

Session V: Food Security Measurement Applications

Dynamic Determinants of Food Insufficiency

Craig Gundersen

Joseph Gruber is a co-author of this paper.

A household's current well-being depends not only on its current income, but also, in part, on past actions and its expectations of the future. Economists have incorporated into many analyses the effects of past actions and expectations. For example, our wages today depend on past human-capital investments; current consumption depends upon past savings; and the decision to participate in an assistance program depends, in part, on a household's expectation of future income.

A household may face unexpected changes to its expenditures, such as an emergency health expense or a large car repair, or to its income. High- and middle-income households may weather negative shocks through savings and other assets. Low-income households, however, may experience more negative consequences because they may lack this savings buffer and may be more likely to be liquidity constrained. Our model relates food insecurity to asset positions, shocks, liquidity constraints, and lack of savings in the context of a household's dynamic decisionmaking process. Chris Hamilton raised some of these matters about dynamics yesterday.

Current income clearly matters in predicting food insufficiency. In 1992, of those households with income less than 50 percent of the poverty line, 10.2 percent are food insufficient, while of those households above 150 percent of the poverty line, only 2.6 percent are food insufficient. But why are only 10 percent of the very poor households food insufficient and the other 90 percent food sufficient? Furthermore, if an income of 150 percent of the poverty line suggests that income is sufficient for food sufficiency, why are 2.6 percent of such households food insufficient?

Our paper provides some answers to these questions.

Our model begins with a standard dynamic optimizing framework. Current-period utility is defined over two goods, food consumption and other goods. Expected utility is maximized, subject to an intertemporal budget constraint and initial assets A_0 ; interest and subjective discount rates are ignored. A household knows its mean income Y and the variance of its income, although it does not know the size or timing of income shocks. Consumption is the sum of food and other goods expenditures. Upon solving the model, optimal consumption C_t equals $Y + (1/T) A_0$.

A household is food insufficient in a period if its food falls below a level \underline{F} , and a household is "other goods insufficient," for example, inadequately sheltered, if other goods consumption falls below \underline{OG} . Minimum expenditures \underline{Z} , given by $p_F \underline{F} + p_{OG} \underline{OG}$, is necessary to avoid both types of insufficiency. If a household has $Y + (1/T) A_0 < \underline{Z}$, it has the possibility of being food insufficient. As Professor Mayer said yesterday, low income by no means implies food insufficiency. In our model, a household can trade-off: it may choose to be food sufficient at the cost of other-goods insufficient or, conversely, a household may choose to be food insufficient to maintain sufficiency in other goods. Households with low initial assets are more likely to face such a choice. Hereafter, for discussion I will suppose that such households will be food insufficient after all. Thus, the first explanation for food insufficiency is that the household has low income, at least on average over the planning horizon, and low initial assets. Such a household cannot maintain food sufficiency in every period. The model allows for other explanations of food insufficiency, including the role played by cross-household variation in prices or the levels of household-specific \underline{OG} , which can vary across households due, for example, to medical needs.

If $Y + (1/T) A_0 > Z$ for a household, it has income and assets sufficient to maintain food sufficiency on average. However, even this household can face a negative income shock so large that it may become food insufficient. If current period assets, based in part on past saving, are small relative to the income shock and a household faces liquidity constraints, food insufficiency can be a consequence of the shock.

In the empirical sections, we compared food-sufficient and food-insufficient households to see if food-insufficient households have more income shocks, less savings, and more liquidity constraints. We do find that these factors are relevant.

We used the 1991 and 1992 panels of the Survey of Income and Program Participation, the only nationally representative data set with monthly information before and after a household is food insufficient. Because 80 percent of all food-insufficient households are below 200 percent of the poverty line and only 0.06 percent of households above 200 percent of the poverty line are food insufficient, we confined our sample to households with incomes below 200 percent of the poverty line in Wave 3 of 1992 panel and Wave 6 of 1991 panel. A household is classified as food insufficient if it answers that they sometimes or often do not get enough of the kinds of foods they want to eat. The food-insufficiency status is observed for a household in months 9 through 12. The first bout of food insufficiency for a household can be in any of those last 4 months, and we look at households in the 8 months leading up to that event.

We used descriptive statistics rather than an econometric panel model or some other treatment because we did not have food-insufficiency data for every period and because the SIPP does not contain long-term consumption data.

The paper provides detailed results, including those variables that, at 95-percent confidence, turned out not to affect food sufficiency. Here we focus on certain variables that do make a difference.

We say that a household lost earnings if its earnings fell to zero in any month, even if it later regained its earnings. In the sample, only 14.8 percent of food-sufficient households lost earnings, while 23.6 percent of food-insufficient households lost earnings. Income shocks are also more common among food-insufficient households.

Losing food stamps may have a bigger impact on food sufficiency than losing an equivalent amount of earnings due to the greater marginal propensity to consume out of food stamps than out of cash. In the sample, only 5.9 percent of food-sufficient households had lost food stamps, while 14.8 percent of food-insufficient households had lost them. Although some households lose food stamps due to an increase in income, we find that an income-increase is present in only about 15 percent of the households, and about the same for food-sufficient and food-insufficient households.

At the conference yesterday, people were speculating about the effect of savings on the ability to weather shocks. We classified a household as one with liquid savings if it earns interest in every month. We found that food-sufficient households are much more likely to have savings than are food-insufficient households, 26.7 versus 3.6 percent.

Homeownership is not a liquid asset, but you can borrow against equity and it has other advantages. Health insurance, including Medicaid and Medicare, is not a marketable asset, but it is a buffer for unexpected health shocks. In the data, food-sufficient households are much more likely to be homeowners and have health insurance than are food-insufficient households.

We also examined differences across households in the subgroup of those that experienced an income shock. For example, in that subgroup food-sufficient households were more likely to have savings than were food-insufficient households.

The SIPP does not have a direct question about access to credit. Neither can we conduct a formal indirect test for liquidity constraints, as in Zeldes' 1989 paper,¹² because it requires consumption data and a long time period. However, Jappelli's paper shows that liquidity-constrained households have lower incomes and lower savings and are more likely to be renters and non-white than households not liquidity constrained.¹³ Similar characteristics are more likely to hold for food-insufficient households than for food-sufficient households. Thus, liquidity constraints of some sort—be it low savings or limited access to credit—do seem to characterize the types of households that are food insufficient.

In conclusion, we make four points. First, that current economic status has a major impact on who is food insufficient. The work of Prasanta Pattanaik, Amartya Sen, Susan Mayer, Christopher Jencks, and many others has shown that current income is not always well correlated with more direct indicators of well-being. We have shown this is the case with food insufficiency as well.

Second, the level of savings and liquidity constraints are important determinants of food insufficiency. In terms of policy, we can encourage households to plan over a longer time horizon while still recognizing the serious constraints that low-income households face. We can also encourage a larger presence of the mainstream banking in low-income areas and other ways to improve access to credit for low-income households.

Third, the asset test as part of the eligibility criteria of the Food Stamp Program appears to be accurately screening out households with lower probabilities of food insufficiency. Hence, if food stamp funds are limited, using the asset test appears to be effective at better targeting those

¹²Zeldes, Stephen. "Consumption and Liquidity Constraints: An Empirical Investigation," *Journal of Political Economy*. Vol. 97, No. 2. pp. 305-346. 1989.

¹³Jappelli, Tullio. "Who is Credit Constrained in the U.S. Economy?" *The Quarterly Journal of Economics*. Vol. 105. pp. 219-234. 1990.

more in need, at least in terms of food insufficiency.

Fourth, we emphasize the important role food stamps play in our efforts to eradicate food insufficiency. Our work has shown the serious consequences faced when households lose food stamps, and policymakers may wish to take this into consideration when changing the Food Stamp Program. The recent Personal Responsibility and Work Opportunity Reconciliation Act eliminated the eligibility of most unemployed able-bodied adults without dependents (ABAWD's) and non-citizen immigrants, and there is some evidence that people leaving TANF are also leaving food stamps for unexplained reasons, despite their continued eligibility. Our work indicates that these households may be at greater risk of becoming food insufficient. Whether this is the case is an important area for future research.

Discussion

Thesia Garner

Craig related food insufficiency to current income, savings, and ability to borrow. For a given income—even if it is a somewhat higher income—a household without savings and facing liquidity constraints is more likely to be food insufficient. That implication fits the comment yesterday of a discussant, Beth Osborne Daponte, that when you make a lot, you spend a lot.

Advantages of the model in this paper include its examinations of trade-offs and of the dynamic processes. A major criticism of our current poverty measure, that is, current annual income, is that it is not dynamic. At the Census Bureau, there has been work using SIPP to look at dynamic poverty. For the paper presented here, the advantage of using SIPP is that it reports the number of months, as well as the specific months, in which food insufficiency was experienced by a household, thus avoiding the time problem of the 18-item CPS scale.

Craig and Joseph have done an excellent job on the two issues of financial assets and constraints.

But what about the value of home production and in-kind transfers? Or other constraints such as time or skills? Time may be the key constraint for single parents. Could we collect more data on uses of time? Skills in financial management, food management and preparation, and shopping are important too. Another constraint is medical expenditures, which is under consideration in revising the official poverty line. Medical expenditures enter the theoretical model through “other goods.” What about some other shocks such as births, deaths, or morbidity?

I have some concerns. The theoretical model was not formally tested. I also suggest that the study limit the sample to those who do not have enough to eat due to “not enough money” rather than to other reasons such as “no working stove.” You might consider subjective poverty lines, as in some work done at the World Bank. I also encourage you to use the results to come up with food-insufficient gaps similar to poverty gaps from income-distribution analysis. I think the Department of Agriculture is uniquely situated for developing food-insufficiency gaps using some of the best family and resource management economists.

Food Insufficiency and Children's Health Status in the United States: Findings From NHANES III

Katherine Alaimo

This work was jointly conducted with Christine Olson and Edward Frongillo, Jr. I would also like to acknowledge the input of Dr. Ronette Briefel.

The data we studied are from the Third National Health and Nutrition Examination Survey conducted by the National Center for Health Statistics, which is one of the Centers for Disease Control and Prevention. The survey was a cross-sectional representation of the U.S. population who were not homeless, living in an institution, or in the military. It lasted from 1988 to 1994 and included interviews and medical examinations of over 34,000 people, including the approximately 3,000 children, 6 to 11 years old, that we used for our study.

For the purposes of NHANES III, food insufficiency was defined as an inadequate amount of food due to a lack of resources. We combined those children who lived in families that answered they sometimes and often did not get enough food to eat and called those children food insufficient. From 1988 to 1994, over 1 million children were food insufficient, approximately 14 percent in the low-income population, defined as below 131 percent of the poverty line, and approximately 2 percent in the middle-income population. In the middle-income group, most children who were food insufficient were below 200 percent of the poverty line.

To measure health status, we used the question: "Would you say your child's health in general is excellent, very good, good, fair or poor?" We combined those who replied "fair" or "poor" into a single group, leaving four categories. This question has been used extensively with adults, and to some extent with children. In adults it has been shown to be valid and reliable and a strong independent predictor of mortality and the onset of disabilities.

To examine how well the replies were associated with other health indicators in children, we ran an ordinal logistic regression model between the 4-part question as the outcome and 10 separate health indicators: physician-reported health status, colds, stomach aches, headaches, ear infections, coughs, iron deficiency, blood lead level, infections, and school-restricting impairment. Proxy-reported health status was associated with almost all of the health indicators. We concluded that by using this question there is a minimal risk of reporting bias.

Physicians rated less than 1 percent of the children in fair- or poor-health status. Mothers were a little more critical of their children's health status—they rated 4 percent of their children in fair- or poor-health status. Food-insufficient children were much more likely to be reported in fair- or poor-health status. The prevalence was about 14 versus 3 percent for the food-sufficient children.

Among low-income households, 14 percent of the food-insufficient children had fair or poor health, while only 7 percent of low-income children had fair or poor health if they were food sufficient. The figures for the middle-income group are 9 versus 2 percent.

Was the difference in health status between food-sufficient and food-insufficient children due to food insufficiency itself, or was it due to some other factor that could be associated with food insufficiency and health status? To answer this, we ran ordinal logistic regression models to control for other variables. The NHANES III survey provided data about family income, health insurance coverage for children, age of children, gender, race and ethnicity, family size, marital status of family head, the family head's educational level, employment status of the family head, mother's age at the child's birth, and metropolitan or nonmetropolitan residence. Each of these factors can potentially affect the child's food insufficiency status and health status. NHANES III also provides data on children's health care, specifically, access to a regular source of health care, as well as environmental and past health factors, including blood lead level, low birth weight, birth complications, prenatal exposure to

smoke, and attendance at day care or nursery school before the age of 4. We ran an ordinal logistic regression with the 18 factors to see whether food insufficiency was an independent predictor of the child's health status.

Ordinal logistic regression compares each category of health status with the category above it. The odds ratios it calculates are the odds of the child being in a poorer health status. I will show just the odds ratios that were statistically significant.

As expected, the children's family income was significantly related to their health status. The children in low-income families were 2.6 times more likely to be in poorer health status than children in high-income families, while in the middle-income families, the odds ratio was 1.6.

Mexican-American children whose proxy answered the health status question in Spanish were 4.5 times more likely to be in a poor health status. I think that at least part of the difference is an artifact of a nuance of language: English-speakers tend to answer "good" when asked about health and Spanish-speakers tend to answer "fair." This nuance leads to classifying the health of Spanish-speakers' children as poorer than it actually is. However, Mexican-American children whose proxy answered in English were still more likely than non-Hispanic white children to have poorer health status, as were non-Hispanic black children.

Educational attainment of the family head was significantly related to children's health status. Those children whose family heads did not have a high school diploma were 1.9 times more likely to be in poor health status than those whose family head had at least a high school diploma.

Employment status of the family head was also significant, with an odds ratio of 1.5.

Interestingly, whether the child attended day care or nursery school before the age of 4 was significantly related to their health status. The odds ratio was 1.6.

Finally, food insufficiency was associated with health status, even after controlling for all of these other factors. Children who were living in food-insufficient families are 1.6 times more likely to have poor health status than children living in food-sufficient families.

I want to emphasize that because this data is cross-sectional, causality cannot be determined. We cannot conclude that food insufficiency necessarily causes children to have poorer health status. Nevertheless, this study demonstrates an association between food insufficiency and children's health status and, once again, highlights that our poor children are vulnerable and are at an increased risk for negative outcomes.

Discussion

Kathy Radimer

I am going to use Katherine's well-presented paper as a jumping off point for my points about measurement and issues in outcome analyses. My views are based upon the 32 women I interviewed for my research, as well as the 7 years I spent living in developing countries.

First, I believe that adult hunger is important to measure, not just children's hunger. A household with a woman who eats a piece of toast a day for a month, but who is able to feed her children is classified as not hungry. I think that this is hunger and that it needs acknowledging.

Second, I advise that we not lump those who say they are worried about food and are running out of food with the food-secure households. Maybe we could call them at risk. There is a fluidity between categories for these households, presumably depending on the security of their additional food resources. If they are going to mom's and something happens to mom, or if they are going to the food pantry and the food pantry runs out, then they suddenly drop to a food insecurity category. Analyses should separate this at-risk group from the food secure.

Third, while outcome-type analyses, such as the one that Katherine did, are important and inter-

esting, I would not like us to think of them as validation. If a household is food insufficient, but no health or behavioral problems are detected, it still matters that somebody went without food. I do not know that we can eliminate all hunger, but food insufficiency matters, even if we do not detect any health effects.

Fourth, for stronger outcome analyses, more precise indicators are needed. Maybe we should separate children, adult, and household items, and look at each individually. For example, children's food security status specifically could be used to analyze children's diets. Of course, that doesn't mean that only children's items can be used to examine effects on children. As Cheryl pointed out yesterday, if a household or mother is having food problems that can affect her child's behavior, school performance, and mental health, we might want to look at those associations. Women who are spending time trying to scrape together enough food to feed their families can't spend that time with their children, and the psychological stress they feel from the situation affects their children.

Fifth, we need to think about how to distinguish between a person who went hungry, say, every

day for a month or two from a person who went hungry, say, several days each month. Outcome indicators, such as diet and weight loss, may be different for these groups, so we need to try to separate them in analyses.

Sixth, we need to find out more about what's causing these problems. Different causes suggest different courses of action. Craig covered many of the income issues. I talked with women whose husbands did not get paid for work they had done. This can be dealt with legally. Others just had extra expenses: medical expenses, or a husband came back and food stamps did not cover him, or they tried to help a relative's food problems. Emergency food stamps could help here. Some people who I talked to had low competency levels or management skills. Help for these people requires more than just extra money.

Finally, the people we are talking about are Americans. They do not want to be outcasts in their own society. They don't want to live in a way that might be acceptable in other countries. Their kids want to be like other kids. They do not want to be told to accept standards from other times and other societies; they want to be a part of today's American society.

Food Insecurity and Medical Conditions Observed in an Adult Population

Karin Nelson

I did this work in collaboration with Margaret Brown and Nicole Lurie in response to our involvement with patients during a residency at Hennipen County Medical Center. As physicians, we became interested in this area through several cases including K.J., who is a 32-year-old woman with Type 1 diabetes. She was admitted to the hospital for ketoacidosis, a condition that is precipitated by a deficiency of insulin. Usually, either the body does not use the insulin correctly, for example, with an infection, or the patient stops taking the insulin. Some patients wrongfully think that if they get too sick, they should not take their insulin. K.J. came in with ketoacidosis. She had stopped taking her insulin because in the previous week she kept on having insulin reactions. These are low blood sugars that can actually cause you to faint and feel really sick. She was having these insulin reactions because she could not afford food and kept on taking her prescribed insulin. Even though it was a county hospital, we had not seen this circumstance before.

K.J. had been recently unemployed and had lost her food stamp benefits. I interviewed about 10 other diabetics and found that people were having similar sorts of problems. We decided to do a survey to see if the problem was prevalent in our patient population.

The purpose of our study was twofold. We wanted to know the prevalence of hunger in our adult patients and to identify the impact of hunger on diabetics. In 1997, we interviewed all people who were admitted to the medical, surgical, and neurological services for 2 weeks. We also wanted to get an outpatient sample: we interviewed all patients who had attended our general medicine clinic for a week. To get a subsample of diabetics, we got pharmacy data and called all the people who had received insulin for a month. We also collected self-reported data for demographics, health status, lifestyle habits, health

insurance information, and any changes in food stamp benefits.

We used an eight-item measure for hunger and food insecurity, which we divided into two groups. The questions that we considered hunger items were not having enough food or the kind of food you wanted, cutting down on the size of meals or skipping meals, not eating for a whole day, and going hungry but not eating.

We added an atypical question about food quality because we were interested in diabetics: we asked for the numbers of fruits and vegetables eaten in the last 2 days before hospitalization. We interviewed a total of 567 patients in the inpatient/outpatient sample. Our response rate was 80 percent.

There were several differences between the inpatient and outpatient sample: the inpatients were more likely to have an income of greater than \$25,000 and to be older and white. We also had 170 diabetics. Our analysis included descriptive statistics, chi-square comparisons, and a logistic regression to understand independent predictors of hunger and food insecurity.

In the total sample of 567 patients, the average age was 47, with 50 percent being white, 34 percent black, and 7 percent Native American. The patients were poor, with 50 percent annually earning less than \$10,000. The current employment rate was 32 percent, and 32 percent had less than a high school education.

We found fairly high levels of food insecurity and hunger. We asked questions for the last year and the last month. I will report the 12-month items. Thirty-five percent of our patients had reported worrying that their food would run out. Twenty-eight percent said their food did not last. Twenty-eight percent said they put off paying a bill to buy food. Twenty-seven percent had gone to an emergency food bank, and 13 percent went to a soup kitchen.

Somewhat fewer patients affirmed the hunger items. Twenty-four percent reported that they had cut down on the size of meals or had skipped

meals. About one in eight patients said they did not have enough food. Similar proportions affirmed that they did not eat for a whole day, they went hungry, and did not eat. Interestingly, almost 20 percent of our patients said that they had no fruits and vegetables in the 2-day period.

Compared with people who did not report hunger, people who reported not eating for an entire day were more likely to have an income of less than \$10,000. They were more likely to have their food stamps reduced or eliminated in the prior year, and they were more likely to report illicit drug use. Alcohol and cigarette use was not significantly different between the two groups.

A total of 226 patients in the primary sample, or about 40 percent of our sample, had received food stamps. Half of the food stamp recipients interviewed had their benefits reduced or eliminated in the prior year.

The people who had their food stamps reduced or eliminated were more likely to report food insecurity and hunger on all the measures that we used. For example, 53 percent of those with food stamp reductions worried that their food would run out, while only 41 percent of food stamp recipients without a reduction worried that their food would run out and just 29 percent of those who had never received food stamps had worried that their food would run out. Thirty-three percent of patients who had a reduction in food stamps reported that they cut size of meals or skipped meals in contrast to 27 percent of food stamp recipients without a reduction and 20 percent of those who never received food stamps. All these differences were statistically significant.

In the logistic regression analysis, the independent predictors of food insecurity included an annual income of less than \$10,000, non-white race, reduction in food stamps, and illicit drug use. For these analyses we defined food insecurity as a positive response to any food insecurity item. We analyzed each hunger item separately and similar predictors were found for hunger.

The diabetic sample showed rates of hunger and food insecurity similar to the other sample.

In addition, we asked our diabetic sample about insulin reactions and hypoglycemic reactions; 103, or 61 percent, reported having insulin reactions in the previous year. We then asked if any of these reactions were due to not being able to afford food. Thirty-one percent of these insulin reactions were attributed to being unable to afford food. Of these, 26 percent, or eight people, said they passed out, went to the emergency room, or were hospitalized.

In addition, we asked if the diabetics had to cut down or stop their insulin because they could not afford food and they were trying to adjust at home. Eight percent of the sample did report this behavior.

In conclusion, we found that hunger was prevalent in this urban public hospital population. We found that reductions in food stamps were associated with several measures of food insecurity and hunger, and that one-third of our hypoglycemic reactions reported by our diabetic sample were due to an inability to afford food.

Discussion

Gail Harrison

I think that the paper is important for several reasons. First, it relates food insecurity and its causes to the management of adult chronic disease and indirectly to health care costs, a topic near to the hearts of all policymakers. On a worldwide basis, many developing countries must deal with emerging adult chronic diseases along with continued malnutrition and food insufficiency. The World Health Organization estimates diabetics will double by the year 2020, with huge implications for health care costs. Russia and parts of Europe have very high levels of adult chronic disease, and they are experiencing the economic and political shocks that create hunger and food insufficiency. Yesterday, somebody mentioned the percentage of household income going to food in Russia is 40 percent and rising.

Aspects of the paper attend to what Johanna Dwyer yesterday called “groups at high medical and social risk.” These people not only are at high-risk of food insecurity but are often outside the sampling frames of our national surveys.

It is interesting but not very surprising that illicit drug use predicted hunger in this population. A recent study at UCLA compared a population of cocaine-using pregnant women with income-comparable women who were not using cocaine. They were each interviewed immediately after delivering a baby. The interesting thing was that the women using illicit drugs were experiencing something like maternal depletion syndrome, a condition has long been observed in the poorest countries of the world. In it, a woman’s prepregnant weight and body mass index declined with age and parity—in direct contrast to the usual process that occurs in North America and other industrialized areas, where body mass index of women increases with age and with each pregnancy. The predictors of the severity of this decline included housing instability, which was measured along a continuum as opposed to simply the extreme of homelessness, and food insecurity, which was measured in a crude way simply by asking how many times in the previous 6 months the individual had gone 24 hours without eating for lack of money. The difference in birth weights between the cocaine-using group and the non-drug-using group was fairly well explained by the differences in prepregnant body mass

index and the measured life stressors, including housing instability and food insecurity.

The paper creates questions about health care costs. In a vulnerable population, does food insufficiency have the potential to precipitate a downward spiral of poor health or other kind of dynamics? Such outcomes might relate to the dynamic process that was mentioned earlier by Craig.

The paper reminds me of an early literature on food insecurity, in which households were classified as secure, resilient, or fragile. Resilient households were conceptualized as those who could become food insufficient in the short term in response to a shock, such as an income shock, but who had the resources to recover. A shock to a fragile household could precipitate a downward trend ultimately resulting in homelessness and other outcomes that would not be easily reversible.

Over the last several years, I have worked on food insufficiency in several low-income countries where stunting in children is fairly prevalent. The condition is certainly correlated with food insecurity. I am beginning to be convinced that it is more a marker of a vulnerable household than it is necessarily the other way around. Perhaps there are markers we need to be able to begin to look at also in the United States for a vulnerability to the extreme bad effects of food insufficiency.