Food Stamps and Food Insecurity: Does Reporting Error Influence this Relationship for Households with Children?

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Extended Abstract

The largest food assistance program in the United States, the Food Stamp Program is "…the most critical component of the safety net against hunger because it provides basic protection for citizens of all ages and household status (U.S. Department of Agriculture, Food and Nutrition Service 1999, p. 7)." In particular, it constitutes an important program for children – over half of all food stamp recipients are children (Cunnyngham and Brown, 2004). Given this role it may be surprising, at least on the surface, that children in households receiving food stamps are far more likely to be food insecure (i.e., living in households which did not have access to enough food for active, healthy lives) than children in households not receiving food stamps. These higher rates of food insecurity – which remain even after controlling for relevant covariates – have been ascribed to many factors including adverse selection (those most at risk of food insecurity are more likely to receive food stamps), the timing of the food insecurity questions versus food stamp receipt (someone may have been food insecure and then entered the Food Stamp Program), misreporting of food stamp receipt, and misreporting of food insecurity status.

Previous work has studied these first two issues (e.g., Gundersen and Oliveira, 2001; Nord *et al*., 2004). In this paper, we focus on the fourth issue. In particular, we investigate how conclusions about relationships between food stamps and food insecurity vary depending on a researcher's maintained assumptions about the nature and degree of food insecurity reporting errors. Our approach, based largely on nonparametric methods developed in Horowitz and Manski (1995), Bollinger (1996), Kreider and Pepper (2004, 2005), and Kreider and Hill (2005), will investigate what can be learned about the relationship between food stamps and food insecurity when food insecurity status may be reported with error. Our work contrasts with the previous literature on food insecurity which has implicitly assumed that food insecurity is reported without error. This is a strong assumption that may be questioned for a variety of reasons. Beyond random errors – which themselves confound identification – some types of respondents may systematically misreport food insecurity. For example, some food stamp recipients may report being food insecure if they believe that to report otherwise would jeopardize their eligibility. (There is much discussion in the disability literature about the extent to which self-reports of work capacity may be influenced by respondents' desire to maintain eligibility for disability transfers (see, e.g., Benitez-Silva *et al*., 2004).) When the possibility of misreported food insecurity is allowed, true relationships between food insecurity and food stamp recipiency are generally only partially identified. We will illustrate how the strength of the conclusions about the relationship between food insecurity and food stamp participation among households with children depends on the strength of the assumptions the researcher is willing to impose.

Theoretical Framework

To highlight the identification problem, we begin with a diagram (Figure 1) that illustrates what can be learned about (a) the food insecurity rate for households with children and (b) the difference in the food stamp participation rate between the food insecure and the food

secure given that we do not necessarily observe true food insecurity status, denoted *FI*. In Figure 1, the circle represents the 41% of eligible households with children who participated in the Food Stamp Program. The top portion of the figure comprises the 42% of respondents who reported being food insecure ($FI_R = 1$), while the bottom portion comprises the remaining 58% who reported being food secure ($FI_R = 0$). (As described below, these values are taken from the Core Food Security Module (CFSM) in the December Supplement of the 2003 Current Population Survey (CPS).) Some food insecurity status classifications are accurate, denoted Z=1, with inaccurate classifications denoted Z=0. Given the methods used to calculate food insecurity, Z may be unobserved for at least some households.

To illustrate basic concepts, we initially assume that the researcher is unable to verify food security or insecurity for any particular respondents. The unknown fraction of respondents who were truly food insecure is given by P(FI = 1) = A + C + F + H (capital letters, dotted region). This group includes those accurately classified as food insecure and those falsely classified as food secure. The remaining fraction, P(FI = 0) = b + d + e + g, were food secure. Unless *FI* is known to be accurately reported by all households, neither the prevalence of food insecurity, P(FI = 1), nor the difference in food insecurity rates between food stamp recipients and non-recipients,

$$\Delta = P(FS = 1 | FI = 1) - P(FS = 0 | FI = 1), \qquad (1)$$

is identified by the data.

Since one cannot identify the true food insecurity rate, one therefore cannot identify food stamp participation rates conditional on food insecurity status. To see the implications of this measurement problem, consider the first part of the right-hand side of equation (1). (A similar scenario holds for the second part of the right-hand side of equation (1)). Using Bayes' Theorem, we can write this as follows:

$$P_{11} \equiv P(FS = 1 | FI = 1) = \frac{P(FS = 1, FI = 1)}{P(FI = 1)}. \qquad (2)$$

Neither the numerator nor the denominator is identified since *FI* is unobserved. We can make progress, however, by first decomposing these quantities into identified and unidentified components:

$$P_{11} \equiv P(FS = 1 | FI = 1) = \frac{P(FS = 1, FI_R = 1) + \theta_1}{P(FI_R = 1) + \theta_2} \qquad (3)$$

where $\theta_1 \equiv P(FS=1, FI_R=0, Z=0) - P(FS=1, FI_R=1, Z=0)$ measures the (unknown) excess of false negative versus false positive food insecurity classifications among those who participated in the food stamp program and $\theta_2 = P(FI_R=0, Z=0) - P(FI_R=1, Z=0)$ measures the excess of false negative versus false positive food insecurity classifications among all respondents. In terms of Figure 1, $P(FS=1, FI_R=1)$ corresponds with area C+F, $P(FI_R=1)$ corresponds with area A+C+F+H, θ_1 corresponds with area F-d, and θ_2 corresponds with area F+H-(b+d).

To say anything useful about the probabilities of interest, the researcher must be willing to impose restrictions on the patterns of false positive and false negative self-reports. To begin, suppose that the researcher is only willing to impose a limit on the total degree of "corruption" in the self-reported food insecurity variable: $P(Z=0) \leq q$ for some postulated value of $q \in [0, 1]$.

(Horowitz and Manski (1995) refer to the data as "corrupt" when nothing else is known about the data-generating process for the potentially mismeasured variable.) When $q = 0$, no misreporting is allowed. In this case, equation (1) is point identified as 0.52-0.35=0.17: i.e., children in households receiving food stamps are 17 percentage points more likely to be food insecure than children in households not receiving food stamps. When $q = 1$, each respondent may be misreporting food insecurity status. Middle-ground cases are examined by varying the value of q.

In this paper, we consider what happens to the food stamp-food insecurity relationship when we impose stronger assumptions on the nature and degree of classification error. Without additional assumptions, we cannot identify whether food stamp recipients are more or less likely than non-recipients to be food insecure even for small values of q. We first consider the case that a researcher is willing to verify the accuracy of food insecurity status for particular observed subpopulations, remaining agnostic about the classifications for other subpopulations. We use data on food expenditures to classify food insecurity status as "verified" for certain households. As a starting point, we plan to verify a household as food secure if it (a) reports being food secure and its expenditures exceed the level associated with the Thrifty Food Plan or (b) reports being food insecure and its expenditures fall short of the Thrifty Food Plan level. Otherwise, a household's status remains unverified. This verification strategy is quite conservative relative to the usual implicit assumption in the literature that food insecurity status is automatically verified. We will test the sensitivity of our results to different food expenditure thresholds and to other types of verification assumptions. (For discussion in the context of self-reported disability, see Kreider and Pepper, 2004.)

Beyond verification of a subset of responses (i.e., imposing restrictions on q), we will illustrate the identifying power of a variety of other assumptions. For example, a researcher may also, or instead, be willing to assume that reporting errors occur independently of true food insecurity status ("contaminated sampling"), perhaps in conjunction with an assumption that reporting errors occur independently of food stamp recipiency conditional on true food insecurity status ("nondifferential" measurement error). Under contaminated sampling, the true food insecurity rate is restricted to be the same among accurate and inaccurate reporters of food insecurity: $P(FI = 1) = P(FI = 1|Z)$. Under nondifferential reporting errors, $P(FI_R=1|FI=0, FS)=P(FI_R=1|FI=0)$ and $P(FI_R=1|FI=0,FS)=P(FI_R=1|FI=0)$ must hold: conditional on true food insecurity status, knowing food stamp status provides no information about reporting errors. (We will also explore weaker variants of these assumptions.) Monotonicity assumptions can also confer substantial identifying power. Conditioning on certain covariates, it might be assumed that true food insecurity declines monotonically in education level or per capita household income, that false negative reports of food insecurity are less prevalent than false positive reports (or vice versa), and so on. Monotone instrumental variable (MIV) methods developed in Manski and Pepper (2000) and extended by Kreider and Pepper (2005) to correct for finite-sample bias are useful on this front. Ultimately, researchers and policymakers can decide for themselves which combinations of assumptions are most appropriate, weighing the desirability of imposing weak assumptions against the desirability of obtaining tighter bounds on the parameters of interest. Our results will illustrate how the strength of the conclusions varies with the strength of the maintained assumptions.

Data

To implement the theoretical framework described above, we use data from the December Supplement of the 2003 CPS. Along with being the official data source for official

poverty and unemployment rates, the CPS includes the CFSM which is used to establish official food security rates in the United States. In this role, the CFSM has been included in the CPS at least one month in every year since 1995; in 2003, it was included in the December Supplement. Along with the CFSM, the December CPS contains information on food stamp participation status.

The CFSM contains 18 questions that provide detailed information about the experiences of households as it pertains to their inability to meet basic food needs due to financial constraints. The official discernment of food insecurity status is constructed using responses from 18 questions for households with children. Some of the conditions people are asked about include "I worried whether our food would run out before we got money to buy more," (the least severe item), "Did you or the other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food," "Were you ever hungry but did not eat because you couldn't afford enough food," and "Did a child in the household ever not eat for a full day because you couldn't afford enough food" (the most severe item for households with children). The food insecurity scale is determined as the sum of the responses. Households that report two or fewer problems are classified as "food secure," which is interpreted as having "assured access to enough food for an active, healthy life" (Hamilton et al., 1997, p. ii). Households that report three or more problems are classified as "food insecure." The central questions posed in this paper emerge due to the inability of the researcher to know whether reports within the CFSM are accurate. In addition to information on food insecurity and food stamp participation status, the December Supplement has information on food expenditures which is relevant to our verification of a subset of responses. This expenditure information takes two forms - actual and usual expenditures. (For a use of these measures in conjunction with food insecurity see Gundersen and Ribar, 2005.)

Implications

In this paper, we will add to the food insecurity, food assistance, and broader poverty literatures in at least two important ways. First, we will provide researchers and policymakers with a new framework for thinking about critical relationships between food stamp recipiency and food insecurity. Our framework will formalize the basic identification problem associated with potentially mismeasured food insecurity status and make transparent how conclusions depend on a researcher's maintained assumptions. We expect our analyses to stimulate discussion about the appropriate measurement of food insecurity and about the consequences of uncertainty about data reliability. Moreover, our demonstration of the analytical methods will provide researchers with a new methodology for analyzing other relationships between assistance programs and outcomes of interests.

Second, to the extent that estimated relationships between food stamps and food insecurity are robust under different sets of assumptions, policymakers and program administrators can feel confident about using the food security measure as a guide in evaluating the effectiveness of food stamps in alleviating food insecurity. To the extent that such relationships are sensitive to the set of maintained assumptions, the relative usefulness of the food security measure as a policy tool (at least with respect to the Food Stamp Program) may be questioned. In the end, researchers and policymakers can judge for themselves the credibility of different sets of assumptions and come to their own conclusions accordingly.

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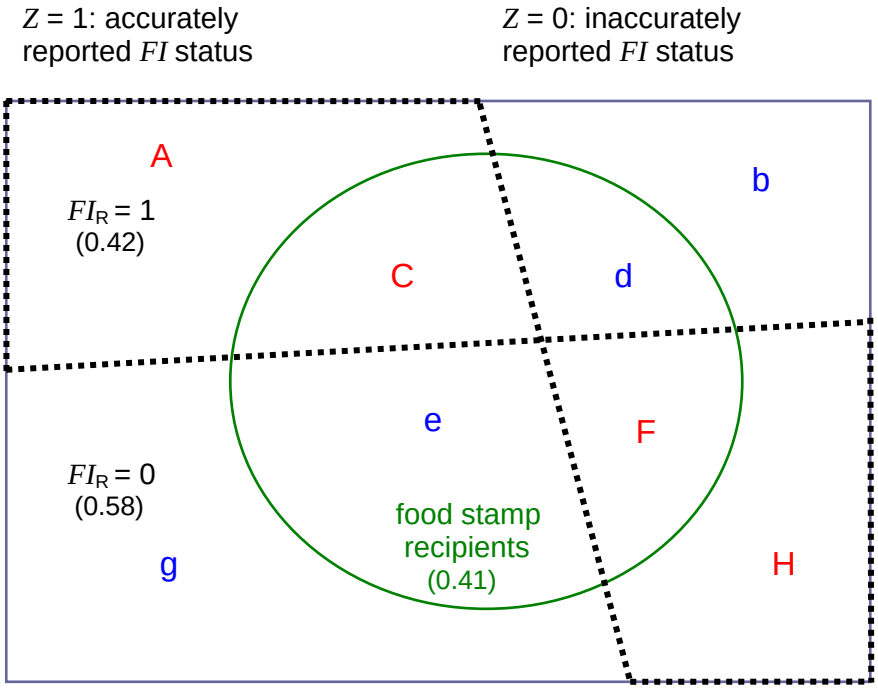
Figure 1



(not drawn to scale)