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# **Does Food Stamp Receipt Mediate the Relationship between Food Insufficiency and Mental Health?**

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## **Abstract**

Although the Food Stamp Program is the largest entitlement program remaining in the social safety net, comparatively little is known about the potential benefits that the program may confer on recipients. In this paper we examine an important dimension of well being, mental health, and the extent to which participation in the Food Stamp Program may attenuate the effect of food insufficiency on mental health status. Using data from a nationally representative sample of families in the 2001 Panel Study of Income Dynamics (PSID) we model the probability of being severely emotionally distressed as a function of food insufficiency and other known risk factors for poor mental health. We allow participation in the Food Stamp Program to have a direct impact on mental health, and then test whether food stamp participation mediates the effect of food insufficiency on emotional distress. Our model admits the possibility for simultaneity between food insufficiency, food stamp participation, and mental health status, and thus we employ an instrumental variables estimator in our analysis. We find that food insufficiency has a sizable deleterious effect on the chances of poor mental health, but that participation in the Food Stamp Program mitigates this negative effect between 20 and 50 percent depending on the ex ante risk of emotional distress. This research provides the first evidence that the Food Stamp Program has an important positive spill-over effect on mental health through its mediation of household food insufficiency.

Mental health problems are of great social, economic, and policy concern. A recent review estimated that every year, five to six million workers in the United States lose, fail to seek, or fail to obtain employment because of psychiatric disorders; in addition, mental illness decreases annual income by \$3500-\$6000 (Marcotte and Wilcox-Gok, 2001). Psychiatric disorders such as depression and anxiety are higher in women than men, lower in blacks and higher in Hispanics compared to whites, and are inversely related to educational level and income (Kessler et al. 1994). High rates of food insecurity, food insufficiency, and hunger are also a significant problem in the United States (Alaimo et al., 1998; Nord et al., 2002). It is currently estimated that more than 33 million people live in food insecure households, meaning that at some time during the previous year, they were unable to acquire or were uncertain of having enough food to meet basic needs due to inadequate household resources (Nord et al., 2002). Rates of food insecurity are substantially higher among those in households with incomes below the poverty line (36.8%) and in households with children headed by a single woman (31.0%).

While there has been some research on the links between food insufficiency and mental health (Campbell 1991; Corcoran, Heflin and Siefert 1999; Olsen 1999; Siefert et al. 2000, 2001, 2002), none to date has been conducted on the general population and none has examined the impact of policy interventions on the relationship between food insufficiency and mental health.<sup>1</sup> The latter omission is particularly surprising in light of the fundamental changes to the social safety net over the past decade. As part of the 1996 Welfare Reform Act the primary cash assistance program for low-income families, Aid to Families with Dependent Children, was abolished and replaced by the Temporary Assistance for Needy Families Program (TANF).

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<sup>1</sup> We use the term “food insufficiency” here in the narrow sense to distinguish restricted household food stores or too little food intake among adults or children in the household. “Food insecurity” includes those who are food insufficient in addition to those who are anxious about meeting their household’s food consumption through culturally normalized means, along with various attempts to limit, augment, or stretch the food supply (Scott and Wehler, 1998).

TANF, which provides time limited cash assistance for single mothers who fulfill work requirements, is funded as a block grant to states and is no longer an entitlement. The Food Stamp Program (FSP), which provides food assistance to low-income and low-asset families and individuals, was also affected by the 1996 welfare reforms—access was limited for recent immigrants to the United States and for able-bodied adults without children. While the FSP largely retained its entitlement status, the US Congress has in recent years considered converting the program to a block grant to states much like TANF. These changes in the safety net are being made without the aid of research to suggest what the possible unintended consequences of reforming the programs might be on many dimensions of well being, including mental health (Blank 2003). There has been considerable research on the work disincentive effects of income transfers (Moffitt 1992) and on the consumption-smoothing benefits of income transfers (Fraker 1990; Gruber 2000; Gundersen and Ziliak 2003; Kniesner and Ziliak 2002), but with the notable exceptions of Medicaid and SSI, research on the connection between transfer programs and health is scarce.

In this paper we begin to fill this gap in the literature by examining the extent to which participation in the Food Stamp Program mediates the relationship between food insufficiency and mental health. The Food Stamp Program, which in fiscal year 2003 had over 21 million participants and appropriations over \$21 billion, may improve health outcomes by allowing low-income populations to purchase a larger (and potentially improved) bundle of food, thereby reducing unmet food need and in turn improving mental health. Using longitudinal data from the 1999 and 2001 waves of the Panel Study of Income Dynamics, we test whether and to what extent participation in the Food Stamp Program attenuates the effect of food insufficiency on severe emotional distress, controlling for other known risk factors for poor mental health. A key

advantage of the PSID is that to our knowledge this is the first analysis of its kind to examine the effect of food insufficiency on mental health using data from a representative sample of the US population, and the first analysis to examine the interaction of public policy on the links between unmet food need and mental distress. We find that food insufficiency has a strong and deleterious effect on mental health, but that participation in the Food Stamp Program mitigates this negative effect between 20 and 50 percent depending on the ex ante risk of emotional distress. This research provides the first evidence that the Food Stamp Program has an important positive spill-over effect on mental health through its mediation of household food insufficiency.

## **II. Links Between Food Insufficiency and Mental Health**

There are several potential pathways whereby household food insufficiency could have a detrimental effect on the mental health of the household head. We draw on two main theoretical traditions. The first is sometimes termed the neomaterial view. Here, food insufficiency could have a negative impact on mental health through a direct effect of nutritional shortfalls or reductions in positive health behaviors (Bhattacharya, Currie, and Haider forthcoming; Lynch et al. 2000). For example, research has documented that even the early stages of nutrient deficiency can have adverse effects on behavior and mental performance. In an experimental study of 1,081 young men in good health, Hesecker and his colleagues (1992) found that reduced vitamin intake over a two-month period was associated with negative changes in psychological disposition and functioning. Specifically, inadequate vitamin intake was associated with increased irritability, nervousness, depression, feelings of fear and decreased well-being, and memory and reaction performance. Importantly, providing the subjects with vitamin supplements reversed several of these adverse effects. Bhattacharya, Currie, and Haider (forthcoming), using data from the National Health and Nutrition Examination Survey III, find

that heightened food insecurity does exacerbate nutritional shortfalls among adults, but conditional on poverty status, does not help predict nutrition amongst children.

The second potential causal pathway is the psychosocial environment interpretation. Proponents of this view suggest that awareness of disadvantage in regard to relative social positioning creates feelings of shame and distrust that have negative biological consequences through the psycho-neuro-endocrine chain and through stress induced behaviors such as smoking (Lynch et al. 2000). This reasoning is supported by research indicating that an individual's sense of mastery is largely a consequence of experiencing oneself as efficacious (Gecas and Schwalbe 1983), as well as by research that shows that exposure to stressful life experiences can erode one's sense of mastery (Krause and Tran 1989). Likewise, the association between cumulative or persistent stressful life events or conditions and the onset or chronicity of mental illness, particularly depression among single mothers with low self-esteem and lack of support, is well documented (Brown and Harris 1978; Costello 1982; Brown and Moran 1997).

Drawing on theories of the social production of health and disease (Krieger et al., 1993; Kreiger and Zierler, 1995; Link and Phelan, 1995; Williams, 1997; Williams et al., 1997; Denton and Walters, 1999), Siefert, Heflin, Corcoran and Williams (2001) hypothesized that household food insufficiency could be a contributor to poor health and mental health among welfare recipients. In a cross-sectional analysis using the Women's Employment Study, a longitudinal survey of women on welfare in a Michigan urban county, that controlled for a wide range of other factors known to influence women's health and well-being, food insufficiency remained a significant predictor of self-rated health, limitations in physical functioning, and major depression, but did not predict generalized anxiety disorder. The authors then analyzed the relationship between household food insufficiency and women's health in the same sample at

two points in time: fall 1997 and approximately one year later (Siefert et al., 2002). Controlling for common risk factors, the authors found that women who reported food insufficiency at both times were significantly less likely to report a high sense of mastery over their lives. Food insufficiency at wave 2 only was significantly associated with meeting the diagnostic screening criteria for recent major depression, as well as with a lower sense of mastery. Finally, Heflin et al. (2002) used three waves of data and fixed effect models to examine the relationship between a change in food insufficiency and a change in mental health, controlling for a number of covariates and time invariant unobserved heterogeneity. The authors found that a change in household food insufficiency status was positively correlated with a change in depression status, but not mastery.

The research to date has provided compelling evidence that food insufficiency is linked to worse mental health among specialized populations. However, research is lacking on the general population of American families, or even the broader population of low-income families that are simultaneously at greater risk of food insufficiency and poor mental health, and more likely to participate in transfer programs such as food stamps.

### **III. The Food Stamp Program as Mediator**

The Food Stamp Program is an integral component of the social safety net in the United States. This cornerstone of food assistance programs works under the principle that everyone has a right to food for themselves and their families and, hence, with few exceptions, the program is available to all citizens who meet income and asset tests. Most participants receive an Electronic Benefit Transfer (EBT) card for the purchase of food in authorized, privately run retail food outlets. Subject to passing the income and asset limits, which vary with family size, the program is an entitlement to needy families, and participation moves countercyclically with

the state of the macroeconomy (Ziliak, Gundersen, and Figlio 2003). At its peak in 1994 over 27 million people received food stamp benefits at an expense of \$25 billion to the federal government. In some states with low TANF benefit levels, food stamp benefits can constitute more than 50 percent of the disposable income of TANF recipients.

Households have to meet three financial criteria to qualify for the Food Stamp Program: the gross income, net income, and asset tests. A household's gross income before taxes in the previous month must be at or below 130 percent of the poverty line. Households with disabled persons or headed by someone over the age of 60 are exempt from this test (although they must pass the net income test). After passing the gross income test, a household must have a net monthly income at or below the poverty line. Net income is obtained by applying a standard deduction and then itemized deductions for part of labor earnings, for child care and/or care for disabled dependents, medical expenses, and excessive shelter expenses. Finally, net-income-eligible households must meet a liquid-asset test (\$2,000 if the head is under 60 years old) and vehicle-value test (\$4,650 in 2001, though certain exemptions are allowed such as a car for work-related purposes). The amount of food stamps a family receives is equal to the maximum food stamp benefit level minus 0.3 times its net income. So a family with zero net income will receive the maximum benefit level. Food stamp recipients must occasionally recertify their continuing eligibility and the proper amount of benefits. The frequency of recertification depends on the state of residence and the source of a household's income.

Relative to the TANF program, and its predecessor AFDC, there is comparatively little research on the Food Stamp Program (Currie 2003). Much of the research has focused on the effect of food stamps on food spending, the results of which tend to indicate that the typical food stamp recipient is *infra-marginal*, implying that they spend more on food than their food stamp

allotment, and that the marginal propensity to consume is higher out of a dollar of food stamps than out of cash (Fraker 1990; Breunig et al. 2001). In more recent years with the introduction of the food sufficiency and food security scale questions to major social surveys such as the Current Population Survey, the PSID, and the Survey of Income and Program Participation, there has been a flurry of research on unmet food need and various measures of well being. Much of the work indicates that food stamp recipients have higher rates of food insufficiency than eligible non-recipients, though recent research that allows for the possibility of self selection into food stamps find mixed evidence on the links between food insufficiency and food stamp use (Gundersen and Oliveria 2001; Jensen 2002). Likewise, whereas much research indicates that food stamp receipt is positively associated with nutrient intake, Butler and Raymond (1996) find that conditional on self selection into the Food Stamp Program, the nutrition of the elderly is not improved by receipt of food stamps. Though the evidence is mixed, we expect that participation in the FSP will be associated with declines in food insufficiency and in turn with improved mental health. However, our model will clearly need to confront endogeneity issues between FSP participation and health addressed in some of the recent literature.

### **III. Data and Empirical Model**

To test whether and to what extent the Food Stamp Program mediates the link between food insufficiency and mental health we use data from the Panel Study of Income Dynamics (PSID). The PSID is a longitudinal study of a representative sample of U.S. men and women drawn in 1968. While there has been considerable attrition out of the PSID since its inception, the fact that it follows children over time out of the original 5,000 families and that it refreshes the sample with “births”, means that the PSID continues to be representative and thus an excellent source of data for social science research (Fitzgerald, Gottschalk, and Moffitt 1998).

The PSID emphasizes the dynamic aspects of economic and demographic behavior, but its content is broad, including sociological and psychological measures.

The PSID has several characteristics that make it a good choice for this project. First, the 2001 PSID includes a measure of 30-day emotional distress from the National Health Interview Survey. Kessler et al. (2003) indicates that the measure provides a reliable measure of serious mental illness, defined as meeting criteria for at least one of the DSM-IV diagnoses, other than a substance use disorder, and a Global Assessment of Functioning score of less than 60. Second, the PSID includes the single item food insufficiency measure in both 1999 and 2001. Third, the PSID includes very detailed demographic, income, and transfer program information, including the Food Stamp Program. Fourth, because the PSID follows the same family over time it is possible to utilize past information to predict current behavior. Finally, the PSID is nationally representative and results from the 2001 PSID will be broadly generalizable to the current policy environment.

The focal sample of our analysis is prime aged adult men and women between the ages of 18 and 65 who are present in the PSID as family heads in 1999 and 2001. As food sufficiency is only recorded at the family level in the PSID we direct our focus on household heads. While we are interested in understanding whether and how much participation in the Food Stamp Program mediates the impact of food insufficiency on severe emotional distress in the general population, previous research suggests that families at greatest risk for food insufficiency and emotional distress are income poor and/or low educated. Likewise, program rules dictate that incomes must be low in order to qualify for food stamps, and because of the strong links between income and education attainment, the relevant risk set for food stamp use is the low-income and/or low-education population. Consequently, in addition to a sample of the population we also examine

sub-samples selected on income below 200 percent of the poverty line, high school education or below, and those with less than a high school education. Because the dependent variable in our model is a measure of mental health, and income and mental health may be simultaneously determined (Smith 1999), the samples split on the basis of education attainment are likely to be more robust and free of endogeneity bias.<sup>2</sup> In addition, the case for samples split by education is stronger relative to low-income splits in light of the fact that participation in the FSP is income tested.

[Table 1 about here]

Our measure of mental health, which is the dependent variable in our empirical model described below, records how often a respondent experienced certain symptoms of psychological distress during the past 30 days. Table 1 details the exact wording of this question and the six symptoms that are assessed. The response codes (0-4) of the six items are summed for each person to yield a scale with a 0-24 range. Many studies, including the current one, reduce this to a binary dependent variable by defining a value of 13 or more as serious psychological distress (Kessler et al. 2003; National Center for Health Statistics, 2003).<sup>3</sup> In the full sample, 3.8 percent of the sample meets the criteria for high emotional distress. This is comparable to the population estimates produced by the Center for Disease Control based on the same measure in the National Health Interview Survey. In the low-income sample (defined as household income equal to or less than 200 percent of the poverty line) the prevalence rises to approximately 7.8 percent. The comparable figure for the high school or less sample is 4.7 percent, and for the less than high

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<sup>2</sup> For this reason as well, we do not include income as an explanatory variable in the equation for mental health.

<sup>3</sup> In results not tabulated we also converted the dependent variable to a count of conditions and estimated the model with several count-data methods, including poisson, negative binomial, and zero-inflated poisson that accounts for excess zeros in the dependent variable. The qualitative pattern of results is unchanged from those reported here, but the methods are much less transparent, especially in the context of instrumental variables.

school sample 7.7 percent. This pattern is consistent with earlier evidence that severe emotional distress is more acute among disadvantaged populations (Kessler et al. 1994).

[Table 2 about here]

Table 2 presents descriptive statistics (means and standard deviations) for selected outcomes and demographics across the four separate samples. All variables are measured in 2001, the year in which our dependent variable is measured. *Food insufficiency* is a dummy variable if the household head indicated that they “sometimes” or “often” do not have enough food to eat. *Food stamp participation* is a dummy variable equaling one if the family received food stamps in the previous year. *Female head* is dummy variable indicating if the household head is female. Education level is captured at four levels: *less than high school*, *high school graduates*, *some college*, *4 year degree or more*. Marital status is grouped into three categories: *married*, *ever married* indicating that the head is currently divorced, widowed or separated, and *never married*. Race of the head is measured with a series of dummy variables as *white* if the head self-identified themselves as white; *black* indicates that the head self-identified themselves as having a primary racial identify of black; and *other* indicates that the household identified themselves as American Indian, Asian, Latino or some other combination. *Number of children* indicates the total number of children in the household under age 18. *Age* represents the age in years of the household head and has a range from 18 to 65. *Age of youngest child* indicates the age of the youngest children in the household under age 18. *Family income* is the sum of income from all sources in the 2001 PSID except in-kind transfers or the EITC.

Rates of food insufficiency are on the order of 10 percent in the general population, but they are more than double that level among low educated and low-income families. Likewise, FSP participation rates are 6.8 percent overall, but upwards of 19 percent among families whose

head has less than a high school education and over 25 percent among families with incomes below 200 percent of the poverty line. Examining the other variables in the table the pattern of results is quite consistent: low-income and low-educated families are less likely to be married, less likely to be white, more likely to never have been married, more likely to be young, have more children, and earn less income.

[Table 3 about here]

Table 3 extends the descriptive analysis in Table 2 by splitting the sample based on whether the family head suffers from severe emotional distress.<sup>4</sup> Statistical significance between the samples with and without emotional distress is determined by Pearson's chi-square test of independence for categorical variables (or groups of variables in the case of education, race, and marital status) and by two-sample t-tests for continuous variables. In Table 3 we report the mean followed by the p-value in parentheses from the test of the null hypothesis that the samples are the same. The pattern of those with emotional distress follows that found in other national samples of mental illness (Center for Disease Control, 2003). Emotional distress varies significantly by sex, race, educational level, marital status and the age of the youngest child in the household. Important for this study is the finding that households that are food insufficient or report food stamp participation are at increased risk of emotional distress. While levels of emotional distress are generally higher in the low income and low education level samples, the pattern of results is largely consistent with the full sample. The exception to this pattern is that racial differences in emotional distress among the low-income sample are not statistically significant.

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<sup>4</sup> One caveat is in order: Food insufficiency is a household measure and emotional distress is an individual measure. Given the possibility of the unequal distribution of household resources, it may not be the head of the household who is food insufficient.

## A. Empirical Model

We are interested in more formally modeling the relationship between severe emotional distress and food insufficiency, and the attendant role of public policy through the Food Stamp Program to possibly attenuate the links between unmet food need and mental health.

Specifically, we propose the following model:

$$(1) Y_i = \alpha + \beta * FDSUF_i + \mu * FSP_i + \delta * (FDSUF_i * FSP_i) + X_i \gamma + \varepsilon_i,$$

where  $Y_i$  is a binomial measure of mental health based upon the 30-day emotional distress scale that equals 1 if the family head experienced severe emotional distress,  $FDSUF_i$  is an indicator variable equaling 1 if the household is food insufficient,  $FSP_i$  is an indicator variable equaling 1 if the household participates in the Food Stamp Program,  $FDSUF_i * FSP_i$  captures the possible mediating effect of food stamps on mental health via reductions in food insufficiency,  $X_i$  is a vector of observed demographics such as sex, race, age, education level, and family structure that may affect mental health, and  $\varepsilon_i$  is an error term.

Several comments on the model in equation (1) require further explanation. First, previous research in more limited samples suggests a positive link between food insufficiency and severe emotional distress; thus, we hypothesize that  $\beta > 0$ .<sup>5</sup> Second, it is possible that participation in the Food Stamp Program may have a direct effect on mental distress, i.e.  $\mu \neq 0$ . Studies of food stamp non-participation among eligible individuals often list factors such as stigma and ‘too many hassles’ as reasons for non-participation (Daponte, Sanders, and Taylor 1999). It is possible that by revealed preference actual participants have lower levels of these

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<sup>5</sup> We originally planned to examine food insecurity, which is measured with the 18-item Food Security Module, as well as insufficiency. However, summary food security scale items are not available for 2001 at this time. Therefore, we use the single item food insufficiency item for all analyses shown here.

concerns, but it may be the case that  $\mu > 0$ . Third, if food stamps are effective at mitigating the potential deleterious effects of food insufficiency on mental health, then we expect  $\delta < 0$ ; that is, the covariance between food stamps and food insufficiency has the effect of reducing severe emotional distress. This is the key parameter of policy interest.

## **B. Identification and Estimation Issues**

Identification of the model is complicated by the possibility that  $E[FDSUF_i \varepsilon_i] \neq 0$ , and by implication  $E[(FDSUF_i * FSP_i) \varepsilon_i] \neq 0$ . If the latter two covariance terms are zero then standard binary response estimation methods can be employed, such as least squares (i.e. linear probability) or maximum likelihood (i.e. probit or logit). It is possible, though, that the covariance between food insufficiency and the error term is nonzero if there are shared unobservables such that not only does food insufficiency lead to poor mental health but poor mental health leads to food insufficiency. A similar concern arises if  $E[FSP_i \varepsilon_i] \neq 0$ , which implies the possibility that poor mental health leads to food stamp participation, perhaps by the indirect channel of poor health leading to low income. Each of these possibilities leads to the need to adopt an instrumental variables procedure.

Identification and estimation is complicated further still because both the dependent variable and the potentially endogenous regressors are discrete variables. If all the variables were continuous then the usual conditions for identification of the linear instrumental variables estimator apply, i.e. the identifying instruments are correlated with the endogenous regressor but uncorrelated with the model's structural error term. With discrete dependent variables, coupled with discrete endogenous regressors, identification often requires strong restrictions on the distribution of the error term (e.g. normality for the error term) and evaluation of multiple integrals depending on the number of endogenous variables in the system. However, Heckman

and MaCurdy (1985) argued that in discrete dependent variable models with endogenous regressors many of the usual identification conditions apply in the linear probability model, i.e. by applying usual two-stage least squares to equation (1). The instrumental variables linear probability (IVLP) estimator has many advantages, chief among them are the weak distributional assumptions and the ease of computation. The limitations of IVLP are the same as those affecting the OLS linear probability model, namely that predicted probabilities are not required to lie within the unit interval and that the model error is heteroskedastic by construction. The latter is readily handled by computing Huber-White standard errors for the IVLP estimator, while the former needs to be examined as a model specification check.<sup>6</sup> Because we believe the advantages of IVLP outweigh the potential shortcomings this is the approach we adopt.

As is true in all applications of instrumental variables an identifying instrument is required. In this case we need variables that independently determine food insufficiency and Food Stamp Program participation, but that affect current mental health only via its impact on current food insufficiency or current food stamp participation. One possible reduced-form specification is

$$(2) \quad Z_i = \pi Z_{i,t-1} + X_i \theta + v_i, Z = FDSUF, FSP$$

where  $Z_{i,t-1}$  is the lagged value of the head's food insufficiency or food stamp participation (i.e. each measure comes from the 1999 PSID survey). Equation (2) exploits the fact that we have panel data and observe food insufficiency and food stamp participation in a previous period. It is expected that the lagged level of food insufficiency (food stamp participation) is a good predictor of the current level food insufficiency (FSP participation). If so then the next challenge for

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<sup>6</sup> Heckman and MaCurdy (1985) note that one way to solve the problem of predicted probabilities outside the unit interval is to discretize all the variables in the system, including the instruments. We do not pursue that approach here and instead report the number of cases outside the unit interval.

identification is that the lagged values of food insufficiency and food stamp participation be uncorrelated with the current mental health status. That is, we need the assumption that conditional on controlling for current levels of food insufficiency and food stamp participation, lagged levels have no direct impact on current mental health. This is known as the ‘dynamic completeness’ assumption (Wooldridge 2002). Because our dependent variable measures the extent of emotional distress over the past 30 days, and the identifying instruments come from two years in the past, we believe that the dynamic completeness assumption is reasonable in this context. Indeed, work by Siefert et al (2003) has shown that there is no effect of being food insufficient one year earlier on depression status when not currently food insufficient.

In the case of food stamp participation we have recourse to additional (over) identifying instruments. Specifically, previous research indicates that the state of the macroeconomy affects food stamp participation (Ziliak, Gundersen, and Figlio 2003), that the length of time between recertification for food stamp eligibility and the so-called error rate (over- and under-issuance of benefits by caseworkers) affect program participation (Kabbani and Wilde 2003), and political factors and interactions with the cash welfare system affect participation (Wallace and Blank 1999). We have state-level data from 2001 for the latter variables which we include in the instrument set (and the 2000 value of the state unemployment rate). However, identifying additional instruments that affect food insufficiency but not emotional distress is more difficult, and thus the food insufficiency equation is just identified.<sup>7</sup> Using similar reasoning, if either food insufficiency or food stamp participation is endogenous, then the interaction of the two is

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<sup>7</sup> One possible set of overidentifying instruments for food insufficiency are state-level measures of median home values and median rent paid. This comes out of the static budget constraint of the consumer; namely, the more one needs to spend on housing, the less is available for food, thus raising the chances of food insufficiency. In results not tabulated we tested the inclusion of these variables in the first stage, finding that higher median home values lowers food insufficiency but higher rent raises food insufficiency. The latter is consistent with the budget constraint story, while the former result likely serves as a proxy for income, i.e. higher income leads to lower food insufficiency (and larger and more expensive homes). These instruments, however, do not affect the coefficient or the standard error on food insufficiency in the mental health equation we estimate.

endogenous as well. As such, we use the lagged interaction of the two variables as the identifying instrument.

Our strategy then for estimation is to first estimate equation (1) by OLS linear probability, under the assumption that food insufficiency and food stamp participation are exogenous. Our next step is to conduct a variable addition test of the exogeneity of food insufficiency and FSP participation. Specifically, we estimate the reduced-form, first-stage models in equation (2), and save the fitted residuals from each equation,  $\hat{v}_{i,FDSUF}, \hat{v}_{i,FSP}$ . We then estimate a version of equation (1) without the interaction term but with the first-stage residuals as additional regressors:

$$(3) Y_i = \alpha + \beta * FDSUF_i + \mu * FSP_i + X_i \gamma + \tau_1 \hat{v}_{i,FDSUF} + \tau_2 \hat{v}_{i,FSP} + \varepsilon_i.$$

If the parameter estimates on these additional variables are statistically different from zero then this is evidence against food insufficiency and FSP participation being exogenous to mental health (Wooldridge 2002). This approach is asymptotically equivalent to a standard Hausman-type test of endogeneity, but it is easier to implement as a series of least squares regressions. It turns out that if we find that  $\tau_1 \neq 0, \tau_2 \neq 0$  all of the estimated parameters in equation (3) remain consistent (in the statistical sense), but the standard errors are not because of the presence of the generated regressors. Hence, the straightforward solution is to implement the IVLP estimator which yields consistent parameters estimates and standard errors.

#### **IV. Results**

Table 4 presents the results from the OLS linear probability models for the four separate samples assuming exogeneity of food insufficiency and FSP participation. Model 1 begins by examining the direct relationship between food insufficiency and emotional distress, holding all else constant. Model 2 enters an additional control for food stamp receipt along with an

interaction term between for food insufficiency and food stamp receipt. The standard errors, which correct for heteroskedasticity of unknown form, are recorded in parentheses below the coefficient estimates.

[Table 4 here]

Model 1 from the full sample indicates a clear relationship between household food insufficiency and emotional distress ( $p < .001$ ). The coefficient on household food insufficiency ( $B = 0.109$ ), results in a substantively large increase in the baseline probability of severe emotional distress for an individual, holding all else constant. This finding broadens earlier results by Siefert et al. (2001) of a cross-sectional relationship between food insufficiency and mental health in a sample of women on welfare to the general US population. Other factors found to be correlated with emotional distress in Model 1 are education level, marital status, age of youngest child, and gender of the family head. Higher levels of education are associated with lower probabilities of emotional distress. Individuals who are married have lower probabilities of emotional distress compared to those who are divorced, separated, or widowed. Women face higher odds of emotional distress than do men. As the age of the youngest child increases, the probability of emotional distress is found to decrease.

Model 2 indicates that the relationship between food insufficiency and emotional distress is attenuated by participation in the food stamp program. Once food stamp participation is included in the model, the magnitude of the main food insufficiency effect on emotional distress increases by 25 percent. Food stamp participation also has an independent positive effect on the probability of emotional distress, mostly likely due to stigma and the hassles of obtaining benefits. However, the interaction term is large, negative, and significant (at the 8 percent level). The test that food insufficiency, food stamp participation, and the interaction of the two are

jointly equal to zero is soundly rejected ( $p$ -value  $< 0.000$ ). This suggests that food insufficient families who chose to participate in the food stamp program experience a substantial decrease in their risk of emotional distress. Education level and marital status remain significant correlates of the likelihood of emotional distress. However, the marginally significant relationship between gender of the head and emotional distress becomes insignificant once food stamp participation is entered into the model.

This same pattern of results is repeated with each of the other three samples. Food insufficiency is positive, significant, and large in magnitude in Model 1. Once food stamp participation is entered into the model, the magnitude of the direct effect of food insufficiency increases. The coefficients on both the food stamp participation variable and the interaction term increase in absolute value in the education samples compared to the full sample, but the effects are muted somewhat in the low-income sample. Across all samples at high risk of emotional distress the joint tests of significance of the three variables sharply reject the null that they are zero.

Among the demographic control variables, the qualitative pattern of results is similar across the three samples, although significance levels vary. Women have higher probabilities of emotional distress in Model 1 but this increased risk disappears once food stamp participation is included in the model. Higher levels of education are consistently associated with lower likelihood of emotional distress in each of the samples. Being currently married or never married is associated with lower probabilities of emotional distress, compared to those who are separated, divorced, or widowed, though the effect of being married is weakened in the most vulnerable samples of heads with low incomes or with less than a high school education. Finally, we find an inverse relationship between age of youngest child and risk of emotional distress.

These patterns of relationships are in accord with prior research on mental health outcomes (National Center for Health Statistics, 2003; Kessler et al. 1994).

### **A. Endogeneity Tests**

There is reason to worry that shared unobservables result in not only food insufficiency leading to emotional distress but also emotional distress leading to food insufficiency. Additionally, food stamp participation may affect the likelihood of emotional distress but emotional distress could also affect food stamp participation. As discussed in the methods section above, we first use the variable addition technique described in equation (3) to test if food insufficiency and food stamp participation should be treated as endogenous. As presented there, the test involves a two-stage model in which the possibly endogenous variables are predicted in the first stage with the use of unique identifying instruments, as well as all other exogenous instruments. The first stage results can be found in Appendix A. In brief, the lagged value of food insufficiency and food stamp participation are very strong predictors for current food insufficiency and food stamp participation status, respectively, and the overall  $r$ -squares of the first stage regressions tend to be around 0.14 for food insufficiency and 0.40 for food stamp participation (the  $p$ -values on the set of excluded instruments are less 0.01 across all four samples). In the full sample, and the sample split based on low-income status, higher error rates in food stamp benefits and longer re-certification periods for food stamp eligibility both lead to higher probabilities of food stamp participation, though the effects are significant only at about the 12 percent level. The latter are not statistically significant in the education samples. The state level indicators of the macroeconomy and political environment are generally not statistically significant predictors of food stamp participation in any of the four samples examined. This is in contrast to previous literature, but the latter had the advantage of both

cross-section and time-series variation to identify economic and political effects on food stamp utilization.

[Table 5 here]

Residuals from the first stage that are entered in the second stage, along with the results of the joint F-test for significance are shown in Table 5 for each of our four samples. Once again, if the residual is found to be statistically significant, this is considered to be evidence of the presence of endogeneity. As Table 5 illustrates, the tests of endogeneity across the four samples yield a mixed message. In the full sample and the low income sample, the food insufficiency residual is significant while the residual on food stamp participation is not. Additionally, in the full sample and the low-income sample the joint test indicates that the two residuals are different from zero (p-values of 0.07 and 0.03, respectively). In both of the education samples, the individual and joint tests indicate that the null hypothesis that food insufficiency and food stamp participation are exogenous to severe emotional distress cannot be rejected.

Thus, the evidence regarding the presence of endogeneity between emotional distress and food insufficiency and food stamp participation is inconclusive. While the residual is found to be zero in many cases, the finding is not robust across model specifications. However, the residual for food stamp participation is consistently insignificant in each of the models. Given that the joint test is significant in two of the samples, we follow a conservative approach and proceed to models that include instrumental variables to correct for the presence of endogeneity between food insufficiency and emotional distress and food stamp participation and emotional distress.

## **B. Instrumental Variable Results**

Table 6 presents results from the instrumental linear probability models that include the same set of instrumental variables as in Table 5 to correct for the endogeneity between our three

regressors (food insufficiency, food stamp participation, and their interaction) and the dependent variable, emotional distress. As with Table 5, results are shown for each of the four samples for two models: Model 1 includes our standard set of demographic control variables and food insufficiency; Model 2 adds food stamp participation and the interaction term between food stamp participation and food insufficiency. The standard errors are the correct one-stage instrumental variables estimates and are also adjusted for heteroskedasticity.

[Table 6 here]

Across all four samples the pattern of results is similar to those found in the least squares estimates reported in Table 4, although as is typical in instrumental variables applications the standard errors are larger than their least squares counterparts. The most striking change is that the direct effect of food insufficiency on the probability of severe emotional distress increases by a factor of 2 to 5 depending on the sample. If the instrumental variables were weakly related to food insufficiency we typically would expect the IVLP food insufficiency coefficient to be biased toward the least squares estimate (Bound, Jaeger, and Baker 1995). While the case for treating food stamps as endogenous in the model of emotional distress is weak as indicated in Table 5, the case was strong for food insufficiency and the point estimates in Table 6 suggest that least squares estimates severely underestimate the effect of food insufficiency on severe emotional distress.<sup>8</sup> We interpret these coefficients more fully below.

### **C. Simulations of the Role of Food Stamps as Mediator**

In Table 7 we quantify the extent to which food stamp participation attenuates the impact of food insufficiency on severe emotional distress. The base probability is calculated by estimating the predicted value of emotional distress when all the variables in the equation are

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<sup>8</sup> In results not tabulated we also estimated models where the direct effect of FSP participation is treated as exogenous, but food insufficiency and the interaction term are instrumented. There is little change in results relative to those reported in Table 6.

evaluated at their mean. Working from that base, we then add the effect of being food insufficient alone to arrive at the second row of results. Then we add the effect of participating in the food stamp program to the base probability to arrive at the third row of results. Finally, we add the two main effects plus the interaction effect to the base for the last row.<sup>9</sup>

[Table 7 here]

The pattern of results is consistent across the four samples and the two estimation techniques: While the base probability of meeting the cutoff for severe emotional distress is quite modest, ranging from 3.4 in the full sample to 7.8 in the low-income sample, being food insufficient substantially increases the probability from 16.7 to 59.3 percent, depending on whether we examine the full sample or the sub-sample of low-income families, and whether we use least squares or instrumental variables. Participating in the food stamp program increases the probability of meeting the criteria for severe emotional distress by a smaller range, 10.5 to 16.5 percent. However, the joint effect of being food insufficient and participating in the food stamp program is much less than the additive affect of the two main effects. Individuals who are food insufficient but who also are on the food stamp caseload have increased risks of emotional distress ranging from 8.5 to 28 percent. That is, the FSP mediates the impact of food insufficiency on emotional distress by about 20–30 percent for the general population (the smaller percentage is from IVLP estimates), by about 50–55 percent for the samples of high school or less and less than high school, and from 25–75 percent for the population with incomes less than 200 percent of poverty. As discussed in previous sections our prior was that the effect of food insufficiency on emotional distress, and the potential mediating role of the FSP, would be highest among the at-risk population (i.e. low education and/or low income), and our results

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<sup>9</sup> As noted previously, predicted probabilities in a linear probability model are not required to lie in the unit interval. For the full sample 4 percent of the predicted probabilities lie outside the unit interval. This rises to about 9.5 percent with the high school and less sample.

provide confirming evidence of that hypothesis. In short, the FSP provides critical support to those family heads that are food insufficient and under severe emotional distress.

## **V. Conclusion**

The federal safety net for the poor is in transition in the United States. Cash welfare has already undergone a large and, some would argue, overdue reform. Provisions in the reauthorization of welfare calling for the block granting of the Food Stamp Program to a number of states on a provisional basis suggest that attention may be focusing next on food and nutrition programs. Yet, surprisingly there has been little direct empirical evidence on the possible spill-over effects of food programs on the health and mental health of the populations they are designed to serve.

This research provides the first evidence supporting the contention that the Food Stamp Program has important positive spill-over effects on mental health through its mediation of household food insufficiency in a nationally representative dataset. We find clear and convincing evidence that food insufficiency is positively correlated with severe emotional distress. However, the results suggest that food stamps mitigate the negative effect of food insufficiency on mental health. Using data from the Panel Study for Income Dynamics and both least squares and instrumental variables linear probability models, we estimate a range of risk for emotional distress in the food insufficient population from about 17 percent to 59 percent. In the population that is food insufficient but who also receive food stamp benefits, the range of risk for poor mental health is considerably lower—8.5 to 28 percent. We interpret this reduction of between 20 to 50 percent as the mediating effect of Food Stamp Program participation on emotional distress among food insufficient individuals.

There are several implications for our results. One is that any reforms undertaken in the Food Stamp Program need to keep in mind the important spillover effects of this program on mental health. In order to do this, reformers will need to expand their focus beyond the labor supply and food consumption effects of food stamps. Second, given our finding that food stamp participation has the greatest mediating effect on the relationship between food insufficiency and emotional distress within low education populations, it is important to examine more closely the relationship between educational level and income as both determinants of food insufficiency and as determinants of eligibility for the Food Stamp Program. Finally, given the growing body of evidence regarding deleterious effects of food insufficiency, it is important to continue research into the determinants and correlates of food insufficiency.

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Table 1. Description of the 30-Day Emotional Distress Scale

In the past 30 days how often did you feel...	Full Sample	High School or Less	Less than High School	Income < 200% of Poverty
... So sad nothing could cheer you up?				
(0) none of the time	67.42	61.46	54.36	53.75
(1) a little of the time	16.61	17.68	19.19	20.12
(2) some of the time	12.57	16.12	19.29	19.87
(3) most of the time	2.36	3.30	4.88	4.45
(4) all of the time	1.04	1.44	2.28	1.81
... Nervous?				
(0) none of the time	54.81	55.87	54.46	54.49
(1) a little of the time	23.21	20.51	17.12	18.96
(2) some of the time	17.89	18.22	19.92	19.29
(3) most of the time	2.42	3.22	4.98	4.20
(4) all of the time	1.68	2.18	3.53	3.05
... Restless or fidgety?				
(0) none of the time	49.27	49.96	46.06	44.85
(1) a little of the time	21.83	19.31	18.78	19.46
(2) some of the time	22.59	23.00	24.38	25.31
(3) most of the time	3.40	3.50	4.88	5.44
(4) all of the time	2.92	4.23	5.91	4.95
... Hopeless?				
(0) none of the time	84.95	82.01	76.14	75.76
(1) a little of the time	7.02	7.50	8.51	8.66
(2) some of the time	6.14	7.69	10.48	11.38
(3) most of the time	1.06	1.55	2.80	2.47
(4) all of the time	0.84	1.24	2.07	1.73
... That everything was an effort?				
(0) none of the time	59.98	55.83	50.41	47.90
(1) a little of the time	14.71	13.87	14.83	13.93
(2) some of the time	16.03	17.91	20.75	21.68
(3) most of the time	4.42	5.52	5.91	7.09
(4) all of the time	4.86	6.88	8.09	9.40
... Worthless?				
(0) none of the time	88.29	85.12	80.39	79.80
(1) a little of the time	5.76	6.41	7.78	7.75
(2) some of the time	4.50	6.25	8.51	9.40
(3) most of the time	0.74	1.09	1.45	1.48
(4) all of the time	0.72	1.13	1.87	1.57
High emotional distress (>13)	3.38	4.66	7.68	7.75
N	5003.00	2574.00	964.00	1213.00

Table 2: Selected Summary Statistics

	Full Sample	High School or Less	Less Than High School	Income < 200% of Poverty
Food Insufficient	0.102 (0.302)	0.147 (0.354)	0.228 (0.420)	0.264 (0.441)
Food Stamp Participation	0.068 (0.252)	0.110 (0.312)	0.185 (0.388)	0.255 (0.436)
Female Head	0.241 (0.428)	0.272 (0.445)	0.315 (0.465)	0.491 (0.500)
Less than high school	0.193 (0.394)	0.375 (0.484)		0.411 (0.492)
High school graduate	0.322 (0.467)	0.625 (0.484)		0.363 (0.481)
Some college	0.248 (0.432)			0.168 (0.374)
College or more	0.238 (0.426)			0.058 (0.233)
Married	0.584 (0.493)	0.543 (0.498)	0.481 (0.500)	0.317 (0.466)
Ever Married	0.228 (0.419)	0.246 (0.431)	0.268 (0.443)	0.331 (0.471)
Never Married	0.189 (0.391)	0.211 (0.408)	0.251 (0.434)	0.352 (0.478)
White	0.606 (0.489)	0.505 (0.500)	0.415 (0.493)	0.318 (0.466)
Black	0.311 (0.463)	0.395 (0.489)	0.391 (0.488)	0.542 (0.498)
Other	0.083 (0.276)	0.101 (0.301)	0.194 (0.396)	0.139 (0.346)
Age	42.239 (10.508)	41.580 (10.676)	42.012 (11.593)	39.806 (10.765)
Number of children	1.040 (1.228)	1.160 (1.319)	1.272 (1.469)	1.618 (1.524)
Age of youngest child	4.025 (5.282)	4.153 (5.241)	3.767 (4.896)	4.485 (4.932)
Family Income	66020.200 (80163.900)	45452.710 (44982.820)	34543.41 (29373.420)	17378.950 (10555.640)

Table 3: Selected Summary Statistics by Emotional Distress Status

	Full Sample		High School or Less		Less Than High School		Income < 200% Poverty	
	No Distress	Distress	No Distress	Distress	No Distress	Distress	No Distress	Distress
Food Insufficient	83.76	16.24 (0.00)	84.38	15.63 (0.00)	84.38	15.63 (0.01)	83.72	16.28 (0.00)
FSP Participation	87.72	12.28 (0.00)	87.23	12.77 (0.00)	84.83	15.17 (0.00)	88.03	11.97 (0.00)
Female Head	94.04	5.96 (0.00)	92.43	7.57 (0.00)	88.49	11.51 (0.00)	90.76	9.24 (0.06)
< High School	92.32	7.68 (0.00)	92.32	7.68 (0.00)	92.32	7.68	89.98	10.02 (0.08)
High school	97.14	2.86	97.14	2.86			94.32	5.68
Some college	97.09	2.91					92.65	7.35
College or more	98.91	1.09					94.29	5.71
Married	97.84	2.16 (0.00)	96.85	3.15 (0.00)	94.83	5.17 (0.00)	94.81	5.19 (0.01)
Ever Married	95.34	4.66	94.66	5.34	92.15	7.85	92.74	7.26
Never Married	94.56	5.44	92.59	7.41	87.98	12.02	89.28	10.72
White	97.43	2.57 (0.00)	95.92	4.08 (0.20)	92.00	8.00 (0.91)	91.19	8.81 (0.59)
Black	95.57	4.43	95.08	4.92	92.31	7.69	92.55	7.45
Other	94.70	5.30	93.44	6.56	93.05	6.95	93.49	6.51
Age	42.28	41.17 (0.18)	41.61	40.94 (0.50)	42.01	42.09 (0.95)	39.82	39.59 (0.84)
Number of children	1.04	1.14 (0.30)	1.16	1.19 (0.79)	1.28	1.15 (0.45)	1.64	1.37 (0.10)
Age youngest child	4.05	3.24 (0.05)	4.23	2.67 (0.00)	3.86	2.61 (0.03)	4.59	3.23 (0.01)
N	5003.00		2574.00		964.00		1213.00	

Table 4: The Effect of Food Insecurity and Food Stamp Participation on Emotional Distress, OLS Linear Probability Models

	Full Sample		High School or Less		Less Than High School		Income < 200% Poverty	
Food Insufficient	0.109 (0.035)	0.136 (0.045)	0.098 (0.038)	0.140 (0.051)	0.086 (0.046)	0.133 (0.062)	0.089 (0.041)	0.118 (0.059)
FSP Participation		0.077 (0.020)		0.086 (0.023)		0.107 (0.033)		0.056 (0.022)
Food Insuf*FSP		-0.121 (0.071)		-0.160 (0.075)		-0.171 (0.093)		-0.088 (0.082)
Female Head	0.019 (0.009)	0.013 (0.009)	0.030 (0.014)	0.020 (0.014)	0.046 (0.027)	0.028 (0.027)	0.029 (0.020)	0.023 (0.020)
Age (x10)	-0.002 (0.003)	-0.002 (0.003)	-0.005 (0.004)	-0.005 (0.004)	-0.001 (0.008)	-0.002 (0.008)	-0.009 (0.007)	-0.008 (0.007)
Black	0.001 (0.006)	-0.002 (0.006)	-0.002 (0.009)	-0.006 (0.009)	-0.020 (0.021)	-0.027 (0.021)	-0.013 (0.019)	-0.016 (0.019)
Other	0.008 (0.012)	0.007 (0.012)	0.003 (0.017)	0.002 (0.017)	-0.005 (0.024)	-0.008 (0.024)	-0.020 (0.025)	-0.019 (0.025)
High school	-0.039 (0.009)	-0.032 (0.009)	-0.039 (0.010)	-0.032 (0.010)			-0.042 (0.018)	-0.035 (0.018)
Some college	-0.039 (0.010)	-0.031 (0.010)					-0.034 (0.024)	-0.028 (0.024)
College or more	-0.051 (0.009)	-0.043 (0.009)					-0.045 (0.032)	-0.032 (0.033)
Married	-0.016 (0.008)	-0.014 (0.008)	-0.020 (0.013)	-0.018 (0.013)	-0.041 (0.026)	-0.039 (0.026)	-0.035 (0.023)	-0.030 (0.023)
Never Married	-0.011 (0.010)	-0.014 (0.010)	-0.028 (0.015)	-0.032 (0.015)	-0.035 (0.029)	-0.039 (0.029)	-0.042 (0.021)	-0.042 (0.021)
Age youngest child (x10)	-0.010 (0.005)	-0.008 (0.005)	-0.026 (0.007)	-0.022 (0.007)	-0.035 (0.017)	-0.030 (0.017)	-0.038 (0.015)	-0.034 (0.015)
Number of children	0.002 (0.003)	-0.002 (0.002)	0.002 (0.004)	-0.003 (0.004)	-0.001 (0.008)	-0.008 (0.008)	-0.005 (0.006)	-0.009 (0.006)
Constant	0.080 (0.017)	0.075 (0.017)	0.105 (0.024)	0.101 (0.024)	0.113 (0.045)	0.114 (0.045)	0.177 (0.043)	0.164 (0.043)
N	5003	5003	2574	2574	964	964	1213	1213

Table 5: Variable Addition Tests of Exogeneity of Food Insufficiency and Food Stamp Participation

	Full Sample	High School or Less	Less Than High School	Income < 200% Poverty
Food Insufficient	0.249 (0.106)	0.166 (0.110)	0.313 (0.151)	0.370 (0.138)
Food Stamp Participation	0.092 (0.042)	0.111 (0.048)	0.060 (0.069)	0.046 (0.055)
1 <sup>st</sup> Stage Residual on Food Insufficient	-0.176 (0.111)	-0.097 (0.117)	-0.276 (0.162)	-0.329 (0.143)
1 <sup>st</sup> Stage Residual on Food Stamp Participation	-0.044 (0.046)	-0.060 (0.053)	0.020 (0.078)	-0.013 (0.059)
P-value on Joint Test of Significance of Residuals	0.070	0.243	0.226	0.034
N	5003	2574	964	1213

Table 6: The Effect of Food Inefficiency and Food Stamp Participation on Emotional Distress, IV Linear Probability Models

	Full Sample		High School or Less		Less Than High School		Income < 200% Poverty	
Food Insufficient	0.276 (0.105)	0.318 (0.168)	0.204 (0.105)	0.289 (0.167)	0.317 (0.156)	0.450 (0.249)	0.352 (0.142)	0.700 (0.325)
FSP Participation		0.105 (0.048)		0.133 (0.051)		0.087 (0.073)		0.084 (0.062)
Food Insuf*FSP		-0.163 (0.289)		-0.281 (0.258)		-0.303 (0.358)		-0.548 (0.412)
Female Head	0.018 (0.009)	0.010 (0.010)	0.028 (0.014)	0.014 (0.015)	0.042 (0.028)	0.030 (0.031)	0.032 (0.020)	0.031 (0.024)
Age (x10)	-0.002 (0.003)	-0.003 (0.003)	-0.005 (0.004)	-0.005 (0.004)	-0.003 (0.008)	-0.004 (0.008)	-0.012 (0.008)	-0.011 (0.008)
Black	-0.000 (0.006)	-0.005 (0.007)	-0.003 (0.009)	-0.010 (0.009)	-0.025 (0.021)	-0.033 (0.021)	-0.015 (0.020)	-0.019 (0.021)
Other	0.003 (0.012)	0.002 (0.013)	-0.003 (0.019)	-0.005 (0.019)	-0.018 (0.026)	-0.026 (0.028)	-0.028 (0.026)	-0.032 (0.028)
High school	-0.032 (0.010)	-0.023 (0.010)	-0.036 (0.010)	-0.025 (0.010)			-0.028 (0.019)	-0.012 (0.022)
Some college	-0.031 (0.011)	-0.020 (0.011)					-0.023 (0.024)	-0.004 (0.026)
College or more	-0.042 (0.010)	-0.031 (0.010)					-0.026 (0.035)	-0.003 (0.040)
Married	-0.014 (0.009)	-0.011 (0.008)	-0.020 (0.013)	-0.017 (0.013)	-0.041 (0.027)	-0.041 (0.028)	-0.032 (0.024)	-0.021 (0.026)
Never Married	-0.012 (0.010)	-0.015 (0.010)	-0.029 (0.015)	-0.034 (0.015)	-0.033 (0.030)	-0.036 (0.029)	-0.041 (0.022)	-0.036 (0.023)
Age youngest child (x10)	-0.010 (0.005)	-0.006 (0.005)	-0.026 (0.007)	-0.020 (0.007)	-0.038 (0.017)	-0.032 (0.018)	-0.042 (0.015)	-0.037 (0.017)
Number of children	0.001 (0.003)	-0.004 (0.004)	0.002 (0.004)	-0.006 (0.005)	-0.002 (0.008)	-0.007 (0.009)	-0.004 (0.006)	-0.008 (0.007)
Constant	0.073 (0.017)	0.066 (0.018)	0.101 (0.024)	0.095 (0.024)	0.114 (0.047)	0.112 (0.047)	0.161 (0.044)	0.125 (0.050)
N	5003	5003	2574	2574	964	964	1213	1213

Table 7: Simulations of How Food Stamp Participation Mediates the Effect of Food Insufficiency on the Probability of Emotional Distress  
(Percent)

	Full Sample		High School or Less		Less Than High School		Income < 200% Poverty	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Base Probability	3.37		4.66		7.68		7.75	
Food Insufficient Only	16.66	34.46	16.60	29.29	17.94	42.38	16.47	59.27
Food Stamp Participation Only	10.54	13.19	12.36	16.48	16.36	14.74	11.92	14.04
Food Insufficient with Food Stamp Participation	11.80	28.12	8.48	13.39	9.97	19.91	12.12	12.63

Appendix Table A: First Stage Estimates

	Full Sample		High School or Less		Less Than High School		Income < 200% Poverty	
	Food Insuf	FSP	Food Insuf	FSP	Food Insuf	FSP	Food Insuf	FSP
Food Insuf 1999	0.307 (0.043)	0.045 (0.030)	0.335 (0.050)	0.049 (0.034)	0.342 (0.063)	0.014 (0.045)	0.317 (0.053)	0.038 (0.045)
FSP 1999	0.062 (0.017)	0.485 (0.028)	0.063 (0.020)	0.499 (0.031)	0.087 (0.030)	0.500 (0.041)	0.063 (0.021)	0.456 (0.033)
UN Rate 2001	0.002 (0.005)	-0.006 (0.006)	-0.000 (0.007)	-0.008 (0.010)	-0.003 (0.017)	-0.020 (0.020)	0.022 (0.018)	-0.031 (0.025)
UN Rate 2000	-0.001 (0.004)	0.004 (0.005)	-0.002 (0.006)	0.007 (0.009)	0.006 (0.014)	0.022 (0.017)	-0.014 (0.015)	0.023 (0.021)
Error Rate (x100)	0.081 (0.078)	0.179 (0.113)	0.095 (0.135)	0.118 (0.187)	0.346 (0.292)	-0.059 (0.365)	0.225 (0.308)	0.653 (0.434)
Certification Period (x100)	0.065 (0.079)	0.140 (0.108)	0.008 (0.137)	0.001 (0.173)	0.067 (0.298)	-0.136 (0.330)	0.182 (0.291)	0.553 (0.412)
AFDC/FSP Benefit (x1000)	-0.022 (0.014)	0.006 (0.024)	-0.007 (0.026)	0.034 (0.038)	-0.013 (0.057)	0.055 (0.070)	0.011 (0.050)	0.057 (0.082)
Female Head	-0.000 (0.007)	0.048 (0.011)	0.005 (0.012)	0.075 (0.017)	-0.002 (0.022)	0.104 (0.032)	-0.011 (0.019)	0.073 (0.027)
Age (x100)	0.027 (0.021)	0.031 (0.030)	0.028 (0.037)	0.045 (0.050)	0.090 (0.075)	0.134 (0.090)	0.083 (0.072)	-0.060 (0.106)
Black	0.004 (0.005)	0.024 (0.007)	0.005 (0.008)	0.022 (0.010)	0.003 (0.017)	0.032 (0.023)	-0.003 (0.016)	0.035 (0.024)
Other	0.019 (0.010)	0.005 (0.012)	0.041 (0.017)	0.003 (0.019)	0.040 (0.024)	0.006 (0.027)	0.027 (0.027)	-0.007 (0.036)
High School	-0.023 (0.008)	-0.049 (0.011)	-0.020 (0.008)	-0.044 (0.012)			-0.026 (0.017)	-0.068 (0.026)
Some college	-0.028 (0.008)	-0.053 (0.011)					-0.021 (0.021)	-0.027 (0.033)
College or more	-0.031 (0.007)	-0.059 (0.010)					-0.044 (0.021)	-0.165 (0.030)
Married (x10)	-0.002 (0.066)	-0.116 (0.091)	0.083 (0.101)	-0.059 (0.139)	0.158 (0.211)	-0.176 (0.285)	0.117 (0.228)	-0.336 (0.313)
Never Married (x10)	0.009 (0.077)	0.205 (0.121)	0.012 (0.118)	0.302 (0.184)	-0.056 (0.232)	0.187 (0.327)	0.071 (0.181)	-0.036 (0.285)
Age youngest child (x100)	-0.005 (0.044)	-0.206 (0.064)	0.018 (0.076)	-0.262 (0.103)	0.111 (0.184)	-0.093 (0.219)	0.152 (0.155)	-0.507 (0.216)
Number of Children (x10)	-0.001 (0.025)	0.284 (0.041)	0.005 (0.039)	0.387 (0.059)	0.013 (0.076)	0.463 (0.092)	-0.052 (0.054)	0.427 (0.087)
Constant	0.021 (0.023)	0.008 (0.034)	0.010 (0.037)	-0.030 (0.053)	-0.059 (0.089)	-0.080 (-0.106)	-0.073 (0.073)	0.016 (0.115)
N	5003	5003	2574	2574	964	964	1213	1213