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Child Food Security and the Food Stamp Program: What a Difference a Month Makes*

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1 Introduction

Most Americans believe that children should not have either persistent concerns about the quality and quantity of food to eat or lack of actual access to food due to low household resources. However, in 2007, approximately 3.3 million households (8.3 percent of households with children) had food insecure children who did not have consistent access to adequate and safe foods (Nord and Golla, 2009). This implies less than complete coverage of children by the food-assistance safety net.

The United States's Supplemental Nutrition Assistance Program (SNAP), historically and commonly known as the Food Stamp Program (FSP), is a federal-assistance program designed to provide food assistance via benefit payments to low- and no-income households.[1] FSP is the largest component of the USDA's nutrition program. During fiscal year 2011, an average of 44.7 million persons per month (on average 14 percent of Americans) participated in the FSP program. Federal spending for the program in fiscal year 2011 was $75.3 billion, comprising 73 percent of all Federal food and nutrition spending (USDA 2011). With so much of the nation's food assistance resources devoted to the FSP, it is important to document the effectiveness of the FSP in providing basic protection to food insecure populations, and to food insecure children in particular.

Child food insecurity often occurs in response to a negative shock to the household economic well-being and close attention needs to be paid to the dynamic relationship between food security status and FSP participation. Most studies have examined and measured both food security and FSP participation on a yearly basis, but a household (and children in the household), may move in and out of food security and participate in the FSP within a year due to reasons such as income and employment volatility. A preliminary look at the Panel Survey of Income Dynamics (PSID)1999, 2001 and 2003 waves indicates that 10-15

[1]Since the data used in the paper was compiled before the rename of the program, we use Food Stamp Program as a generic reference.

percent (depending on the year) of PSID households classified as food insecure reported that they "had difficulty getting enough food" in only one month while between 32 and 43 percent reported difficulties in only two months. More than half of food insecure households only reported problems in three months or less during each survey year. FSP participation also shows considerable within year variation. Among PSID wave 1999, 2001 and 2003 households that reported FSP participation, 24-29 percent reported six months or less FSP participation. The intra-annual dynamics of FSP participation and food security will be masked in an analysis with annual data, which may potentially lead to incorrect inference about the effectiveness of the FSP in addressing food security. Therefore, in this paper interaction between food security and FSP participation is investigated using monthly instead of annual measures of FSP participation and child food security status. Further, unlike most previous literature that examines the effectiveness of the FSP by comparing FSP participants with eligible non-participants, the paper specifically focuses on households that at some point become participants in the FSP. This eliminates concerns about unobserved heterogeneity between participant and non-participant households.

2 Literature Review

Any analysis of FSP impacts on child food insecurity in large survey samples is complicated by endogeneity, i.e. self-selection bias. That is, households with higher food insecurity among children are more likely to participate in the FSP to begin with because of unobservable household characteristics that affect both food security and the FSP participation decision. Unobserved household heterogeneity may result in FSP participation being an endogenous variable when attempting to quantify its impact on food security. Many early studies that attempted to control for endogeneity found either no effect, or sometimes a paradoxical negative effect of FSP participation on food security. Most studies have focused on the

food security status of households, rather than children within households. Gundersen and Oliveira (2001) employed a simultaneous equation model to control for endogeneity and found no effect of FSP in participating households' food insecurity. Similarly, Huffman and Jensen (2006) used a simultaneous model relying on two-stage estimation and instrumental variables and found no statistically significant evidence for any alleviating impact of the FSP on food insecurity with hunger. Gibson-Davis and Foster (2006) used propensity score matching to address endogeneity problem and also found no ameliorative effect of FSP on food insecurity.

Several recent studies that took advantage of FSP policy related instrumental variables to control for endogeneity of FSP participation have, however, estimated an ameliorative impact of the FSP participation on household food insecurity. Yen et al. (2008) find a small but negative effect of the FSP on food insecurity using data from the 1996-97 National Food Stamp Program Survey, a survey of roughly 2,200 FSP participants and income-eligible nonparticipants. Mykerezi and Mills (2010) employ both instrumental variable models and a natural experiment of losing FPS benefits due to government interruption using 1999 Panel Survey of Income Dynamics data and find a negative and significant impact of FSP participation on food insecurity. Ratcliffe and McKernan (2010) control for endogeneity with state program rules as instruments and use state and year fixed effects to control for endogeneity of policy changes and find that FSP participation reduces instances of both low food security and very low food security.

Interestingly, several studies using panel datasets to examine FSP impacts on household food insecurity have not found a strong relationship between participation in the FSP and reduced food insecurity (e.g. Wilde and Nord, 2005; Ribar and Hamrick, 2003). The lack of impact of FSP uptake on food security in a panel data setting may stem in part from the aggregate timeframe used for measuring FSP participation and food security in these analyses. Specifically, deterioration of food security that may lead a household to enter the

FSP usually occurs within a period shorter than one year. As mentioned, aggregated annual measures may mask the transition in and out of the FSP and food insecurity and thereby temper the true impacts of FSP participation on food security. A notable exception is Nord and Golla (2009), who examine the relationship between the time of FSP entrance and food security status in the month of December of the years 2001 to 2006 with the Current Population Survey. They document that food security deteriorates in the 6 months prior to entrance into the FSP and then improves after commencing FSP use. The Nord and Golla (2009) result highlights the need to view food security as a dynamic, not statistic process.

The above studies focus on the relationship between the FSP and *household* food security, rather than food security among children within the household. However, the link between the FSP and child food security is itself an important research question. Food insecurity can lead to a variety of undesirable outcomes in children's health and development: a less healthy food consumption pattern (Casey et al., 2001; Kaiser et al. 2002), higher risks of being overweight (e.g.Casey et al., 2006; Jyoti et al., 2005), adverse physical health outcomes among young children (Cook et al., 2004, Cook et al., 2006, and Skalicky et al., 2006), as well as comprised mental health, social skills and academic performance (Dunifon and Kowaleski-Jones, 2003; Howard, 2011; Alaimo, Olson and Frongillo, 2001).

Few studies focus on the impact of Food Stamp Program use on child food security specifically. But recent studies have investigated the effects of Food Stamp benefits on child poverty and the impacts of children-targeting food assistance programs on the food security of children-resided households as well as the impacts on children's dietary outcomes. The findings provide some indirect evidence that food assistance programs do impact child food security. By adding Food Stamp benefits to family income, Jolliffe et al. (2005) calculate large reductions in the depth and severity of child poverty by the FSP despite only moderate reduction in the incidence of child poverty. Their policy simulations also show that increased Food Stamp benefits targeted at the poor and extreme-poor FSP households with children

effectively reduce the depth and severity of child poverty. Kabbani and Yezbeck (2004) find that the NSLP helps households with school age children to avoid hunger. Nord and Romig (2006) utilizes the seasonal differences in availability of the NSLP between spring and summer and find greater seasonal differences in food security households with school-age children and in states with lower numbers of Summer Food Service Programs and other summer time school lunch programs. Bartfeld and Dunifon (2006) examine state-level predictors for food security and find that greater state participation rates of both the Summer Food Service Program and Summer Time School Lunches are associated with lower risk of food insecurity. Gundersen, Kreider and Pepper (2011) provide more direct evidence for the effectiveness of the NSLP, in that the receipt of free and reduced-price lunches leads to substantial reductions in food insecurity for households with children.

The literature examining the effectiveness of food assistance programs on children's nutritional outcomes is extensive. Early studies find substantial positive effect of the school lunch program and on children's nutrient consumption (e.g.Akin, Guilkey, and Popkin, 1983; Price et al. 1978). Carlson and Senauer (2003) find a significant positive impact of the Women, Infants, and Children (WIC) Program on children's health in participating households. More recent studies show more mixed results on the effectiveness of the NSLP: the NSLP leads to increased intake of desirable nutritions such as vitamins and minerals as well as undesirable higher intake of dietary fat (Gleason and Suitor, 2003) and NSLP participants consume higher quantity rather than quality lunches (Campell et al., 2011).

This study fills a gap in the literature by specifically focusing on the impact of the FSP on food security among children in households that become FSP participants. More importantly, the paper employs novel intra-annual measurements of child food security and FSP participation and a dynamic model of FSP impact on food security based on monthly measures. Utilization of panel data and a fixed effect model effectively controls for time-invariant unobserved heterogeneity that is prevalent across FSP participants.

3 Data and Methods

The Panel Survey of Income Dynamics (PSID) is employed to estimate the dynamic impact that FSP participation has on child food security. The PSID was first conducted in 1968 and is a nationally representative longitudinal survey of individuals and families. The 1999, 2001, and 2003 waves of the PSID provide detailed information on month-to-month variations in both Food Stamps and child food security in the previous calendar year and are therefore uniquely suited to address the issues raised in this paper.[2] Specifically, each household reporting FSP receipt for the previous year was asked whether or not they received FSP benefits in each month of the year. Similarly, each household with children that answered at least three of the Food Security Core Module items in the affirmative way were asked to report whether they "had difficulty getting enough food" in each month of the reference year.

Monthly child food security is determined in a similar fashion to monthly household food security. Annual food security among children is based on the number of affirmative answers to the eight questions concerning children's food security in the household. When less than two questions are answered affirmatively, the household has food secure children. If a household answers 2 to 4 questions on child food security affirmatively, children in the household are classified as food insecure with low food security. If a household answers 5 or more questions affirmatively, children in the household are classified as food insecure with very low food security. All food insecure households with children are asked whether the household had difficulty getting enough food in each month of 1998, 2000, and 2002. Monthly food security among children is approximated by assuming that if the household was food insecure in a certain month and children in the household experienced food insecurity for

[2] 1999, 2001, and 2003 are the most recent three waves that include the ERS-USDA Household Food Security Module and the resulting child food security measure used in the paper.

the year, then children in the household also experienced food insecurity in that month.[3] For instance, if a household has food insecure children in 1998 and reports difficulty getting enough food in January, children in the household are considered to be food insecure in January.

The PSID includes 3,393 households with children in 1998, 3,484 households with children in 2000, and 3,540 households with children in 2002. Food insecurity rates among children are 5.72 percent, 5.51 percent, and 6.32 percent, respectively, in 1998, 2000, and 2002 (Table 1). Consistent with the literature, food insecurity among children is lower than food insecurity in the household, because children are usually the last household members to be exposed to food insecurity (Nord, 2009). It is also worth noting that food insecure rates among children are significantly higher for households that have at least some interactions with the FSP in the same years. As shown in table 1, among those with exposure to the FSP, 15 percent children were food insecure in 1998, 18 percent children were food insecure in 2000, and around 17 percent were food insecure in 2002. The simple descriptive statistics support self-selection bias among FSP participants in terms of lower pre-existing child food security for households participating in FSP.

The paper investigates how food security among children evolves before and after a household enters the FSP to examine the effectiveness of the FSP. Therefore, only households that were in the FSP at some point from 1998-2003 are included in the study. Further, a household's interaction with the FSP is divided into pre-FSP and in-FSP periods. The pre-FSP period is disaggregated into 1, 2, 3 months before entering the FSP and a 4-12 months aggregate pre-FSP period.[4] Similarly the in-FSP period is disaggregated into 1, 2, 3 months

[3]Most households with food insecure children are also food insecure in our dataset and therefore asked about monthly difficulty getting enough food with the exception of five households in 2002 that have food insecure children but are food secure by definition. Since monthly food difficulty is unknown, these households are not used in analysis.

[4]The non-immediate pre-FSP period (4-12 months before FSP entry) and long-term participating period (4-14 months in the FSP) are aggregated to maintain adequate observations, as the number of observations decreases significantly with duration of time before and after entering FSP.

in the FSP and a long-term participating period of 4-14 months in the FSP.[5] A two-month post-FSP period is also identified and disaggregated into 1 and 2 months after exiting the program.[6] Distinguishing between pre-FSP and post-FSP periods allows for any possible asymmetric effects of entering and exiting the program.

A fixed effect model is employed to account for potential endogeneity of FSP participation arising from time invariant unobserved household characteristics. The model is estimated with monthly observations of food insecurity status among children, FSP participation status relative to month of observed food security status, and employment status in the month of observed food security status.

$$\begin{aligned} FI_{it} &= \eta_1 FSPP3_{it} + \eta_2 FSPP2_{it} + \eta_3 FSPP1_{it} + \eta_4 FSP1_{it} + \eta_5 FSP2_{it} + \eta_6 FSP3_{it} \\ &\quad + \eta_7 FSP4_{it} + \eta_8 FSPE1_{it} + \eta_9 FSPE2_{it} + \theta UNEM_{it} + \kappa OLF_{it} + M_{it}\omega + \mu_i + \varepsilon_{it} \end{aligned}$$

FI_{it} is a binary variable that equals to 1 if children in household i are food insecure in month t, and equals to 0 otherwise. $FSPP3$, $FSPP2$, and $FSPP1$ represent 3, 2, and one months prior to FSP entry, while $FSP3$, $FSP2$, $FSP1$ represent 3, 2, and 1 months in FSP, and $FSP4$ represent the long-term participation period of 4-14 months. $FSPE1$ and $FSPE2$ represent 1 and 2 months after exiting the FSP. The non-immediate pre-FSP period (4-12 months prior) is the baseline period. $UNEM_{it}$ is a binary variable that indicates if the head of household i is unemployed in month t and OLF_{it} is a binary variable that indicates if the

[5]The slight difference in the length of pre-FSP and in-FSP periods is due to data limitations. Survey information for all three waves was collected in January or later months of 1999, 2001, and 2003. Therefore, FSP participation is observed for all households only up to January of those years. This affects the identification of pre-FSP months in 1998, 2000, and 2002, and consequently the farthest temporal distance from FSP entry is only 12 months before FSP entry. The in-FSP period is free of this data limitation.

[6]The post-FSP period is short because exiting the program is unlikely to have a long-term impact on food insecurity and long post-FSP period complicates the identification of pre-FSP periods.

head of household i is out of labor force in month t. M is a vector of month dummies used to capture seasonal effects, μ_i is the household specific fixed effect, and $\eta's$, θ, κ, and ω are estimated coefficients.

The specification effectively compares the base food security status of children in participating households 12 to 4 months prior to entering the program with the food insecurity status of children in participating households three to one months prior to entering the FSP, with the status one month after program entrance to up to 14 months after entering the program, and with the status the first two months after exiting the program. A fixed effect Linear Probability Model (LPM) is used to estimate the relationships.[7]

4 Results

Descriptive statistics on child food security rates at the different intervals before and after interaction with the FSP are presented in table 2 for households with some interaction with the FSP in 1998, 2000, and 2002. Food insecurity among children increases in the months prior to FSP participation, with the rate of food insecurity going up from 2 percent in the 4-12 months pre-FSP period to 7.7 percent in the month immediately prior to participation. The rate of food insecurity among children then declines once the household participates in the FSP, dropping to 5.3 percent in the first month in FSP and to 3.8 percent in the second month. The food insecurity rate bounces back up by 0.5 percentage point in the third month due to an increase in households with very low food security among children. In the long-term participating period, the food insecurity rate among children actually reaches its highest level along the timeline, at 9.9 percent. This may be because most long-term participating

[7]Fixed effect probit models do not yield consistent estimates (Baltagi 2008). Conditional fixed effects logit models yield consistent estimates but drop households where the dependent variable does not change over time; i.e. Households that do not have a change in food security status over time are dropped. Another popular method to estimate panel datasets with binary dependent variables is the random effect probit model. Random effect probit were estimated as well and the estimates of FSP impacts do not substantially differ from the LPM estimates.

households are chronically food insecure, rather than an impact of the FSP. The fixed effect model will control for this possible self-selection based on fixed-unobservables. After exiting the program, the food insecurity rate among children decreases again for households that are one month out of the FSP, to 3.4 percent and then bounces back up to 6.3 percent for households that are two months out of the FSP. This indicates that after households exit the program the child food security more or less returns immediately to the level seen 4-12 months prior to FSP entry. Child food security then possibly deteriorates again in absence of FSP benefits, but the sample size is small so care is needed in making this inference.

Similarly, the relationship between parent labor market shocks and food security among children is examined in table 3. Food security among children appears to be relatively constant before exposure to unemployment and then deteriorates in the months after a parent becomes unemployed, with FI increasing from 2.5 percent in the 1st month after unemployment to 11.2 percent in the 4th month after unemployment. Thus, change in employment status appears to have a relatively strong immediate impact on child food security.

Results from the fixed effect LPM model that examines how food insecurity among children changes before and after the FSP entry after controlling for unemployment status are presented in table 4. All independent variables are binary and the omitted categories for the independent variables (by table row) are employed household heads, the month of January, and the non-immediate (4-12 months) pre-FSP participation period.

The first column provides parameter estimates for the sample in which households all have a change of FSP participation status (according to the temporal distance from program entrance as defined before) in each year (1998, 2000, and 2002). The change in probability of food insecurity among children in the different periods with respect to FSP participation shows a similar pattern to that shown in the descriptive statistics presented in table 2 until the last (the long-term participating) period. Compared to the non-immediate pre-FSP

period (the baseline), children in a household are estimated to be 2.5 percentage points more likely to be food insecure 3 months before FSP entry, and the probability continues to increase as the household gets closer to FSP entry, reaching a peak of 4.6 percentage points more likely to be food insecure the month before a household enters FSP. The probability of children being food insecure then starts to decrease once the household enters the FSP. After one month in the program, the probability of children being food insecure declines to 3.3 percentage points above the baseline and continues to decline to 2.8 percentage points above the baseline when the household is 2 months into the program. Food insecurity then increases slightly, as children are 3.2 percentage points more likely to be food insecure 3 months into the program compared to the baseline. Finally when the household enters the long-term participation period (4-14 months), children are only 2.3 percentage points more likely to be food insecure compared to the baseline, which is back to the level seen 3 months before participation. In the first two months after exiting the program, children in the household are no more likely to be food insecure compared to the baseline of 4-12 before program entry, although numerically the probability increases in the second month out of the FSP. This indicates that child food security goes back to pre-FSP levels after program exit.[8]

It is worth noting that in the descriptive statistics in table 2, the child food insecurity rate is much higher in the long-term participating period than in other periods, while results from fixed effect LPM show that children are less likely to be food insecure during long-term participating period compared to immediately prior to and after FSP entry. This difference arises because unobserved household heterogeneity is controlled for in the fixed effect model and, therefore, the parameter only captures the difference in food insecurity relative to timing of FSP participation of the same household. This eliminates selection bias associated with

[8]There are also statistically significant differences between some of the "non-baseline" pre- and in-FSP periods. Of note, child food insecurity one month before entering the program is statistically higher than 4-14 months in the program and also one month after exiting the program.

long-term FSP participation. Figure 1 presents a straightforward illustration of the change in the probability of food insecurity among children in each period relative to the base period of 4-12 months prior to FSP participation.

Labor market indicator variables for the model in column one also have expected signs. Compared to the baseline case of a working household head, being unemployed increases the probability of children in a household being food insecure by 4.0 percentage points while being out of labor force increases the probability by 2.5 percentage points. A t-test also shows that the impact of being unemployed is statistically different from that of being out of labor force at the p=0.01 level. As for seasonal effects, the probability of a child being food insecure is numerically lower in most months from February to November, compared to the baseline of January. While the probability is higher in December than in the January baseline. However, none of the month coefficients are statistically significant. The results suggest that there may be some evidence that children's FI tend to get worse at the beginning and end of the year, possibly due to financial stresses from heating expenses or the holidays faced by households. Contrary to previous findings, children do not appear to be more protected from food insecurity during the school year in the PSID sample(Nord and Romig, 2006; Bartfeld and Dunifon, 2006).

Results in columns 2 and 3 of table 4 are based on the same specification of the model, but with slightly different samples. Unlike column 1, which only includes households with a change in FSP status in the observed year, column 2 includes the larger sample of household observations of households that experience a change in FSP status in at least one year out of the three years. Column 3 includes all households in the sample for which FSP status can be identified for each month of 1998, 2000, and 2002, whether they experience a change in status or not. Parameter estimates in columns 2 and 3 are very similar to those of column 1, with the same estimated trends of increasing food insecurity among children in the pre-FSP periods and stabilization of rates on food insecurity in the in-FSP period. There is also

a consistent jump in the probability of food insecurity when a household is 3 months into the program, but the likelihood then goes back down in the long-term participation period. The consistent increase in child food insecurity 3 months in the program may be related to the prevalence of a short FSP recertification period of 3 months in the late 1990s and early 2000s.[9] The finding is also consistent with concerns that short recertification periods can exclude needy households from the FSP and raise rates of food insecurity.

In order to test the robustness of the results to the FSP lead and lag structure the model is re-estimated with the pre-FSP period disaggregated into 1, 2, 3, 4 months before and a non-immediate pre-FSP period of 5-12 months before FSP entrance and in-FSP periods disaggregated into 1, 2, 3, 4 months in FSP and a long-term participating period of 5-14 months in the program. Also, the post-FSP period is extended by one more month. The results, table 5, are presented for the same household samples, those that have a change in FSP status in the specific year, those with a change in at least one out of the three years, and all households including those with no change in FSP status. Estimates for the major parameters of interest are similar to those in table 4. The probability of children in a household being food insecure is not statistically different 4 months before FSP entry from the non-immediate pre-FSP period (5-12 months) . Then as the household gets closer to FSP entry, children are more likely to be food insecure, with the probability increasing from around 3 percentage points above the baseline 3 months before FSP entry to almost 5 percentage points above the baseline the month before FSP entry. Once the household enters the FSP, the likelihood of children being food insecure begins to decline to 4 percentage points and 3 percentage points above the baseline 1 and 2 months in the program respectively. However, again, when the household is 3 months in the program, the probability bounces

[9]Kabbani and Wilde (2003) noted that in the late 1990s and early 2000s, many states drastically increased their use of short recertification periods (three months or less) to lower their Food Stamp error rates. Nationally the rate of short recertification periods reached 36% for participants in working households and around 24% for all participants in fiscal year 2000.

back slightly before going back down to around 2 percentage points above the baseline in the long-term participating period. When the household first exits the FSP, children are statistically no more likely to be food insecure compared to the baseline, 5-12 months before program entry. Then in the second month out of the FSP, the probability of children being food insecure increases to around 3 percentage points above the baseline and the difference is statistically significant. Interestingly, however, in the third month out of the program, the probability difference becomes statistically insignificant again, indicating that the household readjusts to post-FSP changes and retains the food security level seen when first out of the program.

The use of intra-annual measures and incorporation of pre- and in-FSP dynamics are the key novel components in our model specification. Table 6 presents fixed effect LPM regressions of children's food insecurity on FSP participation and parent's employment status using annual measures of food insecurity and FSP participation to determine if the monthly data and intra-annual lag structure lead to our finding of significant FSP impacts. Estimates in the first column are based on the sample of households that had a change in FSP status in each year (in correspondence with column 1 of table 4), estimates in column 2 are based on the sample of households that had a change in FSP status in at least one out of the three years (in correspondence with column 2 of table 4) and column 3 is based on the entire sample of households with children in waves 1999, 2001, and 2003 of the PSID. As indicated in the table, the coefficients for the indicator for annual FSP participation are -0.078, -0.024 and -0.001, respectively. Importantly, the estimates are not statistically significant. Thus, no evidence of FSP impacts on children's food insecurity is found with annual measures. This result suggests that a dynamic model containing monthly food insecurity and FSP participation measures may be crucial to uncovering the true effect of FSP participation on food security.

5 Conclusions

Our results indicate that the FSP plays an important role in protecting the well-being of needy children by effectively ameliorating declining food security conditions among children in the face of negative economic shocks to low-income households. Instead of focusing on the impact of the FSP on children's food security at a single point in time, this paper uses monthly measures of both household FSP participation and child food insecurity to examine how food security evolves before and after a household enters the FSP for participating households. Unlike most previous literature that examine the effectiveness of the FSP by comparing participants with eligible non-participants, our paper focuses on the change of food security conditions in the subset of the population with children that are program participants at some point in time. Results indicate that children's food security starts deteriorating a few months before a household enters the FSP, but the FSP effectively ameliorates participants' worsening food security conditions, once enrolled. After 4 months in the program the food security of children returns to the levels seen 3 months before FSP entry. These intra-annual effects are masked by annual measures, as an annual indicator of FSP participation does not show a significant impact on an annual measure of children's food security using the same data, years, and fixed effect model.

The results have important policy implications for food assistance programs. A two-tiered FSP is required to truly address (child) food insecurity problems in the U.S. In tier one, or the short term, the FSP needs to foster quick access before household food security deteriorates significantly. Also, some indirect evidence from our results suggest that the 3 month recertification window may increase child food insecurity. The FSP should minimize the transaction costs associated with 3 month recertification that discourage FSP participation. Further, the strengthening of linkages between the FSP and unemployment application should be explored, as unemployment of adult household members is strongly

related to deteriorating child food security. For tier two assistance, the FSP needs to identify those households with long-term needs. There is substantial unobserved heterogeneity associated with the long-term food insecure population. The mental health of adult household members is likely a key unobserved variable, as parent mental health status is often found to be significantly correlated with child food security (e.g.McLeod and Veall, 2006; Lent et al., 2009; Heflin and Ziliak, 2008). Assistance programs that help address household mental health issues may more effectively protect child food security. Tier two assistance may also need to foster human capital and other household asset investments to increase adult household member earnings capacity and reduce long-term reliance on food assistance. Distinguishing the short-term and long-term needs of these two food assistance tiers will allow for the better design of assistance programs to meet their distinct needs.

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Table 1. Food Insecurity among Children by Year (%)

Food seucrity among children	1998	2000	2002	1998	2000	2002
	Entire smaple			Households with exposure to the FSP		
Food secure	94.28	94.49	93.68	84.57	82.03	83.4
Food insecure with low food security	4.98	4.88	5.47	12.07	15.44	14.48
Food insecure with very low food security	0.74	0.63	0.85	2.96	2.53	2.12
Total number of observations	3,393	3,484	3,540	439	395	518

Table 2. FSP Participation and Food Security Status among Children (%)

Month	Food secure	Food insecure with low food security	Food insecurity with very low food security	Total number of observations
non-immediate pre-FSP period	98.0	1.5	0.6	1,925
3 months before participation	95.6	3.8	0.6	342
2 months before participation	93.8	5.9	0.3	370
1 months before participation	92.3	6.8	0.9	426
1 month in the program	94.7	4.6	0.7	417
2 months in the program	96.2	3.4	0.4	445
3 months in the program	95.7	2.9	1.3	445
long-term participating period	90.1	9.4	0.6	1,984
1 month out of the program	96.6	3.4	0.0	206
2 months out of the program	93.7	6.3	0.0	142

Table 3. Parent's Labor Market Shock (Unemployment) and Food Security Status among Children (%)

Month	Food secure	Food insecure with low food security	Food insecure with very low food security	Total number of observations
4 months before unemployment	99.1	0.6	0.3	346
3 months before unemployment	98.4	1.6	0.0	430
2 months before unemployment	98.8	1.2	0.0	481
1 month before unemployment	98.5	1.3	0.2	540
1st month of unemployment	97.5	2.3	0.2	518
2nd month of unemployment	95.3	4.4	0.3	339
3rd month of unemployment	94.9	5.1	0.0	198
4th month of unemployment	88.9	10.4	0.7	144

Table 4. Children's Food Insecurity and FSP Participation (Fixed Effect LPM)

Variables	At least a change every year	At least one change in 3 years	Including no changes
Head is unemployed	0.040***	0.016*	0.022**
	(0.011)	(0.009)	(0.009)
Head is out of labor force	0.025**	-0.003	-0.008
	(0.010)	(0.008)	(0.006)
February	-0.005	-0.004	-0.007
	(0.010)	(0.009)	(0.007)
March	0.005	-0.002	-0.007
	(0.010)	(0.009)	(0.007)
April	-0.005	-0.009	-0.010
	(0.010)	(0.009)	(0.007)
May	-0.003	-0.007	-0.008
	(0.010)	(0.009)	(0.007)
June	-0.003	-0.004	-0.008
	(0.009)	(0.009)	(0.007)
July	-0.002	0.001	-0.002
	(0.010)	(0.009)	(0.007)
August	-0.008	-0.006	-0.006
	(0.010)	(0.009)	(0.007)
September	-0.014	-0.016*	-0.017**
	(0.009)	(0.008)	(0.007)
October	-0.008	-0.010	-0.008
	(0.011)	(0.009)	(0.007)
November	-0.002	0.003	0.007
	(0.011)	(0.010)	(0.008)
December	0.011	0.012	0.015*
	(0.012)	(0.010)	(0.008)
3 months before participation	0.025***	0.027***	0.025**
	(0.010)	(0.010)	(0.010)
2 months before participation	0.040***	0.039***	0.036***
	(0.011)	(0.011)	(0.011)
1 month before participation	0.046***	0.047***	0.044***
	(0.011)	(0.011)	(0.011)
1 month in the program	0.033***	0.037***	0.034***
	(0.010)	(0.010)	(0.010)
2 months in the program	0.028***	0.032***	0.029***
	(0.011)	(0.011)	(0.011)
3 months in the program	0.032***	0.038***	0.036***
	(0.012)	(0.013)	(0.013)
long-term participating period	0.023**	0.023***	0.019***
	(0.010)	(0.007)	(0.007)
1 month out of the program	0.010	0.008	0.005
	(0.013)	(0.012)	(0.012)
2 months out of the program	0.020	0.017	0.015
	(0.017)	(0.016)	(0.016)
Average household fixed effects	0.031***	0.041***	0.052***
	(0.009)	(0.008)	(0.007)
Number of observations	6,480	9,372	15,420
Number of groups (fixed effects)	491	555	874

Notes: Heteroskedastic robust standard errors are in parentheses. Asterisks indicate levels of significance: ***= 1%, **= 5%, * = 10%.

Table 5. Robustness checks (Extending lead and lag structure)

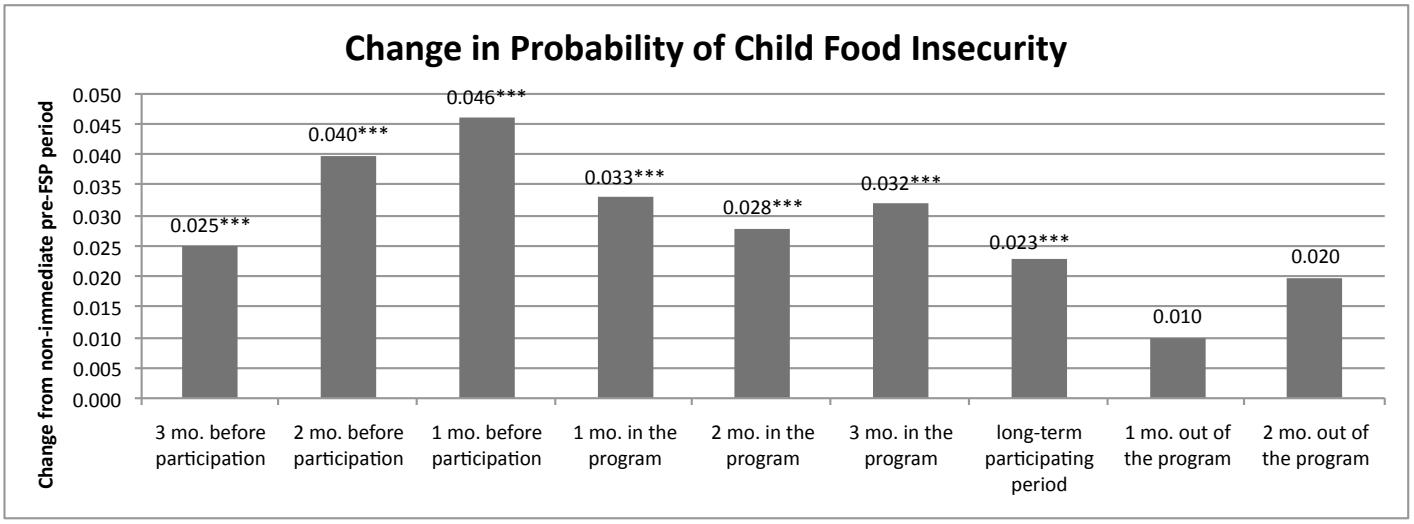
Variables	At least a change every year	At least one change in 3 years	Including no changes
Head is unemployed	0.038***	0.013	0.021**
	(0.011)	(0.009)	(0.009)
Head is out of labor force	0.024**	-0.001	-0.007
	(0.010)	(0.008)	(0.006)
February	-0.003	-0.003	-0.006
	(0.010)	(0.009)	(0.007)
March	0.004	-0.002	-0.008
	(0.010)	(0.009)	(0.007)
April	-0.006	-0.010	-0.010
	(0.009)	(0.008)	(0.007)
May	-0.001	-0.005	-0.007
	(0.009)	(0.008)	(0.007)
June	-0.002	-0.003	-0.007
	(0.009)	(0.008)	(0.007)
July	0.002	0.003	-0.000
	(0.009)	(0.009)	(0.007)
August	-0.005	-0.005	-0.005
	(0.009)	(0.008)	(0.007)
September	-0.012	-0.013	-0.017**
	(0.009)	(0.008)	(0.007)
October	-0.006	-0.007	-0.007
	(0.010)	(0.009)	(0.007)
November	0.001	0.007	0.008
	(0.011)	(0.010)	(0.008)
December	0.013	0.013	0.015**
	(0.011)	(0.010)	(0.008)
4 months before participation	0.002	0.004	0.004
	(0.008)	(0.008)	(0.008)
3 months before participation	0.025**	0.027**	0.026**
	(0.010)	(0.010)	(0.010)
2 months before participation	0.038***	0.037***	0.036***
	(0.011)	(0.011)	(0.011)
1 month before participation	0.045***	0.046***	0.044***
	(0.011)	(0.011)	(0.011)
1 month in the program	0.038***	0.042***	0.040***
	(0.011)	(0.011)	(0.011)
2 months in the program	0.031***	0.035***	0.033***
	(0.011)	(0.011)	(0.011)
3 months in the program	0.036***	0.041***	0.040***
	(0.013)	(0.013)	(0.013)
4 months in the program	0.035***	0.039***	0.036***
	(0.012)	(0.013)	(0.012)
long-term participating period	0.024**	0.024***	0.022***
	(0.011)	(0.008)	(0.008)
1 month out of the program	0.016	0.014	0.011
	(0.013)	(0.012)	(0.012)

2 months out of the program	0.031*	0.027*	0.025*
	(0.016)	(0.015)	(0.015)
3 months out of the program	0.028	0.024	0.025
	(0.018)	(0.017)	(0.017)
Average household fixed effects	0.025***	0.036***	0.048***
	(0.009)	(0.008)	(0.008)
Number of observations	6,864	9,804	15,696
Number of groups (fixed effects)	518	580	890

Notes: Heteroskedastic robust standard errors are in parentheses. Asterisks indicate levels of significance: ***= 1%, **= 5%, * = 10%. Extending the lead and lag structure adds the changes of 4 months in FSP to 5 months in FSP and results in more households that have a change of FSP status, and therefore, a few more observations in the first columns of table 5 compared with table 4.

Table 6. Children's Food Insecurity and FSP Participation (Annual Meausres; Fixed effect LPM)

Variables	Households with at least a change every year	Households with at least one change in 3 years	Entire sample
FSP participation	-0.079	-0.024	-0.001
	(0.239)	(0.135)	(0.018)
Head is unemployed	0.006	-0.017	-0.006
	(0.315)	(0.089)	(0.013)
Head is out of labor force	-0.036	-0.021	0.016
	(0.271)	(0.071)	(0.015)
Average household fixed effects	0.226	0.180	0.056***
	(0.291)	(0.132)	(0.004)
Number of observations	540	781	10,375
Number of groups (fixed effects)	491	555	4,846


Change in Probability of Child Food Insecurity
Change from non-immediate pre-FSP period
0.050
0.045
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0.025***
0.040***
0.046***
0.033***
0.028***
0.032***
0.023***
0.010
0.020
3 mo. before participation
2 mo. before participation
1 mo. before participation
1 mo. in the program
2 mo. in the program
3 mo. in the program
long-term participating period
1 mo. out of the program
2 mo. out of the program