immigrants ineligible for the Food Stamp Program and for certain other public assistance programs. Researchers examined conditions before and after the rule change among the subgroup of immigrants subject to the new restrictions. Food security after the rule change was considered to be a counterfactual for what food security would have been in the pre-rule-change period.² Since conditions were compared for the entire group that was subject to the new restrictions (both participants and non-participants), this procedure directly estimated the average treatment effect on eligibles. From that estimate, the average treatment effect on participants was calculated. In this natural experiment, SNAP (then called the Food Stamp Program) was found to have a beneficial effect on the food security of participants. Such natural experiments occur rarely, however, and often provide estimates for small subpopulations only.

In the absence of random assignment or natural experiments, researchers may attempt to estimate a counterfactual by applying statistical methods to survey data. The most straightforward of these methods uses multivariate regression methods to compare conditions among participants with conditions among eligible nonparticipants while statistically controlling for income, employment, and other relevant factors. This approach estimates the counterfactual food security for each participant by calculating the food security of non-participants with observable characteristics, such as income and employment, that are similar to those of the participant. Unfortunately, important factors that affect both food security and SNAP participation may not be observed in a particular survey, and some factors may be virtually impossible to observe or measure in any survey. Examples include actual food needs, local food prices, needs other than food that place unusual demands on resources, and informal sources of

¹However, random assignment experiments have been used to assess the effect of providing benefits that can only be used to buy food (i.e., food stamps, the predecessor of SNAP benefits) versus providing equivalent benefits in cash. In this case, the ethical concerns were met because there was ambiguity about which was the superior form of assistance. While these “cash out” experiments provided insight into the effect of the form of the benefit, they did not assess the effect of receiving versus not receiving the benefit.

²An adjustment was made for estimated changes that would have taken place in the absence of the rule changes based on changes that occurred among otherwise similar non-immigrants and immigrants not subject to the new restrictions.

Continued on page 3

Continued from page 2

financial and nonfinancial support. Regression methods, even in surveys with the most detailed data, have found SNAP participants to be more food insecure than their estimated counterfactuals. Most researchers believe that this counterintuitive result is attributable to biased estimates of counterfactuals due to unobserved conditions that affect both food insecurity and the decision to participate or not participate in SNAP.

Statistical methods that are more complex than single-equation regression attempt to simultaneously model the decision to participate in SNAP and the effect of participating. The objective is still to estimate a counterfactual, but the methods are designed to explicitly take into account factors affecting the decision to participate. These methods provide the strongest results when they include factors that directly affect SNAP participation but do not affect food security, except indirectly through their effect on participation. Such factors enable the methods to sort out factors influencing participation from those influencing food security. In practice, such factors can be difficult to find in survey data. These methods have yielded widely differing results in different studies, and it is difficult to ascertain which results are reliable, given uncertainties about the underlying assumptions.

Panel data—data collected from the same household at two or more points in time—can overcome some of the problems caused by unobserved factors. In effect, a household's food security during a period of nonparticipation is taken as the counterfactual for that same household at a time when they do participate. Regression methods are used to adjust for observed factors that vary over time for each household, such as income and employment. Since unobserved factors

that do not change over time are the same for the actual and estimated counterfactual case, those factors do not distort the estimation of the counterfactual. However, even panel data methods cannot adjust for unobserved factors that do change over time. To date, such approaches have generally found higher food insecurity during periods of SNAP participation than during periods of nonparticipation, although the differences are smaller than differences between participants and nonparticipants in cross-sectional survey data.

Panel data methods used previously are similar to the method used in this study with one important exception—timing. Panels that have collected food security data in each interview have almost all been annual surveys. As seen in the present study, the deterioration in food security prior to entering SNAP generally occurs over a period of time shorter than a year.

The research reported in this study uses food security of SNAP participants in the months immediately preceding program enrollment as an estimate of the counterfactual—what their food security would have been later, after SNAP enrollment, if these participants had not enrolled in the program. Like all estimates of counterfactuals, this study's estimates may be inaccurate for any individual participant. The food security of some recent program entrants would have improved between the two times even if they had not joined the program. However, the food security of others would likely have deteriorated further had they not joined. The basis of this study's method is the assumption that, averaged across households, food security in the period immediately before entering SNAP is a reasonable estimate of their later food security in the (counterfactual) absence of SNAP participation.

Previous Research on SNAP and Food Security

Researchers have used various methods to attempt to control for unobserved differences between SNAP recipients and nonrecipients and for the associated self-selection bias. Multivariate regression or propensity matching techniques can control for observable differences between households. However, many important differences may be unobserved. Analyses using multivariate regressions continue to show a positive association between program participation and higher food insecurity (Jensen, 2002; see also a review of this and other early work on the effect of SNAP on food security in Fox et al., 2004). More recently, Gibson-David and Foster (2006) used a propensity score approach to analyze food security data provided by the Early Childhood Longitudinal Study. A limited model showed a higher probability of food insecurity for SNAP participants than for nonparticipants and no association of SNAP participation with the severity of food insecurity. However, a more extensive specification using propensity scoring methods showed no association between SNAP participation and food insecurity and, among households with any measureable level of food insecurity, less severe food insecurity for SNAP participants than for nonparticipants.

Kabbani and Kmeid (2005) used a creative approach to conduct what was, in effect, a longitudinal analysis using cross-sectional survey data. Using Current Population Survey Food Security Supplement (CPS-FSS) data, they limited the analysis sample to households that had very low food security (a severe range of food insecurity) at some time during the 12 months prior to the survey. They then examined the association, within that subsample, between very low food security during the 30 days prior to the survey and receipt of SNAP benefits during the 30 days prior to the survey. They found no statistically significant difference in the likelihood of very low food security between SNAP recipients and nonrecipients, but did find a significant association with the level of benefits. Among households with very low food security at some time during the 12 months prior to the survey, those that received higher SNAP benefits were less likely than those that received lower benefits to have very low food security in the 30 days prior to the survey.

Approaches that have attempted to explicitly account for selection have found inconsistent results. Gundersen and Oliveira (2001) used a simultaneous equations approach to jointly estimate food insufficiency and program participation using the 1991-92 Survey of Income and Program Participation (SIPP), administered by the U.S. Census Bureau. They found no statistically significant relationship between SNAP participation and food sufficiency. Huffman and Jensen (2003) expanded this work by including labor force participation and using a measure of food insecurity rather than food insufficiency. They found that being food insecure increased the likelihood of SNAP participation, but found no significant effect of SNAP participation on the probability of having very low food security, although among participants increases in the size of the SNAP benefit decreased the likelihood of very low food security. Yen et al. (2008) applied an instrumental variables approach to National Food Stamp Participants Survey data, using State-level policy differences as identifying variables. SNAP participation was found to reduce the probability of very low food security by about one-third.

Identification in these models is typically problematic, depending on unverifiable assumptions about the functional forms of associations, distributions of errors, and the independence of identifying variables.

Unobserved time-invariant differences between households can be controlled by applying fixed-effect models to longitudinal data. This has been found to reduce, but not remove, the self-selection bias; some of the unobserved heterogeneity appears to be within the same household over time rather than between households. Wilde and Nord (2005) used a 2-year panel constructed from the CPS-FSS to estimate a fixed-effects model to control for time-invariant household heterogeneity. The fixed-effects estimate of the association between SNAP participation and food insecurity was smaller than a cross-sectional estimate, but was still positive, which was attributed to unobserved household-specific variation over time. Ribar and Hamrick (2003) used the 1993 panel of the SIPP combined with the Survey of Program Dynamics (SPD) to examine the dynamics of poverty and food security transitions. They found that SNAP participants were less likely than nonparticipants to exit from food insecurity, which they attributed to unobserved heterogeneity (i.e., self-selection bias). Hofferth (2004) analyzed within-household changes in food security status for households with children between the 1997 and 1999 waves of the Panel Study of Income Dynamics (PSID). The analysis included SNAP participation as an explanatory variable but did not control for unobserved differences in households. Hofferth found that, although SNAP participants were more likely to be food insecure than nonparticipants, leaving SNAP was associated with a higher risk of becoming food insecure or remaining food insecure.

A promising approach has been to take advantage of “natural experiments” to identify impacts of food assistance programs. Natural experiments are differences, among groups or over time, in access to food assistance programs that, while not random, are not caused by differences in food security. Borjas (2004) compared State-level changes in food insecurity in States with differing welfare policy toward immigrants of different types before and after the 1996 changes in the welfare system. He found convincing evidence that food security worsened among immigrant populations whose access to public assistance (including, but not limited to, food assistance) had been impeded. Bartfeld et al. (2006) compared the probabilities of food insecurity in households with children across States with different SNAP participation rates. Higher SNAP participation rates could indicate more outreach by State and county programs or higher social acceptability of receiving assistance, and these differences across States create a sort of natural experiment. Controlling for household demographic and economic characteristics and relevant State-level characteristics, food insecurity was found to be less likely in States with higher SNAP participation rates.

The inconsistent associations found between SNAP participation and food security do not demonstrate that the program has no effect. A finding of no effect in models that attempt to control for selection bias could mean that the SNAP is not working as intended or that selection bias has not been fully controlled in the analysis and is offsetting the positive effect of the program. Multivariate approaches may fail to control for unobserved differences, and simultaneous equation models generally depend on assumptions that cannot be tested.

Needed: More Detailed Information on the Timing of Food Insecurity

The seeming intractability of the self-selection problem results, to a considerable extent, from a lack of information on when, exactly, households were food insecure relative to when they received SNAP benefits. Household fixed-effect analyses such as that by Wilde and Nord (2005) eliminate the selection effects due to unobserved differences across households and demonstrate that those effects account for a substantial share of the higher food insecurity among SNAP participants in cross-sectional data. The hypothesized remaining selection effect—due to a household being more likely to enroll in SNAP when food insecurity is more severe—could be sorted out more reliably if the food security of households could be tracked week by week or month by month just before and after beginning to receive SNAP benefits. Competing hypotheses about the relationship between SNAP participation and food security predict different temporal patterns of food insecurity in the few months before and after beginning SNAP participation.

Hypothesis: *SNAP benefits alleviate food insecurity. The observed positive association between SNAP receipt and very low food security is a result of selection bias.* Under this hypothesis, food security would deteriorate over some period of time prior to initial receipt of SNAP benefits, then improve after households begin to receive benefits.

Counter-hypothesis #1: *There is some selection effect, but SNAP participation has no substantial effect on food security.* Under this hypothesis, food security would deteriorate prior to initial receipt of SNAP benefits, and not change systematically after beginning to receive benefits.

Counter-hypothesis #2: *There is no selection effect; households apply for SNAP for reasons unrelated to food insecurity, and SNAP participation makes households more food insecure.* Under this hypothesis, food security would not change systematically during the months prior to initial receipt of SNAP benefits. Then, after beginning to receive benefits, food security would deteriorate.²

Two changes introduced to the CPS-FSS in 2001 and 2002 allow testing of these hypotheses by examining the timing of food insecurity relative to the beginning of a spell of receiving SNAP benefits. Beginning in 2001, the CPS-FSS has been conducted in December of each year. Because of the design of the CPS (to which the CPS-FSS is a supplement), this survey schedule provides food security and SNAP data for each household in 2 consecutive years. Then, in 2002, the CPS-FSS began collecting information on which specific months households received SNAP benefits.

For this study, data from the same households were linked between 2 survey years, and households that began receiving SNAP benefits in Year 2 were analyzed. Three pieces of information were brought together: households' food security status in December of Year 1, the month in Year 2 that they began receiving SNAP benefits, and their food security status in December of Year 2. Combining these data across households that entered the program in different months during Year 2 provides a detailed trajectory of the average food security of households from 12 months prior to entering the program to about 10 months after entering the program.

² Counter-hypothesis #2 seems improbable; no mechanism has been suggested by which receipt of SNAP benefits would cause food insecurity to worsen. The hypothesis is included for completeness, because it would account for the observed positive association between food insecurity and SNAP receipt. It predicts a distinct temporal pattern of food insecurity relative to beginning SNAP participation, so is empirically testable.

Data and Methods

Data were provided by the December CPS-FSS for each year from 2001 to 2006. The CPS-FSS is an annual supplement to the monthly Current Population Survey. It is administered by the U.S. Census Bureau and is nationally representative of the civilian, noninstitutionalized population. The sample size averaged about 48,000 households each year during the study period.

Two-Year Panel Construction

Households in the monthly Current Population Survey (core labor force) sample are interviewed in 4 consecutive months; a year later, they are interviewed again in the same 4 months. About equal numbers of new households enter the survey each month, so in a given month's survey about half of the households were in the survey 12 months previously, and the other half will be in the survey 12 months later. The analysis sample was constructed by matching households in the CPS-FSS (conducted in December) across the 2 years that each household was in the survey. Five such matched samples were assembled and pooled, beginning with 2001-02 and ending with 2005-06.

Two factors reduce the number of households that can be used for any 2-year panel analysis of the CPS-FSS. First, some households were interviewed in only one of the two years, or completed the supplement in only one of the two years. Second, the CPS is a sample of housing addresses; if a household interviewed in Year 1 moves out and another moves in, the new household is interviewed in Year 2.³ On average, the matched household file included 71 percent of the households in the matchable half-samples.⁴

Previous research has found that households that do not match year to year—either because they moved or missed an interview in one of the two years—are more likely to be food insecure than those that do match (Wilde and Nord, 2005). The analysis sample, then, is biased somewhat toward more stable and more food-secure households.

Identifying the Beginning of SNAP Spells

The CPS-FSS has, since its inception in 1995, collected data on whether households received SNAP benefits at any time during the previous 12 months and at any time during the previous 30 days. Beginning in 2002, households that received SNAP benefits in the previous 12 months were also asked in which specific months they had received benefits.⁵ Response to this question allowed identification of the first month in which households received SNAP benefits—a key piece of information for the analysis. The primary analysis sample consisted of households that began receiving SNAP benefits in February or later in Year 2 and did not receive SNAP benefits at any time in Year 1 nor in January of Year 2. The restriction of no receipt in January of Year 2 was needed to avoid seam bias. (Seam bias is the overestimate, due to misreporting, of month-to-month changes between conditions in the final month of one survey period and the first month of the subsequent survey period.) This restriction avoids misclassifying as new recipients in January of Year 2 households that received SNAP benefits in Year 1, but failed to report them, and continued receiving benefits in Year 2.⁶

³The CPS-FSS data identify households that move into a sampled address by incrementing the value of the variable HUUHNUM. Households in which HUUHNUM differed between Year 1 and Year 2 were omitted from the panel analysis sample. An additional very small proportion of households had the same HUUHNUM in the 2 years, but were clearly different households based on their age, race, or gender composition. They were also omitted from the analysis sample.

⁴See Wilde and Nord (2005) for further details on matching CPS-FSS households across years.

⁵The 2001-02 matched sample was usable even though specific month of receipt was not collected in 2001, since only 12-month SNAP receipt information was needed for Year 1 of each 2-year panel.

⁶Analysis of month-to-month entries confirmed the presence of substantial seam bias. SNAP “entrants” were a much larger proportion of total monthly recipients in January than in any other month.

The total sample of matched households from 2001-02 to 2005-06 numbered 84,724. However, beginning a SNAP spell is a relatively rare occurrence. Most households in the matched sample received no SNAP benefits in Year 2, and most of those that did had also received benefits in Year 1 or in January of Year 2. The primary analysis sample consisted, then, of the 635 households that began receiving SNAP benefits between February and December of Year 2 after not receiving SNAP benefits in Year 1.

SNAP receipt is generally underreported in household surveys. Comparison with administrative records of the SNAP caseload (not shown) suggests that underreporting is quite serious in the CPS-FSS, but that the extent of underreporting is only slightly greater for months early in the year than for months late in the year (and therefore nearer the time of the December survey). It seems unlikely that underreporting would distort these results substantially. Only households that reported receiving SNAP benefits are in the analysis sample. Any random error in reporting month of first receipt would weaken the observed associations. Any systematic bias in reporting month of first receipt would simply compress or extend the reported versus actual time until (or since) first receipt, but would not affect the association with food security in Year 1 or Year 2. The analytic results would be threatened only if reporting error on month of first receipt was systematically associated with level of food insecurity or if underreporting of any receipt was systematically associated both with month of first receipt and with level of food insecurity. These possibilities cannot be ruled out, but there is no obvious reason to expect them.

Assessing Food Security During the 30 Days Ending in Mid-December

The other two key pieces of information needed for the analysis were measures of households' food security in the 30 days prior to the survey in December of Year 1 and in December of Year 2—that is, households' food security status prior to, and after, entering SNAP. This information, along with the specific month in Year 2 in which benefits were first received, provided estimates of the average prevalence of very low food security in each month from 2 to 12 months before households first received SNAP benefits and from 1 to 10 months after. Consider, for example, households whose first receipt of SNAP was in March of Year 2. The percentage of those households that had very low food security in December of Year 1 is an estimate of the prevalence of this condition in households 3 months prior to entering SNAP. The percentage with very low food security in December of Year 2 is an estimate of the prevalence of this condition in households 9 months after entering SNAP (or re-entering after having been out of the program for a year or more).

Household food security—access by all household members at all times to enough food for active healthy living—is measured in the CPS-FSS by responses to a series of questions about food-related conditions and behaviors that typically occur in households when they are having difficulty meeting their food needs (Hamilton et al., 1997a; Hamilton et al., 1997b; Bickel et al., 2000; Nord et al., 2007). The questions cover a wide range of food access problems, from worrying about running out of food to not eating for a whole day. Each question specifies a lack of money or other resources to obtain food as the reason for the condition or behavior, so the measure is not affected by behaviors such as voluntary dieting or fasting.

Based on the number of food-insecure conditions reported, households are classified as either food secure or food insecure. Food-insecure households are further classified as having low food security or very low food security. Very low food security, the condition analyzed in this study, is a severe range of food insecurity characterized by reduced food intake and disrupted eating patterns of one or more adults due to inadequate resources for food.

The standard food security measure, on which USDA's annual food security reports are based, represents conditions over the 12-month period prior to the survey. This study uses an alternative measure of very low food security—more temporally precise—based on households' experiences over the 30-day period prior to the survey (Nord, 2002).⁷ The 30-day scale is based on the same concepts and statistical methods as the standard 12-month U.S. Food Security Scale. To minimize any measurement effects associated with the presence and ages of children, household food security was assessed using only the 7 adult-referenced items in the 30-day scale (Nord and Bickel, 2002). That is, the scale that would normally be applied to households without children was used for all households. Households with and without children and with children in different age ranges might differ in seasonal patterns of likelihood of beginning receipt of SNAP (in relation to the school year, for example). Use of the adult 30-day scale obviates any confounding associations between food insecurity and timing of SNAP spells that could result from such patterns.

Analytic Methods

Descriptive analyses were based on cross-tabulations of the month of SNAP entry by food security status in Year 1 and, in a separate analysis, by food security status in Year 2. Single-month sample sizes were too small to provide reliable estimates of the prevalence of very low food security, so 3-month rolling averages were also calculated for descriptive purposes.

To test the statistical significance of the patterns observed in the descriptive statistics, the association between very low food security and number of months until SNAP entry (and, in a separate analysis, the number of months since SNAP entry) was estimated using logistic regression methods. With very low food security in Year 1 as the dependent variable, this analysis tested the hypothesis that the likelihood of very low food security increased as households neared the beginning of SNAP participation. With very low food security in Year 2 as the dependent variable, the analysis assessed whether the likelihood of very low food security changed as households were on SNAP for increasing number of months, and whether the change was significant. In the logistic regression analyses, both linear and quadratic functional forms were estimated for months-until-program-entry (and months-on-the-program).

To test the size and statistical significance of change in food security from before to after initial receipt of SNAP benefits, the average prevalence of very low food security 1 to 6 months after beginning receipt of SNAP benefits was compared with that 2 to 6 months prior to program entry. Variances of these prevalence rates were calculated as $P(1-P)/N$, where P was the weighted prevalence rate and N was the unweighted number of cases in the denominator.

⁷ In December 2005, the CPS-FSS began collecting 30-day food security data for all questions that make up the 12-month scale. This supports a full-range 30-day scale. In this study, however, the same methodology was used for the 2005 and 2006 data as for 2004 and earlier years so that measures would be consistent in all years.

To provide context for these estimates, the prevalence of very low food security was also calculated for two groups of households outside of the primary analysis sample: those that received SNAP benefits in both years (N=2,527), and those that were income-eligible for SNAP but did not receive benefits in either year (N=4,268).

One factor that could have distorted the analytic results is that different types of households with different propensities toward very low food security might have different seasonal patterns of food insecurity and SNAP entry. As a check on this possible confounding factor, logistic models were also estimated with controls for household composition and annual household income. Substantial changes in the coefficients on months prior to first receipt or months since first receipt would indicate confounding by seasonal factors.

Variances of estimates were calculated in two ways. The first method assumed no design effect and calculated variances based on the unweighted numbers of cases. The second method used a jackknife replication based on the five independent 2-year matched samples.⁸ The jackknife method may be considered the more conservative, since it accounts for measurement error as well as sampling error.

Household sampling weights were used for all analyses. The key analyses were repeated without using case weights. Weighted analyses were also repeated using a broader measure of 30-day food insecurity that included as insecure households that affirmed any of the adult-referenced questions.⁹ The results of both analyses were similar to those presented and the statistical significance of key coefficients did not change.

⁸The jackknife estimation followed standard procedures for such analysis. Each of the five 2-year matched samples was omitted from the analysis sample in turn, and the regression analysis was conducted using the remaining four samples. The mean of the estimated coefficient across the five analyses was taken as the best overall estimate of the coefficient. The squared difference between that best estimate and the coefficient estimate from each analysis was summed across the five analyses. The jackknife estimator for the variance of the coefficient estimate was then calculated as 4/5 times that sum of squared differences.

⁹This categorization identifies some households with food insecurity less severe than those with very low food security, but it does not identify all food-insecure households. Prior to 2004, 30-day information was not collected for the questions about less severe conditions that are needed to differentiate food-secure households from those with low food security.

Findings

In these 2-year matched samples, as in earlier studies, very low food security was more prevalent among SNAP recipients than among income-eligible nonrecipients. Among households that received SNAP benefits in both years, the prevalence of very low food security was about 13 percent, compared with 6.3 percent among those that did not receive SNAP benefits in either year. Much of this difference could be attributed to self-selection across households, but not all of it. Households in the matched samples that received SNAP benefits in only one of the two years were somewhat more likely to have very low food security in the year they were in the program (12.2 percent) than in the year they were not in the program (11.2 percent).

In the main analysis sample—the 2-year panels of households that entered SNAP in Year 2—food security typically deteriorated in the 6 to 8 months prior to entering SNAP. The prevalence of very low food security 10 to 12 months prior to program entry was around 8 percent—not far above the level of low-income households that did not receive SNAP benefits in either year (table 1; fig. 1). For example, of the households that entered the program in November, 8.07 percent had very low food security 11 months earlier, in December of Year 1. The 3-month rolling average centered on November program entry was 8.21 percent. About 8 or 9 months prior to beginning SNAP participation, the prevalence began increasing. The 3-month rolling

Table 1

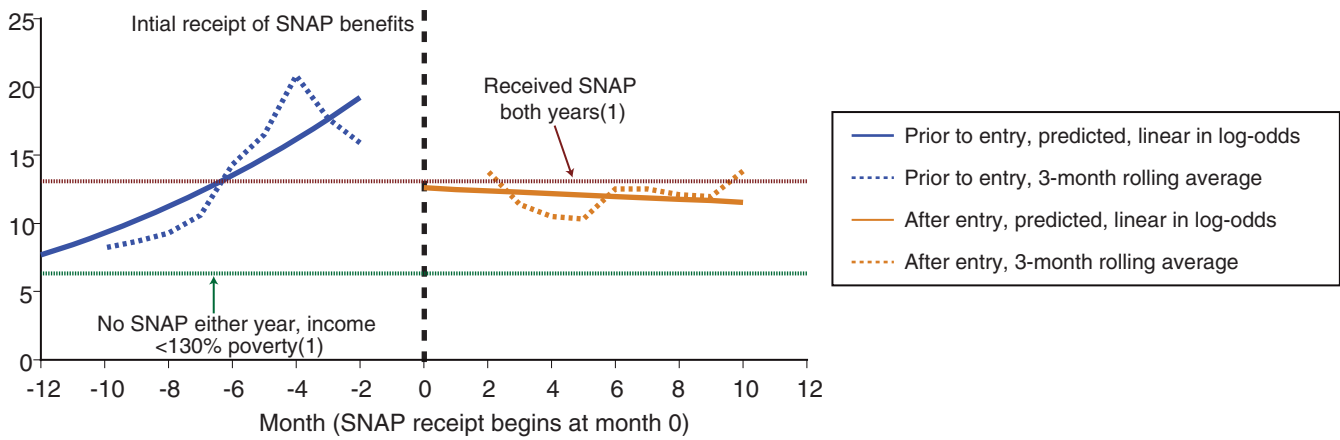
Households in 2-year panels (2001-02 through 2005-06), by very low food security status and month of first receiving SNAP benefits

Month of first receipt	Number of cases (unweighted)	December of Year 1				December of Year 2			
		Months prior to first receipt	Number with very low food security	Weighted percent with very low food security	3-month rolling average percent with very low food security	Months after first receipt	Number with very low food security	Weighted percent with very low food security	3-month rolling average percent with very low food security
February	28	2	5	11.63		10	5	14.28	
March	32	3	3	12.61	15.87	9	5	9.23	13.83
April	36	4	8	21.02	15.90	8	4	16.36	11.97
May	21	5	5	17.44	20.82	7	2	5.93	12.12
June	40	6	8	22.12	16.54	6	5	10.63	12.52
July	59	7	8	12.27	14.25	5	9	15.95	12.51
August	58	8	8	10.85	10.63	4	7	10.54	10.30
September	94	9	9	9.70	9.34	3	6	7.39	10.53
October	119	10	9	8.32	8.68	2	16	13.32	11.39
November	109	11	12	8.07	8.21	1	17	13.17	13.85
December	39	12	3	8.29		0	6	17.75	
Total	635		78	11.21			82	12.22	

Source: Calculated by the authors using Current Population Survey Food Security Supplement data from 2001, 2002, 2003, 2004, 2005, and 2006. Data from 2 consecutive years were assembled for each household in the analysis sample by matching households in month-in-sample 5-8 in 2002-06 to the same household in month-in-sample 1-4 in the previous year. Households that had moved between the two surveys were omitted. Households that received SNAP benefits at any time in Year 1 or in January of Year 2 were omitted.

Figure 1

Prevalence of very low food security (adult, 30-day) before and after initial receipt of SNAP benefits
Percent of households



¹Prevalence rates for households that received SNAP benefits in both years or in neither year are shown as constant levels for references. It is not meaningful to consider them in regard to a SNAP starting month.

Source: Calculated by the authors using Current Population Survey Food Security Supplement data from 2001, 2002, 2003, 2004, 2005, and 2006. Data from 2 consecutive years were assembled for each household in the analysis sample by matching households in month-in-sample 5-8 in 2002-06 to the same household in month-in-sample 1-4 in the previous year. Households that had moved between the two surveys were omitted. Households that received SNAP benefits at any time in year 1 or in January of year 2 were omitted.

average peaked at about 20 percent 4-6 months prior to initial receipt of benefits, then declined somewhat before households actually began to receive SNAP benefits.

The observed increase in food insecurity in the months prior to SNAP entry was statistically significant. The predicted probability of very low food security, based on a logistic regression linear in log-odds, reached 20 percent 2 months prior to beginning a SNAP spell. The coefficient on *months prior to beginning SNAP* was highly significant (table 2, model 1). The probability of the null hypothesis under a two-tailed test was .015, but the hypothesis tested was directional, so a single-tail test would be appropriate, giving a probability of the null hypothesis of about .008. The jackknife variance estimate for this coefficient resulted in a single-tailed p value of .012.¹⁰

Although the single-month estimates and 3-month rolling averages suggest that food security may have improved in the last few months prior to beginning receipt of SNAP benefits, that pattern was not statistically significant. In the logistic regression model with *months prior to beginning SNAP* entered as a quadratic, the squared term was not statistically significant ($p=.289$; table 2, model 2). However, it was more nearly significant based on the jackknife variance ($p=.143$), and it may be worthwhile to examine this pattern further in future research. Some households may begin to take other steps to address their deteriorating food security at about the same time that they begin to consider applying for SNAP.

The increase in very low food security prior to beginning a SNAP spell does not appear to reflect differential timing of initial participation by different types of households. Adding controls for household composition and income resulted in a negligible change in the coefficient on *months prior to begin-*

¹⁰ The predicted probability of very low food security for 1 month prior to beginning food stamps is not shown in figure 1 because it would be an out-of-sample estimate. A single-month estimate for 1 month prior to SNAP entry could not be generated due to the omission of households that apparently entered the program in January.

Table 2

Logistic regression of very low food security in December of Year 1 on number of months to initial receipt of SNAP benefits (N=635)

Variable	Model 1		Model 2		Model 3	
	Coeff.	p	Coeff.	p	Coeff.	p
Intercept	-1.226		-1.930		-1.484	
Months prior to beginning SNAP	-0.105	.015	.144	.548	-.111	.016
Square of months prior to beginning SNAP			-.018	.289		
Two-parent with child (reference) ¹						
Single female with child					.780	.024
Two or more adults, no child					-.348	.437
Male living alone					.884	.059
Female living alone					.806	.059
One or more elderly in household					-.920	.063
Income above 2 x poverty line (reference) ²						
Income < 50 percent of poverty line					.627	.145
Income 50-75 percent of poverty line					-.565	.332
Income 75-100 percent of poverty line					-.315	.539
Income 100-125 percent of poverty line					.955	.018
Income 125-150 percent of poverty line					-.504	.381
Income 150-200 percent of poverty line					.064	.885
Income not reported					-1.038	.204
Somers' D	.174		.184		.398	
Model p based on Wald chi-square		.015		.039		<.001

¹Reference category for household composition also included a very small proportion of "single male with child" households and households with children in complex living arrangements such as children of a boarder, unmarried partner, or housemate of the household reference person.

²Annual income in Year 1.

Source: Calculated by the authors using Current Population Survey Food Security Supplement data from 2001, 2002, 2003, 2004, 2005, and 2006. Data from 2 consecutive years were assembled for each household in the analysis sample by matching households in month-in-sample 5-8 in 2002-06 to the same household in month-in-sample 1-4 in the previous year. Households that had moved between the two surveys were omitted. Households that received SNAP benefits at any time in Year 1 or in January of Year 2 were omitted.

ning SNAP (table 2, model 3). The coefficient increased in magnitude very slightly compared with model 1 and remained highly significant.

Once households began receiving SNAP benefits, the probability of very low food security declined within a month or two, although only by about one-third. The average prevalence of very low food security during the period from 1 to 6 months after first receiving benefits was 11.7 percent, slightly below the level of households that received benefits in both years (fig. 1). This was 6.0 percentage points lower than the prevalence during the period from 2 to 6 months prior to first receipt (17.7 percent), and the difference was statistically significant ($p=.04$). Changes over the first year after program entry were not statistically significant either in linear or quadratic formulation, or with controls for household composition and income (table 3).

The estimates of very low food security after beginning a SNAP spell shown in figure 1 include a small proportion of households that entered SNAP during the year but left the program prior to December. Omitting those "leaver" households raised the mean prevalence of very low food security slightly, to almost exactly the level of households that were on the program in both years (analysis not shown). The time trend remained nonsignificant.

The association of very low food security in Year 1 with month of SNAP entry in Year 2 resulted primarily from differences in the likelihood of exiting very low food security. The patterns described above are based on

Table 3

Logistic regression of very low food security in December of Year 2 on number of months since initial receipt of SNAP benefits (N=635)

Variable	Model 1		Model 2		Model 3	
	Coeff.	p	Coeff.	p	Coeff.	p
Intercept	-1.936		-1.697		-2.016	
Months since beginning SNAP	-0.010	.828	-.174	.267	-.010	.828
Square of months prior to beginning SNAP			.017	.273		
Two-parent with child (reference) ¹						
Single female with child					.495	.153
Two or more adults, no child					.160	.653
Male living alone					.528	.259
Female living alone					.859	.038
One or more elderly in household					-.428	.273
Income above 2 x poverty line (reference) ²						
Income < 50 percent of poverty line					-.268	.575
Income 50-75 percent of poverty line					-.391	.437
Income 75-100 percent of poverty line					-.539	.300
Income 100-125 percent of poverty line					-.569	.274
Income 125-150 percent of poverty line					-.211	.678
Income 150-200 percent of poverty line					.070	.883
Income not reported					.465	.328
Somers' D	.009		.079		.210	
Model p based on Wald chi-square		.828		.537		.470

¹Reference category for household composition also included a very small proportion of "single male with child" households and households with children in complex living arrangements such as children of a boarder, unmarried partner, or housemate of the household reference person.

²Annual income in Year 2. Analysis was repeated using annual income in Year 1; the coefficient on "months since beginning SNAP" was even smaller and the p value was .947.

Source: Calculated by the authors using Current Population Survey Food Security Supplement data from 2001, 2002, 2003, 2004, 2005, and 2006. Data from 2 consecutive years were assembled for each household in the analysis sample by matching households in month-in-sample 5-8 in 2002-06 to the same household in month-in-sample 1-4 in the previous year. Households that had moved between the two surveys were omitted. Households that received SNAP benefits at any time in Year 1 or in January of Year 2 were omitted.

averages for all households that began receiving SNAP benefits in a given month. Among households entering SNAP in the first 6 months of Year 2, the prevalence of very low food security declined from December of Year 1 to December of Year 2. This implies that the number of households that exited very low food security exceeded the number that entered that status. On the other hand, among households entering SNAP in the last 6 months of the year, the prevalence of very low food security increased from December of Year 1 to December of Year 2, implying that the number of households that entered very low food security exceeded the number that exited that status. Analysis (not shown) of changes in the food security status of each household from December of Year 1 to December of Year 2 revealed that these patterns primarily reflected differences in rates of exit from very low food security. The very-low-food-security entry rate (i.e., the percentage of households that were food secure or had only low food security in Year 1 and had very low food security in Year 2) differed little across groups of households that began receiving SNAP in different months. However, the very-low-food-security exit rate (the percentage of households with very low food security in Year 1 that were either food secure or had only low food security in Year 2) was higher for households that began receiving SNAP benefits early in Year 2 than for those that entered the program late in the year.

Conclusion

Month-by-month information on households' food security reveals a substantial deterioration in food security beginning 7 or 8 months prior to initial receipt of SNAP benefits and suggests an ameliorative effect of the program. The prevalence of very low food security increased from around 7 or 8 percent 12 months prior to entering SNAP to nearly 20 percent in the last few months prior to entry. Within a few months of program entry, the prevalence of very low food security declined to around 12 percent, where it remained with little change during the period observed (up to about 10 months on the program).

These patterns cannot be observed either in cross-sectional or simple longitudinal analysis. Cross-sectional analysis of the Current Population Survey Food Security Supplement (CPS-FSS) data for the years studied (2001-06) finds the familiar pattern of very low food security being higher among SNAP recipients (around 13 percent) than among income-eligible nonrecipients (6.3 percent). Simple panel analysis of households that entered the program in Year 2 (that is, panel analysis that does not take account of the month in which households began receiving SNAP benefits) finds that the prevalence of very low food security was slightly higher for households in the year they were in the program (12.2 percent) than for the same households in the year they were not in the program (11.2 percent). The deterioration in food security prior to SNAP entry and the improvement after entry can be observed only in the finer grained detail of month-by-month analysis.

These results clearly demonstrate the self-selection by households into SNAP at a time when their food security has worsened. Household-fixed effects analyses in earlier research had demonstrated that self-selection of more food-insecure households into SNAP accounted for some, but not all, of the consistently observed positive association between SNAP participation and food insecurity in cross-sectional surveys. Self-selection based on time-variant factors within the same household—the higher likelihood of a household applying for SNAP at time when food insecurity is more severe—has been hypothesized as the cause of the remaining positive association, but the process had not been convincingly demonstrated by previous research, nor had its extent been estimated.

The results are also consistent with a moderate ameliorative effect of SNAP—reducing the prevalence of very low food security among recent entrants by about one-third. The only important threat to a causal interpretation (i.e., that SNAP benefits caused the decline in very low food security) is that entering SNAP could act as a marker, identifying households that have recently experienced unusually high levels of food insecurity. A variable that changes randomly in members of a population will regress toward the population mean for a subset of the population with above-average values on the variable at a point in time. Some households in this subpopulation, marked as more food needy by having applied for SNAP, may have subsequently experienced an improvement in food security due to processes unrelated to receipt of SNAP benefits. Such regression to the mean could account for some or all of the decline in very low food security after entering SNAP. Lacking a random assignment or natural experiment, however, these results provide, perhaps, the most credible estimate to date of the extent to which SNAP may reduce the prevalence of very low food security.

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