

Food Insecurity and Insufficiency at Low Levels of Food Expenditures

Craig Gundersen
Human Development and Family Studies Dept.
Iowa State University

David C. Ribar
Department of Economics
University of North Carolina at Greensboro

March 2007

Abstract: In this study we investigate the validity of the food insecurity and insufficiency measures—specifically, how these measures correlate with food expenditures—using the December 2003 Food Security Supplement of the Current Population Survey. We focus on a special segment of the population—households with low incomes and low food expenditures. If reports of food problems are based on a lack of food, reports should be nearly ubiquitous at the bottom of the expenditure distribution. We find, however, that this is not the case. We define and scale food expenditures several different ways and find that the reported incidence of food insecurity never rises above one-half anywhere along the corresponding expenditure distributions, leading to concerns about the external validity of the measure.

JEL Codes: I32, D12

Keywords: food insecurity, food insufficiency, external validation

Contact author: Craig Gundersen, Human Development and Family Studies Department, Iowa State University, 74 LeBaron Hall, Ames, IA 50011, (515) 294-6319, Fax: (515) 294-2502, cggunder@iastate.edu

Acknowledgments: The authors thank Mark Nord, Steven Haider, and Alison Jacknowitz for their helpful comments; David Davis for useful discussions on geographic variation in food prices; and participants in sessions at the annual meetings of the National Association for Welfare Research and Statistics and the Association for Public Policy Analysis and Management.

Food Insecurity and Insufficiency at Low Levels of Food Expenditures

Measures describing food insecurity and food insufficiency have become important tools for policymakers, advocacy groups, and researchers. Since 1995 food security supplements have been regularly fielded as part of the Current Population Survey (CPS), and the U.S. Department of Agriculture (USDA) has used these to estimate the prevalence of food hardships. In 2003 nearly one in eight Americans was in a household identified as food insecure (Nord et al. 2004). In addition to indicating the extent of food hardships, the measures are used to gauge progress toward national objectives, such as the “Healthy People 2010” goals to reduce hunger, and to evaluate the effectiveness of food assistance programs and other social supports (Wilde 2004). They have also been used by researchers studying the antecedents and consequences of food hardships.¹

With their wider use these food hardship measures have also faced growing scrutiny. Of particular interest to social scientists is how best to interpret these measures. Formally, households are defined as being food secure if they “had access, at all times, to enough food for an active, healthy life for all household members” and food insecure if they lacked such access (see, e.g., Nord et al. 2004). Although this definition encompasses several elements, a key and policy-relevant feature is the quantity of food available to household members. Researchers and the public have generally interpreted the measures this way.²

Attention then turns to how closely the food hardship measures actually correspond to other objective measures of food adequacy and needs—that is, whether food insecurity and insufficiency have strong external validity. Here the record becomes surprisingly equivocal. While reported food hardships have the expected broad negative associations with household incomes and expenditures and positive associations with household size and other measures of

need (Nord et al. 2004), there are also many incongruous findings. One such finding is the surprisingly high proportion of reported food hardships among households with moderate and high levels of income (Nord and Brent 2002). Another finding is that the average intakes for food insufficient households exceed 100 percent of the Recommended Daily Allowances for most nutrients (Rose and Oliveira 1997). Along the same lines, Bhattacharya et al. (2004) found that children in poor, food insufficient households had nearly the same Healthy Eating Index values as children in more affluent, food sufficient households. These results indicate that the validity and possibly interpretation of the hardship measures needs to be more closely examined.

In this paper, we carefully investigate properties of the one-question food insufficiency measure and the 18-item food insecurity measure from the December 2003 Food Security Supplement (FSS) of the CPS. Specifically, we compare these measures to alternative measures of food expenditures each scaled by different measures of food needs, focusing on households at the low ends of the income and expenditure distributions. Our focus is motivated by a logical and straightforward interpretation of the food hardship measures in which people report problems when their consumption falls below some critical threshold. This leads to the standard implication that food expenditures and food hardships should be negatively associated. More than that, however, it also implies that reports of problems should be nearly ubiquitous among people with extremely low expenditure levels. When we compare reports of food hardships from the CPS with reports of food expenditures scaled by an objective measure of needs, we find evidence for the first prediction but not the second. In particular, there is no point along an objectively-scaled expenditure distribution where more than half of the survey respondents report experiencing being food insufficient or insecure. This finding obtains even when we restrict the analysis to households with very low incomes.

When we re-run the analysis using measures of food expenditures that are scaled by a subjective measure of needs, we do find the expected pattern of near-universal reporting of food problems at the low end of the expenditure distribution. These latter findings taken together with the strong positive correlation between the food insecurity and insufficiency measures, lead us to conclude that the measures are internally valid (people are answering similar questions in similar ways). However, the modest levels of reporting at the low ends of the objectively-defined distributions indicates there may be an external validity problem.

Construction of the Food Insufficiency and Insecurity Measures

We analyze two food hardship indicators: the food insufficiency measure and the food insecurity scale.

To gather information about whether Americans and especially low-income Americans obtain enough to eat, the USDA established the “food insufficiency question.” The question has appeared in numerous surveys since 1977 and is included in the FSS. People are asked to think about food consumption and affordability in the previous 12 months and then respond to the statement “Which of these statements best describes the food eaten in your household

1. Enough of the kinds of food we want to eat,
2. Enough but not always the kinds of food we want to eat,
3. Sometimes not enough to eat, or
4. Often not enough to eat.”

The potential responses reflect increasingly severe conditions associated first with the adequacy and variety of the household’s diet and then with its levels of consumption. In December 2003, 78.7 percent of households reported having enough and the kinds of food they wanted to eat;

17.8 percent reported having enough but not the kinds of food they wanted to eat; 2.8 percent reported sometimes not having enough to eat, and 0.7 percent reported often not having enough to eat.³

In contrast to single-item food insufficiency measure, the food insecurity scale is constructed using responses from several questions: 18 if the household has children or 10 if it does not. 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,” 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). A complete list of questions is found in Appendix A.

The food insecurity scale is determined from the sum of the responses, with the thresholds for some categories of insecurity depending on the presence of children. Households, regardless of the presence of children, that report two or fewer problems are classified as “food secure.” Households with children are classified as “food insecure without hunger” if they report three to seven problems, while households without children are so classified if they report three to five problems. Households that report more problems—eight or more problems for households with children and six or more for those without—were classified in 2003 as “food insecure with hunger,” meaning that they were likely to have experienced the physiologic symptoms and discomfort associated with a lack of food.⁴ From the December 2003 survey, 88.5 percent of households were categorized as food secure; 7.7 percent were food insecure without hunger; 3.5 percent were food insecure with hunger, and 0.3 percent did not provide enough data to make a classification.⁵

Conceptual Measurement Model

There are clear differences between the food insecurity and insufficiency scales, with the insecurity measure addressing conditions of anxiety, differential food experiences of children and adults, and occurrences of skipped meals that the food insufficiency question does not. Nevertheless, both measures are alike in primarily describing the adequacy and availability of food. For instance, Nord et al. (2004, p. 2) state that the food insecurity scale measures “difficulty meeting food needs” stemming from “a lack of money or other resources.” Habicht et al. (2004, p. 12) similarly characterize food insecurity as “a concept that refers to a lack of food.” Indeed, all but one of the items that comprise the food security scale ask in some way about the quantities of food purchases and intakes. To be defined as food insecure a household would have to respond affirmatively to at least one of these quantity questions. The food insufficiency measure is even more explicit in describing a lack of types or amounts of food.

We assume that these same general interpretations guide how people answer questions regarding food hardships. Specifically, we assume that a person answers these questions by comparing his or her household’s level of food consumption, C , with assessments of the household’s food needs, N , over the relevant time period. The person reports that a food hardship has occurred if consumption falls below needs.

Although this model is very simple, it provides a framework for evaluating the food measures. It also helps to explain how people who are otherwise alike in terms of their consumption and other objectively observed circumstances might still give different answers to the questions. In particular, unmeasured differences in needs, including differences in food preferences, cultural ideas regarding diets, and subjective assessments of adequate food intakes, could influence people’s responses.

Three primary implications emerge from this model. The first is that reports of food hardships should be negatively associated with food consumption. For our empirical analyses, we use weekly food expenditures as a measure of consumption. Expenditures are an imperfect measure because a household's consumption will also vary depending on how much time it spends preparing or growing food, how much money it allocates to wasteful or luxury purchases, and how much food it gives to or receives from others. Also, while some types of public food assistance, such as food stamps, are included in the expenditure measure, other types, such as school lunches and breakfasts, are not. In addition, expenditures may be reported with error. Despite the differences between expenditures and consumption, we would still expect that food expenditures would be strongly associated with food hardships. Food expenditures are also relevant for policy purposes because the major food assistance programs operate by increasing expenditures.

The second implication of our model is that reports of food hardships should be positively associated with measures of food needs. For instance, we would expect that other things held constant, larger households would have greater needs and report more hardships than smaller households.

Previous validation studies involving objective measures have focused mainly on general associations between reported food hardships and either consumption or needs. The third implication of our model departs from this previous work. If the minimum threshold for reporting a hardship is high enough so that it falls within the distribution of consumption levels, there will be a range of consumption levels in which everyone reports a hardship. Allowing for errors in the reports of food hardships and food expenditures and allowing for some food consumption from sources other than expenditures, there should still be a critical level of food

expenditures below which most people report food hardships. This third implication motivates our analysis of reported hardships at the bottom of the expenditure distribution.

Empirical Analysis

Analysis Sample and Measures of Expenditures and Needs

For our empirical analyses of the food insecurity and insufficiency measures, we select observations from the December 2003 FSS for households that were not living in group quarters. We exclude households that contain sub-families and unrelated individuals because of the possibility that the person reporting on the household's food hardships might not include them. We also exclude households from Alaska and Hawaii because of the unusually high costs of food and other items in those states. For similar reasons, we omit households with more than eight members. For all of our analyses we use household weights that are supplied with the FSS.

We use two measures of food expenditures. Our first and primary measure is a report of the usual weekly expenditures by the household. The second measure is a report of the household's expenditures in the previous week. There are advantages and disadvantages associated with each measure. On the one hand, usual expenditures should be more representative of the household's food experiences. On the other hand, expenditures from the previous week may be recalled more accurately.

Needs are much harder to measure than expenditures. Accordingly, we use several alternative indicators. Two readily observable measures are described and used by Nord et al. (2004): household sizes and the budget amounts from the USDA Thrifty Food Plan (TFP), which vary with the size and age composition of the household. The TFP is the least expensive of several food plans that the USDA created with minimum amounts of foods that would make up a

nutritious diet; as such, it represents a very conservative estimate of food needs and is appropriate for identifying low levels of expenditures.

In some analyses, we also construct model-based estimates of food needs. For these, we estimate ordered probit models of food insecurity with the natural log of food expenditures and a series of additional objective observable measures as explanatory variables. Thus, the latent indicator, y^* , in the ordered probit model can be written as

$$y^* = \alpha \ln(\text{usual expenditures}) + B'X + \varepsilon$$

where X is a vector of observable variables (which includes non-parametric indicators for the number of adults in the household, non-parametric indicators for the number of children, linear controls for the ages of the youngest and oldest person, and dummy indicators for the state of residence), α and B are coefficients, and ε is a random error. If we assume that our measurement model applies, the term $B'X$ provides an observed indicator of needs. For our measure, we scale the predicted value of $B'X$ in terms of the level of food expenditures, such that the estimated threshold value of needs equals $\exp(-B'X / \alpha)$. Equivalently, we could use the predicted linear index (including expenditures) from the ordered probit specification as a scaled measure of expenditures. This model-based approach is straightforward, data driven, and flexible. For instance, it allows us to incorporate controls for state effects (e.g., cost of living, institutional, and market differences) that are not a part of the TFP. The chief disadvantage is that it incorporates the food insecurity scale itself as an input, which may result in a needs measure that is artificially *over-correlated* with hardships.

In addition to these objective, observable measures of needs, we are also able to construct a subjective measure. After the question about usual food expenditures, the FSS asks whether the household would need to spend more than, less than, or the same as it usually does in order to

just be able to meet the members' food needs. Respondents who indicate that the household would have to spend a different amount are asked how much more or how much less would be needed. We construct a subjective threshold for food needs by taking the household's usual food expenditures and adjusting it up or down by the amount people say they would need to just meet their food needs.⁶ For people who indicate that they can meet their food needs by spending the same as they usually do, we use their usual food expenditures as the subjective standard. The subjective measure explicitly relates people's spending with their food needs. As such, it allows us to check whether expenditures are a possible consideration in reporting food problems. More formally, it allows us to examine the internal validity of the data—specifically, whether expenditure-based reports of hardships are consistent with other reports.

Correlation Between Reported Food Hardships and Food Expenditures

We begin our empirical analysis by investigating the correlation between measures of food hardships and measures of expenditures and needs. We expect that hardships will be negatively associated with the former and positively associated with the latter. One complication that arises in our data is that the food insufficiency and insecurity outcomes are categorical. Standard (Pearson) correlations involving categorical variables can be sensitive to the number of categories, making it difficult to compare results across variables. To address this problem, we estimate associations between continuous and categorical variables using Cox's (1974) method and associations between pairs of categorical variables using polychoric correlations. Both approaches assume that the categorical variables are manifestations of latent normally distributed variables. Cox's approach additionally assumes that the continuous variable is normally distributed. Each approach estimates correlations between the normally distributed variables.

Table 1 lists Cox and polychoric correlations between the two indicators for food hardships and alternative measures of food expenditures and needs.⁷ The top half of Table 1 reports statistics for all households in the sample. The first column lists sample means for the expenditure and need measures. The next column lists correlations with the food insufficiency measure, and the final column lists correlations with the food insecurity measure. The bottom half of the table reports the same statistics calculated for FSS households with incomes below approximately 185 percent of the poverty line. To reduce respondent burden, survey costs, and the number of erroneous reports, the December 2003 FSS only asked the food security questions of households that either (a) had incomes below 185 percent of the poverty line, (b) reported not having enough kinds or amounts of food in the food insufficiency question, or (c) reported resorting to some strategy to stretch their food budgets. We examine outcomes among lower income households because, first and foremost, they are a policy-relevant and vulnerable group. However, the analysis of low-income households also serves a methodological purpose. The use of food insufficiency as one of the screening conditions for asking the food insecurity questions leads to an artificial correlation between these measures in the full sample. Because everyone in the low-income group was asked both sets of questions, we can more readily compare the results for this narrower sample.

[Table 1 about here].

The first row in each panel of Table 1 lists correlations of the food insufficiency and insecurity measures with the household's usual weekly food expenditures scaled by the number of people in the household. As expected, weekly per-person food expenditures are negatively correlated with both food insufficiency and food insecurity. Although these correlations are statistically different from zero, neither of them is especially strong. When the sample is

restricted to households with incomes less than 185 percent of the poverty line, the same pattern of results appears, but the correlations with expenditures are even weaker. Correlations between household size and the food hardship measures also show the expected pattern, with modest positive correlations for both the general and low-income samples.

The second rows of the top and bottom panels list correlations involving usual weekly food expenditures scaled by the TFP, with results that are almost identical to those involving per-person food expenditures. Given that the TFP not only adjusts for household size but also for the age and gender composition of the members, we expected a stronger relationship with food hardships. However, if anything, the correlations are weaker on balance when the TFP is used to scale expenditures.

The third rows of the top and bottom panels of Table 1 list correlations involving the household's food expenditures from the previous week scaled by the TFP. Because the usual and previous week's expenditures each have relative strengths, it is hard to say a priori whether the correlations involving one measure or the other should be stronger. The figures in the table indicate that the correlations for the previous week's expenditures are slightly stronger than those for usual expenditures in the general sample but slightly weaker in the low-income sample. The similarities in the results increase our confidence that expenditures are being reported consistently.⁸

The next rows list results for usual weekly expenditures scaled by our model-based estimate of needs. The model-based estimate accounts for more conditions, including state-specific conditions, and is derived from the food insecurity measure, so it is not surprising that it leads to stronger correlations—both when used as a scaling term and when examined by itself—than the household size and TFP measures. Once again, we see the expected negative

association between expenditures and hardships and the expected positive association between needs and hardships.

So far, we have examined food expenditures scaled by objective measures of needs. In the fifth row of each panel, we report statistics for food expenditures scaled by a subjective measure. For the full sample of households, the correlations between the food hardship measures and subjectively-scaled expenditures are negative and stronger than the correlations involving the per-person or TFP-scaled measures but weaker than the correlations involving the model-based needs measures. However, among the low-income households, the correlations involving the subjectively-scaled measures are stronger than those for all of the objectively-scaled measures. One possible explanation for the stronger performance in the low-income sample is that these households may have a better sense of what constitutes an actual hardship threshold. This would be consistent with the work on subjective poverty thresholds where more weight is placed on the responses of those lower in the income spectrum when constructing thresholds (see, e.g., Kapteyn et al. 1988).

Food Hardship Rates Among Households with Low Food Expenditure Levels

Our analysis of Table 1 is similar to previous analyses that have mainly examined raw or partial associations between hardships and other measures. In Table 2, we turn to the more novel implication from our measurement model—that most households with very low food expenditures should report food hardships. Table 2 lists the proportion of households with different characteristics that report having insufficient amounts of food (column 1), having insufficient amounts or kinds of food (column 2), and being food insecure in the last 12 months (column 3). As before, results are reported for the full sample of households in the top panel and

for a subsample of households with income below 185 percent of the poverty line in the bottom panel.

[Table 2 about here].

The first rows in the top and bottom panels list the total proportions of each sample reporting different hardships. The statistics confirm previous findings that low-income households are several times more likely to report food hardships than other households. This is not surprising insofar as we would expect a higher incidence of food hardships among poor and near-poor households due to their having fewer resources available for food purchases. Just under 40 percent of low-income households report that they were unable to obtain the amounts or kinds of food that they wanted, and about a quarter report being food insecure at any point during the previous year.

The next five rows in each panel list the incidence of food hardships among households whose food expenditures fall below certain thresholds. As our first indicator, we consider households whose usual weekly per-person food expenditures are in the bottom 5th percentile—less than \$12.50 per person. Given such a low level of expenditures, we would expect to see many reports of hardships among households in this portion of the distribution. The estimates from Table 2 reveal, however, that this is not the case. To be sure, the proportions of households with hardships are higher in the second row of each panel than the first; however, none of these proportions—not even for low-income households—reaches 50 percent. If we look at the final column of figures, less than a quarter of households with in the bottom 5th percentile of the per-person food expenditure distribution reported being food insecure, and if we restrict our attention to low-income households with low expenditures, the reported incidence of food insecurity only rises to about one-third. These figures strike us as being astonishingly low.

We see very similar results when we define the cut-off in usual food expenditures at one-half of the value of the TFP (about \$36 for the household) and when we consider the previous week's expenditures. Recall that the TFP itself represents a low-end estimate of the minimum amount needed to purchase a nutritious diet; thus, one-half of this amount is a very miserly level. Nevertheless, the incidence of food hardships in each of our samples remains low.

In the fourth row of each panel, we calculate the incidence of food hardships among households whose usual food expenditures scaled by our model-based estimate of needs are in the bottom 5th percentile of the distribution. The model-based estimate appears to be a better indicator of needs. When this scaling is used as opposed to other objective scalings, we observe a higher incidence of reported food problems among households in the bottom part of the expenditure distribution. For instance, using the model-based scaling, one-third of the low-expenditure households in the general sample and one-half of the low-expenditure households in the low-income sample report being food insecure. While the reported incidence of food hardships is higher with this definition of needs with the other objective definitions, the level of hardships remains lower than expected.

In the last rows of each panel, we adopt a subjective rather than an objective threshold. When we do this, the proportion of low-expenditure households classified with food hardships increases dramatically. For example, about two-thirds of households with subjectively low usual expenditures report having insufficient amounts or kinds of food, and about half of the households report being food insecure over the past year. Among the sample with incomes below 185 percent of the poverty line, the incidence of hardships is even higher: 76 percent report having insufficient amounts and kinds of food, while 60 percent report being food insecure over the past year. These results indicate that people's reports of food hardships are

consistent with their responses regarding expenditure thresholds.

Non-parametric Regressions

Our measurement model implies that food hardships should be reported when food expenditures fall below some threshold, but it does not specify where the threshold should be. Although the thresholds in Table 2 are all very stringent, there are many other points that could be considered. One way to show the robustness of our results to different thresholds is to calculate the incidence of food hardships at every point along the expenditure distribution. We do this by estimating non-parametric (kernel-smoothed) regressions of the food hardship measures on the expenditure measures. Along with allowing us to examine the robustness of our results to alternative thresholds, these nonparametric regressions will allow us to consider the relationship between food expenditures and food insufficiency and food insecurity at other points along the expenditure distribution.

The first row of Figure 1 displays results from non-parametric regressions that graph each of the binary indicators from Table 2—insufficient amounts and kinds of food, insufficient amounts of food, and food insecurity—against usual weekly per-person expenditures. Each graph displays results for the entire sample of households (dark lines) and for the restricted sample of low-income households (light lines). All of the regressions exclude a small number of observations that reported having no usual food expenditures.⁹ For the low-income sample, they also omit a few observations with weekly per-person expenditures in excess of \$200.

The figure provides a more complete picture of the relationships between reported food hardships and expenditures than Table 2. Several features are consistent with our earlier descriptive results. Low-income households are more likely to be classified as having a food

hardship than other households at all levels of food expenditures. For both the low-income and general samples, food hardships generally decline with expenditures, except at the very lowest levels of expenditures. In line with the findings from Table 2, we never observe near-universal reporting of food hardships at any point along the expenditure distribution when household size is used as a scaling variable. With this scaling, the highest incidence of food hardships occurs around \$10-\$12 per person, where roughly half of the low-income households report having insufficient amounts and kinds of food and about 40 percent report being food insecure.

The second row of graphs presents results from non-parametric regressions with the same dependent variable but using usual weekly expenditures scaled by the TFP as the explanatory variable. The results are very similar to the previous regressions. In particular, the highest incidence of having insufficient amounts or kinds of food among low-income households is 50 percent, while the highest incidence of food insecurity among low-income households is 40 percent.

The third row of graphs in Figure 1 displays results of non-parametric regressions that use the previous week's expenditures scaled by the TFP as an explanatory variable. The results are also similar to the results from the previous rows with two exceptions: the incidence of food hardships declines across the entire range of expenditures in the new graphs, and the maximum incidence of food hardships is slightly higher in the estimates based on the previous week's expenditures.

In the fourth row, we examine the relationship between food hardships and the distribution of usual food expenditures scaled by our model-based estimate of needs. The estimates from these non-parametric regression models show a stronger relationship than the estimates from our previous models. The reported incidence of food hardships falls with

expenditures across the entire distribution. At the bottom of the expenditure distribution, 60 percent of low-income households report having insufficient amounts or kinds of food and just over 50 percent report being food insecure.

The graphs in the final row show the results of non-parametric regressions run using usual weekly expenditures scaled by the subjective threshold as the explanatory variable. The estimates fit the pattern predicted by our theoretical model—there is near-universal reporting of food hardships at the lowest levels of expenditures, and hardships subsequently decline with expenditures. Another interesting feature of the graphs is that the reporting behavior of low-income households is almost identical to that of the general set of households when expenditures are below the subjective threshold.

Alternative Explanations and Sensitivity Analyses

Our analyses reveal both that when simple objective scalings are used, food expenditures are only modestly associated with reported food hardships and that when any type of objective scaling is used, households with low food expenditures report surprisingly few hardships. In contrast, a much higher percentage of households with low food expenditures below a self-identified subjective threshold report food hardships. As we consider this evidence, we need to evaluate possible reasons for the weak relationship between objectively-scaled expenditures and self-reported food hardships.

An immediate concern is that the food expenditure measures may be noisy indicators of food consumption, which could reduce the association with hardships. Indeed, some patterns in the results, such as the households that report zero usual food expenditures and the initially rising incidence of food hardships at very low levels of usual expenditures, suggest that there may be

reporting deficiencies. To see whether these deficiencies may affect our results, we repeated our analyses several different ways. First, we restricted the sample to only include households with annualized food expenditure-to-income ratios between 5 and 50 percent. In the full sample, only about one-sixth of households had food expenditures that were outside of these ranges. When we eliminate these households, there was little change in the results.

Second, we re-examined the results looking at households at successively lower points in the income distribution. The idea behind this exercise is that households with very low incomes and very low expenditure levels should be especially likely to experience low levels of food consumption. We replicated the results of Table 2 restricting the sample to households with incomes below 50 percent of the poverty line (a common definition of extreme poverty).¹⁰ As expected, the incidence of food hardships is higher among these groups than among the general sample of households but only slightly higher than the low-income (185 percent threshold) sample.

Third, we looked at households which may be at greater risk of food hardships for reasons associated with their demographic characteristics. In particular we looked at households headed by someone with less than a high school degree and households with children headed by a single parent. Neither of these sample restrictions change the general results of Table 2.

Fourth, we were concerned that expenditures would be an inaccurate measure of consumption if the household either (a) had access to free food via food pantries, soup kitchens, food banks, and “meals-on-wheels” programs or (b) had trouble remembering purchases made with food stamps. Either of these conditions could lead to expenditures understating consumption and thus explain lower reported levels of food hardships. We re-analyzed the data using a sample that omitted households that reported receiving meals from “free” sources—about

5 percent of the general sample reported getting this type of assistance. Results from this restricted sample, however, were not different from the general sample. We also re-examined the incidence of food hardships among households that appeared to be eligible for food stamps on the basis of income.¹¹ We found that households with food stamps reported more food hardships than eligible households without food stamps, suggesting that food stamps were not contributing to under-reporting of problems.

Fifth, the availability of multiple reports of food expenditures provides another way to account for possible mismeasurement in any one report. Specifically, we used factor analysis to extract the common factor (presumably an alternative measure of usual expenditures) from each of our expenditure measures scaled by the TFP. The factor analyses indicated that the two expenditure measures were closely related. Non-parametric regression estimates based on the resulting factors (shown in Appendix B) are very similar to estimates based on the individual expenditure measures. As a further test, we conducted a second factor analysis and extracted a common factor from the two expenditure measures along with the income-to-needs ratio. We found that a single factor could adequately account for the correlation among these variables. Non-parametric regression results for this factor were also similar to our other results.

In addition to problems in using expenditures as a measure of consumption, we also considered potential reporting and recall problems in the food hardship indicators themselves. Random variation would weaken the correlations between these and other measures. It does not seem, however, as though measurement error is a major culprit in the pattern of results. For one thing, the incidence of hardships is fairly low. Because of the boundary condition, response errors would tend to inflate the measured incidence of hardships rather than diminish it, at least along some parts of the distribution. Also, the answers to the food insecurity items mostly

follow expected severity patterns and are correlated with other subjective measures. Similar patterns in the food insecurity results for households with and without children, despite the differences in the numbers of questions asked of each type of household. The available evidence indicates that the hardship measures are internally valid.

Conclusion

Our empirical analysis carefully examines the relationship between self-reported food insecurity and insufficiency measures and several measures of expenditures and needs. Unlike previous validation studies, our analysis is framed in terms of a measurement model. The model generates the standard predictions that self-reports of food hardships should be negatively associated with food consumption and positively associated with food needs. However, it also predicts that reported food hardships should be nearly universal once food consumption falls below a threshold level. The model motivates an analysis of the incidence of food hardships at different food expenditure levels but especially at the low end of the distribution. It also indicates ways in which people might combine objective and subjective elements in answering questions about food hardships.

Consistent with previous research finding evidence that food hardships have some basis in objective, material circumstances, we find that food insecurity and insufficiency are associated with incomes, expenditures and needs in the expected directions. However, we also find that the association between self-reported food hardships and objectively-scaled food expenditures is weak and that the prevalence of hardships among households with low levels of income and objectively-scaled expenditures is low. The highest incidence of food insecurity when the full sample of households is arrayed along an objectively-scaled measure of food expenditures, is 40

percent. The incidence rises among households with lower incomes but is never much above 50 percent.

When we use a subjective normalization, we find a much higher incidence of food hardships among households with low food expenditures. This leads us to conclude that reports of food hardships are internally consistent. Nevertheless, the low level of reporting among households at the bottom of the expenditure distribution indicates the skepticism expressed by some social scientists regarding the accuracy of food hardship measures may be well-placed. The most reasonable explanation for these reporting patterns is social-desirability bias, which occurs when survey subjects are uncomfortable reporting potentially embarrassing information. Unfortunately, the data in the CPS-FSS do not allow us to pursue this explanation further.

Reporting problems notwithstanding, food insecurity and food insufficiency appear to be real phenomena with serious consequences. Our analysis shows that they are associated, albeit modestly, with incomes, expenditures, and needs, and other research has related these measures to economic, social, and health outcomes. Our findings that food hardships are under-reported at the low end of the expenditure distribution should be disquieting to researchers and policymakers. The data may be masking genuine distress among the disadvantaged households, and the modest relationship with food expenditures may mean that the food insecurity and insufficiency measures will have difficulty registering increases in well-being from policy innovations and economic improvements.

References

- Bhattacharya, J., J. Currie, and S. Haider. 2004. "Poverty, Food Insecurity, and Nutritional Outcomes in Children and Adults." *Journal of Health Economics* 23(4): 839-862.
- Bitler, M., C. Gundersen, and G. Marquis. 2005. "Are WIC Non-Recipients at Less Nutritional Risk than Recipients? An Application of the Food Security Measure." *Review of Agricultural Economics*, in press.
- Borjas, G. 2004. "Food Insecurity and Public Assistance." *Journal of Public Economics* 88: 1421-1443.
- Cox, N. R. 1974 "Estimation of the Correlation between a Continuous and a Discrete Variable." *Biometrics* 30: 171-178.
- Davis, D., and E. Leibtag. 2005. *Interstate Variation in WIC Food Package Costs: The Role of Food Prices, Caseload Composition, and Cost-Containment Practices*. Washington, DC: U.S. Department of Agriculture, Economic Research Service, Food Assistance and Nutrition Research Report 41.
- Dunifon, R., and L. Kowaleski-Jones. 2003. "The Influences of Participation in the National School Lunch Program and Food Insecurity on Child Well-Being." *Social Service Review* 77(1): 72-92.
- Furness, B., P. Simon, C. Wold, and J. Asarian-Anderson. 2004. "Prevalence and Predictors of Food Insecurity Among Low-Income Households in Los Angeles County." *Public Health Nutrition* 7(6): 791-794.
- Gundersen, C., L. Weinreb, C. Wehler, and D. Hosmer. 2003. "Homelessness and Food Insecurity." *Journal of Housing Economics* 12(3): 250-272.
- Habicht, J., G. Pelto, E. Frongillo Jr., and D. Rose. 2004. "Conceptualization and

- Instrumentation of Food Insecurity.” Paper prepared for the NAS Committee on National Statistics Workshop on the Measurement of Food Insecurity and Hunger, Washington, DC.
- Kapteyn, A., P. Kooreman, and R. Willemsse. 1988. “Some Methodological Issues in the Implementation of Subjective Poverty Definitions,” *Journal of Human Resources* 23(2): 222-242.
- Laraia, B., A. Siega-Riz, C. Gundersen, and N. Dole. 2006. “Psychosocial Factors and Socioeconomic Indicators are Associated with Household Food Insecurity Among Pregnant Women,” *Journal of Nutrition* 136: 177–182.
- Nord, M. 2002. *A 30-Day Food Security Scale for Current Population Survey Food Security Supplement Data*. Washington, DC: U.S. Department of Agriculture. E-FAN Report 02-015.
- Nord, M., M. Andrews, and S. Carlson. 2004. *Household Food Security in the United States, 2003*. Washington, DC: U.S. Department of Agriculture, Economic Research Service, Food Assistance and Nutrition Research Report 42.
- Nord, M., and C. Brent. 2002. *Food Insecurity in Higher Income Households*. Washington, DC: U.S. Department of Agriculture, Economic Research Service, E-FAN Report 02-016.
- Oliveira, V., and D. Rose. 1996. “Food Expenditure Estimates from the 1995 CPS Food Security Supplement: How Do They Compare with the Consumer Expenditure Survey?” Washington, DC: Economics Research Service, Staff Paper no. AGES 9617.
- Ribar, D., and K. Hamrick. 2003. *Dynamics of Poverty and Food Sufficiency*. Washington, DC: U.S. Department of Agriculture, Economic Research Service, Food Assistance and Nutrition Research Report 33.

- Rose, D. and V. Oliveira. 1997. *Validation of a Self-Reported Measure of Household Food Insufficiency with Nutrient Intake Data*. Washington, DC: U.S. Department of Agriculture, Economic Research Service, Technical Bulletin 1863.
- Van Hook, J., and K. Balistreri. 2006. "Ineligible Parents, Eligible Children: Food Stamps Receipt, Allotments, and Food Insecurity Among Children of Immigrants." *Social Science Research* 35(1): 228-251.
- Wilde, P. 2004. "The Uses and Purposes of the USDA Food Security and Hunger Measure." Paper prepared for the NAS Committee on National Statistics Workshop on the Measurement of Food Insecurity and Hunger, Washington, DC.

Table 1. Correlations between food hardship, food expenditure and food needs measures

| | | Correlation ^a with | |
|--|---------|-------------------------------|--------------|
| | | Food | Food |
| | | insufficiency | insecurity |
| | | measure – | measure – |
| | (Mean) | 4 categories | 3 categories |
| <i>All households</i> | | | |
| <i>Alternative measures of food expenditures scaled by needs</i> | | | |
| Usual weekly per-person food expenditures | (47.24) | -0.246 | -0.266 |
| Ratio of usual weekly food expenditures to TFP | (1.47) | -0.248 | -0.264 |
| Ratio of previous week's food expenditures to TFP | (1.63) | -0.264 | -0.288 |
| Ratio of usual weekly food expenditures to model-based objective threshold | (70.30) | -0.363 | -0.541 |
| Ratio of usual weekly food expenditures to subjective threshold | (1.17) | -0.284 | -0.429 |
| <i>Alternative measures of food needs</i> | | | |
| Household size | (2.42) | 0.047 | 0.066 |
| Thrifty Food Plan | (72.42) | 0.043 | 0.055 |
| Model-based objective threshold | (3.84) | 0.163 | 0.186 |
| Subjective threshold | (93.18) | 0.034 | 0.079 |
| <i>Households with incomes less than 185 percent of the poverty line</i> | | | |
| <i>Alternative measures of food expenditures scaled by needs</i> | | | |
| Usual weekly per-person food expenditures | (35.79) | -0.105 | -0.090 |
| Ratio of usual weekly food expenditures to TFP | (1.13) | -0.096 | -0.078 |
| Ratio of previous week's food expenditures to TFP | (1.22) | -0.082 | -0.054 |
| Ratio of usual weekly food expenditures to model-based objective threshold | (41.36) | -0.234 | -0.331 |
| Ratio of usual weekly food expenditures to subjective threshold | (1.02) | -0.241 | -0.373 |
| <i>Alternative measures of food needs</i> | | | |
| Household size | (2.48) | 0.074 | 0.086 |
| Thrifty Food Plan | (72.04) | 0.075 | 0.084 |
| Model-based objective threshold | (5.73) | 0.124 | 0.150 |
| Subjective threshold | (84.01) | 0.172 | 0.187 |

Notes: Statistics calculated using weighted data from December 2003 CPS-FSS.

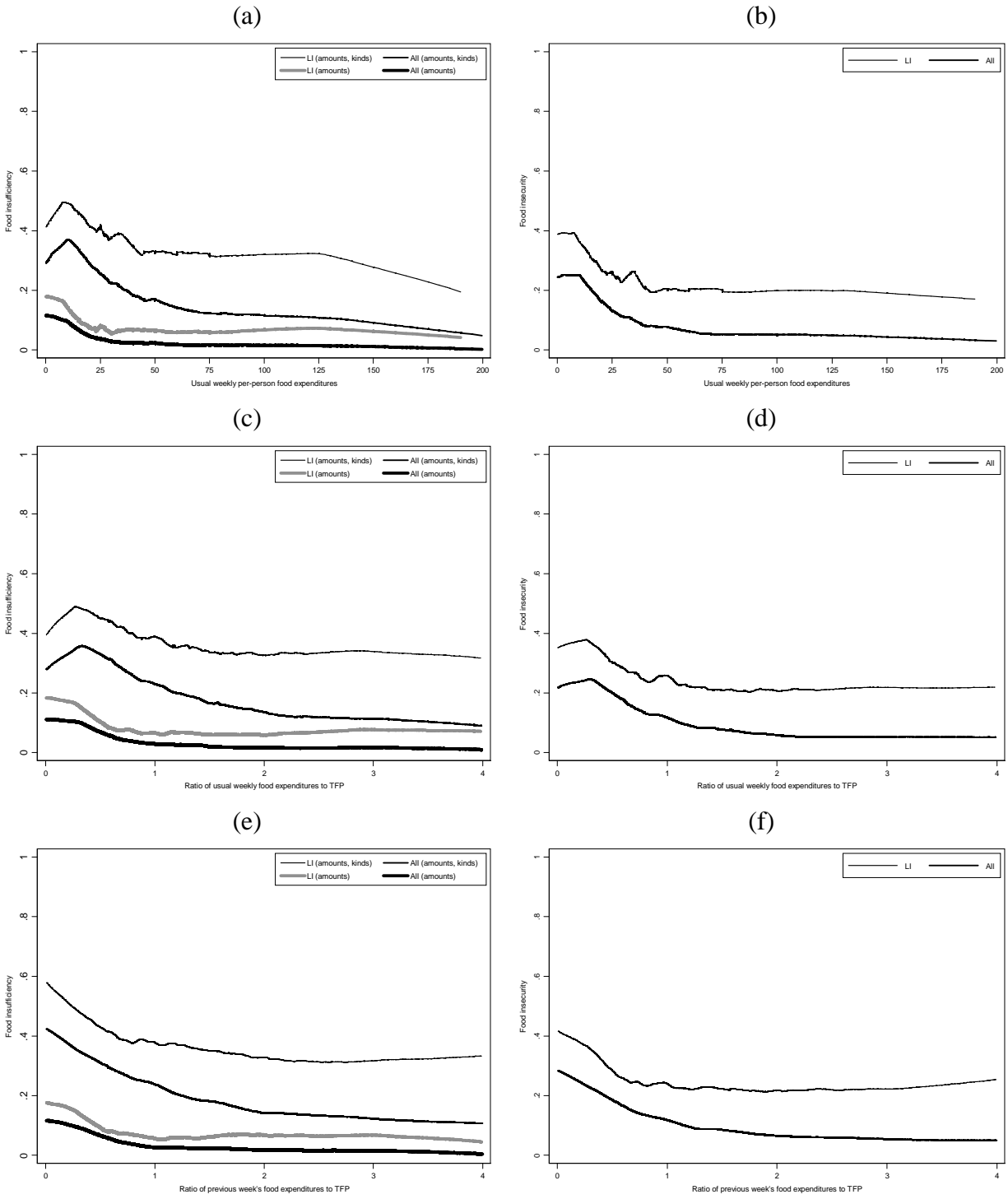
^a Cox's (1974) method is used to measure correlations between continuous and categorical variables, and polychoric correlations are used to measure the association between categorical measures. All of the correlations are statistically different from zero at the 5 or 1 percent level.

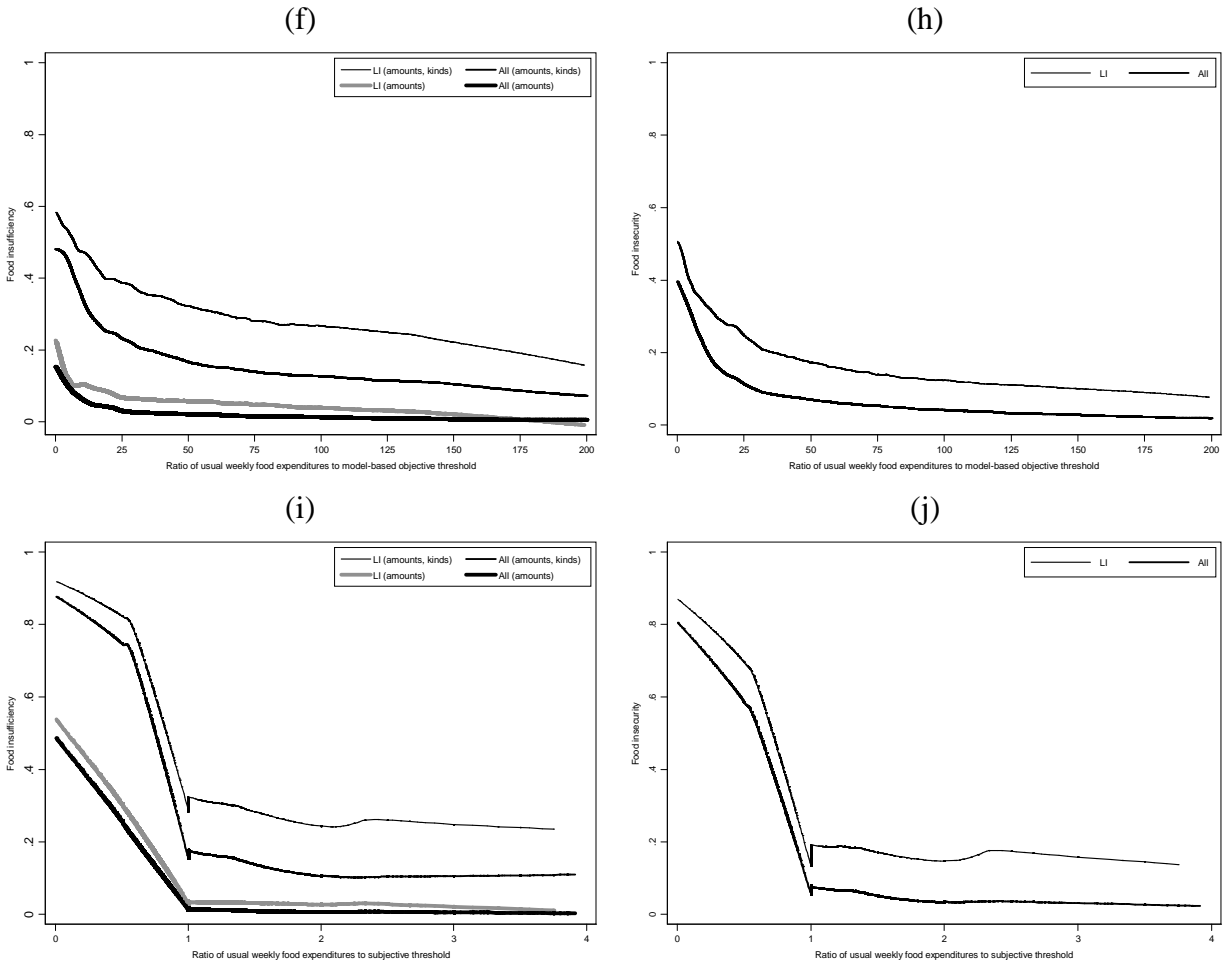
Table 2. Proportions of households in different conditions reporting food insufficiency and insecurity

| | Insufficient amounts of food | Insufficient amounts & kinds of food | Food insecure |
|---|------------------------------------|--|---------------|
| <i>All households</i> | | | |
| All households | 0.033 | 0.203 | 0.106 |
| Usual weekly per-person food expenditures in lowest 5 th percentile | 0.092 | 0.319 | 0.225 |
| Usual weekly food expenditures below ½ TFP | 0.090 | 0.323 | 0.222 |
| Previous week's food expenditures below ½ TFP | 0.057 | 0.256 | 0.154 |
| Usual expenditures low relative to model-based objective threshold (lowest 5 th percentile) | 0.107 | 0.463 | 0.334 |
| Usual expenditures below subjective threshold | 0.203 | 0.665 | 0.492 |
| <i>Households with incomes less than 185 percent of the poverty line</i> | | | |
| All low-income households | 0.083 | 0.393 | 0.260 |
| Usual weekly per-person food expenditures in lowest 5 th percentile | 0.138 | 0.451 | 0.344 |
| Usual weekly food expenditures below ½ TFP | 0.140 | 0.458 | 0.347 |
| Previous week's food expenditures below ½ TFP | 0.112 | 0.449 | 0.315 |
| Usual expenditures low relative to model-based objective threshold (lowest 5 th percentile) | 0.133 | 0.540 | 0.498 |
| Usual expenditures below subjective threshold | 0.254 | 0.758 | 0.603 |

Notes: Statistics calculated using weighted data from December 2003 CPS-FSS.

Figure 1. Non-parametric regression estimates of the relationship between food hardships and weekly food expenditures





Note: Non-parametric regressions estimated using weighted data from December 2003 CPS-FSS. The estimates omit households with no reported expenditures and households with very high expenditures (usually above the 95th percentile).

Appendix A. Food security questions on the December 2003 CPS-FSS

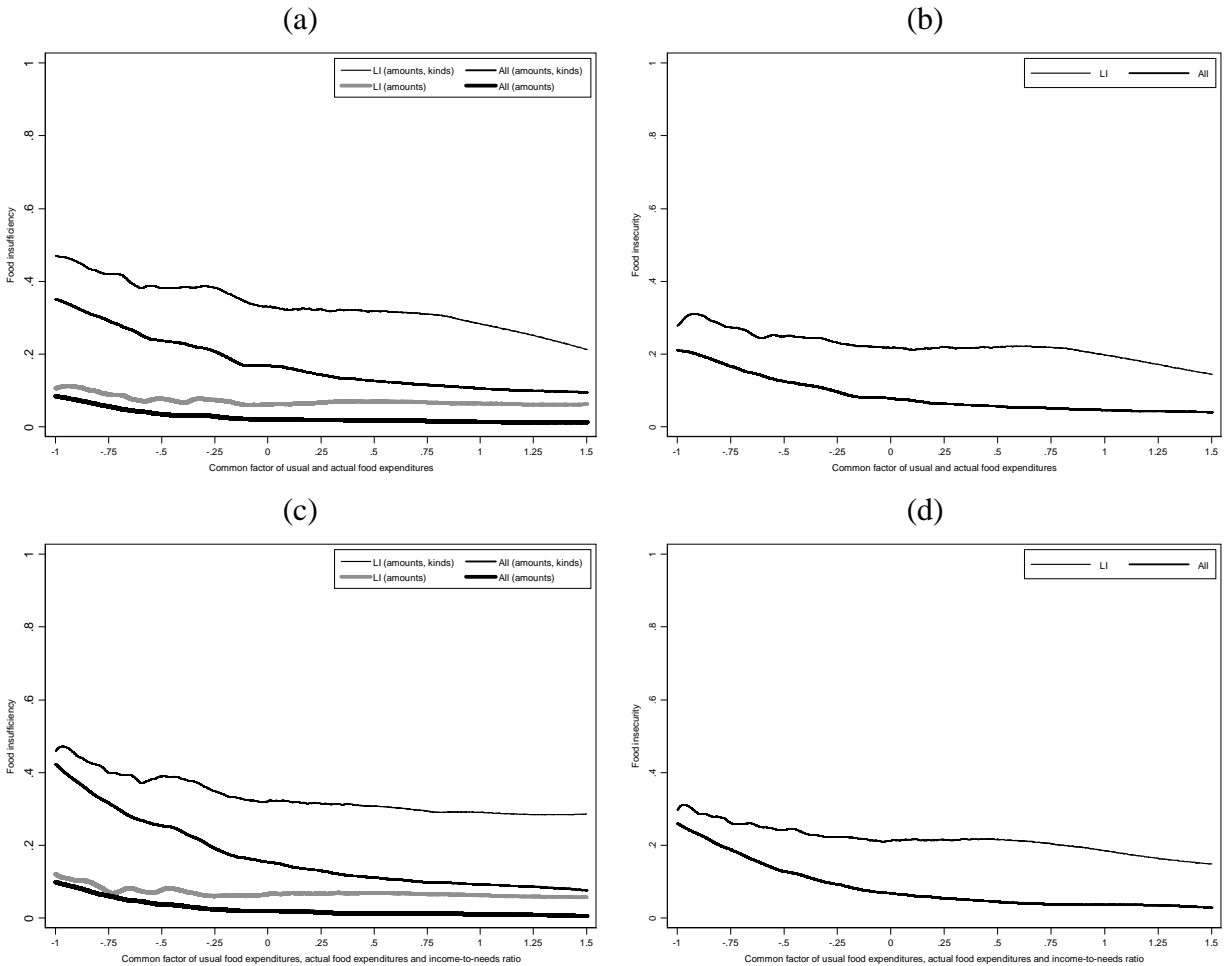
“Now I'm going to read you several statements that people have made about their food situation. For these statements, please tell me whether the statement was OFTEN true, SOMETIMES true, or NEVER true for (you/your household) in the last 12 months.”

- “(I/We) worried whether (my/our) food would run out before (I/we) got money to buy more. “
- “The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more. “
- “(I/we) couldn't afford to eat balanced meals. “
- “(I/we) relied on only a few kinds of low-cost food to feed ((my/our) child/the children) because “(I was/we were) running out of money to buy food.”
- “(I/we) couldn't feed ((my/our) child/the children) a balanced meal, because (I/we) couldn't afford that.”
- “((My/Our) child was/The children were) not eating enough because (I/we) just couldn't afford enough food.”

The remaining questions ask whether a condition occurred in the last 12 months and if so, how often (“almost every month, some months but not every month, only 1 or 2 months”),

- “Did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?”
- If yes, did adults skip in 3 or more months?
- “Did you ever eat less than you felt you should because there wasn't enough money to for food?”
- “Were you ever hungry but didn't eat because you couldn't afford enough food?”
- “Did you lose weight because you didn't have enough money for food? “
- “Did you ever cut the size of (your child's/any of the children's) meals because there wasn't enough money for food?”
- “Did (you/you or other adults in your household) ever not eat for a whole day because there wasn't enough money for food?”
- If yes, did adults not eat for a whole day in 3 or more months?
- “(Was your child/ Were the children) ever hungry but you just couldn't afford more food?”
- “Did (your child/any of the children) ever skip a meal because there wasn't enough money for food?”
- If yes, did children skip meals in 3 or more months?
- “Did (your child/any of the children) ever not eat for a whole day because there wasn't enough money for food?”

Appendix B. Non-parametric regression estimates of the relationship between food hardships and factor-analytic summaries of weekly food expenditures



Note: Non-parametric regressions estimated using weighted data from December 2003 CPS-FSS. Factors in panels (a) and (b) come from analyses of the usual and actual weekly food expenditures for households each scaled by the TFP. Factors in panels (c) and (d) come from analyses of the usual and actual weekly food expenditures scaled by the TFP and the annual income-to-needs ratio. The non-parametric regressions omit the bottom one percent and top five percent of the factor values.

Endnotes

¹ Recent examples include Bhattacharya et al. (2004), Bitler et al. (2005), Borjas (2004), Dunifon and Kowaleski-Jones (2003), Furness et al. (2004), Gundersen et al. (2003), Laraia et al. (2006), Ribar and Hamrick (2003), and Van Hook and Balistreri (2006).

² Wilde (2004) provides a thorough discussion of the uses and misuses of the food security measure.

³ All of the estimates that are reported in this study use sampling weights provided with the CPS.

⁴ Recently, the USDA changed the definition of this condition to “very low food insecurity.”

⁵ Several of the food insecurity questions are followed by additional queries regarding whether the household experienced the same problem or condition in the past 30 days. These can be used to calculate the “30-day food insecurity scale” (Nord 2002). In principle, the shorter recall period for the 30-day scale should lead to more accurate responses. However, the use of the 12-month insecurity questions as screens means that false negatives from these items will be transmitted to the 30-day measure. We have examined these data and found that they have much weaker associations with our expenditure and needs measures than the 12-month measures.

⁶ For example, someone who reported that their household usually spent \$100 per week on food and that would need to spend an additional \$20 per week to meet their food needs would have a subjective needs level of \$120.

⁷ Results based on Pearson (product-moment) correlations are similar, though the absolute values of the correlations are generally smaller.

⁸ Oliveira and Rose (1996) found that expenditure reporting in the FSS was consistent with reporting from the Consumer Expenditure Survey.

⁹ The households reporting no usual expenditures were dropped because of the obvious inconsistency with food consumption. The incidence of hardships among these households was slightly lower than the incidence among households with small positive expenditures.

¹⁰ In the CPS, income is reported in 14 intervals rather than continuously. To establish income, we assign the midpoint of the relevant interval to each household.

¹¹ To receive food stamps, households must meet three financial criteria: a gross-income test, a net-income test, and an asset test. Because of the limited data in the CPS, we could only apply the gross-income test, restricting the sample to households with gross monthly pre-tax incomes approximately below 130 percent of the poverty line.